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CONTENTS

FEATURES

In addition, a supplement was published with Vol. IV, No. 2, 32 pages in length, and not numbered in sequence with the rest of volume IV, entitled LOCAL NAMES OF FRUITS AND VEGETABLES IN THE ENGLISH-SPEAKING CARIBBEAN. The authors of this revised and more extensive version of an earlier publication, by the Caribbean Organization, were Dr. C. Dennis Adams of the Botany Department, U.W.I., and Dr. Saranya K. Reddy of C.F.N.I.

HOW BREAST FEEDING REALLY WORKS
(Facts vs Medical Folklore)

by

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The subject of breast feeding tends to be obscured and made more difficult by ill-informed dogma, emotional discussions and opinionated assertions rather than guided by knowledge of the abundant, clear-cut facts, in many cases known for decades, concerning the normal behaviour of mother and newborn in mammals in general, and in man in particular.

In view of the rapidly increasing concern with declining breast feeding in less developed parts of the world, it seemed timely to review some more practical aspects of knowledge of the psychology and physiology of lactation, or, more properly, of the emotional and nutritional interaction of nursing mother and child - in other words, the process of breast feeding.

Problems of Being a Primate

For most mammals, the process of suckling their young is almost entirely instinctive. However, the so-called higher primates seem to pay a penalty for their cerebral complexity and need two other things to ensure successful lactation.

The first of these is *knowledge* or *instruction* - at least as gained subconsciously in girlhood by observation of females suckling their young in the group, clan or community.

In human societies, this is a normal, everyday part of the scene in all traditional communities. It is only recently that this has no longer become so in currently industrialized, urbanized communities, where Western

concepts, over-emphatically labelling the female breast as aesthetic sex symbol, have made suckling the infant in public taboo.

Interestingly, the need for prior knowledge also applies to chimpanzees and other non-human primates. If reared in captivity, females have difficulty with suckling their young.

Secondly, in humans especially, breast feeding is most easily accomplished if *guidance* is given to the mother, especially early on. This is shown in many traditional societies where incantations or various herbal medicines or other procedures may be employed as galactogogues.

Unrealized Reflexes

The process of breast feeding depends principally on the functioning of certain reflexes in both the newborn baby and in the mother. These receive little attention in textbooks of midwifery or paediatrics intended for both medical students and nurses.

On the baby's side, three reflexes are operative. These are the *rooting reflex, the sucking (or more correctly the suckling) reflex* and the *swallowing reflex.*

With the rooting reflex, pressure on the infant's cheek is followed by him turning his head towards the pressure, and opening and closing his mouth as he seeks for the breast. The sucking reflex is the complicated series of movements, whereby the baby "milks" secretion out of the terminal lacteals by squeezing the breast between his hard palate and his tongue.

These reflexes are present in all normal full-term babies, and even in some low birth weight infants. They may be absent in prematures and impaired in neonates severely ill with brain damage, jaundice or infection. Also, mechanical difficulties may occur with such congenital abnormalities as cleft palate.

On the mother's side, two reflexes are responsible for successful lactation. Firstly, the *prolactin reflex* is the main hormonal factor in milk production. In this, sucking by the newborn leads to impulses passing from the nipple and areola up the vagus nerve to the anterior pituitary, which lead to the secretion into the circulation of prolactin, responsible for the secretion of milk. (Figure 1)

The second reflex is known variously as the *let-down reflex*, the *draught reflex* or the *milk ejection reflex*. It is very important to appreciate that it is above all a *psychosomatic* reflex - with a bodily or somatic component, which can, however, be influenced by the mother's emotions.

The somatic component of the let-down reflex starts with the baby sucking the mother's breast. This stimulates the areola and impulses pass (again via the vagus nerve) to the *posterior* pituitary, which releases oxytocin, which passes in the blood stream back to the breast. Here, it acts on the muscle cells (myoepithelial cells) of the alveoli, squeezing milk out of them and propelling it down to the terminal lacteals, where it is easily accessible to the infant. (Figure 2)

As mentioned, this reflex is highly sensitive to the mother's emotions. As is well appreciated by dairy farmers, the reflex is easily inhibited by anxiety or worry; a "strange" milker produces less yield from a cow.

A sudden emotional shock can, as is well known, "dry up" a woman's milk. Conversely, confidence leads to an unimpaired, or even an enhanced, let-down reflex.

Practical Points

In addition to knowledge concerning these main reflexes, there is also much information concerning the best practical methods of initiating breast feeding. This is well documented, but seems to have penetrated rather little

into medical thinking.[8,9]

For example, it has been clearly shown that the puerperium is *the* critical period as far as initiation of lactation is concerned.[5] In other words, the sooner the newborn is put to the breast, the better and the more likely lactation is to succeed.

Also, early close contact is more and more recognised as being a fundamental feature of mammal mother-child behavioural "imprinting" responsible, in part, for subsequent social behaviour.[6,10] In addition, the oxytocin produced by the resulting early suckling minimizes uterine haemorrhage. Likewise, it has been clearly shown that the number of feeds are extremely important in relation to prolactin secretion and consequent milk production.[2] In other words, *as frequent feeds from as soon after birth and for as long as the baby wishes is physiologically sound advice*, based on scientifically collected data.

Another great controversy concerns the question of whether one or both breasts should be taken by the baby. The answer physiologically and nutritionally is that after the first minute of vigorous sucking, the infant should be moved to the other side. This is the way to obtain maximum nutrients and to empty *both* breasts as much as possible - another important stimulus to milk production.

Another major practical point is that it has been shown time and again that the introduction of so-called complementary bottle feeds is rarely necessary and is a potent deterrent to successful lactation. Except under extreme climatic conditions, unrestricted breast feeding is a source of water as well as other nutrients. This was, for example, shown to be so in West Bengal, India.[4]

The use of complementary bottle feeds fills the infants stomach and lessens his sucking vigour, so vital for both let-down and prolactin reflexes.[7] In addition, both the easier obtaining of cow's milk formula from the bottle

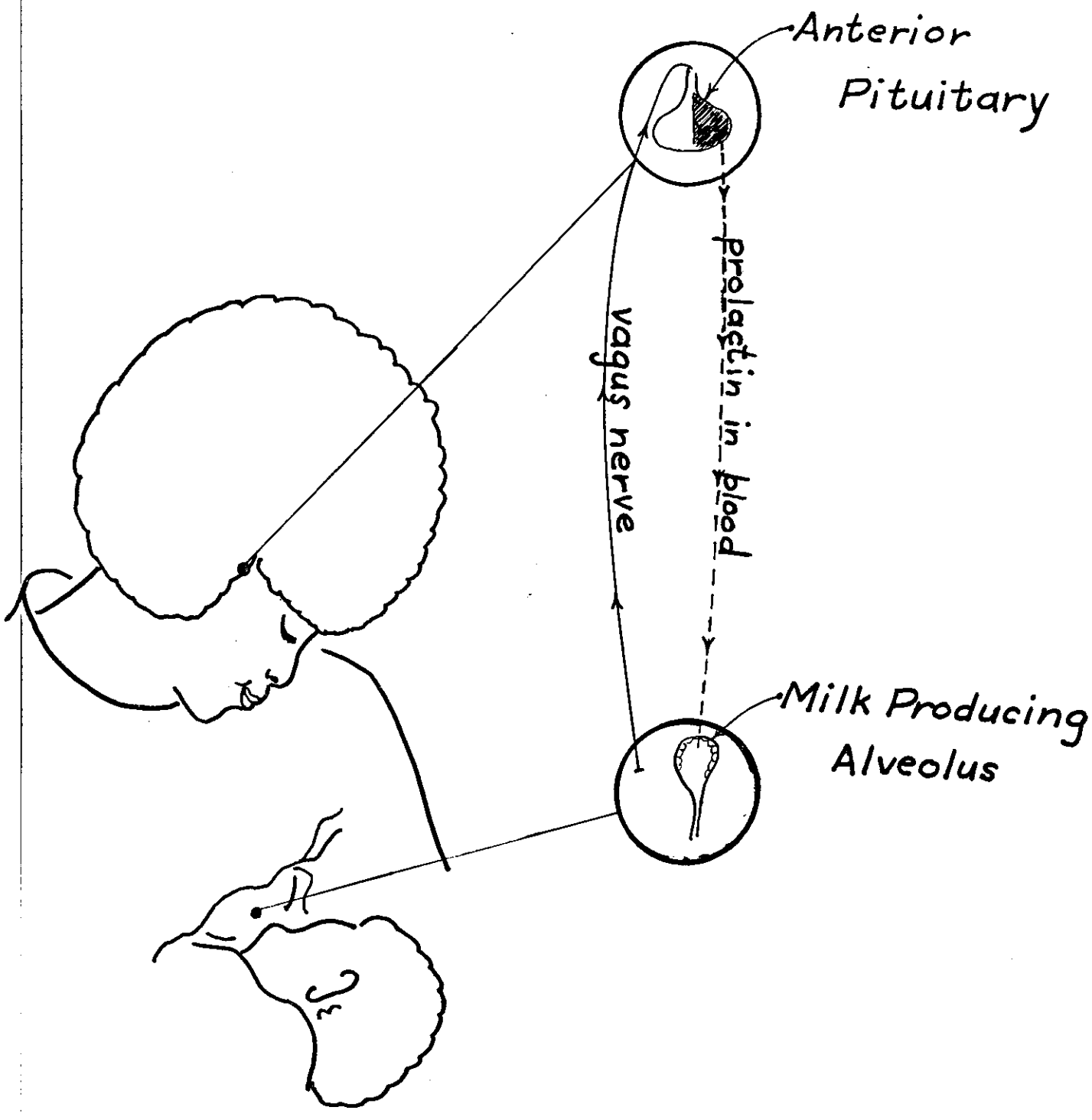

FIGURE 1 PROLACTIN REFLEX
(see text for explanation)

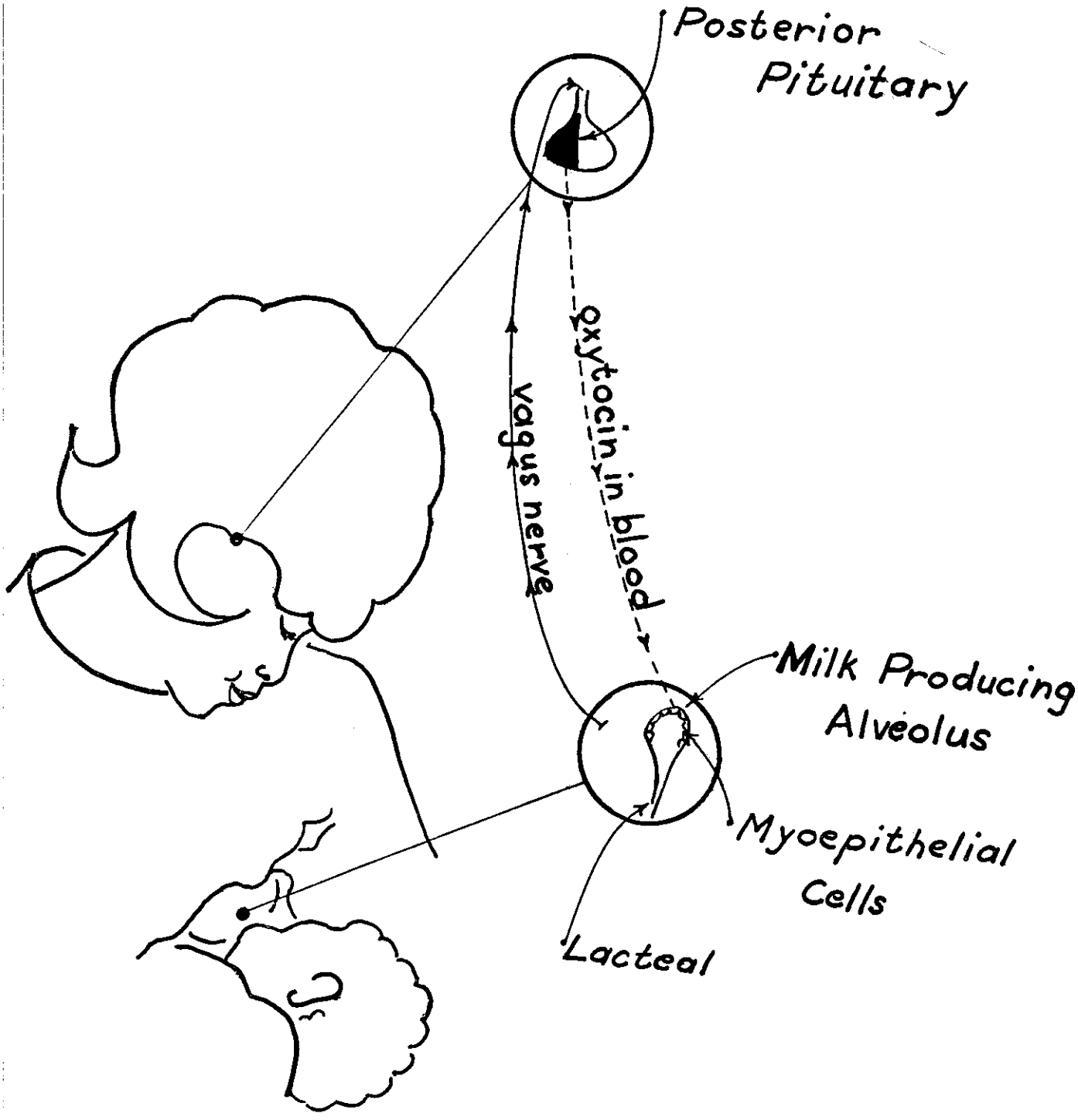

FIGURE 2: LET-DOWN REFLEX
(see text for explanation)

(and perhaps its greater sweetness) and the different "sign stimulus" of the bottle nipple interfere with the normal breast feeding process.(3)

Maternity Wards - Help or Hindrance?

With the available scientific knowledge concerning lactation and breast feeding, it is instructive to examine the situation of the young, inexperienced urbanized mother in her usual puerperal environment - that is, the maternity ward. As opposed to her traditional village sister, the young, inexperienced urbanized mother may never have seen a baby breast-fed or have had very little opportunity to do so. On the contrary, she may have heard a great deal concerning problems of unsuccessful breast feeding, such as cracked nipples, engorgement and breast abscess. She will have been bombarded with advertisments in women's magazines, the daily press, radio and TV concerning the excellence of proprietary milks. In some cases, anywhere, and in the majority in more affluent parts of the world, she can also afford these processed cow's milk preparations and knows that these offer a practical alternative which will permit her to return to wider social engagements or to "town-type" work, either to supplement the family income or to fill her fashionable liberated role. She will also have been reached by the misinformation of the modern folklore concerning breast feeding's effect on "the figure".

She may, therefore, not be able to breast feed because she has to work, or she may not wish to do so because the whole process is not "with it", or is "animal-like". Nevertheless, a large number of mothers wish to breast feed but are unsuccessful. The question is why?

It is obvious that a vigorous full-term baby with all the reflexes is needed, and also a healthy, well-fed mother, although the latter is less imperative than often thought. Poorly nourished, sickly peasant women all over the world lactate surprisingly well, but to their own detriment. By the time

they have reached the fourth or fifth pregnancy-lactation cycle, they are prematurely aged, nutritionally depleted and likely to have a high mortality. In other words, it is necessary to emphasize the feeding of pregnant and lactating mothers in relation to breast feeding, using realistic, economical diets based on local food mixtures.

However, there is no doubt that the main factor responsible for success or failure is the let-down reflex, which, it will be recalled, is principally related to sucking stimulus at the breast and lack of anxiety or, more positively, confidence.

The modern maternity ward usually helps not at all in any of these matters, although lip-service may be paid to "breast is best". In fact, the newborn baby, unless very sick, falls between two specialities; he sits on the frontier between obstetrics and paediatrics, and, too often, is nobody's concern.

The young inexperienced urbanized mother has no knowledge concerning breast feeding, nor, usually, have the medical or nursing staff, although they are meant to be the experts. The crowded regimented unprivate atmosphere of the usual maternity ward means that the mother has limited time to receive individual advice and guidance, even if anyone really knows what to advise. Her baby is often separated from her and put in the nursery - an extraordinary and inhuman travesty of obvious physiological and psychological needs. Not surprisingly, the mother is anxious, apprehensive and uncertain. Her let-down reflex is likely to be inhibited, so that the baby receives little milk and it is dissatisfied. He protests by crying and thus further increases the mother's apprehension. (Figure 3) The over-worked nurse or midwife galloping around the ward makes the instant diagnosis of "not enough milk" or "milk doesn't suit the baby". The recipe is either complete removal to artificial feeding,

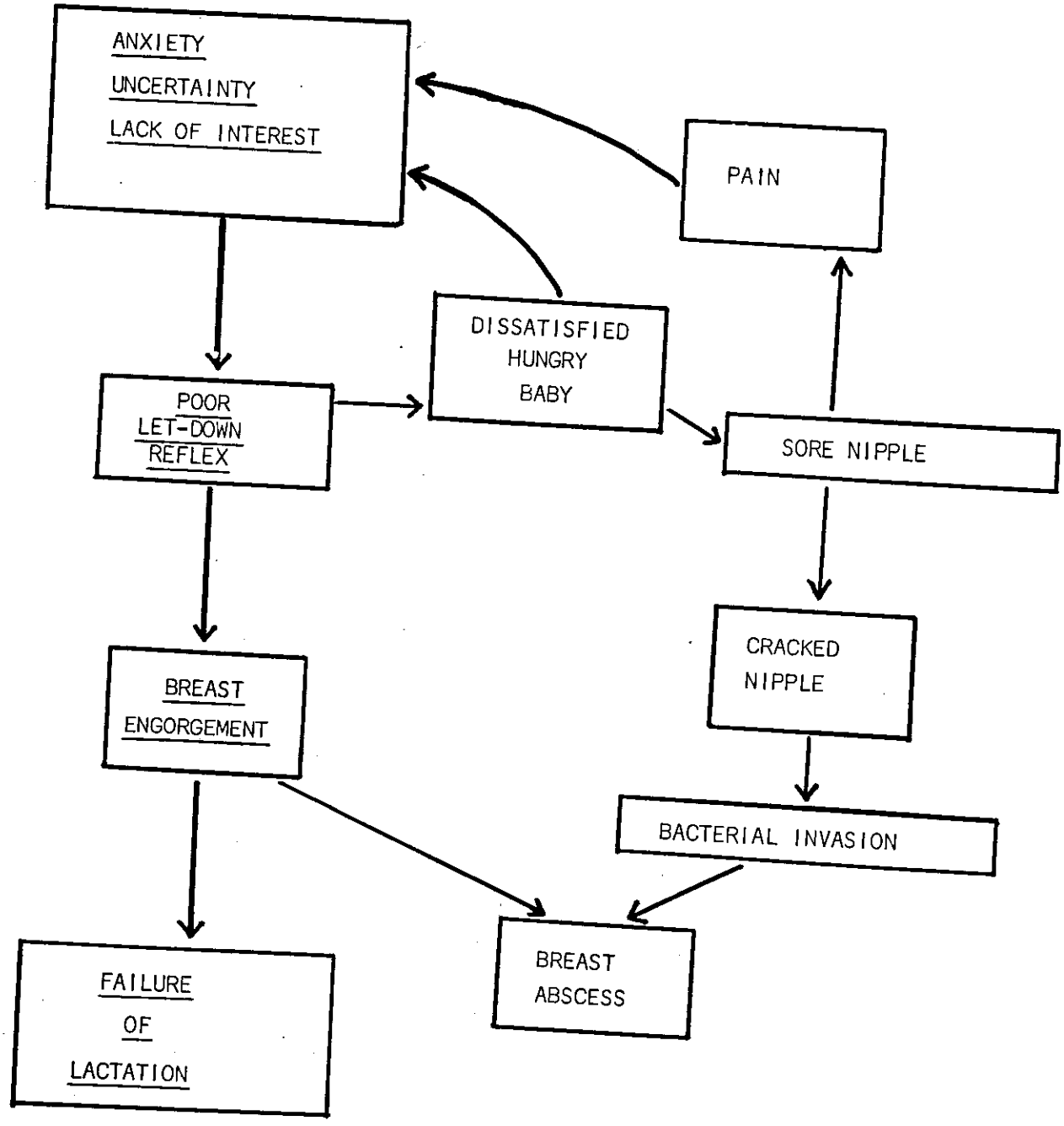

FIGURE 3: THE EFFECT OF ANXIETY ON LACTATION

or, at best, a "temporary" complementary bottle feed, which increases the mother's lack of confidence and, for reasons mentioned previously, often is the worst possible sabotage of the vigorous sucking needed for successful lactation and breast feeding.

Needs

To improve the situation with regard to breast feeding, there are three needs in the health field. Firstly, medical and nursing staff need to know the rudiments concerning the psycho-physiology of breast feeding, and this needs inclusion in their training.(1)

Secondly, maternity wards need to be re-thought as regards structure, functioning and procedures.

Thirdly, public health authorities and nutritionists need to realize that breast feeding is, for nutritional and emotional reasons, a highly important component of biologically time-tested rearing of human babies.

These needs are important anywhere, but are a top priority in so-called less developed countries where alternatives to develop breast feeding are just not possible economically or hygienically, and artificial feeding is a major cause of the rising incidence of failure to thrive and the diarrhoea-marasmus syndrome, especially in urban areas.

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NUTRITION NEWS AND OPINION FROM THE CARIBBEAN

CARIBBEAN FISH MARKET ATTRACTS INVESTMENTS

From League For International Food Education Newsletter, October 1970, itself an excerpt from the UNDP Pre-Investment News of September 1970

Investments worth at least an initial $17 million for developing Caribbean fisheries -- including trawlers, shore facilities and marketing -- are either underway or at present being considered.

Since 1965, the United Nations Development Programme (UNDP) has been surveying the Caribbean's fish potential, with three of its own research vessels now in the area. Valuable fish resources have been disclosed; particularly along the Guyana shelf. Shrimp trawling and shark line-fishing also could be expanded.

The Caribbean nations now import about three-quarters of their fish needs. As the Trinidad Guardian wrote: "Saltfish and salmon still come in from Canada, and we get canned kippers from Europe. Even canned shrimps from Japan find a market in the Caribbean, from where they quite likely would have originated."

Experts from the Food and Agriculture Organisation (FAO) who are carrying out the project estimated recently that if the Caribbean nations keep their 1975 fish imports down to the 1967 level they will save nearly $30 million in foreign spending. Rapid growth of local production is essential.

Emphasizing this point at a recent fisheries officers training course in Barbados, the UNDP-FAO project manager, John Dibbs, an Australian, said: "The production locally of high protein foods (such as fish) for local consumption can be as valuable to the economies of the Caribbean region nations as an agricultural export crop."

HEALTH PLANNING SECTION SET UP IN MINISTRY

From the Daily Gleaner, Kingston, Jamaica, February 19, 1971

A Health Planning Section has been set up in the Ministry of Health "In order to determine more fully the degree of priorities in the Health Services". Giving reasons for this development yesterday, the Minister of Health, the Hon. Dr. Herbert Eldemire, said that over the years it had become more and more apparent that there was "pressing need to investigate the aims, needs and methods of the medical-care system more thoroughly". Decisions were usually made on the basis of demand rather than need, he said, but what was needed was an assessment of the optimal uses to which the services could be put, and of priorities.

Dr. Eldemire was addressing the opening of the three-day Government Medical Officers Conference in the Medical Lecture Theatre at the University of the West Indies. One reason Dr. Eldemire gave for constant assessment of the quality of medical care being provided was that "medical care is becoming increasingly expensive", and one could only hope increasingly beneficial. He said the cost of the health services in Jamaica had trebled over the last 6 years. The budgetary provision six years ago had been $7 million and in 1970 it was over $25 million. "Over the last three years the proportion of the Gross National Budget spent on our health services has increased from 8.14 per cent in 1967 to 16.14 per cent in 1970. But we realise that the more advanced the society becomes, the greater are the demands for up-to-date, sophisticated medical services both in the preventive and curative areas".

The Health Minister went on to list a number of developments taking place in the Ministry. A Nutrition Unit was working in collaboration with other agencies to produce a high-calorie, high-protein weaning diet, based on locally available foodstuffs. A pilot study, being carried out in an eastern parish, was yielding valuable results and, it was hoped, would form the base of a model maternal and child health programme for the island.

FAO TO HELP WITH STATISTICS AND MARKETING EFFORTS
From the Daily Gleaner, January 13, 1971

Three areas of major need in which the Food and Agriculture Organization is presently endeavouring to offer assistance to the English-speaking Caribbean have been named by the Assistant Director-General of the FAO and representative for Latin America, Mr. Juan Felipe Yriart. These are the provision of the services of a qualified agricultural statistician to compile data required for the efficient operation of the Agricultural Marketing Protocol and to form the basis for co-ordination of the various statistical systems in use in the different countries; provision of the services of a marketing expert to assist in this field and assistance in the creation in association with the UN and ECLA of a multi-disciplinary task force to work on regional development including, among other things, the rationalisation of regional agriculture.

Mr. Yriart, who was delivering the main address at the Consultation on Agricultural Development Problems in the Caribbean Region at the Sheraton-Kingston Hotel yesterday, said that the assistance in these areas was in addition to the several projects in which FAO was providing help to the CARIFTA countries.

He told delegates: "We in FAO are most appreciative of the steps that have already been taken in the Region, especially with regard to CARIFTA. We welcome the opportunity of working with you in programmes of agricultural development and diversification and towards your goals of intra-regional rationalisation of agriculture and increased trade both within and without the Caribbean. In regard to the latter, we would encourage you to look towards Latin America and the possibilities of integrating with other trading blocks such as the Andean Pact and the Central American Common Market, wherein you would undoubtedly be able to widen your area of complementarity.

"Permit me now to briefly list some of the more pressing problems facing the Region and your individual countries regarding which FAO is already co-operating with Governments.

"In a recent report the Secretariat of CARIFTA has stated that one of the more formidable obstacles to regional integration as well as the development of secondary economy activities is related to the inadequacy of statistical data. Much of the data required for the efficient operation of the Agricultural Marketing Protocol is not available. In order to assist the countries and CARIFTA in this matter FAO is disposed to make available the services of a qualified agricultural statistician and has so informed the Secretariat of CARIFTA in this regard.

"In December 1969, FAO sponsored a Conference on Marketing for the English-Speaking Caribbean Area at St. Vincent. As a result of this Conference, FAO is prepared to provide the services of a marketing expert to assist in this general field. The United Nations, and more specifically the Economic Commission for Latin America, is currently preparing to assist the CARIFTA Region with a multidisciplinary task-force to work on regional development including, among other things, the rationalisation of regional agriculture. We in FAO have already been in conversations with the CARIFTA Secretariat and ECLA for the purpose of determining how best we might be able to join in and participate in this task-force. It would appear to me that we have a very definite role and contribution to play in this matter. Furthermore, we appreciate the opportunity to work together with other agencies within the UN family, especially on such worthwhile and important projects such as this.

"FAO is proud of the on-going programme of the Eastern Caribbean Institute of Agriculture and Forestry located in Trinidad. We feel that the work coming out of this Institute will have valuable implications for many of the territories of the region. Together with the Pan American Health Organization, FAO is also actively collaborating with the Caribbean Food and Nutrition Institute with headquarters in Kingston. We feel, as you must, that the nutritional aspects of planning and development cannot be overlooked and this must be considered in any programme of regional rationalisation.

"There is the on-going FAO/UNDP Regional Fisheries Project located in Barbados which will soon be supplying valuable information necessary for the development of a progressive and viable fisheries industry and which besides becoming an important factor in inter-regional trade and an earner as well as a saver of foreign exchange, can also serve the invaluable function of helping to close the protein gap which exists in some of the countries. Lastly, FAO has also been lending support to the Caribbean Plant Protection Commission in the preparation of model plant quarantine legislation; and, in co-operation with PAHO and WHO is prepared to assist CARIFTA in drafting animal quarantine legislation.

"Then, of course, there are the numerous country programmes of which you are familiar and which will undoubtedly be important not only for the country in which they are located but for the region as a whole. For example, FAO has just completed an analysis of the agricultural situation of Trinidad and Tobago in relation to its Third Five-Year Plan and the Agricultural Marketing Protocol of CARIFTA. Thus, I repeat, FAO is indeed interested in this

area and we in the Regional Office feel a common bond of sympathy and understanding with the Caribbean countries."

GRENADA AGRICULTURAL BANK PLANS MORE ACTIVE ROLE IN FOOD DRIVE

From the Trinidad Guardian, October 29, 1970

In the report of the Grenada Agricultural Bank for the year ending 1969 reference is made to the imbalance in loans made for planting food and vegetable crops as compared to that for nutmegs and cocoa. Greater emphasis has to be directed towards the planting of vegetable crops, and the year 1970 would see the Bank playing a more active role in the drive to more food and vegetable crop cultivation. It has been recognised, the report states, that the needs for development override legal difficulties such as obtaining adequate security for the issue of loans.

*Populations of Caribbean and Other Countries participating in the 1970 Census showing absolute increases and annual rates of increase between 1946-1960 and 1960-1970***

Country	Census Population			Absolute Annual Increase		% Annual Rate of Increase	
	1946	1960	1970 Provisional	1946 - 1960	1960 - 1970	1946 - 1960	1960 - 1970
Jamaica*	1,237,000	1,609,800	1,861,400	21,900	25,200	1.56	1.46
Trinidad & Tobago	558,000	828,000	945,200	19,300	11,700	2.86	1.33
Guyana	369,700	560,400	714,000	13,600	15,400	3.01	2.45
Barbados	192,800	232,300	238,100	2,800	580	1.34	0.26
British Honduras	59,200	90,500	119,600	2,200	2,900	3.08	2.83
St. Lucia	70,100	86,100	101,100	1,100	1,500	1.48	1.62
Grenada	72,400	88,700	94,500	1,200	600	1.46	0.64
St. Vincent	61,600	79,900	89,100	1,300	900	1.88	1.09
Dominica	47,600	59,900	70,300	900	1,000	1.66	1.61
Bermuda	37,400	42,600	52,700	400	1,000	1.32	2.13
St. Kitts/Nevis#	41,200	49,800	45,800	600	- 400	1.36	-0.83
Montserrat	14,300	12,200	12,300	- 100	10	-1.13	0.08
Cayman Islands	6,700	7,600	10,700	60	300	0.90	3.48
British Virgin Islands	6,500	7,900	10,500	100	300	1.40	2.88
Turks & Caicos Islands	6,100	5,700	5,500	- 30	- 20	-0.48	-0.35

*Jamaica's Census was taken in 1943

#Anguilla's figures excluded from St. Kitts/Nevis Total

**As published in the Daily Gleaner, Kingston, February 1971, originating from the Department of Sociology, UWI, Mona.

AGRICULTURE, FOOD AND NUTRITION IN DEVELOPING COUNTRIES*

by

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'What men eat and drink is shaped not only by cooking techniques and equipment but by agriculture and animal husbandry, by the availability of water and fuel, by knowledge of botany, biology and the ecology of plants, insects and animals. Success or failure in the quest for food has dictated population growth and urban development as well as economic, social and political theory. And the quest itself has been the catalyst of exploration, trade, technological development and, not infrequently, war and dominion.'

This quotation from a book recently published in England (Tannahill 1968) indicates the many interrelated factors and disciplines which have to be shaped together when planning for man's food requirements.

Success or failure in meeting man's needs for food and nutrients is one of the primary features which distinguish between the so-called developing and more developed countries. As long as 3,000 years ago the Indian, Chandogya, maintained that: 'Food is better than power. If a man abstain from food for ten days, though he live, he would not be able to see, hear, perceive, think, act and understand. But when he obtains food he is able to see, hear, perceive, think, act and understand' (Tannahill 1968). Sydney Smith, 150 years ago in England, was 'convinced that character, talents, virtues and qualities are powerfully affected by beef, mutton, pie crust and rich soups' (Tannahill 1968). The Indian's doubts about the availability of food from day to day and

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This paper was a contribution to a Symposium held on 7 May 1970 at the Royal Society of Medicine, London, on Problems of World Medicine. It was first published in the Proceedings of The Royal Society of Medicine, Nov. 1970, v.63, pp. 1177-1181. The kind permission of the Honorary Editors and the author to reproduce the article is gratefully acknowledged.

the Englishman's unquestioning acceptance of a rich diet epitomize one of the major continuing differences between developing and developed countries.

In England, in the days of Sydney Smith, men of his kind probably still had to take sufficient exercise (Mann *et al.* 1955) to maintain a reasonable blood cholesterol level; in the classification developed by Passmore (1964) they would be categorized *homo sportivus*. Nowadays such men (and women) are likely to spend the time which Sydney Smith had to devote to exercise, in driving around in automobiles, flying in aircraft, or sitting in front of television screens. They have become *homo sedentarius* whose food supplies and food consumption exceed his requirements, who becomes obese and who is, as likely as not, headed towards the skills of eminent cardiologists or a premature grave. Even more disturbing in the developed countries is the probability that *homo laborans*, due to technological advances in industry, a shorter and shorter working week, and a lack of inclination or absence of opportunity to become *homo sportivus*, will also degenerate, if he has not done so already, into *homo sedentarius*. In the developing countries it is as yet only a small percentage of the population at the top of the socio-economic scale who could yet be categorized *homo sedentarius*. However, FAO's main interest is with the developing countries. In co-operation with the World Food Programme FAO is successfully implementing projects which transfer food surpluses built up in the more developed countries to the developing countries to assist them in many different aspects of socio-economic development.

Apart from their poverty (except for those with large revenues derived from oil) a common characteristic of developing countries is their dependence on agriculture. About 70% of the people in the developing world depend upon agriculture for their livelihood. Agriculture accounts for more than 80% of their exports. These agricultural exports are not all foodstuffs and include

forest products, wool, hides and skins and so on.

FAO's thinking about the future of the developing countries is contained in its Indicative World Plan for Agricultural Development (IWP) which analyses the main issues which will be facing agriculture in the 1970s and 1980s, and suggests the most effective ways in which they can be resolved by national and international action (Food and Agriculture Organization 1969). It provides data for production, consumption and trade objectives projected to the years 1975 and 1985 based on the years 1962-4 and on trends in food production and consumption established in the 1950s. The IWP has been prepared by a group of economists, agronomists and nutritionists working closely together and drawing on demographic and socio-economic data provided by the United Nations. Through the IWP, FAO makes proposals to governments on the development of land and water resources, the use of improved agricultural technology in food production and on changes in institutions which directly affect the agricultural economy of the developing countries. By far the greater part of agricultural production in developing regions consists of food for consumption within the region where it is produced. Serious doubts have existed in many quarters on the ability of developing countries to produce enough food to keep pace with rising population and economic demand. It is the IWP conclusions on this aspect of the problem, rather than the projections and assumptions on which they are based, that are considered in this paper.

What was the situation in 1962? The data shown in Table I are derived from careful scrutiny of national food balance sheets covering about 80% of the world's population. It could well be said from these figures that the situation does not appear to be too bad in respect of calories and protein. The gaps between supply and requirement, which are not more than about 10% in Africa south of the Sahara, the Near East and North Africa and the Far East,

might well be compensated by physiological adaptation without too much loss in working efficiency or health. If the levels of requirement set by FAO and WHO (Food and Agriculture Organization 1957, 1965) were to be lowered only a little it might well be that supplies would meet *per caput* requirements in all regions. However, the picture given by Table I is not as rosy as it might appear. The peoples of all the developing regions, whether their diets are adequate or not in energy and protein, are increasing in numbers at rates of up to 3% per annum in spite of child mortality rates which may be as high as 400 per 1,000 between birth and attaining the age of 5 years. And what a waste of energy and protein such mortality rates imply! The prevalence of protein-calorie malnutrition is a serious public health problem in all the developing regions in spite of the reasonably adequate supplies at *per caput* level indicated in Table I.

Table I: Energy and protein supplies (S) and requirements (R) by regions in base years (1962-64) at per caput level (Food and Agriculture Organization 1969)

	Calories (per day)			Protein* (g/day)		
Region	S	R	S/R (%)	S+	R	S/R (%)
North America	3,090	2,710	114	91(64)	74	123
Oceania	3,200	2,540	126	93(62)	73	127
Eastern Europe	3,020	2,570	118	94(34)		
Latin America	2,600	2,380	109	68(25)	65	105
Africa south of Sahara	2,130	2,240	95	58 (9)	63	91
Near East and North Africa	2,140	2,340	91	64(13)	64	100
Asia and Far East	1,990	2,210	90	51 (7)	58	88

*practical allowance

+total proteins, with animal sources shown in parentheses

When food consumption data rather than food balance sheet statistics are considered a different picture emerges which shows that the principal factors concerned in the epidemiology of malnutrition in developing countries are: (1) Inequality of distribution of available food within the home. (2) Inequality of distribution between socio-economic groups. (3) The bulkiness of diets based on cereals, starchy roots and tubers. (4) The extremely high incidence and prevalence of infectious diseases and parasitic infestations. I have observed subjects who were in nitrogen equilibrium on a trial diet go into a negative nitrogen balance of 3-4 g (20-25 g of protein) within 24 hours of developing an attack of malaria. Table II shows that, even when adult Nigerian peasant farmers are eating diets which provide between 100% and 125% of their energy needs, the diets consumed by their 4- to 6-year-old children cover only 70% to 90% of their requirements. The same diets provide these peasant farmers and their young children with ample amounts of protein provided they are based on the cereals (sorghum, pennisetum and eleusine) grown in the savannah and montane areas. However, in the rain forest and derived savannah areas, where the staple foods are yams (*Dioscorea, Xanthosoma, Colochasia*) and cassava (*Manihot*), the diets consumed supply amounts of protein which fall far short of the 'safe practical allowance' for both young children and adults and only just reach the 'minimum requirement' for young children. Factors which limit the consumption of food by young children in these parts of the world are: (1) Ignorance on the part of parents of the relatively high nutritional needs of children compared with those of adults. (2) The 'two large meals a day' dietary pattern. (3) The physical bulk of cereal and root-based diets. In cereal-consuming areas children of about 2 years of age and upwards could consume enough of the family diet if it was divided into 4 or 5 meals. But this is not the customary family pattern of living in developing countries.

Table II: Ratio of energy and protein intakes (I) to requirements (R) of children aged 4-6 years compared with those of adults in same families (Nigerian peasant farmers) (Nicol 1959a, b)

Vegetation zone	Calories per day		Protein (g/day)			
	I/R (%) Age 4-6	Adult	I/SPA (%) Age 4-6	Adults	I/MR (%) Age 4-6	Adults
Sahel savannah	87	128	220	240	330	360
Sudan savannah	95	110	190	200	280	300
Guinea savannah	70	115	200	250	300	370
Montane	75	100	170	200	250	300
Rain forest	77	95	70	85	105	130
Derived savannah	70	87	70	76	105	110

SPA, safe practical allowance as defined by FAO/WHO Expert Committee on Protein Requirements, 1957

MR, minimum requirement as defined by same Committee

Yam and cassava based diets, even if split into 4 or 5 meals a day, cannot be ingested by children up to 6 years of age in large enough amounts to meet their calorie and protein requirements. In such areas a radical alteration of food production is needed, involving a change from staple root crops to staple cereals (rice or maize) and legumes and special foods must be developed for infants and young children.

The beneficial effect on nutritional intake of increased purchasing power at rural and small-town community level is well illustrated in Table III. At world level, it is surprising to find that the percentage of calories derived from protein increases very slightly between countries having a Gross Domestic Product (GDP) *per caput* per year equivalent to US $50 or less and those with a GDP *per caput* of US $2,600 or more. However, the quality of this protein improves greatly throughout this wide range of income on account of the

increasing amounts of animal foods consumed. The consumption of separated and animal fats increases, thus concentrating the calories and making the diets less bulky and more suitable for meeting the nutritional requirements of small children. Nevertheless, as stated earlier, *homo sapiens*, adult or adolescent, will be aware of the dangers associated with rising income and an increasing consumption of saturated fats and will direct his energies and increasing leisure towards becoming *homo sportivus* rather than *homo sedentarius*.

Table III: Nutrient intakes per day of different socio-economic groups in Nigeria (Nicol 1959a)

	Niger delta (freshwater and mangrove swamp)		Bida area (Guinea savannah)	
	Traders	Fishermen	Native Authority officials	Farmers
Calories	3,000	2,200	3,200	2,600
Protein (g):				
Animal	50	68	45	5
Total	84	80	90	75
Fat (g)	86	39	50	44
Vitamin A (i.u.)*	9,000	5,700	8,000	5,000
Thiamine (mg)	1.02	0.30	3.60	3.20
Riboflavine (mg)	1.37	0.68	1.20	0.76
Ascorbic acid (mg)	71	40	100	98
Calcium (g)	1.3	2.9	1.3	0.5
Iron (mg)	21	24	56	40

*1 I.u. preformed vitamin A taken as equivalent of 3 i.u. of vitamin A as carotene

How does the IWP predict the future demand for food in the developing regions with which it is mainly concerned? It is tempting for the nutritionist to conceive a diet for the horizon year so compounded as to satisfy all physiological requirements. He has means of estimating requirements in terms of energy and nutrients but there is an infinite variety of food combinations that could supply them, depending upon ecological, economic and other factors.

The economist, on the other hand, may be tempted to propose a diet that satisfies physiological requirements at least cost, using linear programming to select the various food components of the diet as is done by producers of poultry and livestock feeds. But man eats foods and not nutrients and his receptivity of foods is largely determined by the psycho-sociological aspects of eating. Such aspects cannot be ignored. Therefore the IWP is concerned primarily with projecting the effective economic demand for food on a community basis. Food production patterns are then oriented to meet this increasing economic demand in such a way as to make the maximum possible improvement in the patterns of nutrients ingested. This approach may seem cold-blooded but it is the market demand in relation to supply that determines (a) whether prices will rise - causing a food crisis with greatest hardship among the lower income groups in the urban areas - or (b) whether food surpluses will be produced - causing a crisis for governments and farmers.

What does the IWP predict the future demand for food will be during the projection period (1962 to 1985) in the developing regions? Table IV shows that the total increase in demand will amount to 140% - in other words overall food supplies should increase roughly two and one-half times between 1962 and 1985. Of this increase in demand for food 70% will result simply from increase in population and about 30% will result from increased *per caput* income.

How far will food supplies be able to keep pace with this increase in demand? Provided IWP rates of increase in GDP and food production can be achieved and that population increase does not rise above the United Nations predictions used in the IWP, food supplies should be able to cover energy and protein requirements at *per caput* level by 1985 but they will not quite meet the expected economic demand (Table V). Any measurable reduction in the rate of population increase during this period due to family planning activities

will be an unexpected but welcome bonus. These encouraging projections of food production and utilization give cautious recognition to the advantages which it is hoped will be provided by the new high yielding varieties of cereals and to work being carried out by plant breeders to maintain and improve the quantity and quality of the protein in those varieties. It also recognizes the possibility of proteins derived from single-cell organisms, cultured on paraffinic hydrocarbon or carbohydrate residues from petrol or sugar refining, being used as a contribution to animal feeds. Thus the IWP food-production projections up to 1985 are mainly based on the development of the conventional food resources, namely plants, animals and fish, processed where necessary using conventional techniques. However, FAO is following very closely the possibilities of supplementing those conventional sources by other approaches to human feeding which may need to be employed in future, e.g. leaf protein, fish protein concentrate, synthetic amino-acid fortification of staple foods and the use of single-cell protein for human feeding as opposed to its use for animal feeds.

Table IV: Projected increase (%) in demand for food by developing regions, 1962-85. Level at base period = 100 (Food and Agriculture Organization 1969)

Region	Total increase	Increase due to growth in		Proportion of increase due to	
		Population	Income*	Population	Income*
Asia and Far East	154	78	43	64	36
Near East and North Africa	143	87	30	74	26
Africa south of Sahara	122	80	24	77	23
Latin America	120	94	13	88	12

*Income per head

Table V: Energy and protein intakes during the projected period (1962-85) in developing countries (Food and Agriculture Organization 1969)

	Relative to nutritional requirements (%)		Relative to projected economic demand (%)	
	Calories	Protein	Calories	Protein
1962	92	91		
1975	102	99	99	97
1985	110	106	97	94

But the encouraging projections given in Table V are at *per caput* level and because of inequalities of distribution, from whatever cause, a certain fraction of the world's population will remain undernourished. It is foreseen that distributional inequities within a country will diminish in regard to calories as food supplies increase but, because of the close correlation between available animal protein supplies and income, they will be accentuated in regard to protein.

The vulnerability of the young child in developing countries to inequities of food distribution and the resulting prevalence of protein-calorie malnutrition has been mentioned earlier. Hence the need to develop formulated infant foods for the prematurely weaned infant and for the preschool-age child. Such foods must provide high-quality protein, properly balanced with sources of energy suitably concentrated into a bulk easily ingested by those age groups. They should be enriched with enough vitamins and minerals to meet all physiological needs. As such foods are formulated so as to meet all the nutritional needs of small children they are one of the vehicles most suited to fortification with synthetic amino acids. FAO, WHO and UNICEF are vigorously pursuing a programme for the production of such foods with the governments and industries of developing countries.

In conclusion, if the targets proposed by the IWP for 1985 are met, calorie and protein supplies and those of most other nutrients will cover physiological requirements. However, unless a serious effort is made by governments to reduce the inequalities of distribution within countries, the problem of undernourishment and malnutrition will not be entirely solved. There will remain some black spots on the map of the world, but assuming the IWP targets are reached, international efforts could be narrowed down and effective food aid could be given to a few countries containing only a small fraction of the world's population.

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GENERAL NUTRITION NEWS AND OPINION

SOME RECOMMENDATIONS BY A PUGWASH SYMPOSIUM CONCERNING COMMUNITY NUTRITION PROGRAMMES

From Pugwash Newsletter, July 1970 (Volume 8, No. 1)

A Pugwash Symposium was held in Germany in May last on the subject of "Overcoming Protein Malnutrition In Developing Countries". The recommendations included a section on Community Nutrition Programmes, which we reproduce here:

In order to overcome nutrition deprivation, action on the part of governments and institutions is not enough. It is necessary that a spark of individual, local initiative be there.

The efforts of selected community nutrition programmes should be part of the action to attain some minimum level of freedom from deprivation. Individuals from several disciplines (psychology, sociology, anthropology, education, home economics) should join the already existing structures of the community nutrition programmes in these efforts.

In all age groups and through all health services, nutrition education must be a major concern, in co-ordination with parallel endeavours through schools, agricultural extension and community development.

1. *Services for Mothers and Children*

With limited funds and other resources, priority needs to be given to nutritionally vulnerable groups - infants and young children, and pregnant and lactating mothers.

MCH services based on newly developed scientific principles, adapted to the local needs, built on existing services, and employing appropriately trained auxiliaries, aides and volunteers are the spearhead of these activities, co-ordinated with associated educational, food production and village improvement activities by community development, agricultural extension and education.

Preventive programmes will vary with the local aetiology, but will usually be concerned with young children, especially in the first two years of life, and with pregnant women, and will usually include *nutrition education* (breast feeding; vegetable multimixes; consumer education; supplementary processed food issued), *rehabilitation and treatment of malnutrition* (including nutrition rehabilitation units), *nutrition supervision* (weighing), *prevention of infections* (education, immunization), *early treatment of infections*, *child spacing* (family planning), *psychological welfare* (mothers, children) and *increased local food production*.

We recommend that adaptive MCH services form an integral part of any community programme to overcome protein malnutrition.

2. *Nutrition Education*

Three aspects of nutrition education deserve special mention:

(a) *Home produced village weaning mixtures.* There is a great need for guidance in the production of scientifically blended village weaning mixtures that are nutritionally balanced (as regards protein, calories and other nutrients), digestible, locally available at low cost, and culturally and culinarily feasible.

It is recommended:-

(i) that attention be given to the development of such recipes, ultimately given in terms of domestic household measures;

(ii) that low-cost village level equipment be developed to facilitate the preparation of such mixtures (e.g. hand mills);

(iii) that adequate liaison be maintained between different extension agencies and between those responsible for agricultural innovations (e.g. newer plant varieties).

(b) *Human milk.* There has been an increasingly rapid decline in lactation performance in peri-urban regions in recent decades in many less developed regions, with a rise in incidence of malnutrition (especially marasmus and diarrhoeal disease) in the early months of life with a high mortality. In view of the high cost of substitutes, poor home hygiene and low levels of maternal education, further declines in lactation will lead inevitably to still higher rates of infantile malnutrition.

The interaction between mother and child constitutes a psychological unit of great importance for the physiological and psychological development of the infant. The preservation of the normality of such a unit is probably the most important factor in precluding deprivation, including nutrition deprivation. Family planning will contribute simultaneously to the nutritional and psychological well being of infants and to the physical and mental health of mothers. These programmes should, therefore, be integrated with community nutrition programmes.

We recommend:

(i) that the unique nutritional and protective properties of human milk for human infants needs endorsement, especially in less developed countries;

(ii) that human milk be considered as a major natural food resource by nutritionists, food planners and health authorities, and its production increased as a national asset;

(iii) that the economic consequences of lactation failure be appreciated, not only in relation to the treatment of resulting malnutrition, but also in relation to the need to produce, import and pay for large quantities of breast milk substitute;

(iv) that studies be undertaken into the social and psychological aetiology of cessation or disruption of lactation;

(v) that programmes to promote lactation, especially for the first 6-12 months of life, based on these studies, be given high priority by nutritionists, and health workers, including training programmes for their staff, and the development of branches of La Leche League;

(vi) that programmes of family planning be instituted soon after birth, preferably not using hormonal tablets interfering with lactation.

(c) *Processed Infant Foods.* The infant foods, including processed milks and supplementary foods, introduced by Western food industry into less developed, mainly tropical regions, are having a serious ill-effect especially in urban situations on the nutrition of young children ("commerciogenic malnutrition") because of a "displacement effect" on breast feeding and because of the impossibility of their being used adequately in view of their high cost and because of poor home hygiene.

The need of processed infant foods for urban and peri-urban communities and for government nutritional intervention programmes is pressing in many countries. The programme of the FAO, WHO and UNICEF for development, manufacture, promotion and distribution of infant foods, based on essentially local protein resources, might be expanded in areas where pre-requisites for such an expansion are fulfilled.

Commercialization of infant foods, such as processed milk foods, weaning foods and supplementary foods in developing countries must include proper nutrition communication/education of target populations, in order to avoid "displacement effects" on breast feeding and such other sound, already existing practices. It must be ensured that commercial efforts in this area do not depend on high-cost imported infant foods. The skills of professional communicators in motivational tasks should be harnessed to create the right kind of nutrition awareness, to accompany product promotion.

Care should be exercized to avoid the excessive use of scarce protein raw materials in the commercialization of protein foods which cannot possibly reach low-income groups. The concept of supplementation rather than substitution should be promoted.

We recommend:

(i) that the ill-consequence of unrestricted importation and home production of nutritionally inadequate high cost infant foods be brought to the attention of all concerned at governmental and international levels, and suitable regulations considered, wherever such situations exist;

(ii) that the infant food industry and paediatric nutritionists from less developed regions meet to explore ways to use modern technology for mutual profit and for nutritional benefit, especially by the local production of nutritionally balanced low cost infant foods for urban communities and institutional feeding.

IRON-FORTIFIED FORMULAS

Statement by Committee on Nutrition, American Academy of Pediatrics - taken from a supplement to the Academy's Newsletter, December 15, 1970

In its recent statement on iron,* the Committee on Nutrition emphasized the value of iron-fortified, proprietary milk formulas for the prevention of iron-deficiency anemia of infancy. Despite this recommendation, the most recent marketing information available to the Committee shows that more than 70 percent of the proprietary formulas currently prescribed by physicians do not contain added iron.

The reasons for continuing routine use of formulas not fortified with iron are not entirely clear. One reason may be that some physicians still believe iron additives increase the incidence of feeding problems or gastrointestinal disturbances. There is no documented evidence that this is a significant problem.

The Committee strongly recommends when proprietary formulas are prescribed that iron-supplemented formulas be used routinely as the standard - that is, that this be the rule rather than the exception. There seems to be little justification for continued general use of proprietary formulas not fortified with iron. The Committee is fully aware that only a small percentage of American infants are fed proprietary formulas after 6 months of age. Fluid whole milk (available in bottle or carton) or evaporated milk, both of which contain only trace amounts of iron, are substituted at the time of greatest iron need and highest prevalence of iron-deficiency anemia. The infant's diet is usually deficient in iron, unless other foods are carefully selected to insure adequate iron intake.

Since the major dietary component during infancy is milk, two courses of action should be taken:

1. Pediatricians and other health professionals should engage in a program of public education to convince American mothers to provide their infants with a source of dietary iron. This can be achieved by continuing an iron-fortified formula as long as the infant is bottle fed, and then using the same iron-fortified formula as beverage milk along with the usual solid foods until the infant is at least 12 months of age.

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*Committee on Nutrition: *Iron balance and requirements in infancy.* *Pediatrics, 43:134, 1969*

2. Iron-fortified fluid whole milk or evaporated milk should be made available for infant feeding. Although iron-fortified, fluid whole milk is sold in a few localities, this type of milk has not met with widespread acceptance. This lack of acceptance has been due, in part, to the objectionable color changes seen when the milk is used in cooking or in coffee and to the accelerated rate of development of rancidity in pasteurized whole milk. However, this objection should not deter the use of this type of milk for infant feeding. Considerable public and professional education about the use of iron-fortified milk would be necessary to assure its use.

The knowledge and means to prevent iron deficiency as a significant pediatric problem are available now. As a first step in dealing with this major public health concern, proprietary formulas, when used for infant feeding, should be iron-fortified.

WELFARE ORANGE JUICE IN UNITED KINGDOM
From 'The Lancet', 19 December 1970

In reply to a question on the possible harmful effects on children's teeth of welfare orange juice, Sir Keith Joseph, Secretary of State for Social Services, said that the Department was aware of the danger of the misuse of undiluted fruit syrups, and had decided to place no further contracts for welfare orange juice. It would cease to be available by the end of 1971. Cod-liver oil, which was also supplied under the welfare foods service, was unpalatable to some children, and unpopular with their mothers. Welfare orange juice and cod-liver oil would, therefore, be replaced by a new preparation containing vitamins, A, D, and C to be administered in the form of drops. Expectant and nursing mothers, who were at present entitled to vitamin A and D tablets and orange juice, would in future be given vitamins A, D, and C in single-tablet form. The necessary order would be made early in the new year.

PANIC IN THE PUBLIC
From an Editorial in Clinical Medicine, December 1970 by Wallace E. Herrell

After discussing the ill-effects of tobacco and alcohol and advocating a cool and sensible approach to the problem, the author turns to food and drugs:

I come now to the food and drug panic, our greatest problem in this regard. As a result of unfortunate publicity, we have almost reached the point as a nation where our people are afraid to eat a normal diet.

As a result of the much publicized "stuff" concerning cholesterol, I have seen literally hundreds of individuals who no longer eat eggs and bacon or butter for breakfast for fear that elevated blood cholesterol will develop,

thus predisposing them to early death from arteriosclerosis and heart disease. But these same people often eat sweet rolls and other similar foodstuffs which are very high in sugar and other carbohydrates and which in certain individuals are probably more likely to do harm than the yolk of an egg. Panic!

Witness the recent turmoil concerning monosodium glutamate which has been used in food for centuries. All of this noise about the Chinese restaurant disease has proved to be just so much hogwash and more panic.

Cyclamates

When one speaks of the food and drug panic, it is difficult to ignore the recent fright over the cyclamates. This was a real circus for the press and other media. I wonder how many cancers in the human bladder have resulted from the use of this agent. It is my personal opinion that there have been absolutely none. We have reached a point in time when we must stop giving a drug to rats in doses far in excess of that ever consumed by humans and creating panic if some lesions develop in the animals which have never been seen in man using the normally prescribed amounts of the agent. This, I repeat, is nothing but unjustified panic.

Chicken and Fish

It is also no surprise that panic runs rampant when the public reads and begins to fear that they should no longer eat fish because the content of mercury in fish is "hazardous to your health". In fact, we have no idea of what the content of mercury was during the period 10 years before the present panic. The same could be said concerning a similar release regarding hamburger.

I also know of many individuals who will no longer eat chicken because they are fearful of contracting salmonellosis, a not uncommon disease in poultry. To be sure, we must make every effort to control salmonellosis in the industry, but we must also inform the public that if these products are properly cooked, there is no reason for anxiety or panic.

Editor's Comment:

Readers may have noticed that in spite of the fact that the alarms over the use of cyclamate and monosodium glutamate have occurred during the period 1968-1970 while 'Cajanus' has been in publication, we have scarcely mentioned them, except perhaps to quote one or two sceptical comments from 'Nature'. This is really because we share the conviction that a prudent and moderate view is required, and that in each case must be judged on the evidence available.

We most agree with the article by Linda Grace published in 'Cajanus' Vol. 2, No. 4, pages 290-299, and the statement quoted there from an amendment to the US Foods and Drugs Act. "There are no harmless substances. There are only harmless ways of using them."

JOE BONE - THE NATION'S BACKBONE

by

Brian F. Topper
Farmer and Agronomist
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Seventy-eight percent of all farms in Jamaica are less than 5 acres in extent - scattered, fragmented acres in most cases. Plans for agricultural development must therefore take into special account the farmers on these farms, their way of life from which their attitudes, abilities and shortcomings have developed.

Joe Bone gets up at the first cock crow, denying his bed and his missus the second and third crows, except on Sundays. He walks two or three miles to where perforce he has to keep his cow tethered for access to water. After watering and moving his cow he returns home to a hasty meal - sometimes fried dumplings, sometimes bread, coffee or, if his blood or digestive system requires it, the appropriate bush tea.

Today he has arranged a digging with his friends. His yams are ready for planting. He leaves home carrying bottles of white rum and syrup and his pick. He rounds up those friends who are home after tethering their cows and they all set out in the direction of land which he has rented. The land on which his house stands is being rested for a few years until the limited area suited to yams is regenerated.

Arriving at the land which is already cleared, Joe chooses the bottom 'bar' and begins digging. His friends follow above his 'bar' each above the other. Steady progress is made. The only sounds are the spontaneous grunts made when the picks bite the ground.

Joe's missus arrives with pots, pans, food and friends for the cooking. Someone gets wood, lights the fires, and the cooking starts.

The sun is now well up. There is a call for water. Joe splices it with rum and syrup, continuing as the requests are repeated. The grunts give way to digging songs and banter. The digging goes well, the meal is ready, but is delayed until only a quarter or so of the yam field remains to be finished.

The meal is served - enormous helpings of dumplings, yam and rice with a little meat in heavy coconut oil and seasoning gravy. Everyone is satisfied - they have what their eating satisfaction demands - a full-belly feeling. The white rum flows, is nearly finished, but sufficient is left to complete the digging.

A tired Joe, friends and missus return home. But home does not mean bed. A friend has died and the 'set-up' is a must for commiseration and to lay the 'duppy' which would otherwise interfere with the homestead. Joe and his missus remain all night, chanting, imbibing white rum and coffee, fitfully napping, sometimes in a daze, falling off the bamboo bench under the bamboo-coconut bough booth in the yard. Grave diggers and coffin makers who have been busy nearby put in an appearance. Even the M.H.R. and local Councillor call in token condolence. The first cock crows for Joe to wend his weary way once again to his cow.

This is an epic day in the Spring dry season. Little is required by the other crops at this time, mainly reaping. Coffee and sorrell have already been reaped but yams, bananas, plantains and cocoa continue to be reaped. Road work which is sometimes available at other times is not usually available now. Joe's friends however, have diggings to which he must go.

The situation alters with the Spring rains. In a very short time everything requires weeding and Joe is on the job on his own farm with one or two friends with whom he exchanges days on their own farms.

The planting of short-term crops starts in March before the rains. Pumpkins, cocoas, cow peas and turnips usually find their places in the yam field. Land has been cleared for corn, red peas and gungo peas; these are mostly only 'jammed in' with a machete on less heavy soil. Cooking tomatoes are favoured for their certainty but salad tomatoes and carrots have their leaves 'scalded off' (Joe's words) by the rains and are not planted. Callaloo is planted near the house mainly for home consumption. Sweet potatoes, rated as highly dependable, are put in in August. Cabbages transplanted in December are sited near accessible water with dasheens in hollows nearby. Short-term crops are planted at a time satisfactory by "Whittaker's Calendar" and the moon-phase.

Every Thursday Joe's missus becomes his marketing agent and carries her loaded baskets by truck to the market. This trip is also favoured as an outing. The missus returns with requirements for the home.

Requirements for the farm are negligible: vegetable seeds, rope for the cow, a new machete and file and occasionally a new hoe and a pick. Most of the crops automatically provide their own planting material. Fertilizer is used only for yams that are sold off the farm for it affects taste and keeping quality. Once used, fertilizer had to be continued in use as heads from fertilized yams will not bear well unless fertilized.

This way of life and these attitudes have become inbred over many generations as an answer to circumstances - shortage of land, impoverishment of steep land by erosion, lack of education, lack of amenities and uncertainty of rainfall. It is an existence which small farmers have found by experience to be the only answer and will continue to be so unless the existing circumstances are fundamentally changed.

CFNI NEWS

As 'Cajanus' enters its fourth year of publication we are engaged in a revision and correction of our mailing list. Already we have been producing 2,500 copies per issue and do not wish, for technical reasons, to exceed this. The only way whereby we can continue to accommodate new requests for inclusion on the mailing list is to take special care to remove all names and addresses which have become incorrect through transfer or retirement or of persons who do not wish to receive it any longer. At the same time we can make sure the addresses retained are correct. Please keep the Editor informed of future changes of address.

"Guidelines to Young Child Feeding in the Contemporary Caribbean" has been published by the Pan American Health Organization. This is the outcome of a Technical Group Meeting held in June 1970 attended by West Indian representatives from paediatrics, obstetrics, nutrition and public health. These guidelines are based on much research into the actual situation in the area as regards various aspects of infant feeding, and represent an authoritative consensus of local opinion. The booklet (Scientific Publication No. 217) can be obtained from the Pan American Health Organization, 525 Twenty-third Street, N.W., Washington D.C. 20037, U.S.A.

CFNI staff participated in the Consultation on Agricultural Development Problems in the Caribbean Region, January 11-16, 1971 in Kingston, Jamaica organized by the Jamaica Agricultural Society, the International Federation of Agricultural Producers and FAO. Under the leadership of Dr. Yang, Deputy Director, and with the help of Miss Fox, Nutritionist, Ministry of Health, a session was presented on human nutrition and agriculture.

The Ministry of Health, Jamaica and CFNI sponsored a workshop on Food Service, January 27-29 at West Indies School of Public Health. The workshop emphasized the following subjects:

- organization of the food service department;
- interrelationship of food service department to other departments;
- basic principles of menu planning, food purchasing, food storage, sanitation and work flow;
- the importance of nutrition in food service.

Preparations are well in hand for the National Food and Nutrition Survey in Guyana to commence in mid-April.

Dr. & Mrs. Jelliffe participated in a one-day seminar in Barbados on Young Child Feeding. Another such seminar is to be held in Jamaica at the central level on March 10 and several others at parish level shortly after. These are part of a series which will be held throughout the area in 1971 as part of the follow-up of the technical group meeting. At these the guidelines are discussed, and particularly their adaptation to precise local circumstances and possible methods of popularisation.

MALNUTRITION AND LEARNING

by

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The consequences of malnutrition depend on the time in the life of the individual when nutritional deficits occur, as well as on their severity and duration. The brain may be damaged by various influences during the period of its fastest growth, which in human beings occurs from about five months before to about 10 months after birth. At the end of the first year the brain has achieved approximately 70 percent of its adult weight, and by the end of the second year, it has practically completed its growth.

The brain grows both by increase in the number of cells and by increase in the size of each cell. Experiments with rats, made by Myron Winick of the Cornell University Medical College in New York, show that severe malnutrition during the period of cell division permanently reduces the total number of cells despite subsequent nutritional rehabilitation. Severe food restriction later during the growth period may reduce cell size during the period of starvation, but the cells retain the ability to enlarge with increased feeding.

Obviously, similar studies cannot be done with human infants. However, the brains of infants who died of marasmus in Chile were found by Dr. Winick to have only 40 percent of the expected number of cells when compared with the brains of infants who died from accidents. Severe malnutrition in a pregnant woman may

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affect the unborn child by reducing the nutrients available to it for normal cell growth. Also, severe malnutrition during the first six months of the infant's life further reduces the number of brain cells the baby will develop. The timing of nutritional deprivation, therefore, is crucial.

Although information from experiments with animals cannot be applied directly to humans, who are infinitely more complicated, it can point the way to possible consequences for man. Rats and pigs fed severely restricted diets during periods of fastest brain growth and then later fed good diets have shown changes in behavior as well as in the size and composition of their brains. The animals cannot learn as fast as their normal littermates, cannot unlearn a task they have finally mastered, and tend to overreact in an agitated and irritable way when exposed to unpleasant situations.

In a pioneer study begun in 1955 in South Africa, investigators compared a group of 20 severely malnourished Negro infants, mostly aged 10 months to two years, with a second group of better nourished babies matched for race, age, sex, and low socioeconomic class. Eleven years later the severely malnourished children displayed significantly smaller head sizes and much lower intellectual achievement on various test measures than did the second group. Although their greater emotional and social deprivation may have affected the first group's test performance, the implications of long-lasting effects of malnutrition on mental development could not be ignored.

Another important early study was done by Joaquin Cravioto, currently Head of the Department of Nutrition, Hospital Infantil de Mexico, on 20 Guatemalan preschool children who had been hospitalized for severe malnutrition in earlier childhood and had recuperated. Here Dr. Cravioto found that intellectual development was related to the age of the child at the time of affliction and to the duration of the malnutrition. Events during the first six months of life appeared most

critical for later normal development. For the first three years of their lives these children showed slower rates of mental and motor development than children matched in all ways except for the malnutrition. With time, some of the differences narrowed between the groups, except in cases in which the malnutrition occurred very early in life.

Recently, Ernesto Pollitt, Assistant Professor of Psychology at Yale, critically reviewed eight investigations - made in underdeveloped countries and completed in the last six years - in which children hospitalized with severe protein-calorie malnutrition were observed after recovery. Overall, the results suggested that kwashiorkor (protein deficiency) was not necessarily associated with permanent intellectual damage, at least if the child was older than 12 months when the condition began. Dr. Pollitt concluded that a child who suffers from kwashiorkor after an otherwise healthy early development seems to have a fair chance of recovering his full intellectual potential.

Children suffering from marasmus, on the other hand, were found to be more likely to have intellectual damage. Marasmus, resulting from severe reduction of calories from all food sources, often strikes very early in infancy at the same time that the brain is undergoing its most rapid growth. Furthermore, marasmus which develops gradually from birth may increasingly debilitate the infant and limit his responsiveness to his surroundings, especially to his mother. As the child's responsiveness decreases, the mother in turn may become disheartened and transfer her attention to other healthier children in the family. Thus, the marasmic child seems more likely to be permanently impaired because of his longer exposure to poor diet and multiple adverse environmental factors.

In Chile, Fernando B. Monckeberg, Head of Pediatrics at the University of Chile Medical School in Santiago, studied three groups of urban preschool children: a middle-class well-nourished group; a lower-class group participating in a

nutritional supplementation program; and a group of lower-class malnourished children. He found the last group performed significantly less well on tests of intellectual ability, even though their environment was similar to that of the second group. The first two groups performed essentially alike, despite their environmental differences. In this study poor nutrition appeared to be associated with poor test performance.

Studying the population of an impoverished area more closely, Dr. Monckeberg examined 150 preschool children and their mothers. He found poor intellectual performance to be closely associated with smaller head size and low protein diets of the children. After evaluating the mothers' intellectual abilities, he could also relate the low maternal performance with the children's poor nutritional conditions and poor intellectual performance. Thus, the interrelation between inheritence, social deprivation, and intellectual ability remained unresolved.

Although kwashiorkor and marasmus occur infrequently in the United States, cases are now being seen in hospitals that serve large lower-income populations. Peter Chase and colleagues at the University of Colorado Medical Center in Denver have reported a longterm follow-up study of 19 infants admitted to a hospital over a three-year period for treatment of marasmus or kwashiorkor. They compared these infants with another group which, so far as possible, were distinguished from them only by their state of nutrition. The investigators found that although all the children in the study showed an adequate growth rate three and one-half years after treatment, the malnourished children failed to catch up to the second group mentally or physically.

The researchers concluded that the duration of malnutrition in the first year of life of these infants correlated with their physical and mental development at the age of about four and one-half years when the children were studied.

Children who experienced severe malnutrition for more than the first four months of life were most adversely affected. Examination of the family records showed that the mothers of the malnourished infants were under particular emotional and economic stress at the time of their infants' malnutrition, and that home conditions were especially bad. Furthermore, a primary cause of the poor nutritional condition of these infants was family disorganization, probably influenced by poverty and lack of education. In one case, an infant was left in the hands of her five-year-old sister. Since these social problems also may influence intellectual development, the effects of malnutrition alone are somewhat clouded in this study.

There are other conditions that tend to decrease learning experiences and possibly affect subsequent intellectual development. Children hospitalized with protein-calorie malnutrition may have experienced a form of social isolation in the period immediately preceding hospitalization. On top of this, opportunities for social contact frequently are reduced in the hospital rehabilitation ward. The child's fear of the new hospital environment also may inhibit his response to learning opportunities. Pertinent recent studies have shown that social isolation may reduce the size and number of cells in rat brain much the same as malnutrition.

The evidence strongly supports the conclusion that early severe malnutrition is associated with intellectual impairment. However, carefully planned studies are needed to determine whether any effects are due solely to malnutrition or to the unique constellation of environmental factors surrounding the malnourished hospitalized child who has most often been the subject for these studies.

Another major question concerns the effects of mild to moderate malnutrition on intellectual growth. These levels of undernutrition do not necessarily imperil survival and hospitalization is not normally required, but they may cause

growth retardation. Here there are few studies upon which to base a judgment, but the effects, if any, would certainly be expected to be less than for protein-calorie malnutrition. Furthermore, the interplay between social, medical, genetic, and nutritional variables might be expected to play a more prominent role.

In an eight-year study of Mexican children investigators found that intellectual performance at the time of entry into school appeared to be related to the child's history of malnutrition. After the children spent four to five years in school, however, this relationship disappeared, and differences in performance appeared to be related more closely to socioeconomic conditions and regularity of school attendance.

In the U.S., iron deficiency anemia is the most frequently observed nutritional problem among infants and preschool children. Its effects upon learning and behavior have not been systematically investigated. One study of 28 children under the age of three who were admitted to an American hospital with iron deficiency has been reported. The subjects were matched with a group not having anemia. A year after discharge from the hospital, the children who had had anemia were found to have more illnesses, more feeding difficulties, and more behavioral problems than those in the other group. The investigators attributed the behavioral deficits to parental failure and family disintegration rather than to nutritional insufficiency.

A key problem in determining whether malnutrition, disease, or the social environment factors of poverty have the greatest effect on mental development hinges on the timing of the testing. Intellectual and behavioral measurements are best made in middle childhood, whereas the nutritional insult, if it has an effect, probably occurs in infancy. Longterm studies monitoring nutritional intake and behavioral development are essential.

A study that may provide some answers is now being done in Guatemala where many people still live in small, isolated villages, subsist on an inadequate diet, and till the over-worked fields of their ancestors. Without adequate medical care many babies die before their first birthday, and those who survive are short and underdeveloped. In the villages under study, all participants receive heretofore unavailable medical care with special attention given to pregnant women, infants, and young children. The villages are studied in pairs so that they are as much alike as possible on socioeconomic, public health, cultural, and other bases. Each village in a pair receives added stimulation through a carefully planned visitation and examination program. One village in each pair also receives a specially designed nutritional supplement. Thus the investigators hope to define the effects of better nutrition as they follow the growth and development of the children over the first seven years of life.

Up to now it has been generally assumed that intellectual deficits would be proportional to the degree of malnutrition imposed. On the other hand, it is also possible that there may be a level of malnutrition in infancy below which neurological structures are so altered that retarded intellectual development is irreversible. Above this threshold, however, undernutrition would have no serious consequences for neurological development itself. Genetic endowment and socio-logical factors surrounding malnutrition might then be expected to exert increas-ingly significant effects on intellectual ability.

Those who have worked with undernourished children know that they exhibit behavioral alterations. These include apathy, lethargy, inability to pay atten-tion, and perhaps overconcern about food to such a degree that responses to class-room stimuli do not occur. A child in such condition no longer meets the expec-tations of his family or teachers. He begins to live in a world of his own and may seek recognition or gain attention by ways that disrupt learning experiences.

Learning is increasingly recognized as progressing in stages, each stage becoming a foundation for the next. By not responding to early stimulation, the child gradually becomes unable to benefit from "normal" experiences at a later period. He fails to learn, not because the genetic potential or neurological structures are absent, but because he lacks the experiential foundation. Improved nutrition alone will not correct this deficit. Neither will improved educational opportunities by themselves. Both must be provided in a coordinated program to develop the child's potential.

There is a special need for the development of a battery of tests that can measure the behavioral and social variables involved and that are applicable to varied social groups. These tests should be addressed to the changes that we now suspect are related to malnutrition. It is hoped that they will detect those low levels of change that might be expected under less severe nutritional conditions.

Before firm conclusions can be drawn that malnutrition per se is the cause of mental subnormality, carefully designed studies will be required to clarify the role of parents and of the social and environmental factors that accompany malnutrition. Because research cannot at this time give an unequivocal or complete answer to the question of what effect malnutrition has on intellectual development is no reason to delay programs for improving the nutritional status and eating practices of mothers and infants. Information demonstrating the benefits of good nutrition in improved health and physical growth already justify such efforts.

YOUR QUESTIONS ANSWERED

Q. I have been trying to obtain some up-to-date information on what foods contain folic acid, as I know that during recent surveys undertaken by CFNI folate deficiency was found among young children and pregnant women. (Several readers have independently written asking this question)

A. Folic acid deficiency is commonly found in developing countries among young children, pregnant and lactating women and as you have mentioned this deficiency occurs in the Commonwealth Caribbean among these groups.

Folic acid deficiency is usually due to a low intake of foods containing this vitamin, and the actual intake can further be diminished by cooking the foods, as folates are extremely thermo-labile and a further loss will occur if the cooking water is discarded.

Milk is *not* a rich source of folic acid (human and cow's milk contain between 50 and 60 micrograms (mcg) per litre).

Bottle-fed infants receiving feeds of either pasteurized milk or preparatory reconstituted milk formulae, which are usually boiled or heated for hygienic purposes, will thus receive a low folate diet. It is not surprising to find anaemia in this age group, whose additional food supplementation may also be low in folates. Breast fed babies will therefore be at an advantage.

Another cause for deficiency of folate is poor absorption by the individual of the ingested folic acid.

There is ample evidence that requirements for folates increase during pregnancy. Protection of the foetus against folate deficiency is ensured by accumulation of folate from the mother across the placenta. Thus folate deficiency will occur in the pregnant woman. Evidence also exists that lactation will drain maternal stores.

Food Sources of Folic Acid

Many workers have classified food stuffs according to the amount of folic acid they contain as follows:-

(i) Very high - liver and fresh dark green leafy vegetables, i.e. amaranthus leaves (callaloo) and yeast, etc.

(ii) High - kidney and fresh green vegetables, i.e. cauliflower, broccoli, endives.

(iii) Medium - Beef, veal, wheat-cereal foods.

Folate deficiency causes a megaloblastic anaemia.

The diagnosis is made by:-

(i) a clinical examination of the subject, who shows signs of anaemia (pale conjunctiva, lassitude, palpitations, etc.);

(ii) laboratory tests, i.e. blood smear for cell morphology and a bone marrow examination.

It is possible to prevent folate deficiency in vulnerable groups by recommending a diet rich in folate-containing foods and by supplementation with folic acid tablets.

In the 'Guidelines to Young Child Feeding in the Contemporary Caribbean' published in 'Cajanus' (October 1970, Vol. 3, No. 5, p.253) the following dosages of folic acid are recommended:

(a) for pregnant and lactating women 100 mcg daily, preferably combined with 180 mg of ferrous sulphate (60 mg of elemental iron) to combat as well iron deficiency anaemia, given in one tablet;

(b) for infants aged 4 months to 2 years 100 mcg folic acid daily, also combined with 60 mg of ferrous sulphate (20 mg of elemental iron).

A joint FAO/WHO Expert Group has recently recommended the following daily intakes of folate.

Age or Status	Recommended daily intake in mcg per day
0 - 6 months	40 (approximates equivalent daily intake of "free" folate in breast milk)
7 - 12 months	60
1 - 12 years	100
13 years and over	200
Pregnancy	400
Lactation	300

References

1. *W.H.O. Technical Report Series.* 1970. No. 452. Requirements of Ascorbic Acid, Vitamin D, Vitamin B_{12}, Folate and Iron.

2. *American Journal of Clinical Nutrition.* 1970. 23, 6. Symposium: Folic Acid Deficiency.

Q. *Recently when in the hospital I was advised to drink the orange juice on my breakfast tray at the beginning of the meal, whereas I like to have it at the end of the meal or maybe an hour later. Is it better to have the juice at the beginning of the meal or does it matter so long as I drink all of it?*

A. Tart juices and piquant flavours may serve as appetizers, yet the nutritive value would be the same at the beginning or end of the meal.

BOOK REVIEW

WHEAT IN HUMAN NUTRITION by Dr. W.R. Aykroyd and Mrs. J. Doughty FAO Nutritional Studies, No. 23. FAO of the United Nations, Rome 1970, pp. ix + 163. Price: US $3.50

The team of Dr. W. Aykroyd and Mrs. J. Doughty have accomplished once again a major "tour de force" with their latest publication "Wheat in Human Nutrition", in which they trace the origins of wheat and attempt to predict future developments in this internationally used crop. It is, as would be expected, an extremely erudite book, presenting a wealth of scientific facts, with elegance and quiet humour.

The progress of the grain of wheat is followed from its simple beginnings as a wild grass, the carbonised remains of which have been found in Northern Iraq (with a radiocarbon date 6,700 B.C.) through the peripatetic stages of its own domestication and that of its consumer man, the ex-hunter. Some have attributed to this grain, the progress of civilization which has led wandering nomadic tribes to become cultivators and to develop subsequently the sciences of astronomy, languages and writing.

The different species of the Genus Triticum and their origins are discussed including the bread wheat (*Triticum vulgare* and others) and the hard grained wheat (*Triticum durum*) used generally in the manufacture of *pasta* products, such as macaroni. The hardness and softness of wheat is associated with the degree of "strength" or "weakness" of flour. In bread making strong flour with a high gluten content which provides the desired elasticity is used, while weak flour is utilized for cake and biscuit making.

Winter and spring wheats are mentioned as well as the adaptability of wheat crops to a wide range of environments. Wheat, which is presently consumed by more than 1,000 million individuals requires, as do many crops, careful management. In 1965 total world production of wheat was estimated at 266 million tons. Wheat yields will vary, but a combination of measures which include, good soil, efficient water supply, the use of inorganic fertilizers, prevention of fungal diseases such as rust or smut as well as improved methods of farming including mechanization, will result in larger yields per acre. These factors will also apply to the new dwarf species of wheat, first developed in Mexico in joint collaboration of the Mexican Government with the Rockefeller Foundation. These varieties, now being introduced in other countries including the Indian continent, will, under such management, give yields two or three times higher than any variety cultivated until now.

Techniques of milling throughout the ages are described, as well as the newer advances in chemical modifications of bread-making formulae, using substances which age and bleach the flour and will retard staling of loaves. The very early and the most recent methods of conversion of wheat into acceptable and popular foods are fully elaborated upon, covering a wide range including porridges, bulgur wheat, which is used or distributed by relief agencies in many areas, and the invention of cornflakes by the Kellogg family in 1890.

Bread-making is amply dealt with, and the traditional unleavened breads of India and the Arab world are described, as well as the leavened Chinese steamed bun, the crisp French *baguette*, and the North American hygienically wrapped (but so bland) sliced loaf.

A section is devoted to additional ingredients, such as skimmed milk usually added to the flour in the proportion of 5 or 6%, (the lysine in the milk proteins will compensate for the deficiency of this amino acid in wheat and also adds calcium and riboflavin). In some countries, such as Israel, 2% defatted soy flour is added. Sugar (2%), if added, gives the bread crust a better colour, and when fat is included this will soften the dough and improve slicing qualities. These two latter ingredients, however, containing neither protein or vitamins, slightly reduce the nutritive value of the bread. A formula used by some bakers in Jamaica is as follows: 2% salt, 4% sugar, 2% malt, 3-4% skimmed milk and 3-4% fat per 100 lbs. flour.

Research is being actively carried out in many areas of the world, including the Caribbean, on other flours such as cassava, ground nut, soya, breadfruit, etc., which could be used as a diluent to wheat flour in order to decrease wheat imports into tropical countries, where this commodity is either grown on too small a scale or not at all. In the Commonwealth Caribbean, for example, wheat imports present a serious foreign exchange problem. All wheat products consumed in the Caribbean are imported, and the projected consumption for 1975 is considered to be 333 thousand tons which will cost, at the point of origin, $73.2m W.I. ('Cajanus', February 1968, Vol. 1, No. 1, page 13)

The question which will arise in the mind of the reader will naturally be, what is the nutritional value of wheat and bread? A whole chapter is devoted to this important aspect. The composition of different parts of the wheat grain are carefully set out and the results show how erroneous it is to dismiss wheat, as a mere "starchy food". This grain has a protein content which may vary from 8 to 24%, with an average value of 10 to 14%. Lysine is the limiting amino acid in wheat proteins, therefore it will become nutritionally a more valuable food if it is eaten with foods of a complementary amino acid pattern, for example the biological value of bread is 5.2, if however cheese is eaten with bread in the proportion 1:3-4 the biological value will be raised to 7.6. With a wheat of an average protein content, the ND_p Cals % is estimated to be around 6. In these same terms, protein requirements for adults (5.0) will be satisfied with a wheat diet but not so for infants (8.9) or pregnant and lactating women (7.5).

Methods of preparation may alter the nutrient quality of wheat, such as loss of lysine (browning reaction during baking), or loss of thiamine, which is thermolabile, with some manufacturing techniques or with washing of wheat or addition of alkalis.

The nutritive value of flour also depends a great deal on its extraction rate, which itself is determined by many interrelating factors, such as consumer preference for white bread, economic and commercial reasons and even government policy in times of food shortage. Broadly, the nutritive value of flour decreases as the extraction rate falls from 95 to 70% or less. The bran obtained from flour milling is an excellent animal feed, the price obtained by the miller for this commodity will undoubtedly influence his attitude regarding extraction rate.

Controversy regarding the superiority of white bread over brown or vice versa has had exponents in both camps for many centuries, but the discovery of vitamins and the reported occurrence of beri beri among communities who by necessity consumed a large quantity of refined wheat flour (i.e. Labrador and Newfoundland), led to a reappraisal on the policy of extraction rates and promoted enrichment of flour. Flour enrichment with thiamine, riboflavin, niacin and iron is compulsory in some countries and voluntary in others. In Jamaica, for example, these substances are added and provide per lb. of flour, 2.3mg thiamine, 1.3mg riboflavin, 17.0mg niacin and 14.4mg iron. Both high and low extraction flours in the United Kingdom are enriched with calcium carbonate as a national measure.

Fortification with synthetic lysine has also been considered. This measure has been carefully evaluated by the FAO/WHO/PAHO Protein Advisory Group (PAG) in 1966 and 1967, and at their last meeting the difficulties involved in demonstrating the value of amino acid supplementation in field trials with children were emphasized.

As well as beri beri, the relationship between coeliac disease and wheat gluten, and between dental caries and refined wheat flour, are briefly discussed.

Consumption patterns and trends are reviewed, countries are grouped according to their reliance on wheat to provide more than 40% of their total calories from this commodity and those whose calories are obtained from a more varied diet. The Caribbean area is not included in these tables but estimates of per caput consumption are given for Guyana (134gm) and Cuba (80gm). Dr. J. McKigney ('Cajanus' 1968), referring to the Caribbean area, has stated that "wheat flour contributes 20 to 50% of the available nutrients to most segments of the population".

A separate chapter devoted to wheat as a food for young children, re-emphasizes, quoting recent feeding trials, that wheat proteins can meet the needs of adults but do not fulfil completely the nutrient requirements of any age group, and especially not those of young children. Nutritious mixtures, based on wheat to which amino acid complementing foods are added, are reviewed, such as LAUBINA developed in the Middle East, SUPERAMINE in Algeria and BALAHAR in India.

Trends in consumption of wheat in industrialized countries, due to changes in dietetic patterns including weight watching, are declining or stationary, but in many traditionally rice eating areas consumption is rising and relief agencies such as US AID, CARE, Church World Services and others have popularized the use of wheat flour and bulgur. A gaze into the crystal ball may give hope that some wheat importing countries may become, with the successful use of dwarf varieties, future wheat exporters. Changes in the extraction rates of wheat flour may also occur.

The complex problem of flour enrichment must be viewed in its entirety, taking into account the global situation and the expected growth in both production and consumption of wheat by a world population which by the end of this century may number 6,000 million people. The general usefulness and feasibility of this measure must be considered within the framework of the

economy of industrialized and developing countries, the system of wheat trading, and the patterns of diets within each country. The combined advice of specialists in food technology, nutrition and industry is much needed. A relatively small quantity of flour is enriched (flours of 70 to 72% extraction rate). The authors believe that the solution may not be to propagate the use of enriched low extraction flour, but rather to use flour within the 75% to 80% range which would be white enough and suitable for making bread and other wheat products and would meet theoretical thiamine requirements, (40mg per 1,000 calories: 1967 FAO/WHO Expert Committee) even if wheat should form the major part of the diet.

Whatever the solution may be, wheat will remain a nutritious staple food for the populations of the world, and it is hoped that before long the FAO motto "Fiat Panis" ("let there be bread") will be implemented for each and everyone.

E.F.P. Jelliffe

NUTRITION NEWS AND OPINION FROM THE CARIBBEAN

NUTRITION PLAN IN NEW PHASE
From The Advocate-News, Barbados, February 15, 1971

The pilot national nutrition programme which was started last year, has entered another phase with the recent extension of the School Meals Service to St. Peter. Information on the condition of children before and some time after the start of the service will be taken for purposes of comparison. This information is essential to the Nutrition Committee and is also required by the World Food Programme which gives food to the Schools Meals Service. The information will also be passed to UNICEF which has donated home economic and agricultural equipment for use in these schools.

An official of the Nutrition Programme said that during phase one of the programme 1,002 children in St. Peter, all under the age of five, were weighed to determine their nutritional status. Of these, 618 were considered to be mildly undernourished; 73 moderately malnourished and there were 12 cases of severe malnutrition. The other 300 were quite normal.

The severe cases of malnutrition were below 60 per cent of standard weight for age. Treatment was given to these cases at the health centre and they were followed up by regular visits to their homes by nurses. The percentage improvement in weight for age among the severely malnourished who were treated between May and August, was nearly 30 per cent.

Another 1,238 school children aged five to ten, were weighed in the parishes of St. Peter, St. James and St. Lucy between January 19 and 21 this year. Their height and arm circumferences were taken and these will be used, in relation to their ages, to assess their present nutritional status.

As part of the programme, haemoglobin tests for anaemia in pregnant women attending the health centre were given. These showed 24 out of the 111 tested to be below the required minimum standard. These expectant mothers are receiving treatment and the others receiving preventive care, the official states.

The official disclosed that as a result of a workshop held at the Nurses' Home of the Queen Elizabeth Hospital last month, a manual on "Infant Feeding for Mothers" was being prepared. Dr. Frank Ramsey chaired the workshop at which the 62 participants included representatives from the Caribbean Food and Nutrition Institute, Pan American Health Organization, the World Health Organization and the Queen Elizabeth Hospital. It was also attended by dietitians, home economists, nutritionists, social welfare officers and public health inspectors.

The National Nutrition Programme was started following a nutrition survey which was carried out by the Caribbean Food and Nutrition Institute. Phase one of the programme began in St. Peter with a training course in nutrition for 51 persons. Funds were provided by UNICEF.

NUTRITION PILOT SURVEY TO START TODAY
From the Guyana Graphic, March 1, 1971

A pilot project in connection with the comprehensive National Nutrition Survey gets under way today.

The purpose of the project is to pre-test the questionnaires which are to be used for the country-wide survey which will run from April to June this year.

The project will be undertaken in the following areas: Grove, East Bank, Demerara; Golden Grove and Clonbrook, East Coast, Demerara and the Greater Georgetown area.

The National Nutrition Survey will involve over 70 investigators comprising mainly teachers, Public Health Inspectors, Public Health Nurses and a team of five officials from the Caribbean Food and Nutrition Institute.

The co-ordinating staff who will be responsible for conducting the Survey locally are Dr. Robert Baird, Chief Medical Officer; Dr. A. Egbert, Principal Medical Officer, Ministry of Health; Mr. Samuel Dey, Director of Survey, seconded from the Community Development Division, Office of the Prime Minister; Mrs. Veronica Bright, Health Nutritionist and Mrs. Cynthia Blue, Health Education Assistant, Ministry of Health.

PLANS FOR SEMINAR ON YOUNG CHILD FEEDING
From the Royal Gazette, Bermuda, February 12, 1971

A local seminar will be held later this year on young child feeding. This was revealed at yesterday's working session of the Caribbean Health Ministers Conference by Mrs. G. Metaxas, nutritionist with Bermuda's Department of Health and Welfare.

Under consideration was the report of the Caribbean Food and Nutrition Institute. The Director, Dr. D.B. Jelliffe, reviewed recent activities of the Institute. It was started in 1967 by a five-year agreement between the Pan American Health Organization, the World Health Organization, the Food and Agriculture Organization, the governments of Jamaica, Trinidad and Tobago, and the University of the West Indies, and serves 15 countries of the English-speaking Caribbean, by assisting them in the solution to their nutritional problems.

Mrs. Metaxas participated in the seminar on food and dietetic services recently held in Barbados. Resulting from an earlier CFNI seminar was a booklet entitled "Guidelines to Young Child Feeding in the Contemporary Caribbean". This has been published, and a seminar will be held here later this year on this subject.

NEW INTEREST IN BREAST FEEDING
by C. Roy Reynolds in The Daily Gleaner, Jamaica, March 3, 1971

For a few decades now there has been a trend towards the elimination of breast feeding of infants. Under sustained, high-powered and frequently exaggerated advertisements of substitute feeds for infant, more and more mothers throughout the world have departed from breast feeding. Now, however, a new awareness of the consequences of the elimination of human milk in the diet of the young child is becoming apparent. As nutrition has increasingly come under the scope and scrutiny of scientific research the effects of a departure from nature's norm is being realized.

Paediatricians, especially in tropical developing areas are increasingly seeing a parallel between the trend away from breast feeding and childhood malnutrition and incidence of certain diseases in children. It may be early yet to definitely establish the full importance of this trend but it is also interesting to note that paediatricians are mildly concerned about what seems to be a simultaneous increase in malnutrition in very young infants.

Recent studies in Britain, Sweden and other developed countries have demonstrated that not only was mortality rates higher in bottle fed infants but that attacks of certain infectious diseases were of longer duration and increased severity. It should also be noted that the studies have been carried out in communities with adequate incomes and proper environmental sanitation. Other studies have shown that the situation is even more marked in communities of low income levels and where there is poor sanitation and hygiene. In these countries where families are poor and facilities for proper sanitation are inadequate bottle feeding presents two immediate problems. Given the low income levels and the high cost of artificial substitutes mothers have tended to economise by feeding lower concentrations of the artificial feeds than recommended by the manufacturers. The result is that the child is pushed into malnutrition. Again the poor hygiene and lack of facilities such as sterilizing equipment present maximum opportunities for the infant to pick up infectious organisms. Thus the stage is set for malnutrition and exposure to diseases with a harvest of increased mortality and lasting impairment of brain functions.

The milk of mammals is produced to suit the particular needs and growth pattern of the individual species. Thus the milk of whales contain a high percentage of fats to fit the young for its environment while the milk of rabbits contains a superabundance of protein, as young rabbits double their birth weight in six days - compared with 140 days for the human young. Human milk, the natural food of the infant child contains twice as much iron, three times as much copper, and is higher in Ascorbic Acid and Vitamin E than cow's milk. It also contains a much lower level of certain pollutants such as Strontium 90, than cow's milk, as well as a lower bacterial count. Human milk has been found to offer excellent protection from a wide range of infections in infants. The protective functions of human milk are even more marked in less developed countries with low incomes, low educational levels, highly contaminated environment, with inadequate water supply, waste disposal, and few culinary equipments for food preparation and storage.

While it must be conceded that the trend for mothers to work out away from the homes has contributed to the increased dependence of milk substitutes for infant feeding, the fact is that exaggerated advertisements of these substitute products have had serious effects, particularly in poorer countries. These advertisements which seek to present the feeding of substitutes as the sophisticated thing to do, have had the effect of luring poor mothers into unnecessary financial expenditures, and to force their children into malnutrition.

Another area in which these nutritionally misleading advertisements have had undesirable effects lay in the popularly held belief that foreign, expensive preparations of fruits and vegetables are necessarily superior to cheap, locally available ones. Thus, we find that in a country where bananas, pawpaws and oranges are abundant and avocado pears, peas and beans are cheap, mothers still strain their slender budgets to purchase bottled and canned peaches, pears and assorted vegetables.

Against this gloomy situation a new organization has come into being. It is the La Leche League International, composed of women, who appreciative of the values of breast feeding have formed themselves into an organization determined to spread their knowledge throughout the world.

Representatives of La Leche League International have already visited the Caribbean and have held discussions with personnel from the Caribbean Food and Nutrition Institute, a Caribbean organization which has been conducting detailed and continuing research in nutrition in this area.

MOTHER AND CHILD CARE CENTRE OPENED IN PORT ANTONIO
From The Daily Gleaner, Jamaica, March 10, 1971

A Mother and Child Care Centre, to be run in conjunction with the National Family Planning Board, was opened in Port Antonio on Friday last in a function chaired by Mr. C.H. Allison, Executive Chairman of the N.F.P.B. Among those who took part in the opening programme were the Mayor, Councillor F.E. Dyce; who welcomed the visitors; Dr. Christine Moody, Medical Officer of Health for Portland; Mr. Keith Osbourne, secretary of the Portland Parish Council, Dr. Lenworth Jacobs, Medical Director of the N.F.P.B.; Dr. Sam Street, Chief Medical Officer in the Ministry of Health; and Mrs. John Stedman, wife of the acting Custos of Portland, who officiated in the opening of the building.

In outlining the purpose of the centre, Dr. Moody said that the need for such a centre had long been felt in Port Antonio, and that a comprehensive health care programme should be centred in one physical building. She thanked Mr. D.F. Hanna, whom she termed a public-spirited citizen, for having made available, at a very favourable rental, a suite of rooms at the back of his premises at No. 1 Harbour Street, and the Family Planning Board who, with the Portland Parish Council had assisted financially and otherwise in making the Centre possible.

Dr. Moody explained that, under the combined efforts of the Health Department and the National Family Planning Board, plans are for a programme that will be wide in its scope and take care of the health of mother and child, using "health" in its widest form.

The centre, she said, will be open daily and a nurse and doctor will be available to assist with information concerning all aspects of family planning and health care. Apart from weekly ante-natal and post-natal clinics and monthly child welfare clinics the centre will hold regular educational programmes covering the whole field of family health care in its widest form. These programmes, Dr. Moody said, will include cookery demonstrations by Mrs. Donaldson and her team from the Jamaica Public Service Company, sewing classes where mothers can learn to make a layette for the expected baby and clothes for older children, talks on personal hygiene, nutrition, child care, cleanliness in the home, perhaps home nursing and first aid.

Dr. Moody said that it was most reassuring that already many people - and these include several men - have been coming to the Centre for talks with nurse or doctor. "I am convinced", said she, "that one of the weaknesses of our health care programme is that there is not sufficient time for people to talk with doctors and nurses to get the advice and reassurance they need. We plan that this Centre will, among other things, supply this need".

Dr. Jacobs in his address reiterated Dr. Moody's point that males should be brought to realize the importance of their concern in family planning and to take an active part in it. Fathers should do more than just beget children he said. They should father them in the true sense of the word. Brothers also should be made aware of their responsibility in the home. For many years, Dr. Jacobs said, we have been saying that something must be done about over-population, and Government has realized the importance of the problem and is helping to deal with it. The people of Jamaica, he said, must also understand that they hold the future in their hands.

Several other members of the health professions who were present at this function included Dr. P. Cavalié, Country Representative of the World Health Organization, Professor D.B. Jelliffe, Director of the Caribbean Food and Nutrition Institute, and Mrs. Jelliffe, Mr. Harold Haughton, Permanent Secretary in the Ministry of Health, and Miss Helen Fox of the Nutrition Office of the Ministry of Health.

THE URBAN AVALANCHE AND CHILD NUTRITION*

by

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and
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I. *IMPACT DURING THE INDUSTRIAL REVOLUTION AND NOW*

Man is inherently a gregarious, social creature and, as his range of technology has increased, his way of life has widened from hunter-food gatherer, to herdsman, to agriculturalist, to trader-producer, with an accompanying tendency and need to live in larger groups of dwellings. However, pre-industrial, traditional larger towns and cities** only came into being about 5,000 B.C. in Mesopotamia. As elsewhere, ancient cities needed three pre-conditions for their genesis and continued existence (1):

(a) A favorable ecology, including climate, soil, and water for agriculture, especially for irrigation.

(b) A well developed political and economic social organization.

(c) (and mainly) A relatively advanced agricultural technology, including implements, such as the plow, and domesticated plants - especially cereal grains - and improved communications employing the wheel, the sailboat, and animal power.

The pre-industrial city was, in a sense, initially a by-product of an area's ability to produce a sizable food surplus, so that the *sine qua non* in the definition of a city is "a concentration in one place of people who do not grow their own food" (1,2).

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***City: population 100,000 or more; super-city: population 1 million or more.*

Therefore, because of relatively cumbersome, labor-intensive agriculture and limited transport, traditional cities were relatively small and static and only encompassed a small percentage of the population. Babylon has been estimated to have a population of only 80,000, while Imperial Rome at the time of Augustus probably did not number a million, despite a food drainage area covering the Mediterranean littoral.

Urbanization and the Machine Age

In Western Europe, the hundred years from the middle of the eighteenth century were characterized by two inter-related technical revolutions. First, the invention of machines using inanimate energy, especially coal, led to the factory system and the widespread marketing of its products via "the centripetal force of steam," i.e., the railroad and steamships. This phase of the Industrial Revolution resulted in the rapid growth of cities around expanding industries and their sources of power, especially coal fields. In Britain particularly, in a relatively few decades, villages mushroomed into "insensate industrial towns, into sprawling agglomerations, the abode of pestilential heapings of human beings" (3) notable for their high mortality and sickly, undernourished children (4,5).

Second - and underappreciated - this epoch was also characterized by an upsurge of new scientific agricultural practices, as, for example, the introduction of the steel plow, the rational rotation of crops, and the use of chemical fertilizer. Vastly increased food production, aided gradually by imports from the new lands of America and Australia, was the underpinning of the industrial urbanization of Europe. It also buffered the parallel rapid increase in population, as in England and Wales where the population showed a 60 per cent increase from 8.9 million in 1791 to 13.9 million in 1831.

The "neotechnical" phase of the scientific machine age dates from the 1870s and is still in full flower. It is based on electricity and the internal combustion engine. At its most advanced stage, as in the United States and Western Europe, it can be characterized by the almost instantaneous communication of ideas; by the rapid transport of man and goods; by an increasingly mechanically controlled mass production; and by the practical application of science to large-scale mechanized production, preservation, and processing of foods. Above all, it is characterized by still further urbanization in established industrial countries, with adjacent super-cities expanding and coalescing to form megalopoles of millions (6,7).

The Urban Avalanche

Over-rapid urbanization is a world-wide modern phenomenon. In the last century, while the world's population doubled, the world's city population has increased five-fold, one-third of whom currently live in slums or shanty towns.

It is, however, in the technically less developed, mainly tropical countries that the process has its gravest nutritional consequences. In the past few decades, this is where the increasing dimensions and break-neck velocity of the migratory stream has been greatest, the new city-dwellers least prepared, and the resources to feed, accommodate, employ, and care for the influx most meager (8). In the extreme instance of Latin America, the population of Lima, Peru increased by over 50 per cent between 1940 and 1950, but by a further 100 per cent in the following decade. In Asia and Africa, the population living in cities almost doubled in the single decade, 1950-1960.

Reasons for Urbanization

Both "push" and "pull" forces are responsible for the current flood of peasant populations to cities in what is the largest migration in man's history (6). The operative social mechanisms vary in detail from one area to

another. In some regions, the rural exodus may be much related to: a country-side over-populated in relation to productive land; low productivity and low prestige of agricultural activities; seasonal unemployment; and so on. Also the influx is further swollen by refugees, as in Hong Kong, Calcutta, and Saigon (where the population is reported to have increased sixteen-fold in twenty years).

Basically, cities have always attracted the ambitious as centers of social and economic opportunity. In recent decades, the flow of ideas and knowledge concerning modern consumer living has reached previously inaccessible rural areas through many reinforcing channels and with an ever-increasing fortissimo. The press, picture magazines, motion pictures, television, and - above all - the ubiquitous transistor radio are geared to an urban life style and a cash economy. New, previously unknown wants and desires are thus created for the rural peasant, making up part of a revolution of rising expectations. He is, in fact, "hungry for the Twentieth Century" (9). In search of paid employment which will allow him to enter the modern consumer way of life, he migrates in the mistaken belief that "the street of the city was paved in pure gold".

Disurbanization

The urban avalanche in present-day tropical countries resembles population shifts in nineteenth century Europe and North America, but has many differences. First, virtually "non-immune", agrarian, traditional, non-Western populations have suddenly been exposed to the lure of twentieth century urban living, with a resulting almost mass migration to the cities (10-12). Second, although often talked of together, urbanization is not necessarily due to, synonymous with, or even associated with, industrialization. Third,

these great increases in city populations have not paralleled increased rural food production, nor has national revenue increased to permit importation of foods.

Even when associated with some degree of industrialization, the flood of rural dwellers into cities in less technically developed countries has been far above the cities' capacity to employ, house, feed, service, or educate, which has led to what may be termed "over-urbanization", or "disurbanization". In its extreme forms, this is exemplified by the rapidly growing squatter areas, the shanty or tin towns that form a vast marginal peri-urban "septic fringe" around many tropical cities - the *favelas* of Brazil, the *bidonvilles* of North America, or the *bustees* of Calcutta.

Components of Urbanization

The process of urbanization varies from place to place, but everywhere represents an ecologic uprooting, a profound change not only in geography, but also in culture, social organization, and every aspect of life. Basically, urbanization is a move from a relatively small, traditional, rural community with clear-cut relationships and established mores, to life among a large amorphous, mobile, indifferent (or even hostile) mass of anonymous strangers.

The "miniature welfare state" of the extended family or kinship groups is superseded by less stable families or - with the absence of traditional restraints - a series of cohabitations or temporary alliances ("the cooking pot marriages" of African cities) (13). Changes in the male:female ratio may occur, especially if transient labor is common, with prostitution likely to increase (14,15). The role of women is often altered, as they seek outside work to supplement their husbands' earnings (if any), with accompanying decreased opportunity for breast-feeding and often defective care and nutrition of young children left parentless at home.

The physical surroundings of the slum or shanty town are quite alien to the newly arrived countryman. There will be less space, less daylight, less fresh air, less greenery, and more noise. While the water supply, sewage, and refuse disposal are sometimes better than in rural areas, this is often not the case - certainly not in the usually sanitation-less shanty towns. As far as infections of nutritional consequences are concerned, the young child has certain advantages and some problems in the urban environment (16-19). For example, there is less malaria and hookworm infection, but a probably higher risk of diarrheal disease, roundworm infection, and tuberculosis (20).

Social services, including health clinics and schools, are mainly located in cities, with obvious nutritional advantages, until they are swamped numerically, with regard to the supervision of infants and to the nutrition education of school children. Conversely, however, the urban family has lost the social support and mutual self-help of the extended family or kinship group, tribe, or village and is dependent on the state or other agencies for welfare assistance.

Culturally, the new townsman finds himself with confused ideas and mixed loyalties and is sometimes even lost linguistically. The very basis for life is totally different. As has been said of Peru: "The struggle for life in the Sierra is against nature; in the coastal cities, it is a struggle against men" (21).

These rural cultural transplants find the old established values and practices no longer valid, but lack the knowledge to adjust easily to town ways. Often the strains, discontinuities, and conflicts lead to a cultural confusion, to an *anomie*. This is frequently compounded by lack of employment and poverty made more apparent by adjacent affluence, leading easily to passive escape into alcoholism or to violent reaction in the form of juvenile

delinquency, crime or civil unrest.

More obviously central to human nutrition is the question of food availability and changing food habits in the urban environment. Fundamentally, in rural areas, food is mainly grown (or otherwise produced - hunted, batered, or gathered semi-wild), although all over the world improved roads now permit the small village shop and the market to introduce foods from wider afield. By contrast, the urbanite purchases his food and plainly is dependent on money. However, as an advantage, city food supplies may be less subject to seasonal fluctuations, although such factors as transportability and storability may limit available range.

For the successful new townsman with a regular, but limited wage, considerable problems occur during the transition to a cash economy. Competing claims are likely for such necessities as different types of food, rent, special clothing, and transport to work as well as unaccustomed distractions and novelties. Initially, he is often at sea in a cash-based environment, but with continued relative prosperity, the family may achieve improved nutrition (22), although this is not always the case, if marked cultural ambivalence exists (23). For the unsuccessful, for the unemployed, it is "a change to a money economy without money" - a move from subsistence agriculture to urban subsubsistence.

Despite an understandable, emotional retention of the basic food pattern, whenever possible, and especially the main staple (cultural super-food), the city usually produces many changes in food habits (24-26). Some are related to availability and storage, such as the change for millet to over-milled corn or cassava flours in urbanizing parts of East Africa. Some are related to changing patterns of daily life, as when the husband goes to work and purchases his meal from a vendor, or when restricted cooking facilities

and fuel limit the preparation of certain dishes. Probably the most clearcut, predictable change in feeding patterns is related to the increased use of status-convenience foods, such as tea, sugar, bread, soft drinks, and - of particular consequence - highly advertised proprietary infant foods.

II. *SPECIAL PROBLEMS IN DEVELOPING COUNTRIES*

The many interacting changes in family life and food availability resulting from urbanization, especially in less-developed, largely tropical countries, influence methods of infant feeding and hence the pattern of child nutrition (27,28). Dominant in these changes are a decline in breast-feeding, a rise in attempted bottle-feeding with cow's milk, and a tendency to purchase expensive, processed infant foods.

Child Nutrition - Pattern and Parallels

The trend toward the abandonment of breast-feeding has spread from the so-called Western world (29). In part, but in part only, it may reflect the difficulties of continuing breast-feeding in urban employment. In addition, however, it is due to socio-cultural pressures generated by imitation of "economic superiors", as well as locally unethical and inappropriate advertising by milk firms, and poor advice from friends, neighbors, and sometimes, unfortunately, poorly educated health and nutrition personnel. Too often the end-result is an early decline of lactation due to inhibition of the delicate and key psychosomatic "let-down reflex" engendered by uncertainty and anxiety.

As an alternative, the mother attempts to feed her baby on one of the processed milks, usually the most widely advertised and hence the most expensive. The money available only permits the purchase of totally inadequate amounts, and her home surroundings and education make the preparation of clean

feedings improbable (if not impossible). Thus the baby is starved on a homeopathic amount of milk with a heavy dose of contaminating bacteria.

Too frequently the consequence is the "marasmus-diarrhea syndrome". It is this form of severe malnutrition in infants which increasingly dominates the scene in cities, rather than kwashiorkor seen in the second and third years of life in rural circumstances (4).

This shift towards malnutrition in the earlier months of life may be of great significance, since the critical developmental phase for the human brain is from three months prenatally to six months after birth. Also, from the viewpoint of medical economics, marasmus is notoriously slow to respond to treatment and constitutes an expensive, time-consuming "bed-blocker" in the ever-crowded children's ward.

Often unappreciated is the fact that similar nutritional problems were widespread among young children in the urban poor in Europe and North America, even quite recently. Thus, in 1903 in the United Kingdom, the overall infant mortality rate was 132 per 1,000 live births, mostly due to "nutrition-related" conditions, such as atrophy, marasmus, debility, and diarrhea (5). Written in 1906, Newman's remarkable book (5) on infant mortality is almost a primer for those struggling with present-day nutritional problems of tropical cities. He recognized the high infant mortality occurring in the wake of urbanization and the cleavage between the country and towns. For example, in Scotland in 1901, the infant mortality rate in urban Aberdeen was 142 compared with 86 in the rural county of Sutherland (5).

The factors Newman stressed as responsible mirror those of slum areas and shanty towns in tropical countries today, i.e., working mothers leaving their babies at home with young girls or elderly relatives, to be quieted by laudanum and starved on pap or diluted unclean milk which was "almost a

solution of bacteria and little short of a rank poison to an infant" (5). In Newman's time, "hand-fed" babies had three times the death rate of breast-fed infants, and the protective effect of breast-feeding, even in highly unsanitary environments, was well exemplified in London slums, where the infant mortality rate was 106 among people in the Italian quarter (who usually breast-fed their infants) compared with 259 among the native English (5).

Rickets, long recongized as a common affliction of young children in relatively sun-less northern countries, increased with urbanization (5,30). Paradoxically, there is now evidence that rickets, at least of moderate degree, is common in young children in some tropical cities, to some extent due to a low intake of vitamin D, but more to insufficient skin exposure to ultraviolet light in overcrowded slums, sometimes exaggerated by various culturally-based attitudes, such as fear of the "evil eye", which tend to keep infants indoors or overclothed.

Two other nutritional risks need consideration in regard to artificially-fed infants of ill-educated, poor urban dwellers: infantile scurvy and avitaminosis A. While infantile scurvy is virtually unknown in the breast-fed, the risk is great in the artificially-fed infant, and supplementary ascorbic acid, either in tablet form (often the cheapest and bacteriologically safest) or as a locally inexpensive fruit juice, is mandatory with cow's milk feedings. The grave risk of developing avitaminosis A, especially potentially blinding keratomalacia, is very real, if mothers, quite logically, try to feed their infants on cheap dried skim milk, unfortified with vitamin A.

Approaches to Urban Problems of Child Nutrition

The ultimate solutions to the increasingly pressing food and nutrition problems resulting from precipitate over-urbanization lie in the hands of planners, economists, administrators, and, the ultimate arbiters, politicians.

At the same time, nutritionists must be aware of the wider demographic and social changes involved in and resulting from urbanization, if, as is vital, they are to play their role in devising food and nutrition programs for these changing circumstances.

Analysis of the urbanizing process, as in the 1970 Census in the United States, is vital, if causes and remedies are to be devised, and if the most logical and balanced blend of rural-urban development can be sought for the particular country or region. This blend will almost certainly contain elements *of rational, locally realistic town planning, of increased urban employment through industrialization, and of economic development through exploitation of natural resources.* In particular, it must involve improvement in the modernness and attractiveness of rural life, by the spread of amenities, such as electricity, into the countryside, sometimes by the decentralization of industries, and, above all, by giving agriculture an image and a reality that combines profit (agribusiness), status, and "twentieth century" progress. If this can be brought about, it will both diminish the urban flood and increase the food supplies for the swollen cities.

Recent spectacular developments in plant genetics and the use of "intermediate technology" for agricultural machines point the way to the last-mentioned approach. Successes with "packaged" agricultural innovations - improved seed, irrigation, and fertilizer - in India and elsewhere have shown that many farmers *can* be persuaded to modify their methods, if convinced of their profitability. In fact, countries geared to shortages and famines may easily have their storage and distribution facilities overwhelmed by relative surpluses. Vital as the "green revolution" must be to world food supplies in general and to various aspects of urbanization, as with any technical advance, it opens a further "Pandora's box" of problems, notably the profitable disposal of glut

harvests for farmers in countries where the majority of the population, both urban and rural, are impoverished, and where national revenues are too small to subsidize the low-cost distribution of the foods grown (31).

Urbanization is far from a uniform, homogenous process: rather, it is a mixture of numerous factors involving many variables in the immigrants, as well as in the recipient city. The degree of cultural change, especially language differences, the acceptability by the established townsmen, the resources available, the dimensions of the migratory wave, employment opportunities, and the possession of urban skills are some of the pieces of the mosaic. The impoverished refugee in Calcutta (32), the floating seasonal male in-migrants in some tropical cities, the English-speaking Afro-West Indian in London, and the carefully selected Turkish immigrant with an assured job in industrialized Sweden have very different problems, although with certain similarities.

To advise on the best solutions to nutritional problems in the particular urban area, it is necessary to know the form and dimensions of these problems, the reasons for them, and, often forgotten, the existing (or potential) services to deal with them, including the type, function, and training of the staff. The complex information needed can only be acquired from a variety of sources, from persons working in widely varying fields, including, for example, urban geographers and sociologists, demographers, and food retailers.

The young child is as vulnerable nutritionally in the city as elsewhere, so that adaptive maternal and child health services will always be a priority (33) and the promotion of the most appropriate methods of infant feeding a major approach (34).

Nutrition education, geared to the economic, culinary, and social background and the foods available in the city, is a fundamental activity, so much so that special immigrant advice centers and, if relevant, written material in

different languages may be necessary. Acceptability may be facilitated by using trained aides recruited from the area in question.

In the urban context, nutrition education will be very much concerned with:

(a) Making immigrants aware of existing services and their function.

(b) Reinforcing the retention of beneficial traditional practices.

(c) Consumer education.

Caveat emptor - "let the buyer beware" - has been a fact of life from time immemorial. The unsophisticated new townsman, striving for the jet age and with no experience in budgeting and home management, is easy prey to the deceitful half-truths and skillful motivation of the commercial persuaders. This is especially so in relation to the high priced, competitively advertised canned milks, proprietary infant foods, and the so-inappropriately-named "tonic" foods (actually more nearly flavorings). The pediatric nutritionist in many urbanizing parts of the world is left increasingly frustrated by the well financed, steam roller, marketing techniques of the food industry to sell totally unaffordable and inappropriate infant foods in impoverished communities, while mouthing sanctimonious platitudes about their world role in improving child nutrition. The contrary is often the case, and much urban malnutrition in developing countries is in part "commercio-genic", partly because of the "displacement effect" on breast-feeding and partly because of the extremely low cost-nutrient value of the foods offered.

This point can be highlighted by a recent cost-nutrient analysis of foods in various Caribbean islands (Table 1). The cost of 20 gm. protein from dry skim milk (5 cents), pulses (6 cents), and sardines (18 cents) contrasts strikingly with strained vegetables and processed infant meat foods ($2.08) (35).

Table 1: Cost of calories and protein in available foods in the West Indies (35)

FOOD	COST PER 1,000 CALORIES	COST PER 20 GM. PROTEIN
Dry skim milk	$0.25*	$0.05
Pulses	.22	.06
Cornmeal, wheat flour	.10	.08
Salt fish	1.20	.10
Rice	.13	.12
Macaroni, rolled oats	.25	.15
Sardines	.60	.18
Fresh milk	.55	.20
Fresh beef, goat, mutton, Cheddar cheese	.60	.20
Fresh fish	1.80	.20
Bread	.25	.20
Chicken necks and backs	1.10	.20
Corned beef	1.20	.20
Peanut butter	.47	.22
Dry whole milk	.55	.23
Sweetened condensed milk	.25	.23
Evaporated milk	.55	.25
Minced (ground) beef	.90	.25
Ground provisions (root crops)	.25	.28
Fresh pork	.40	.35
Broiler meat	2.20	.35
Irish potatoes	.60	.40
Frankfurters, sausages	1.10	.40
Fresh eggs	1.60	.40
Milk-based, cereal-based infant foods	.80	.51
"Health promoting" foods	.80	.56
Plantain, green bananas, ripe bananas	.29	.59
Infant foods - strained meats	4.87	.69
Infant foods - strained vegetables and meat	4.58	2.08
Arrowroot	.55	13.00
Sugar	.09	infinity
Margarine, cooking oil	.15	infinity
Glucose	.80	infinity

*Eastern Caribbean dollar (50 cents U.S.)

One may perhaps hereby permit the following philosophical, but intensely practical, question to the infant food industry of North America, Europe, and the Antipodes: Is it justifiable (or even ethical) to use ruthless modern advertising campaigns to sell inherently good quality, but highly

expensive milks and infant foods in communities where there is no chance that they can be purchased in adequate quantities?

Breast Feeding and Artificial Feeding

Even in the mechanistic atmosphere of the city, the first bastion of infant nutrition is human milk, particularly during the early months (36), and a corner-stone of any nutrition program must be to promote the optimal lactation pattern for the particular community. Community nutrition programs to achieve this are in urgent need of investigation and must plainly be geared in large measure on such non-nutritional motivations as status, prestige, convenience, economy, and emotional advantage. The activities of La Leche League of the United States may be most helpful in this regard.

There appear to be two views on the increasing lactation failure seen in the cities of less developed regions. One group is of the opinion that "nothing can be done", believing that it is one aspect of the inevitable change accompanying urbanization. If, however, this "inevitable" school is correct, then it must be realized that a consequent rising tide of diarrheal disease and marasmus is even more inevitable.

Successful bottle-feeding depends, at present, on a sufficient income to purchase nutritionally adequate quantities of processed milk,* on a level of general and kitchen hygiene that permits the clean preparation of feedings, and on a mother sufficiently educated to follow the not-so-simple domestic mathematics of formula preparation. This is not in sight for the majority of the slum dwellers and shanty town inhabitants who make up a high percentage of the population of tropical cities. Analogies with rapidly industrializing Europe of fifty years ago, then backed by a parallel increase

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*Or on a national budget sufficient to purchase and issue free, or at a subsidized rate.

in food production nationally and from overseas, and with virgin markets for manufactured goods all over the world, must obviously be made with caution. Urbanization plus industrialization and economic development plus increased food supply cannot be equated with over-urbanization with neither.

Widespread lactation failure also has unappreciated consequences as regards national economics and food production. Alternative sources of protein food suitable for babies, probably animal milk, will either have to be imported (with expenditure of foreign currency) and/or produced locally. The potential magnitude of production required may be suggested by the fact that present consumption in India can be estimated to be over 25 million liters daily. This would need the output of some five million lactating cattle, if cow's milk were used as replacement.

Breast milk must also be taken into account in calculating overall protein supplies in a country, and, the introduction of processed infant foods must be considered in this relationship also.

Man's ingenuity is needed not only to devise new protein sources to bridge the increasing "world protein gap", but to prevent the nutritional retreat of declining breast-feeding, currently occurring with little appreciation of its consequences.

Those concerned with health and nutrition services for young children usually agree with the need to breast feed in developing countries and in the dangers of inadequate artificial feeding. However, their posture is supine, dejected, and apologetic; a more outspoken and aggressive attitude is needed in which the following considerations may play a part:

(a) Disincentives to the use of over-expensive, processed milks given by bottle-feeding. It is extremely important that an awareness of this situation be included in the training of medical and

allied health staff, and all others engaged in nutrition education.

Unpaid advertising for commercial concerns must be avoided. This includes, for example, discouraging the use of inappropriate (ill-health education) commercial posters, pamphlets, booklets, and so on in health centers and hospitals, especially in clinics for young children and maternity units. It includes forbidding the acceptance and use of labelled samples for distribution in health services, regulating the attendance of "milk firm" nurses in the health service, and issuing addresses of newly delivered mothers to milk firms.

Conversely, for babies who must be bottle-fed, positive nutrition education is required to promote, advertise, and use in the health services and elsewhere, the most economical, locally available breast-milk substitute. This is often full cream, powdered milk, or (if this is not financially feasible) dried skim milk, possibly repackaged in the country with due attention to vitamin A intake, or, potentially, less expensive animal-vegetable protein formulas, urgently needing development.

At present, so devious is the "supermarket shell game" that the sorting out of the cost-nutrient values of different available processed milks may tax the ingenuity, patience, linguistics, mathematics, and scientific training of even the literate nutritionist. It is imperative to know the best buy and endorse its use actively.

That only one milk formula is necessary for infant feeding for the majority was indicated by wartime experience in the United Kingdom, when only one full cream milk was available and child nutrition improved and by recent practice in the United States of employing a simple formula of evaporated milk for standard infant feeding in most

children's hospitals. The alleged competitive advantages of most commercial milks are strictly peripheral and minor; they are not only irrelevant, but dangerously confusing, in "front-line" pediatric nutrition in tropical cities.

Potentially, legislation on food standards is needed to guide activities of commercial infant food firms, to control the content of advertising via mass media, and possibly to direct national food policy towards placing inappropriate, expensive imported milks and processed infant foods on a "negative" list. This would also have the advantage of saving foreign currency.

(b) Incentives to promote breast-feeding. Initially, there is great need for combined pediatric and sociologic studies on the pattern of breast-feeding and the epidemiology of lactation failure in various communities in the world.

Campaigns to promote breast-feeding should stress its modernness. The influence of La Leche League may be important here, as can be the examples of internationally famous women or wives of leaders of the community. Potentially, the lactation pattern might also be improved by legislation for lactation leave or by the development of creches where working mothers may be able to breast-feed their babies.

Foods for the Transitional Child

Foods for the transitional child - that is, usually from four to six months of age onwards - pose special problems for parents in urban circumstances. Nutrition education should be geared to the best use of traditional foods, if available. It is, for example, of interest that the Basic Four

items making up the "soul food" of the southern immigrant to the cities of the northern United States - dark green leafy vegetables (collard or mustard greens), legumes (black-eyed beans), corn (pone, hominy grits), and less costly, but often highly nutritious, bits of pork (chitlings) or chicken - constitute near perfect "multi-mixes" (37).

In addition to consumer education and guidance in buying both fresh and processed foods, the overall program must be concerned with legislative price control of nutritionally vital, but less costly foods, the enrichment of staples (where relevant), and collaborative efforts with the food industry towards the development of high status, moderate cost, high-protein family foods that are particularly valuable for young children.

Some form of food subsidization program will be needed, as, for example, the Food Stamp program of the United States or the low-cost sale of dried milk at child welfare centers in Britain. Whatever is issued should be geared to food habits, nutritional needs, and educational aims.

Difficult problems will need consideration in each area, especially methods of selection of recipient children (or families) in relation to limited funds and foods available. A careful balance is needed to deal with real want and to avoid "welfare dependence". In any part of the world, this constitutes an interim measure, becoming less necessary with increasing prosperity and food production.

An especially important aspect of adaptive maternal and child health services for cities is the provision of the most locally suitable form of day-care centers, where children can be left to be cared for and fed while their mothers are working.

Conclusion

Few institutions have evoked such a depth of feeling and contradictory attitudes as have cities. On one hand, they are categorized as "consumers of mankind, offering disease, misery, poverty and want to millions". Conversely, a different image is recognized linguistically in such laudatory words as "urbane" and, indeed, "civilization".

Contrariwise, country life has been categorized historically as unmannerly and rough, so that Holme in 1688 labelled a "Rustick Fellow" as "one without City or School Breeding, without Cleanliness and of Slovenly Speech". Everything rural may be considered as plain, simple, and unspoiled.

In fact, of course, serious problems of all sorts, including those in the nutritional field, exist in both environments. For example, in child nutrition one may contrast rural kwashiorkor with urban marasmus. What is more, both ways of life are inter-dependent on each other in various ways, notably as producer of food and manufacturer of goods, respectively.

Techniques of extending health, education, nutrition, and modernization in general to rural areas will obviously continue to exercise the planners' ingenuity, both because these needs are far from being met and would be an antidote to precipitate, unbalanced disurbanization. At the same time, innovative, imaginative thinking and urgent action are needed to help bridge what may be one of the major and most turbulent ecologic transitions of man's history, from 1850 with 4.3 per cent of the world living in the cities, to 1950 with 20.9 per cent urbanized, toward Doxiadis' ecumenopolis early in the twenty-first century.

Plainly, during this time of change, there is a great danger that cities, perhaps especially in less developed regions, may self-destruct, if Sjöberg's three preconditions for city development (1) become negated by

disurbanization, leading to the development of an unfavorable ecology, i.e., a totally inadequate water supply, with an unstable political and economic social organization, and without the support of increased agricultural food production.

Lessons can certainly be sought from the early Industrial Revolution in Euro-America, but parallels must be made with caution, as the present circumstances with urbanization in less developed regions are so disparate. In particular, unsophisticated new townsmen today may have an almost cult-like expectation of "instant prosperity", fostered by mythologic advertising, the more sensational mass media, and sometimes by politicians, at least while in opposition. Each space-probe or heart transplant endorses the apparent nearness of the age of unlimited scientific wonders and makes the reality of the shanty town and the absence of medical care and social services more difficult to understand - or to bear.

The solution to the world-wide problems of channelling scientific knowledge to the improvement of urban (and rural) living are plainly mainly organizational, administrative, and financial rather than technical. However, within this perhaps-changing framework of man-made constraints, those in the wide field of food and nutrition have much to contribute, by an increased awareness of the new problems, by developing a more meaningful dialogue between nutritionist and food industry, by participating in multi-mind studies of the interaction of food and human nutrition in urban ecologies, and by developing and deploying adaptive programs imaginatively geared both to the needs and aspirations of the new townsman, yet realistically dovetailed with actual opportunities and available resources.

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CFNI NEWS

With this issue readers will be receiving a supplement which lists the very varied and confusing local names of fruits, vegetables and roots in the English-speaking Caribbean. Dr. S.K. Reddy formerly of CFNI and Dr. Dennis Adams of the Department of Botany, U.W.I., have been chiefly responsible for this revision and expansion of an earlier list, assisted by numerous readers in the various islands and Guyana.

A series of one-day seminars on Young Child Feeding is being held in various parts of the Caribbean. They are sponsored either by the governments or by the governments and CFNI jointly. The objective is to discuss the recently published "Guidelines to Young Child Feeding in the Contemporary Caribbean" and in particular to make arrangements for amplification and adaptation to the precise local circumstances (e.g. in respect of food preferences and availability) and for the popularisation of the main principles therein. Such meetings have been already held in Barbados (see p. 51 of this newsletter) and in Jamaica both at the national level and at the local level, in the parishes of Portland, St. Catherine, Westmoreland and Hanover. Seminars are planned for Kingston and St. Andrew parish, Cayman Islands, St. Vincent and Dominica, and it is hoped also to hold similar seminars in all the other parishes of Jamaica and in St. Lucia, St. Kitts and Bahamas.

CFNI is very much occupied also at present with final preparations for the National Food and Nutrition Survey of Guyana to begin in mid-April. The pre-testing of questionnaires was completed early in March.

CAJANUS CAJAN - THE PIGEON OR GUNGO PEA

by

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The pigeon pea or gungo pea (*Cajanus cajan* (L.) Millsp.) is an important source of protein in the human diet in the Caribbean and in many other tropical areas. Mature green seeds are consumed as a vegetable and the dry ripe seeds are eaten as a pulse. People of East Indian origin often split the dry seeds to make "dhal". In addition, the pigeon pea is also an important fodder crop in many parts of the tropics.

Varieties

The pigeon pea varieties that have been grown traditionally in the Caribbean are short-lived perennials which grow to 8-15 feet tall. These varieties are all indeterminate - that is they bear flowers and pods over a period of several weeks, the pods maturing progressively from the base to the apex of a long flowering stalk (the inflorescence). As a result, such plants may have, at any one time, flower buds, open flowers, young pods, mature pods and even dry pods.

Scientists at the Faculty of Agriculture of the University of the West Indies have developed a number of new varieties, some of which are dwarf and, more or less, determinate - that is they produce flowers almost simultaneously.

**Dr. Hammerton and Dr. Pierre are, respectively Agronomist and Plant Pathologist in the Faculty of Agriculture at Mona.* *Dr. Pierre is also Leader of the Faculty's Grain Legume Programme, which has been supported by a Rockefeller Foundation Grant. This article is based largely on work carried out under the auspices of this programme.*

These varieties also bear earlier and are capable of producing three or four discrete flushes of flowers over the period October to March if planted in May or June. The local types, in contrast, bear almost continuously from late - December to February or March. Of the new varieties, a number are dwarf, growing typically to 3-4 feet at flowering, and forming tight rounded bushes, compared with the much taller, laxer and open habit of the local types. With the new dwarf varieties harvesting is easier because of their more compact form, and the greater uniformity in pod maturity. The University of the West Indies collection consists, at present, of 17 varieties which includes medium and tall and indeterminate varieties in addition to the dwarf types, discussed above. Breeding and selection of new varieties continues.

Recent experience with the new dwarf varieties indicates that they are less determinate, and possibly less compact, in Jamaica than in Trinidad, where the breeding and selection has been done. This is, presumably, an effect of latitude or daylength variation, and their determinacy may vary somewhat from island to island in the Eastern Caribbean.

Variety Selection. Pigeon pea plantings generally consist of a mixture of local types, and farmers have given little or no attention to the selection and planting of distinct varieties. Yet there are definite advantages in the use of specific varieties for specific purposes. For example, a variety that can be recommended for home garden use is quite different from a variety suitable for the early production of mature green seeds for marketing, or for large scale production. A recent study has shown quite clearly that one of our University of the West Indies varieties (GI 26/2) is superior in every respect in its processing qualities when compared with the mixtures of varieties that are generally canned in Trinidad. Farmers must become more *variety conscious* and more *quality conscious*.

Agronomy

The pigeon pea tolerates a wide range of soils, but extremely acid soils may inhibit nodulation, while recent work suggests that on some soils of high pH (7.5% or so), regrowth after the first bearing may be extremely chlorotic and plants may suffer severe dieback. The plant is relatively drought resistant but cannot tolerate waterlogging. It appears to be relatively indifferent to the level of soil fertility and does not, generally, show any response to fertilizers. Responses to phosphate, have however, been recorded elsewhere than in the Caribbean. A recent experiment in Jamaica gave a 21% increase in the yield of dry seed (from the first flush of bearing) with heavy applications of a compound fertilizer every 15 days. It is unlikely that this would prove economical.

No special land preparation is necessary, but perennial weeds should be destroyed and a sufficiently fine tilth produced to ensure intimate contact between seed and soil.

Sowing Date. Pigeon peas are photoperiodic - that is, they are sensitive to daylength - and hence are very responsive to sowing date. The height at flowering and number of days to bearing are determined by date of sowing. The new dwarf varieties, for example, were found to vary in height at flowering from 37 to 47 inches when sown in November, to about 90 inches when sown in March. The number of days to flowering varied correspondingly from 70 days (November) to 156 days (March). The conventional time of sowing is May or June, which, in much of the Caribbean, corresponds with the start of the rainy season. From such a sowing, the tall local types will typically start flowering in November, whereas the new dwarf varieties will start in late September or early October.

Spacing. The crop is usually widely spaced from 3 x 3 feet for dwarf varieties, to 5 x 5 feet (and even more if it is to be intercropped) for the tall varieties. It is invariably grown from seeds sown *in situ* - normally 3 to 4 per hole and later thinned to one plant. Transplanting from a seed-bed or from seed-boxes is possible, but is generally unnecessary except in experimental work. With the dwarf varieties spacing has a marked effect on height and yield. Close spacing increases height and reduces yield per plant, but the greater plant number per acre at close spacings substantially increases yield per acre. In an experiment done in Trinidad, two dwarf varieties planted in June averaged 59 inches in height at flowering when planted at 1.6 x 1.6 feet, and 50 inches when at 5 x 5 feet. Corresponding yields of mature green pods *per plant* averaged 7 ozs. and 22 ozs. from two reapings of the first bearing, but yields per acre were 6,950 lb./acre at the close and 2,430 lb./acre at the wider spacing.

Weed Control. Weed control is very important during establishment as early growth is slow, and the crop can be easily smothered if weeds are not controlled. Gesagard 50W (active ingredient prometryne) at 2 lb./acre *pre-emergence* is safe and will control many annual weeds for up to 6 weeks. If weeds are present at the time of planting, Gramoxone (1 pint/acre) should be added to the spray mixture. Maloran (active ingredient chlorbromuron) at 4 lb/acre *pre-emergence* will control white top (*Parthenium hysterophorus*) and gives longer control of weeds than Gesagard. In a recent trial however, Maloran treated plots gave a lower yield than Gesagard plots, although stand and height were unaffected.

Subsequent weed growth can be controlled by shielded sprays of Gramoxone. Ring weeding may be necessary if vigorous weed growth threatens to smother the young crop plants. With the relatively dense habit of the new dwarf varieties,

weed control is usually unnecessary once they are 2½ to 3 feet tall, provided the spacing is not more than 3 x 3 feet.

Pest Control. The most important pests in the field are the leafhoppers and pod borers. Leafhoppers cause severe leaf curling and reduction of leaf size, and may transmit what is probably a virus disease. Leafhopper damage is particularly serious in St. Vincent and Jamaica. This pest can easily be controlled by periodic application of malathion (1 - 1½ lb./acre active ingredient). Several pod borers attack pigeon pea, the most important ones being *Ancylostomia Stercorea, Heliothis virescens, H, zea and Fundella pellucens.* In general, the adults lay eggs on the flowers and young pods and the young larvae burrow into the pod and feed on the developing seeds. The loss of one or more seeds per pod as a result of pod borer damage adversely affects both yield and quality. In the determinate dwarf varieties, three sprays of DDT (2.0 lb./acre), Dipterex (1.5 lb./acre) or Gardona (1.5 lb./acre) at 3-day intervals at peak flowering have given good control. These pests are much more difficult to control in the indeterminate varieties which have an extended flowering period.

Small weevils (Bruchids) cause extensive damage to dry seeds in storage. Since Bruchid infestation can, in fact, begin in the field, fumigation of seed and storage in sealed containers is recommended for seed to be used for human consumption. Seed for *planting* can be protected by dusting with dieldrin or other suitable insecticide. It is better to use a fungicide/insecticide mixture, and captan or thiram are the preferred fungicides.

Disease Control. The most important diseases of pigeon pea are rust (*Uredo cajani*), wilt (*Fusarium sp.*) and collar and stem canker (*Phoma cajani*). Very little is known about the control of these diseases, but investigations now being carried out give some indications of control measures. Rust can cause

severe premature defoliation of plants, and attempts are currently being made to breed for rust resistance.

Yields. There are relatively few reliable data on pigeon pea yields: published data often do not indicate the number of reapings, nor the duration of reaping, so making valid comparisons difficult. Yield data from a Trinidad experiment have already been quoted. In a survey in Trinidad yields varied from 200 to 5,000 lb./acre green pods, but plant spacings varied widely due to intercropping. Other work in Trinidad gave yields of 2,970 to 3,510 lb./acre green pods from the dwarf varieties over a full season, plus small amounts of dry pods, but up to 7,500 lb./acre have been obtained, in Trinidad, over a full season from one of the new dwarf varieties. In Marie - Galante one of our dwarf varieties gave 10,090 lb./acre green pods from two flushes of bearing. This figure is the yield after pod-borer damaged pods had been removed: gross yields exceeded 13,000 lb./acre. In Jamaica, yields of dry seed from the dwarf varieties in three experiments ranged from 900 to 1,610 lb./acre from one flush of bearing. Using a conversion factor of 3.3 to convert dry seed yields to green pod yields gives 3,000 to 5,300 lb./acre. Much of the variation in yield illustrated above can probably be attributed to differences in varieties and agronomic practices, but it appears that the performance of our new dwarf varieties may vary widely from island to island. Part of this variation may be due to pest and disease (particularly rust) incidence, but meteorological factors at flowering, which may be very important in determining pod setting, may also be involved.

A New Idea.

An increasing demand for green peas for processing, and problems of labour for hand reaping, have led us to examine the problems of mechanical harvesting. The compact form and determinacy of bearing of the dwarf varieties are

valuable, or indeed essential, plant characteristics for mechanised harvesting. Since the problems of mechanically reaping pods from discrete, spaced, bushes or from plants grown as a hedge, are considerable and likely to involve large and cumbersome machinery, it was decided to try modifying the plant to make it more amenable to mechanical reaping. This can be done by making our dwarf varieties into "mini" pigeon peas. Planting in November or December reduces plant height at flowering and branching. By crowding such plants, at densities which may need to be about 80,000 per acre (a spacing of 12 x 6.5 inches), the plants bear most of their pods near the top of the plant canopy, and mechanical reaping is immensely simplified. Essentially this technique converts the pigeon pea from a spaced crop to a row crop. Work in both Jamaica and Trinidad has demonstrated the feasibility of this approach. In Trinidad the twigs of dwarf varieties grown in this way and bearing green pods were cut by a mower and successfully threshed by a stationary viner. For production of dry seed a conventional combine harvester, with only minor modifications, could be used.

Work in progress in Jamaica, and planned for the future, aims at determining the optional sowing dates and densities for such late sowing/high density crops. Other factors such as weed control, fertilizer response, and the use of growth regulators to modify plant form, will also be examined.

We are indebted to our colleagues, past and present, in the Faculty of Agriculture, both in Jamaica and Trinidad, on whose work and experience we have drawn in preparing this article. They include D. Henry, L. Kasasian, S. Parasram, W.V. Royes, J. Seeyave, J. Spence and S. Williams. We are similarly indebted to G. Sammy of the Faculty of Engineering, University of the West Indies, Trinidad, for information on canning. Much of the work referred to has been published in the Yearly and Half-Yearly Reports of the Faculty of Agriculture, U.W.I.

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GENERAL NUTRITION NEWS AND OPINION

WHAT IS A NUTRIBUN?
From Free World, Vol. XIX, No. 9

What is a Nutribun? It is a special milk bread created in the Philippines to supplement the diets of undernourished schoolchildren.

It is made up of vitamin enriched flour, dry skim milk, sugar, salt, oil and yeast. It is 133 grams in weight and so while similar in appearance to a large American hamburger bun is heavier and thicker in texture. There are several formulations, but when made up with wheat flour it contains over 17 grams of protein and 511 calories. The children think it delicious and it is quite a satisfying meal for one sitting.

The bun is made up with Food For Peace commodities in the main, and the baking cost is 5 Philippine centavos. The attached table shows the formulation and nutrient composition of the kind used in the Philippines, but there are also other formulations e.g. 25% rolled oats, 75% wheat flour which gives 19.0 gms. of protein and 517 calories per bun and 40% rolled oats, 60% wheat flour which gives 19.9 gms and 521 calories per bun. Again the nutrient value will vary according to how much the flour is enriched and whether the dry skim milk is fortified with vitamins A and D. Then again if a sandwich filling is used, this could supply vitamin C and enrich the value in other ways.

NUTRIBUN FORMULATION

BASIS: 50 lb-bag of flour

INGREDIENTS	BAKERS %	GRAM-WEIGHT
FLOUR, all purpose	100.00	22,700.00
WATER (not less than)	60.00	12,940.00
YEAST, active dry	2.00	454.00
SALT	1.50	340.00
SUGAR, fine granulated	12.00	2,724.00
SHORTENING, liquid	5.00	1,135.00
MILK, powder non-fat	14.00	3,178.00

MIX (conventional mechanical mixer): 20 to 30 minutes

FIRST FERMENTATION: 35 minutes

PUNCH

SECOND FERMENTATION: 15 to 20 minutes

SCALING WEIGHT: 175 grams

FINAL PROOF: 35 to 40 minutes

BAKE: 15 to 20 minutes at 385°F.

AVERAGE BAKED WEIGHT/bun: 150 grams

AVERAGE YIELD: 220 Nutribuns

NUTRIBUN - FOOD COMPOSITION (Per Bun)

COMMODITY	GRAMS	CALORIES	PROTEIN (mg)	CALCIUM (mg)	IRON (mg)	THIAMINE (mg)	RIBOFLAVIN (mg)	NIACIN (mg)	VITAMIN A I.U.	ASCORBIC ACID (mg)
Flour	100	364	11.6	16	2.90	.44	0.26	3.5	0	0
Milk	14	51	5.0	183	.08	.05	(0.25)	0.1	4	1
Oil	5	44	-	-	-	-	-	-	-	-
Sugar	12	46	-	-	-	-	-	-	-	-
Yeast	2	6	(0.7)*	(0.9)	(0.3)	(0.05)	(0.11)	(0.7)	Tr	Tr
	133	511	17.3	199.9	3.28	.54	.62	4.3	4	1

* - Numbers in parenthesis denote values imputed - from another form of the food or from a similar food.

I.U. - International Unit.

Tr - Trace

In Tondo, a slum district in Manila of nearly half a million population, a survey had shown that over half of the schoolchildren were suffering from malnutrition. Yet, the school feeding program was not going well, and in fact, no Tondo schools were participating. The reasons offered were that the people were too poor to afford even this, and the schools so overcrowded that there was no space to cook.

The Nutribun was devised as the answer, baked in local bakeries under contract. In a program run by Catholic Relief Services the children pay only the local cost (10 centavos, about a third of the market value). The children eligible to receive these Nutribuns are those whose weight for age falls into the undernutrition zone of a simple weight for age chart.

ENZYME ACTIONS IN FOOD TECHNOLOGY
Editorial, Lancet, April 25, 1970

The large-scale synthesis of foods has often been predicted; but it still seems as remote as ever. If it should come about, and if the methods used are purely chemical, food production will be divorced from enzymology. Till then, the food technologist must be a versatile and well-informed enzyme chemist, for enzyme actions obtrude themselves in every sector of his craft. They control such processes as the developmental changes that bring seeds, fruits, or leaves into the conditions in which they are ready for harvest; the age-dependent changes in meat; maturation in such commodities as cheese and wine; and some of the changes that take place during storage. They will play an increasing part in the economical recovery of valuable components from material now discarded.

Food technologists are not concerned with the more physiological actions of enzymes; but, by measuring the amount of an enzyme (or the product of its action) in foods, they can give valuable guidance to plant breeders. For instance, some varieties of mango contain 18 times as much ascorbic acid as others, and the shelf-life of many fruits depends on the stability of the pectin in them. Such differences depend on enzyme content, and enzyme assay could be used to guide selection.[1,2]

Food preservation is often regarded simply as a matter of preventing attack by bacteria and other organisms - hence the appeal of sterilization by ionising radiations. This technique has so far proved disappointing, and it is well to remember that, even if sterility could be achieved without causing harmful side-reactions, the enzymes in many foods would remain active and would bring about changes that other methods of preservation control. Heating, if sufficiently prolonged, not only sterilizes food but also inactivates most of the enzymes in it. Drying, or the addition of acid, salt, or sugar, establishes conditions inimical to enzyme action. Most enzyme actions are slowed down by freezing, and oxidations can obviously be prevented by excluding air. But there are exceptions to all these generalisations. Some enzymes are remarkably thermostable, some continue to act even in the dry state, some are activated by freezing, and deterioration may be anaerobic.

Deterioration during storage takes many forms: the development of "off" flavours, the destruction of vitamins, the loss through respiration of the main substance of the food, and the formation of substances of varying degrees of toxicity. The actual nature of the changes that cause "off" flavours is not known. It is easy to show that this deterioration is accompanied by the accumulation of various volatile substances (acetaldehyde, for example) but no as yet identified substance is thought to be actually responsible for the change in flavour. Furthermore, this is a domain dominated by habit and opinion. Since most people agree that perfectly fresh green peas are ideal, cooks and food manufacturers take great pains to minimise enzyme actions by cooking peas soon after harvest and immediately after shelling. The processes used in the manufacture of tea are designed to promote actions similar to those that are so carefully avoided with peas.[3] The enzyme actions that have gone on in the cheeses most relished by gourmets would, in any other protein food, be regarded as a deterioration. The enzymes responsible for these changes do not come from the milk: they are made by other organisms, and the amines produced in a ripe cheese are probably mildly toxic. The more acutely toxic products of deterioration (aflatoxin in a food that has been badly stored, for example) are also the product of the growth of other organisms. The only generalisation that can be hazarded is that changes brought about by a foodstuff's intrinsic enzymes rarely, if ever, make it more toxic; sometimes they improve it and sometimes not. Enzyme actions brought about by even controlled invasion by other organisms are more suspect.

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Far-sighted scientists have for many years been grumbling about our wasteful habits and the pollution that they cause. The theme has suddenly caught public attention. The food industry is a crass offender. Four-fifths of the whey in the U.S.,[4] containing nearly 100,000 tons of protein a year is wasted. When peas are harvested for quick freezing there is more protein in the discarded pods and vines than in the peas; and many other examples could be given. By-products are often used as fodder for ruminant and non-ruminant animals. Interest has recently been increasing in their use as substrates on which to grow bacteria or funguses that could be used as food or fodder. This is encouraging, but animal or microbial conversion is of necessity accompanied by losses that range from 60% to 95%, because of the converters' own metabolic processes. One approach is to extract some at least of the valuable constituents from a waste by mechanical means; more than half of the protein in pea waste can be extracted. Selective enzymic destruction would be an alternative approach. By-products are sometimes discarded for purely aesthetic reasons - the outer leaves of cabbages, for example. More often they are indigestible, either intrinsically (as in feathers) or because of the presence of more fibre than the human gut can tolerate. The amino-acids in feathers would become useful if the structure were dispersed by a keratinase; and useful protein, fat, and carbohydrate would be liberated if a cellulase were available that was substantially free from enzymes able to act on the useful components. Cellulose is the most abundant single organic substance: it is odd that so little attention is paid to the enzymes that act on it.

THE DOMINICAN REPUBLIC DIVERSIFIES EXPORTS
by Campos S. DeMoya, in 'Foreign Agriculture', September 21, 1970

To widen and stabilize its export base, the Dominican Republic has been diversifying its exports in the last few years. Its exports of commodities not traditionally important to its economy increased at a faster rate in the years from 1966 to 1969 than did its exports of other items. This nontraditional share of the total value of exports rose from 1.01 percent to 6.16 percent in the 4-year period. Most importantly, the value of beef exports - mainly fresh or frozen - increased from $200,000 to $4,741,000.

Greatly aiding this diversification were changes in domestic production patterns. Traditionally the Dominican Republic has depended on four agricultural commodities for nearly all of its foreign exchange - sugar, coffee, cocoa, and tobacco. In the early 1960's, however, the country realized that continued heavy reliance on these exports was hampering its economic growth. So, acreage for such commodities as livestock, sweet potatoes, pigeon peas, plantains, yautia, and yucca was increased at the end.

Sugar has been and still is the Dominican Republic's most important export. Overseas sales of this commodity, however, are heavily dependent on the U.S. Sugar Act and the International Sugar Agreement. Quotas allotted to the Dominican

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4. Ben-Gera, I., Kramer, A. *ibid.* p. 77.

Republic fluctuate. As a result, sugar producers have taken steps to free marginal sugarcane lands for the production of other crops, most importantly, beef cattle.

DOMINICAN REPUBLIC: VALUE OF TRADITIONAL EXPORTS

Product	1966	1967	1968	1969
	1,000 dollars	*1,000 dollars*	*1,000 dollars*	*1,000 dollars*
Sugar, raw	70,320	81,822	82,862	88,117
Cocoa	10,682	11,624	13,474	19,809
Coffee, green	20,963	16,967	17,922	21,253
Tobacco	6,602	10,797	11,454	12,643
Total	108,567	123,210	125,712	141,822

DOMINICAN REPUBLIC: VALUE OF NONTRADITIONAL EXPORTS

Product	1966	1967	1968	1969
	1,000 dollars	*1,000 dollars*	*1,000 dollars*	*1,000 dollars*
Peppers	58	197	248	414
Pumpkins	18	45	78	218
Sweet potatoes	6	38	113	160
Coconuts	319	550	605	562
Pigeon peas	285	662	1,473	1,265
Plantains	29	105	0	292
Cucumbers	0	72	225	142
Tomatoes	10	46	69	127
Yautia	70	229	553	733
Yucca	104	220	284	440
Onions	0	1	4	21
Avocado	0	144	69	189
Subtotal	899	2,309	3,721	4,563
Livestock, meat and meat products	200	673	4,111	4,741
Total	1,099	2,982	7,832	9,304

SOME MISCONCEPTIONS ABOUT NUTRITION WHICH ARE COMMON IN THE WEST INDIES

by

Saranya K. Reddy

Education in nutrition is not an easy job, largely because most people already have long-established and deeply rooted ideas about food and nutrition and there is often unconscious resistance to modifying or changing these so as to be more in line with modern knowledge. It may be useful therefore to make an inventory of some of the common misconceptions in the field of nutrition. The following misconceptions I should point out are found not only among the lay public, but a few are shared to some extent by those whose jobs involve educating the public. It is after all, only natural for us to get a little out of date if we do not have the opportunity to review our ideas in the light of newer experience.

MISCONCEPTION NO. 1

Faulty knowledge as to the nature, prevalance and effects of malnutrition

It is often thought that malnutrition means only some kind of vitamin deficiency. It is often not realised that general protein-calorie malnutrition of early childhood (PCM) is by far the major problem and that in many parts of the Caribbean at least 0.5 percent and as many as 2.5 percent of children under 3 years are suffering from *severe* protein-calorie malnutrition at any one point in time. Moreover there are between ten and twenty children with moderate but quite definite malnutrition for every child with the severe degree, and indeed it is a fact that the *majority* of children between 6 months and 3 years of age have in some degree fallen short of the potential growth which they demonstrated in their first three months. Nor is it realised how very closely gastro-enteritis (diarrhoea and vomiting) is linked with this protein-calorie malnutrition.

Most children with moderate or severe PCM have been through repeated episodes of gastro-enteritis.

MISCONCEPTION NO. 2

Failure to give due weight to the importance of caloric intake in the cause and prevention of Protein-Calorie Malnutrition

There has perhaps been undue attention focused on protein insufficiency in PCM with the result that the calorie dimension of this syndrome has tended to be overlooked. Findings from recent dietary surveys (Table I) have revealed that there is need to pay attention to calorie intakes of infants and young children at least as much as to protein intakes, which appear to reach required levels more easily.

TABLE I

(a) *Dietary Survey of Infants and Toddlers in Jamaica 1963 - 64, Fox, H.C. et al.*

Age	% Satisfaction of Requirements	
	Calories	Protein
0 - 11 months	63%	55%
1 - 2 years	63%	58%
3 - 6 "	63%	80%

(b) *Food Consumption Survey 1969 Barbados*

Age	% Satisfaction of Requirements	
	Calories	Protein
6 - 23 months	45.5%	97.8%
2 - 4 years	49.7%	94.7%
Family	96.4%	120.8%

The work of the Tropical Metabolism Research Unit, of the University of the West Indies, showing the key role of caloric intake in recovery from PCM, is very relevant in this respect.

MISCONCEPTION NO. 3

Lack of quantification of poverty and low incomes

While there is general recognition of the existence of poverty, and its role in the genesis of PCM this factor tends to be considered only in the abstract. It is seldom quantified and thus its full significance is often lost.

We have for instance the household expenditure survey of Jamaica 1963 - 64 (Table II), from which it will be seen expenditures on food per family per week ranged between $4.40 to $7.60.

TABLE II

Average weekly expenditure per family per week
(Household Expenditure Survey - Jamaica 1963 - 64)

	Total Expenditure	Food Expenditure	Food as % of Total
	J$	J$	
Kingston Metropolitan Area	16.50	7.60	46
Main Towns	11.90	6.00	50.7
Rural Areas	7.70	4.40	56.6

From the Tropical Metabolism Research Unit unpublished data indicated that 93% of the families of children admitted with severe PCM had less than J$8.00 per week per family for food and 50% had less than J$4.00. These figures provide a frame within which advice must be formulated, if families are to be helped to get the best value for their money. Failure to determine the specific amount of money available will tend to result in advice which is impractical and hence ineffective.

MISCONCEPTION NO. 4

Consideration of cereals as starchy foods only

This concept originates in classifications developed in industrialised nations. In those areas protein-rich foods of animal origin have been relatively easily available, and thus this group of foods has been classed as protein foods, while cereals, because of their proportionately larger content of carbohydrate, have been classed as starchy foods. In essence this classification in the context of the industrialised nations is broadly correct. However, in the developing countries in general this classification is not justifiable, since animal protein foods have always been in shorter supply and the traditional dietary pattern includes a high percentage of cereals. The protein content of cereals is in truth moderately high, ranging as they do from 6 to 14%. Hence the total contribution of protein from cereals in the context of developing countries is considerable. Table III presents percent contribution of food groups to calories and nutrients as found in the National Nutrition Survey of Barbados in 1969. It will be seen that cereals contribute 30% of total protein of diet. Furthermore useful contributions of the B vitamins are also obtained from this food group. In view of these facts, it is quite incorrect in the West Indian context to consider rice, wheat and corn as merely starchy foods.

TABLE III

Percent contribution of food groups to total calories and nutrients intake in diets in Barbados - 1969

	Cals.	Prot.	Ca.	Vit. A	Vit. B_1	Vit. B_2	Ni.	Vit. C
Cereals	38.5	30	12.7	0.6	30.0	12.5	29.5	0
Legumes	4.4	9.2	5.4	0.5	18.3	4.6	3.5	0.1
Milk & Milk Products	8.9	13.6	55.1	29.7	7.3	42.9	0.8	3.0
Eggs	1.0	2.7	1.2	1.7	1.2	4.3	0	0
Meat	12.6	38.8	7.2	2.3	24.6	25.6	58.4	0

MISCONCEPTION No. 5

Equating proteins with foods of animal origin

Proteins are very frequently equated with foods of animal origin such as meat, milk, fish, cheese and eggs. Until lately a kind of stigma of inferiority attached (and still does attach) to vegetable proteins because of earlier classifications of proteins of animal origin as first class and proteins of vegetable origin as second class protein. This, as we know, was based on knowledge available at that time and the superior growth and Protein Efficiency Ratios obtained with animal protein as compared with vegetable proteins. With newer knowledge of amino acid make-up of proteins, the human requirements of amino acids, and the possibility of satisfying these requirements from judicious mixtures of vegetable proteins, the earlier concept is now defunct. Thus rice deficient in lysine and peas deficient in methionine have their deficiencies compensated in a mixture of the two, and provide an amino acid pattern similar to the ideal. Mixtures of vegetable proteins could provide as good and sometimes better nutritional value than animal protein.

The above is no attempt to denigrate animal protein, but all over the world animal protein is expensive. Therefore, where poverty causes many people to fail to get the quantity of protein which they need, it is only common sense to emphasize vegetable protein mixtures.

MISCONCEPTION NO. 6

The raw-vegetables-and-salad mania

There is a tendency, particularly for home economists, nurses, teachers and others from temperate climates, and also indeed for personnel trained or having worked for fair periods of time in such places, to advocate eating practices prevalent there, such as the use of salads and coleslaw, on the grounds

that the nutrients lost in cooking might be conserved. This is not really justifiable for the following reasons:-

(a) It is difficult to get a non salad-eating population to accept salads. "We're not goats, why should we eat bush" is a common retort heard.

(b) The tropical dark green leafy vegetables are not only easily available in great variety but are relatively inexpensive. Moreover, the tropical dark green leafy vegetables are so superior in nutritional value to the anaemic-looking cabbage and lettuce, that even allowing for losses in cooking they would rate superior in nutritional value, as Table IV shows.

TABLE IV

Nutrient Content of Dark Green Leafy Vegetables per 100 gms. edible portion

Nutrients	Cabbage	Lettuce	Dasheen	Callaloo	Horse Radish tree leaves
Protein gms.	1.6	1.3	2.7	2.2	6.7
Iron mg.	0.4	0.5	2.8	3.0	7.0
Vitamin A mcg.	30	0	650	1170	3390
Vitamin C mg.	50	7	40	59	220

One ought therefore to encourage use of local dark green leafy vegetables and attempt to experiment with and introduce highly nutritious dark green leafy vegetables that grow in the West Indies but that are not at present being used for human consumption. An example of this is the leaves of the horse radish tree (Moringa oleifera) which grows wild in almost all the islands are very high in iron and vitamins, but unfortunately is little or not at all used at present.

MISCONCEPTION NO. 7

That anything else besides breast milk is needed during first 4 months of life

It is widely believed here, as it is in industrialised countries that breast milk alone does not satisfy the nutrient needs of a child from the first 4 or even 6 months of life, and hence it is usual practice to start supplements of orange juice (vitamin C), Cod Liver Oil (vitamins A and D) and multivitamin drops from around the first month. A group of paediatricians, obstetricians, nutritionists and public health workers from the West Indies met recently under the auspices of the Caribbean Food and Nutrition Institute and after careful consideration of extensive research and experience in this field made the following statement:

> *"Breast feeding supplies all nutrients needed for the first 4 months of life including water".*

Introduction of supplements on the other hand, e.g. fruit juice not hygienically prepared, can be a means of introducing infection as well as being unnecessary in the baby being successfully breast-fed. Introduction of semi-solid weaning foods as early as 1 or 2 months probably also carries with it a greater risk of inducing allergy than a few months later when the baby's intestinal tract is more developed and less unselectively permeable.

MISCONCEPTION NO. 8

As to the ideal in respect of infant feeding

To many the ideal pattern of infant feeding is as follows:-

(a) Feeding with milk based infant proprietary foods such as Lactogen, Olac, Similac, etc. These are widely believed to be especially designed to cater to the child's needs and even superior to all else including breast milk.

(b) Then supplementing with cereal based proprietary foods such as Nestum, Farex and Pablum, etc. etc.

(c) Graduating finally to jars or cans of processed infant foods such as Heinz, Gerber, Beech Nut, etc. - Ham and Egg, Vegetable and meat, chicken noodle dinner.

The fallacy of this concept (the cult of the can) in the context of the amount of money available for the child's feed and the cost of proprietary foods (Table V) is obvious.

A more suitable and appropriate pattern would be -

(a) breast milk only for four months or as long as six months if desired;

(b) supplementing with cornmeal porridge with some milk or egg, and

(c) gradual transition to food mixtures from family pot.

MISCONCEPTION NO. 9

That Dried Skimmed Milk is an inferior sort of food

Dried Skimmed Milk has come to be looked upon as a negative food and a reject food which is not wholesome and has had some nutrients removed from it. It is also incriminated with causing diarrhoea. Some of these derogatory attitudes probably stem from the fact that it is a surplus food from better developed countries and may be construed by the ill-informed as food positively rejected in the donor country and hence sent on to recipient countries. Explanations of it being milk with fat removed from it may also have been interpreted as being less valuable than the original product. However, the fact remains that, of course, per ounce of powder it has a much higher protein content than dried whole milk and that this is the number one, low cost, high protein food available and of excellent nutritive value. There is therefore need to build up the image of this product so that it is held in higher esteem by the public.

TABLE V

Cost of Cereal Supplement in Jamaican dollars (mid-1970)
(1 J.$ = 1.2 U.S.$ = 2.4 E.C.$ = £0.50)

	lb.	630 calories*	11.3g. Protein*
Nestum	0.68	0.23	0.15
Farex	0.68	0.22	0.11
Pablum	0.60	0.24	0.25
Instant Cream of Wheat	0.28	0.10	0.05
3 Min. Yellow corn meal	0.20	0.06	0.05
Golden corn meal - Quaker	0.20	0.06	0.05
Loose corn meal	0.024	0.02	0.01
Irish potato	0.05	0.11	0.08

Cost of Milk Based Infant Proprietary Foods in Jamaican dollars (mid-1970)

	1 lb.	630 calories*	11.3g. Protein*
Sobee	1.00	0.30	0.11
Olac	0.95	0.28	0.10
SMA	0.90	0.23	0.17
Lactogen	0.75	0.22	0.11
Ostermilk	0.68	0.20	0.06
Gitana dry whole milk	0.68	0.19	0.06
Evaporated	0.16	0.17	0.06

*Requirements per day of a 3 month old child. Food and Nutrition Board, National Academy of Sciences, U.S.A., Recommended Allowances 1968.

BOOK REVIEW*

CONQUEST OF DEFICIENCY DISEASES: ACHIEVEMENTS AND PROSPECTS
by W.R. Aykroyd, Geneva, World Health Organization, 1970, Freedom From Hunger Campaign Basic Study. Price: U.S.$3.00 or £0.90

Among the diseases considered in this study are beriberi, pellagra, rickets, scurvy, protein-calorie malnutrition, vitamin A deficiency and endemic goitre. Much of their history is interesting and often dramatic, and it needs to be taken into account in appraising the present position and in considering future trends.

Beriberi

Records of beriberi probably date back over 3,000 years. In comparatively recent times, it was recorded in the East Indies in 1645 and in India in 1835. In about the 1870s it suddenly became common in South-East Asia, where it was a grave problem for about 40 years and remained fairly widespread until the 1930s. Some of the factors responsible for this large outbreak were the greater consumption of milled rice following the introduction of steam-driven rice mills, and the increasing organization of men into groups, such as armies or labour forces away from their homes and subsisting largely on rice as the main source of calories.

The situation in Malaya at the beginning of this century serves as a good illustration of the problems involved. Malaya contains three distinct communities with different dietary habits. The indigenous Malays then consumed rice that had been very imperfectly decorticated by home pounding, the Tamil Indians ate parboiled rice, and the Chinese obtained most of their calories from imported milled rice. The Malays and the Indians rarely developed beriberi, since the thiamine content of the rice they ate was largely preserved, whereas the disease was rife among the Chinese.

Beriberi was first shown conclusively to be a nutritional disease by the Japanese naval surgeon Admiral Takaki. In 1878 the diet in the Japanese navy consisted almost entirely of milled rice, and about 30% of the ratings suffered from beriberi each year. Following the introduction of a more balanced diet, the disease completely disappeared within 10 years. But another 20 years elapsed before studies in other countries clearly showed that beriberi could be prevented by replacing milled rice with undermilled rice and other foods. Thus the practical solution gradually came to be recognized, even though the cause was not known.

Years of research, beginning with the recognition of the cause of beriberi in South-East Asia and culminating in the identification, synthesis, and large-scale manufacture of the missing vitamin, led to the enrichment of rice

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**Reproduced from a review in a special issue of the WHO Chronicle about nutrition, Vol. 24, No. 12, December 1970, page 562.*

and white flour with thiamine. During the past 25 years the prevalence of beriberi in rice-eating countries has therefore declined. Among other reasons for its decline are a general improvement in diet due to a rise in living standards, an increase in the cost of rice relative to that of other foods, and an increase in the consumption of fat (which does not need thiamine for its metabolism) and of foods other than cereals.

In fishing communities in Newfoundland, during the early decades of this century, white flour was the main source of calories throughout the long winters, with the result that beriberi appeared regularly each spring. The disease was prevented there too by enriching the flour with thiamine, a measure that has been applied to all flour sold in Newfoundland since 1945.

Although beriberi in adults has almost disappeared, thiamine deficiency still exists even in some developed countries - for instance, in Japan. In Thailand, a survey* showed that the incidence of peripheral neuritis (which occurs in thiamine deficiency) was twice as great in an area where there were many rice mills as in another where there were fewer.

Infantile beriberi is an important problem. It affects breast-fed infants whose mothers' milk is deficient in thiamine. Although difficult to diagnose, because of its many clinical manifestations and the possibility of sudden death, it should be suspected from a peak in the mortality of breast-fed infants between the second and sixth months of life. The rapid recovery that follows injections of thiamine is diagnostic.

Pellagra

Pellagra is in some ways analogous to beriberi. It is associated with one of the world's principal cereals - maize - and from being a common and lethal disease it has become comparatively rare.

The earliest description of pellagra was published in 1763, which it was rightly attributed to a poor diet based on maize. Its occurrence in Europe was associated with the introduction of maize, and it has never been a major public health problem in other than maize-eating communities. It disappeared in France early in the nineteenth century, thanks to government action in discouraging maize cultivation. In Italy, it was prevented largely by supplying wheaten bread cheaply to people whose staple diet was maize. It was early recognized that pellagra affected poor people living on restricted diets, and that a varied diet containing milk and meat was an essential part of its treatment.

The first recorded outbreak in the USA was in 1907, and in the following years the disease spread across the southern USA in epidemic proportions, causing several thousand deaths annually during the 1920s. Machine milling, introduced in the early 1900s, probably had little effect, since a diet based on maize causes pellagra even when the grain is not machine-milled. About 1930

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*World Health Organization (1963) Malnutrition and disease, Geneva (Freedom from Hunger Campaign, Basic Study No. 12).

pellagra was shown to be a deficiency disease, and potent liver extracts were developed for its treatment. It was not until 1937, however, that the missing vitamin, nicotinic acid, was identified and its therapeutic effect demonstrated. Subsequently, the vitamin was synthesized and used for the enrichment of maize. Today there is practically no pellagra in the USA, despite a high consumption of maize in some States.

Pellagra is still prevalent in areas of Africa south of the Sahara where maize is the staple cereal. Once a serious problem in Egypt, it has largely or completely disappeared. This decline has been mainly due to a varied diet containing more wheat and other cereals and less maize.

Pellagra has been observed in people eating another cereal, jowar (*Sorghum vulgare*), especially in the Indian city of Hyderabad. For some reason this association has not been shown in Africa, where jowar is widely consumed, or in southern Europe, where it was extensively cultivated up to the 18th century. The proteins of jowar are rich in the amino acid leucine; it has been suggested that the leucine causes pellagra by interfering with nicotinic acid metabolism.

There is as much nicotinic acid in maize as in most other cereals, but some is in bound form and unavailable to the consumer. Moreover, maize is also deficient in tryptophan, which the body can convert into nicotinic acid. It is interesting that pellagra is almost unknown among the American Indians, although maize has been their staple cereal for thousands of years; the reason may be their practice or eating maize as "tortillas", which are unleavened cakes soaked in limewater, a treatment that apparently increases the availability of bound nicotinic acid.

The world-wide problem of pellagra has thus largely been overcome, although it is still common in parts of Africa where maize is the staple food. The enrichment of maize with nicotinic acid offers a practical means for its prevention.

Rickets

Although rickets has probably existed since ancient times, the first full clinical description was given in England in the mid-seventeenth century. This coincided with the greater use of coal fires, which produced a pall of smoke obscuring the sunlight. In towns of western and central Europe and North America, rickets was common during the eighteenth and nineteenth centuries, reaching a peak around the beginning of the twentieth century. Those most affected were children of poor families living in industrial cities in the temperate zone. The high prevalence was caused by a diet that lacked sufficient foods containing vitamin D, such as fresh whole milk (which was expensive), and by lack of sunlight due to climatic and social conditions. Today, rickets is rare among the indigenous population of Europe and North America.

Cod-liver oil, which contains vitamins A and D, has been used as a medicine for sickly children for at least 150 years, but it was not until the second and third decades of this century that laboratory and clinical research showed why it is valuable in preventing rickets. These investigations provided health

services with effective methods of prevention, such as the enrichment of food with calciferol, an artificially produced form of vitamin D. Halibut-liver oil and tunny-liver oil, which are far richer than cod-liver oil in vitamin D, could be made into capsules of standardized potency. Recognition of the antirachitic effect of sunlight influenced slum clearance and methods of child care.

In the United Kingdom, cod-liver oil was the principal weapon against rickets. The development of child health services made its administration possible on a large scale, as a result of which rickets had become a rare disease by the outbreak of the Second World War. Measures that were introduced during or soon after the war included the free supply of cod-liver oil to children under five years of age and to expectant and lactating mothers, the issue of dried milk fortified with vitamin D to all children under five, the enrichment of margarine with vitamins A and D, and the addition of calcium carbonate to flour.

Rickets is found also in tropical and subtropical countries. Mild cases have been revealed in India by radiological examination. For unknown reasons the disease is relatively frequent in the Punjab, and severe cases exist in the Kangra Valley, in the Himalayan foothills. In Lahore, now in Pakistan, rickets was prevalent in the 1930s, especially in Muslim girls living in purdah in old dark houses. A high incidence of mild rickets was reported among children in Calcutta in the 1950s.

In 1965, a WHO survey* of rickets in Algeria, Libya, Morocco, and Tunisia was concerned with children under five years of age in hospitals or attending outpatient clinics. The incidence varied from 3 to 11%. The disease mainly affected children aged 3-18 months and was more prevalent and severe in urban than in rural communities. It was due both to lack of vitamin D in the diet and to housing conditions and social customs that prevented sunlight from reaching the child's skin. A high incidence has been reported in Iran, where it is probably due to children being over-clad and insufficiently exposed to the sun, and in Ethiopia, where it often occurs in association with protein-calorie malnutrition.

Most tropical and subtropical countries are becoming increasingly subject to the hazard of rickets, at least in mild form, owing to the rapid growth of towns with poor housing conditions. It is most unlikely, however, to become as great a problem there as it once was in temperate regions. In the developing countries today, rickets is far less of a problem than protein-calorie malnutrition; the latter may, by retarding growth, actually check the appearance of rachitic deformities, which occur most readily in rapidly growing bones.

Scurvy

Scurvy afflicted the Crusaders in the thirteenth and fourteenth centuries. In the seventeenth and eighteenth centuries it was common on sailing ships, but it was not until the mid-eighteenth century that its cause was established.

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*Joint FAO/WHO Expert Committee on Nutrition (1967) Seventh report, Geneva (Wld Hlth Org. techn. Rep. Ser., No. 377; FAO Nutrition Meetings Report Series, No. 42).

Captain James Cook during his second voyage to the South Seas between 1752 and 1755, prevented scurvy by infusions of germinated grain, which is rich in vitamin C. It was eliminated from the British navy in 1795 by the compulsory issue of lemon juice. Not until 50 years later, however, were similar preventive measures taken in merchant navies, while even as late as 1912 Scott's Antarctic expedition ended in disaster largely because its rations were lacking in ascorbic acid. Scurvy was rife during the Irish famine of 1845, when potato blight destroyed the population's main source of ascorbic acid. In modern times, scurvy has occurred in famines when drought has destroyed fruit and vegetable crops.

Research on scurvy began just after the turn of this century with the experimental production of the disease in guinea-pigs, this being exactly analogous to the condition in man. By means of biological tests on guinea-pigs, the distribution of ascorbic acid in most common foods had been worked out by about 1930. Ascorbic acid was identified and synthesized in the 1930s and subsequently manufactured on a commercial scale. At the same time a simple chemical test for the vitamin rendered guinea-pig tests obsolete.

Milk is a poor source of ascorbic acid, and infants fed on fresh milk receive only just sufficient. Ascorbic acid is destroyed when milk is heated, either for sterilization or in processing. Realization of this fact has led to the giving of fruit juice to infants who are artificially fed.

Whereas scurvy has tended to occur mainly in the spring, because of the lack of fresh fruit and vegetables during the winter, this seasonal tendency has been greatly diminished by improvements in food production, storage, and transport. Scurvy is still seen occasionally in old people living alone on an inadequate diet, and in infants whose parents are poor, ignorant, or neglectful. Several cases of infantile scurvy were found in Canada as recently as the early 1960s. Important preventive measures are fruit juice, the addition of ascorbic acid to evaporated milk, and the education of parents in infant feeding.

Scurvy is rare in breast-fed infants, but breast-feeding is becoming less common in both developed and developing countries, thus rendering ascorbic acid supplements essential. With adequate knowledge of prevention and treatment, however, scurvy is no longer a disease of great public health importance.

Protein-calorie malnutrition

Protein-calorie malnutrition (PCM) covers a range of pathological conditions that predominantly affect infants and young children. In nutritional marasmus, seen mainly in infants, there is wasting and a very low body weight. Kwashiorkor occurs mainly in children between one and three years of age. Causes of PCM include lack of essential foods, bad feeding practices, and infection. The last-mentioned factor, by increasing the rate of tissue breakdown and by reducing protein intake, often precipitates the condition.

Children over the age of three or four years are less prone to develop severe clinical manifestations. Nevertheless, physical development may be retarded for many years as a result of PCM occurring during infancy and early childhood. Even more serious is the danger of permanent mental damage. During

the first months of life, brain growth, which depends largely on protein synthesis, is most rapid and therefore most susceptible to dietary deficiency. Further research is needed into the long-term effects of PCM on physical and mental development.

Infants receiving sufficient breast milk do not develop PCM. However, the quantity of milk available and the duration of lactation depend on the mother's diet and nutritional state, while breast-feeding may be discontinued early as a result of social customs or for cultural reasons. Early weaning can then lead to PCM when satisfactory methods of artificial feeding are either not available or not understood. In many of the poorer countries infants are weaned early to a diet of starchy foods or dilute mixtures of processed cow's milk containing insufficient protein. Gastrointestinal infection, often due to unhygienic feeding, then precipitates PCM, and marasmus ensues. Eventually the cells of the small intestine atrophy, thus further impairing absorption and making the condition worse. Kwashiorkor is often precipitated in the second or third year of life by measles or whooping cough.

Although PCM has virtually disappeared from the prosperous countries, it remains a problem in most of the developing countries. The overall prevalence of marasmus appears to be increasing relative to that of kwashiorkor; this is mainly due to premature weaning, which is associated with the spread of urbanization under poor living conditions.

In the developing countries, malnutrition and infection are the main causes of death between six months and two years of age. Mortality rates during this period can therefore serve as a guide to the prevalence of PCM.

Diarrhoea can precipitate or aggravate PCM. Since it is more frequent and more severe in infants and children who are malnourished and thus more susceptible to infections, it often occurs during or just after weaning. Severe diarrhoea is rare in breast-fed infants.

Trends in prevalence

Kwashiorkor has been recognized as a distinct syndrome for only about 30 years, but it was described in many parts of the world long before its cause was understood, and there is little evidence that its prevalence has recently increased because of changes in feeding habits. Kwashiorkor has declined in many countries during the past 20 years, having been superseded by nutritional marasmus. At the same time improved methods of treatment have reduced the mortality rate, although this is still as high as 15% even in hospitals experienced in treating the condition.

Child health in the developing countries today can be compared with the situation 50 years ago in developed countries. Infant and early childhood mortality fell precipitously in England during the first 20 years of this century and have continued to fall subsequently. Better nutrition played an important part in this improvement. This example and the fact that infant and early childhood mortality are decreasing in many countries throughout the world, including the developing countries, suggest that PCM can be largely eliminated within a generation.

Urbanization produces a trend towards early weaning, owing to the employment of mothers and the existence of social attitudes that discourage breast-feeding. The prevalence of marasmus consequently increases in developing countries, where artificial feeding is generally inadequate. The long-term results of urbanization in these countries are likely to be favourable, however, and comparable to those that have occurred in the developed countries. They include improvements in education on child feeding, better standards of hygiene, and the development of health services - all of which help to eliminate infection and malnutrition.

Epidemiological studies are needed to help clarify to what extent environmental changes and preventive measures influence the prevalance of PCM. The most promising measures are the education of mothers in infant feeding, better hygiene to reduce intestinal infections, and vaccination against such diseases as measles and whooping cough. In some countries, special rehabilitation centres provide the long-term care required by children suffering from PCM.

Future prospects

While the quantity of available food is a cause of concern in many developing areas throughout the world, the quality of food consumed and especially its protein content are even more critical.

In most developing countries children are weaned on watery gruels and other low-protein foods. Although milk, meat, and eggs would be difficult to produce in abundance in these countries, fish, oil-seeds, protein concentrates, and legumes offer a practical alternative and can be processed into protein-rich foods. The introduction of such foods often meets with resistance, both because they are unfamiliar and because, though cheap, they involve some additional expenditure on the part of the consumer. Their promotion is sometimes helped by preliminary free distribution, provided that this is combined with availability on the market. Dried skim milk is likely to remain the principal therapeutic agent in PCM.

Every effort should be made to promote breast-feeding, which is at present in decline. Another approach is to produce processed cow's milk, or cheap milk substitutes, on such a large scale that artificial feeding can be extended throughout the world. Health services must be developed for treating and rehabilitating affected children, for educating mothers in the better feeding of their children, and for distributing supplies of appropriate foods.

Vitamin A deficiency

Night-blindness due to vitamin A deficiency has existed since ancient times. The condition, and its treatment with liver, were described in an Egyptian medical papyrus of 1500 B.C. and a thousand years later by Hippocrates. During the nineteenth century xerophthalmia was described in various parts of the world and the value of cod-liver oil was recognized in its treatment. Xerophthalmia was seen in the Irish potato famine of 1848 and during the First World War in Denmark, where it was caused largely by the replacement of butter by margarine and by the use of separated milk as a food for children. Today it occurs in most developing countries, especially in large urban areas in South-East

Asia, but not in prosperous countries, where sources of vitamin A are plentiful. It is rare in West Africa where red palm oil, rich in carotene, is widely used for cooking.

Xerophthalmia is usually associated with PCM and, like the latter, is often precipitated by infections, particularly gastroenteritis and measles. It is most common in children aged 1-3 years and is often related to weaning; it thus resembles PCM in its age incidence, except that it occurs less frequently in infants. Damaged eyes can often be saved by large doses of vitamin A, but children with keratomalacia are seriously ill and are likely to die from PCM.

Since the serious manifestations of vitamin A deficiency are linked with PCM, trends in the prevalence of both conditions are likely to follow a similar course in the future. Vitamin A deficiency, like PCM, can be largely prevented by the development of maternal and child health services, the education of mothers, and the control of infectious diseases. Large quantities of vitamin A can easily be made available in concentrated form, either as fish-liver oils or as the synthetic vitamin given in capsules or used in the enrichment of foods. Powdered skim milk enriched with vitamins A and D can be used in the prevention of both PCM and xerophthalmia. A higher consumption of fruit and vegetables containing carotenoids can be encouraged by programmes of education in nutrition. The consumption of vitamin A has approached required amounts in recent years, making future prospects encouraging.

Endemic goitre

There is evidence that goitre has existed since ancient times in some regions, for example in China and in parts of Europe, and that it was endemic in the Himalayan foothills 350 years ago. It was prevalent in the Andes in the eighteenth and early nineteenth centuries. Fifty years ago, it was observed that in some Himalayan villages almost the entire population was affected, including over half of all breast-fed infants; in such circumstances cretinism, deaf-mutism, and mental retardation were common.

Goitre is most effectively prevented by adding iodine to table salt, a measure that was first introduced in 1923 in Switzerland and a year later in New Zealand. In both countries, the prevalence of goitre in schoolchildren fell by 90% in two or three decades, while cretinism and deaf-mutism soon began to disappear. Favourable results were subsequently obtained by the same method in other countries. A study* carried out in the Kangra Valley, in the Himalayan foothills, showed a drop in goitre prevalence from about 40% to about 15% within five years, as a result of salt iodization. In many other endemic areas salt iodization programmes are proving successful. In some countries the situation is less satisfactory.

The iodization of salt seems to be the most effective way of preventing goitre. There are many difficulties, however, in preparing and distributing iodized salt on a large scale and ensuring that it is actually consumed by

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*Sooch, S.S. & Ramalingaswami, V. (1965) Bull. Wld Hlth Org., 32, 299.

scattered communities living in the remote, usually mountainous areas where goitre is endemic. Iodine has sometimes proved effective in the form of daily tablets, but this method is even more difficult to apply in remote areas.

Improvements in communication and transport and less poverty have led to a more varied diet in many goitrous areas, and in particular to less dependence on locally grown foods. Endemic goitre has often disappeared from communities as a result. Considering both the natural decline in endemic goitre and the increasing use of iodized salt, it is reasonable to suppose that the condition will soon largely disappear.

On the whole, trends in the prevalence of deficiency diseases allow some degree of optimism. Remarkable progress has been made in preventing some diseases that once afflicted large numbers of people. PCM, however, is a more formidable problem than any of the vitamin deficiency diseases at any point in their history; it affects more people and its geographical range is more extensive. Yet even in this case there are grounds for cautious optimism. The fight against deficiency diseases is being helped by a growing awareness and understanding of the part nutrition plays in health, by rising standards of living and the growth of social services, and by developments in agriculture and food technology.

This very interesting and well-written book can be recommended to all nutritionists and students of nutrition at all levels.

COMING EVENT

A short course in "Handling, Packaging, Storage and Marketing of Fresh Fruits and Vegetables", sponsored by the Canada Plus-One project will be held from 28th June to 9th July, 1971 at the St. Augustine Campus, Trinidad.

This course which should be of special interest to Marketing Boards, Supermarket Operators, Fresh-Fruit and Vegetable Wholesalers and Retailers and Fruit and Vegetable Farmers will be open to participants from Trinidad and Tobago, Barbados, the Eastern Caribbean and Guyana. (A similar course will be held in Jamaica to include participants from the Bahamas and British Honduras, details to be announced later).

Entrance requirements:

(a) A secondary school education or equivalent.

(b) Age: 18-40 years.

Fee:

Tuition will be free, but there will be a registration fee of $5.00 T&T.

Financial Grants:

A limited number, to participants other than Trinidad and Tobago, to assist with passages and/or subsistence.

Closing date for applications:

30th April, 1971.

Further details and application forms may be got from:

Dr. G.M. Sammy,
Department of Chemical Engineering,
The University of the West Indies,
St. Augustine, Trinidad, West Indies.

AGRONOMY AND HUMAN NUTRITION*

by

Kendall W. King
Asst. Vice-President - Grants,
Research Corporation, New York

What is a non-agronomist to say to the soil scientists of this country regarding the impact of their work on the health of mankind? Even people who are only casually familiar with the recent events of history are quite aware of the conspicuous fruits brought to every table in the land by the combined work of America's agriculturists.

In a brief century the whole tenor of American life has changed from that of a dominantly agrarian society barely able to meet its food and fiber needs, even with 90% of its people involved in agriculture, to that of a society in which we are fed and clothed as no nation in history has ever been. And in the process production efficiency has improved so greatly that now only about 10% of us feed the rest of us, freeing the vast mass of the population to provide the unparalleled goods and services that enrich our lives in so many other ways. In achieving these remarkable advances many non-agricultural developments played absolutely essential themes in the overall symphony, but agronomists had a role so obvious that its recounting would have no value. The adaptive research that paved the way to these changes was one of the great intellectual achievements of all time. Then, for some reason, adaptive research lost its lustre. The researchers went "basic". And this was unfortunate. Instead of serving people researchers tend now to study them. I am told that the average family on a

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Navajo reservation now consists of two parents, 1.7 grandparents, 3.4 children, and one anthropologist.

Agriculture has come a long way. One need only look at some agricultural statistics from around 1900 to see that this is true. An hour or so of looking at 1,254 kg/ha (1,120 lbs/acre) of corn, 4 ha (10 acres) of forage land to feed a single dairy animal, the then current annual fertilizer use data, and a few similar numbers, will convince anyone of how it must have been.

The long, strenuous, but tremendously rewarding trail we have followed is clearly documented. Almost as clearly drawn is the picture of the world as a whole today. Mankind is confronted with about a 25% deficit of calories year after year. More children die of protein-calorie malnutrition than of any other disease. Much of the tropical world is less well fed today than it was before World War II. The benefits of intense efforts to upgrade agricultural production all over Latin America were wiped out again in 1968 by the population increase. We are regularly confronted with the dismal data in the public press. There is no need to dwell on them here.

Rather than that, I would like to reflect on where we began, how we have gotten to where we are, and by what means. There is reason to think that a century from now our successors will be able to look back and marvel at the primitive way in which we lived in 1969. I am fully convinced that that will happen if we analyze our present difficulties carefully, apply to them the most powerful tools we possess with imagination and discipline, and work with the confident commitment that has been so characteristic of past generations of agricultural scientists.

Regrettably I must admit that I have no completely thought-out plan for solution of the world's problems. Instead, I want to set forth just two notions which seem to me to be valid, in the spirit that if enough of our energies are

turned to discovery of solutions to our problems, and ideas are pooled and tested in an unemotional atmosphere, we can hope to succeed.

I. *INSTITUTIONS AND ORGANIZATIONS*

The first of these ideas concerns institutions and organizations. At the beginning of the period we are looking back on, three radical new institutions were created, and each fulfilled a distinctive function. They are now so deeply assimilated into American life that it is sometimes forgotten that when they were launched a good bit of the establishment scoffed at such a radical departure from past experience. The three organizations in point are the Land Grant Colleges, the Extension Services, and the Agricultural Experiment Stations. There was almost no precedent for such things and certainly no experience on which to base the massive efforts that quickly evolved. While the Ivy League still offered an education for gentlemen in the classics, here were "cow colleges" springing up all over the country with hardly a Ph. D. on their faculties and with student bodies dominated by graduates of one-room schools getting college credit for courses in breeding livestock and repairing machinery. Their faculties were doing experiments with fertilizers and better kinds of corn and wheat; they even presumed to call it science!

Considering what these three organizations achieved as they evolved into the land grant universities of today with extension services peppered with Ph. D.'s should give us pause. As the mission changed and as the people to be served changed, so did the organizations. By and large, I think, the changes were appropriate and necessary, painful as they may have been. Will a similar story begin with the creation of today's contemporary urban community colleges geared to meet the special needs of the city dweller? Hopefully so. Certainly our own history should lead us to be confident of the long-range utility of

schools and extension programs directed to the special practical problems of large numbers of people. If to begin with, the academic standards seem low, the students uncultured, and the research strangely oriented, ought we not to reflect on the curricula, the faculty quality, the background of the student body, and the nature of the research at any of the land grant colleges in 1900? Ought we not also to recognize that the adaptive research and extension techniques appropriate to modern America are no longer geared to deal with the problems of 70 years ago at home, or of most of the world today?

I plead for patience. These institutions are not perfect. Perfect organizations just do not exist. But organizations are, I think, the pinnacle of the intellectual achievements of man. Let me review a bit of pertinent history.

Something like a million years ago, 4.4 billion years after the beginning of Earth, man or pre-man emerged among the myriad of species competing for life on Earth. Somewhere in Africa he evolved, or perhaps in Asia; but very clearly it was not in this hemisphere. Evidence of civilized man does not begin to appear until about 9,000 years ago in the valleys of the Nile, the Tigris-Euphrates river system, and the Hindus. That amounts to only the most recent half-a-percent of the life of man, and we must remember that even then we had only tiny pockets of the species showing signs of civilization, and within these pockets only a very few of the population shared in its benefits.

The point I am aiming toward is that the idea of organization which makes civilization possible is extremely new, and that it represents a feat of intellect so much more complex than the invention of mechanisms like the wheel and the lever, or even the creation of the idea of money and writing, that it is little wonder that we have only begun to grasp the potentialities

of organizations and institutions. They do not work in general until they are reasonably well understood by the people involved. Only very recently have we had large numbers of such people. How can anything as sophisticated as a republic like ours work smoothly if the citizens do not understand it? If the citizens are uneducated comprehension of such a complex system is very improbable. Yet as recently as 1900 60% of the people in Virginia were illiterate. We have come a long way in an astonishingly brief period.

It seems a simple notion that if a group of people recognize a mutual need that is beyond their grasp individually, they may be able to meet it by banding together. But it is really something quite new to the experience of most men and only vaguely understood by the most sophisticated of persons. Getting together to haul a heavy carcass back to the cave is not very complicated, but it is illustrative of the germination of the idea of mutual effort - of the organization.

In the last 5,000-year moment of history we have applied that basic notion to increasingly complex challenges with spectacular success - and at times with dismaying failure. When there is a clearly defined goal to which the people in the organization can commit themselves, and when the appropriate resources can be concerted to achieve that goal, we do marvellous things.

That is essentially the combination of events that lead to Apollo 11. A very explicit goal was set. From top to bottom the people in NASA knew what they were after. An organization was created to assemble the human, industrial, and economic resources to achieve it. Now it is history. I am among those who feel Apollo 11 was a gross misuse of 38 billion dollars and years of talented lives because of the superficiality of the goal itself. But in our criticism of national values we ought not to lose sight of the fact that as an achievement in organization it is probably unparalleled in history except by one quiet

development across the pacific in a place called Los Banos, the Philippines.

There after years of careful thought and meticulous planning two American foundations pooled their expertise and resources to create the International Rice Research Institute (IRRI) from which have already come the new rices that are revolutionizing food production in all of the rice-eating areas of the world. The singular quality of IRRI, which forces me to judge it even more significant than NASA, is its carefully thought-out mission. The mission was selected from among many alternatives after years of debate among knowledgeable people with deep human values as being the single most needed assault on the world food problem - not the only one but the most critically needed one at the moment. Then followed a combing of the world for the best possible location, the creation of the organization, the selection of superior people to staff it, and a thorough identification of what were the best steps to follow in order to complete the mission. I stress here "complete" the mission because breeding an agronomically superior rice is a futile scientific exercise unless you also produce tons of it for seed and get that seed into the ground and thence into the pots of the world's kitchens. The careful planning and execution of the extension phases of the work are the proof of the pudding. Last year 14.1 million ha (34 million acres) were planted in the new superior cereal varieties.

IRRI, it seems to me, typifies the useful kind of thing we can hope to accomplish through organizations. That few organizations have so clearcut a success to point to does not dismay me. We are new at the business of creating organizations. Sometimes we err in the goal we accept, and we wind up with a NASA or a war machine. Sometimes we err in not setting any specific, recognizable goal. We have some diffuse notion like "fight poverty" or "educate people", and consequently cannot possibly generate an organization having a sense of direction for its members or a clearcut plan of attack. Sometimes we

fall down, I think, because a given organization is charged with so complex a goal that we simply do not have the ability to create a workable organization to grapple with the task yet. This is, I think, a basic problem with contemporary government.

I am at times dismayed and bewildered by the world, but when I back off and look at things from the perspective that history gives, it seems clear to me that we have every reason to have high hopes if we exploit with energy and imagination this greatest intellectual achievement of man to date - the capacity to create institutions through which to achieve the things we cannot do anything about by ourselves.

In connection with these thoughts on organizations and the role we are learning to make them play, there is another very recent development that may be an important one in advancing their significance another step. It is an outgrowth of World War II efforts and has subsequently been applied to a variety of situations with increasing effectiveness. I refer to systems analysis.

II. *SYSTEMS ANALYSIS*

I am going to oversimplify because I am not a systems analyst. I only raise the subject because it seems to me to have so much to offer that its discussion is imperative.

Until very recently researchers analyzed problems and thought about them largely intuitively. They flattered themselves by saying they were being logical, but more often than not they knew it was only a half-truth.

The researchers looked at corn production in a given state and found it bad. Examining what could be done about it, they considered new varieties, new rotations, changed fertilization practices, and a number of other

possibilities. After weighing the possibilities they made the shrewdest judgment they could of the best attack, and went after it. Sometimes the results were pleasing, but often the researchers became all too familiar with those things called blind alleys.

In large part the difficulty is that, when we look at problems of such complexity, we just cannot keep all the pertinent factors in mind at once. We have to look at them one or two at a time, and the interactions often escape us. If, for example, we suddenly boost corn production by 10% we may fail to judge accurately the effect on the market. A problem of this general sort confronted us very recently when Pakistan's new wheat program over-succeeded, and while Pakistanis were starving, there was no way to get wheat to them; export opportunities were sought, only to learn that the infra-structure for exporting didn't exist.

All this simply illustrates that many problems are of such a complexity that intuitive thinking cannot be relied upon to solve them. But systems analysis has been applied to a number of such situations with surprising success - surprising in that often the solutions indicated by intuitive judgments can be shown by systems analysis to be exactly the wrong ones.

The nubbin of the systems analysis approach is a searching study of every factor bearing on the problem in question, for example, the food supply of a country. One must not only identify every pertinent factor, he must also assess quantitatively how it is related to each of the other factors it influences. This process is continued until a system can be defined encompassing everything that is relevant and excluding everything that is irrelevant. Regarding the food supply of a country, it is immediately clear that the system will be immensely complex. Nobody could possibly really comprehend it all and then predict with any reliability what a given program or manipulation would achieve. But a team of systems analysts supported by a competent staff of

agronomists, agricultural economists, food technologists, nutritionists, and extension advisors could, because they would essentially compartmentalize their thought into discrete, tractable units and feed these units into a computer which would do the integrating of the system as a whole. Once the whole system is defined and quantified, the computer can then be used to predict the result of any given manipulation of the system.

The computer is not thinking at all; the people are. But the computer is doing a lot of remembering and arithmetic that the people could never do. When this kind of approach has been applied to a variety of industrial problems it has been eminently effective and often surprising.

Systems analysis has never been applied to a problem as complex as the food supply of a country, but there is every reason to believe that it could - and to considerable public benefit.

There is merit, I think, in considering the establishment of an IRRI-like organization to attempt development of systems analysis to the point where it can handle problems as complex as the management of a national food supply.

In the last 5,000 years or so man has begun to master the most powerful intellectual conception yet to come his way - the organization. He does not use it very effectively as yet, but there has hardly been time. Our history assures us that we just do not master our advances that rapidly. On the other hand, each major achievement seems to allow us to grasp its usefulness more rapidly than the last. The pace of change and adjustment has become at once alarming and encouraging in this century.

To feed ourselves has become a challenge as never before, but an institution to apply systems analysis to national food systems holds promise that the problem, though extremely difficult, may be within the limits of our powers of solution.

YOUR QUESTIONS ANSWERED

Q. Are the results and possible hazards known of the present tendency to introduce mixed feeding of infants with strained foods at an ever-earlier age, sometimes even to babies of two weeks old?

A. This tendency towards ever-earlier addition to the customary milk diet represents the end of a swing of the pendulum of fashion rather than any scientific development in infant nutrition. There is no evidence whatever that such early feeding is any better for the baby of from one to four months than cow's milk, and plenty of evidence that it is a great deal inferior to breast milk. It would seem that the main hazard from this practice is the unnecessary introduction of foreign protein into the intestinal canal of the neonate and the risk of inducing allergy.

This is a reply in the context of the middle-class family of ample financial means. In the case of poverty the attempt to follow fashion can be little short of disastrous if done in an unhygienic way; and the fact that strained foods in jars are extraordinarily expensive in terms of nutrient value for money means that they must often displace cheaper and more nutritious foods.

Q. Chile peppers seem to be more popular and widely used in meat dishes nowadays, (chile con carne, frozen dinners, etc.). Does the chile actually help preserve these meats, or does it just mask the taste and smell associated with rancidity in meats?

A. Chile peppers actually help to preserve food, according to an article in the Journal of the American Dietetic Association (1970, Vol. 56, p. 409). The authors, Stasch and Johnson, experimented with various types of peppers with chicken, pork and beef. It seems that most peppers had a positive antioxidant activity, and the type that demonstrated this activity most was mature green peppers.

Q. What is the best form of iron to give to an infant or pre-school child for the treatment or prevention of iron-deficiency anaemia?

A. Already fourteen years ago in the U.S.A. the Physicians Desk Reference listed one hundred and seventy (170) preparations recommended as useful in the prevention and treatment of iron-deficiency anaemias. None is more effective than simple ferrous sulphate, most are more expensive, and many are more dangerous. It is surely well known that ferrous salts are more effectively absorbed from the gut than ferric salts.

20 mg. of elemental iron daily in the form of ferrous sulphate mixture would be a suitable prophylactic dose, and 60 or 75 mg. daily could be given for treatment of established anaemia.

POTENTIAL LOCALLY PRODUCED ANIMAL FEEDS FOR TRINIDAD & TOBAGO

by

Alison White
Trinidad Nutrition Centre

In Trinidad & Tobago the high cost of meat, eggs and fresh milk is attributed in part to the cost of feeding stuffs. Although feeds are mixed locally many of the constituents are imported and this contributes to the high cost.

The ingredients used by two of the feed manufacturers include wheat middlings, citrus pulp, spent grain, molasses, coconut meal, rice bran and limestone which they obtain from local sources and soyabean, maize, fish meal, unspecified concentrates and 'premix' which they import.

Feeds are roughly divided into roughage feeds and concentrate feeds. The complete rations of herbivorous animals often include both roughage and concentrate feeds. Apart from forages, products such as citrus pulp, brewers grains, rice bran may be classed as roughage according to the level of crude fibre. Concentrates are feeds of high available energy per unit weight usually because of high starch, oil or protein content and low fibre. Concentrate feeds normally carry more than 60% total Digestible Nutrients; an average being about 75%. They are subdivided into (1) Basal feeds (feeds of 16% protein or less) and (2) Protein supplements (feeds of 20% protein or more). Protein supplements are feeds of plant, animal or marine origin. Additional feeding materials include vitamin carriers, mineral element carriers and such supplements as antibiotics and amino acids.

Of the basal feeds of the low fibre group maize is of prime importance in livestock rations. Wheat middlings is also a basal feed. Soyabean, primarily, but also fish meal, meat meal, meat and bone meal and skim milk

powder are imported or used as protein supplements.

It is obvious that Trinidad does not have suitable climate or resources for some of these ingredients, and also that a completely locally produced feed cannot be grown overnight. A practical policy seems to be one of gradually replacing the imported ingredients by locally grown products where possible.

The Present Situation

Wheat Middlings appear to be the basis of many of the feeds in Trinidad. They are regarded as locally available as they are by-products of the Milling industry, but this of course depends on imported wheat. At present, supply of wheat middlings exceeds demand. This is likely to be the situation for some time as the import of wheat is inevitable for three reasons (a) wheat cannot be grown in the tropics (b) its flour is superior to other types and (c) demand is hardly likely to decline.

As supplied to the farmer and feed manufacturers wheat middlings are mixed with 8% Ground Wheat Screenings to provide crude protein not less than 16.0%, crude fat, not less than 3.5%, crude fibre, not more than 9.5% and Nitrogen free extract not less than 53.0%.

Citrus Pulp Meal contributes crude protein 5%; crude fibre not more than 14%; fat not less than 2.5%; minerals 6.9%; and nitrogen free extract not less than 55%. The supply depends on the size of the crop of a particular year and the output of the citrus factory - (the dry pulp representing 9% of the original weight of the fruit) and it cannot always meet local demand because much of the pulp is exported to Puerto Rico.

Brewers grains, spent grain, i.e. the barley husks discarded by the brewery, is incorporated in feeds. At the present time supply meets demand.

Coconut Meal containing 6-7% oil is supplied by the Coconut Growers Association, but supply always falls short of demand varying in extent on the size of the crop.

Molasses and limestone are readily available, some local rice bran is used, but also some is imported from Guyana.

Maize, soyabean, fish meal and other 'concentrates' and 'premix' are imported.

Potential Changes

Although Trinidad's climate is not suitable for growing wheat a certain amount of maize is grown here, but it is limited to a small acreage and yields are low. Up to 1968 almost 80 million lbs. per annum were being imported into Trinidad. However, there have been strains of maize selected which could give yields to make maize growing economically feasible provided sufficient land were available and up to date harvesting employed. Reports of these trials were known in 1968 (L. Cross, Central Experimental Station), but we read in 1971 that 'the Government has named corn (maize) as one of the crops for research and experiment by the German technical team at Chaguaramas' (Editorial, Trinidad Guardian, January 9, 1971). Quite probably more research is needed, but this is no reason not to undertake full-scale trials based on work done at the Central Experimental Station and U.W.I.

Apart from maize being such an important stock feed, the possibilities of its inclusion in foods for human consumption are also numerous, even apart from straight cornmeal. In 1965, 246,000 tons of wheat were imported into the West Indies. Projected for 1970 and 1975 this is increased to 290,000 and 333,000 tons ("Protein Foods for the Caribbean", C.F.N.I., 1968). This represents a huge import bill. As wheat cannot grow here, and as the demand is

increasing markedly it is obvious that at least partial substitution is desirable from the economic point of view. It may, for example be possible to substitute a certain percentage of maize flour without lowering the baking and nutritional qualities of the wheat flour.

Thus there are two very important reasons why government should take steps to make available the hybrid varieties of seed, technical assistance and land if private enterprises cannot be persuaded to devote sufficient land to this crop.

From the crop husbandry point of view another encouraging fact about maize is that it is best grown in rotation with soyabean to the advantage of both crops. And of course, soyabean provides the high protein supplement required in animal feeds - complementing, in fact, the inadequate protein of present varieties of maize especially well. Again the possibilities for direct human consumption (as opposed to the animal feed - animal protein cycle) could also be exploited if sufficient quantity could be grown.

In 1965 over three million lbs. of soyabean oil was imported into Trinidad & Tobago at a value approaching $1 million to supplement locally produced coconut oil and about 10 million lbs. of soyabean meal and cake were imported largely from the U.S. and Brazil at a cost of more than $1 million for the production of animal feedstuffs. Since 1965 the livestock industry has grown steadily so expenditure on soyabean meal and cake is appreciably higher than 6 years ago. Moreover, sterling was devalued in November 1967.

It was against this background that the soyabean research programme was initiated at U.W.I., in late 1965. After selection of suitable varieties, an assessment of the effect of planting date or growth development and yield had to be made. The plant is sensitive to length of day, i.e. time of flowering

depends largely on the number of hours of darkness plants receive each day. So a short-day variety, suited to the temperature and rainfall of Trinidad was selected, the optimum plant density established, crop protection problems studied and the response to fertilizers found.

Of the varieties tested F62/3977 gave acceptably high yields per acre, its seed has a high oil content and the variety showed good standing ability. It appeared at that stage that planting should be restricted to between March and October.

On the basis of results of his experiments Radley recommended as commercial spacing for soyabean a row width of 22"-26" and a within row spacing of 2½"-3½" although quite a wide variation in density is tolerated.

Weed control recommendations for Trinidad are (I) Pre-emergence application: 1.25-2.5 lbs./acre amblen (II) Post-emergence application 0.5 lbs./acre paraquac (2 pints of Gramoxone/acre) using a shield to keep spray away from leaves and stems. For control of insects Dipterex is recommended at a rate of 14 grams/gallon.

The only fertilizer required by the crop on that particular soil was 2-2½ cwt./acre of superphosphate (48% $P_2 O_5$); on potassium deficient soils it may be wiser to apply a 0.20.10 compound fertilizer at a rate of 5 cwt./acre.

The experience gained from these experiments suggests that soyabean, given a high level of management, will give yields in Trinidad which bear favourable comparison with those common in established soyabean growing countries. It is pointed out that commercial performance rarely equals that of small plot trials. Nevertheless, yields of between 1600 and 1700 lbs. per acre should be obtained commercially. This may be considered a realistic figure which could be improved upon by better farmers. At this yield the

home market alone for soyabean meal and cake could absorb the production from at least 8,000 acres.

For commercial production to get underway in Trinidad, it must of course be demonstrated that the crop is likely to be profitable and the whole rotation which is to include soyabean must be examined carefully as well as its suitability in relation to soil and climate being established, its managerial problems being anticipated and overall contribution to the national economy assessed.

There are a number of reasons for suggesting that the rotation should be based on maize and soyabean. First, as with soyabean there is a large and expanding home market for maize. Secondly, the mechanical equipment required for maize cultivation can all be used for soyabean. Thirdly adequate information is now available on both crops (L. Cross, Central Experimental Station, has had encouraging results with maize) and fourthly from a husbandry standpoint it is sound practice to grow a cereal in association with a fertility-building legume.

A crop of maize sown between mid-April and the end of May, to be followed by soyabean during September or October for harvesting at the beginning of the dry season may be expected to produce a total revenue of about T.T. $400-430/acre/annum (assuming a yield of maize 3,000 lbs./acre at 7¢/lb. and yield of soyabean of 1,700 lbs./acre at 12¢/lb.). This is low in comparison with crops like tomato and cabbage - thus both maize and soyabean would have to be grown on a large acreage.

Radley ends his paper by stressing that equipment is expensive. Skilled experienced management supported by well trained farm technicians is essential and certain criteria regarding the land must be met. (I) It must

be capable of at least reasonable production of both crops. (II) There must be no overriding shortcomings such as water-logging (III) must be mechanisable (IV) must be located in an area where there is adequate rainfall from May to July and October to December to sustain growth (or be irrigable). Also there must be some assurance of dry weather between August and October to facilitate harvesting.

Cultivation of maize and soyabean is obviously highly desirable thus ensuring a sounder basis for the livestock industry. What is desirable and what is possible are two different things, and production can only be advised if the conditions outlined are met. Commenting on the distribution of soyabean production, Dr. Max Milner of UNICEF said in Guyana in 1968: 'It is unfortunate that this valuable protein resource is virtually absent among the agricultural products of countries whose need for protein is greatest'.

Other oil seed proteins include cottonseed, peanut and sesame. Sesame is of particular interest nutritionally since for a plant protein it is unusually high in the sulphur-containing essential amino acid methionine. Its protein is therefore an excellent supplement to legume and soyabean foods.

Sesame is grown to a certain extent in Tobago and is a crop deserving a prominent place in present research programmes as the oil is of fine quality for use in margarine etc., and the expressed cake is an excellent protein rich livestock food. For existing varieties Trinidad may have too much rainfall but parts of Tobago are more suitable. Mexico and Venezuela are among the worlds largest producers. It is also grown satisfactorily in Belize (British Honduras) where there is considerable rainfall.

It is usually grown in areas with an annual rainfall of 20-45 inches. Once established it can tolerate short periods of drought but is very intolerant of water-logging. It has poor ability to compete with weeds in early

stages, but is not exacting in its soil requirements and does reasonably well on poor soils; sandy loams are preferred. Sesame is very sensitive to day length and both long- and short-day forms occur.

The crop is grown from seed and is usually grown as a rain fed crop. The seedling stage is precarious and too little or too heavy rain at this time may lead to poor stands. The time taken to maturity varies from 80 to 180 days, but most cultivars take 100-140 days. Harvesting is according to the type - dehiscent types are harvested by hand; the undehiscent cultivars may be harvested mechanically. In peasant production yields of 200-600 lbs. of seed per acre are obtained. Yields of 800-2,000 lbs. per acre have been reported from Venezuela. Mexican yields vary from 350-1,000 lbs. per acre. The most serious disease of sesame is leaf spot. In Uganda the gall midge is a pest. Selection has been made for indehiscent capsules and single stemmed plants which ripen more uniformly from base to tip. With other crops selection has been made for variations in climate and it seems reasonable that a plant geneticist should find it possible to select plants more tolerant to weather conditions. At the same time agriculturalists may be able to control water-logging to a certain extent.

Further Possibilities For Expansion

Ground nuts are grown for their oil - they contain nearly 40%, but the secondary product, groundnut cake is a particularly good cattle feed. However, ten years ago there developed the problem of aflatoxin - a poison produced by the fungus *Aspergillus flavus*. This has checked expansion of groundnut schemes.

Concerning fish as a source of protein; this is a source which is imported in large quantities both for animal feeds and human consumption.

United Nations agencies and various food programmes are continually expounding on fish as an underutilized source of protein waiting for exploitation. Efforts to increase fish production in Trinidad & Tobago seem to have had little effect (H.E. Wood 'Present & Future Status of the Fishing Industry in Trinidad & Tobago' April 1970, Conference on the Child & Family Nutrition). Less than half of the fish consumed in Trinidad & Tobago can be supplied; the rest is imported. Part of the trouble here may be that efforts are directed to the wrong type of fishing. The potential in Trinidad lies in the inshore fisheries. The currents and the ecology of the surrounding sea do not bring or attract the numbers of fish that must be there for trawling to be feasible. It is a gross mistake to say 'what can be done in Peru can be done in Trinidad'.

At the moment the fishermen round our coast are not encouraged to go out more often because they would not be able to sell their fish. This is because they depend on the immediate neighbourhood for their market. At the same time there is a need for fresh or fresh frozen fish in other areas. A properly run plant to fillet and freeze fish and to process waste and excess fish for fish meal would surely be assured of a market for its products.

Nutritional Background

The fact that maize and soyabean are imported in such large quantities and are used the world over in livestock rations is a reflection of their value nutritionally. There is abundant literature to support the use of various cereal - legume mixtures. The protein of maize is not complete; it is deficient in the amino acid tryptophan. Legumes contain this amino acid, so soyabean, and also sesame, complement the maize enhancing the value of the protein. Sesame is richer in another sulphur-containing amino acid, methionine, than either whole wheat or soyabean. Soyabean is particularly rich in lysine.

Again this is of importance because the quality of maize and wheat protein is limited by its lysine. Animal proteins contain more lysine than plant proteins, and this is the reason why there have been extensive experiments and feeding trials using a pure lysine supplement with proteins derived from plant sources. Also, the fact that wheat and maize have low lysine content initiated work to try to breed new strains of these cereals with an improved level of lysine. So far yields have not reached levels of ordinary strains so the total lysine per acre of the improved varieties does not yet compare favourably. (Proceedings of Nutrition Society 1970).

The value of soyabean and sesame lies not only in their protein content but in their oil too. Sesame seeds contain 45-55% oil which is of high quality, odourless and not liable to become rancid. It consists principally of the unsaturated fatty acids of oleic and linoleic acid - about 40% of each and about 14% saturated acids. Linolenic acid is not present. Soyabean contains up to 20% fat dry weight. As the margarine and soap industries depend on coconut oil augmented by imported oil, it makes sound sense to produce more oil locally.

Animal nutritionists are continually trying to formulate feeds which could be mixed by the farmer at a considerable saving on commercial brands.

A pig feed suggested by U.W.I. in 1966 contains wheat middlings, coconut meal, molasses, fish meal, salt and mineral mix, a concentrate, to feed with discarded yams, bananas etc., and grass. In November 1970 combined work at U.W.I., and the Ministry of Agriculture resulted in a feed containing coconut meal, meat and bone meal, wheat middlings, molasses, pea bran and limestone which were said to be locally available and 'other essential ingredients like fish meal' which cannot be obtained locally (Devendna - U.W.I., Parris - Ministry of Agriculture, Trinidad Guardian, November 28, 1970).

It will be noted that coconut meal is included in both these diets. Grieve, Osborn & Gonzales (Trop. Agric. Trinidad) reported some years ago that a ration with 20% coconut oil meal was cheapest. However this commodity is in short supply now.

Apart from these mixtures which are mainly for pigs, there is a large dependence on maize and on commercial feedstuffs which contain maize and soya-bean.

Information from:

Trinidad Flour mills

Coconut Growers Association

Citrus Research Unit, U.W.I.

Full O Pep

Lipscombs

Carib Brewery

Applied Animal Nutrition - Crampton

Tropical Crops. P. 434, Purseglove, 1968

Proceedings of a conference 'Protein Foods for the Caribbean'. Guyana 1968, C.F.N.I.

Journal of the Agricultural Society of Trinidad & Tobago, June 1968, Radley & Stone.

A FUTURE FOR FEEDS

Editorial, Trinidad Guardian, April 21, 1971

A hundred and seventy-five acres of corn are now being planted at Chaguaramas. This project is being undertaken by Government with considerable support from the Government of West Germany. If this pilot project is successful, it will inevitably have a major impact on farming, and especially animal husbandry, in Trinidad and Tobago. The only criticism which can be made of this experiment is that it should have come a long time ago. Experts have always pointed out that one of the major drawbacks to animal husbandry in the country is the high cost of animal feeds. And imported grain constitute the most important components in feeds which are milled locally.

In the Third Five-Year Plan, the argument is advanced that the high cost of feeds in Trinidad and Tobago "causes the farmer to operate on a low profit margin". This is also cited as a "major restraint" to the expansion of beef cattle production in the country. People who are engaged in animal husbandry or are contemplating venturing into this field can do little or nothing about the situation. What, in fact, happens is that there is at least a 70 percent import content in the poultry produced locally. If the present structure of feed production is maintained, there is every indication that the situation will become worse rather than better.

At the moment, the United States is the major supplier of grain to Trinidad and Tobago. But there is every indication that surpluses would not continue for long in the United States. Latin American countries may be regarded as alternative suppliers but this still places animal husbandry in this country in a position of dependence on external supplies of grain.

The obvious answer is to produce as much of the inputs into animal feeds as we can in Trinidad and Tobago. This idea had gained currency with the acquisition of the Orange Grove Estate. But sugar produced at Orange Grove is fetching premium prices and returns per acre for sugar is higher than one can get for any other crop. The uncertainty which surrounds the long-term prospects for sugar, however, should call for serious re-appraisal of the situation in the near future.

There is the other important aspect which is closely connected with restructuring the sugar industry. Our own experts have observed in Cuba that animal husbandry has become an integral part of the sugar industry. In this context, hi-test molasses has become important.

But a lot of this will depend on how viable the pilot project at Chaguaramas will prove to be. By 1973, six hundred acres will be cultivated with corn and soyabean. But one feels certain that farmers will be looking forward to signs of relief long before this.

MANY QUESTIONS WILL BE ANSWERED BY NUTRITION SURVEY
Guyana Graphic (Special Nutrition Issue) April 30, 1971

A message from Minister of Health, Dr. Sylvia Talbot:

"On April 26, when teams of workers commenced their interviews as part of the National Nutrition Survey, a major effort to learn the true status of nutrition in Guyana began.

"Some may question the wisdom of such a survey at this time arguing that malnutrition is obviously a problem and therefore it ought to be attacked without further delay. We know, of course, that malnutrition exists, but in what forms? How prevalent is it, and among what groups in the population? What factors contribute to malnutriton? Is it merely a lack of money or is it a poor choice of foods? Do people lose nutrients in their food because the food is not properly prepared? What cultural factors prevent people from selecting or using certain nutritious foods?

"The answers to these questions and many others will be revealed by the Survey. This is the approach which will provide for us a baseline for action in health, in education, in agriculture and in community development. Relevant and effective action is never based on vague information. Malnutrition is an extremely complex problem and if it is to be overcome it must be defined and analysed.

"Guyana cannot hope to develop socially, economically or otherwise, with malnourished people in its labour force and in its schools. Because we know this and because we realise that corrective action is not a simple matter, the Government of Guyana has put its full support behind this exercise. I appeal to those families who will be invited to participate in the Survey to give their full cooperation. The information obtained in this Survey will help all Guyanese.

"The Government, although assuming major responsibility for the planning and conduct of the Survey, is fortunate to have a team of experts from the Caribbean Food and Nutrition Institute (CFNI) charged with responsibility for the technical aspect of the Survey. The CFNI is a regional institution partially supported by countries in the Region (including Guyana). In its five (5) years of existence, it has given leadership to the promotion of activities in nutrition which will meet needs in the region.

"I am sure that every citizen would wish to know that this Survey is truly a cooperative venture. Not only are we drawing on the resources - human, material and financial - of several ministries of Government, but also on the PAHO/WHO, the FAO, the CFNI, the UNDP, local authorities, community organisations and on hundreds of private citizens. I want to express my appreciation to all for the cooperation already given in the months of preparation and for the cooperation I now anticipate.

"I trust that this supplement will generate interest in nutrition, not only for the limited period of the survey, but for the months and years ahead when a deliberate and specific effort by the community will be needed to solve the problems of malnutrition".

NEGLECT - THE GREATEST ACT OF CRUELTY TO CHILDREN
The Daily Gleaner, Kingston, May 19, 1971

A Message for Child Month from the Jamaica Family Planning Association.

The greatest cruelty that can be done to a child is to neglect it. Unwanted, neglected children are the real outcasts of any society and in Jamaica we have far too many of them.

In order to thrive, a child must be wanted, loved, and grow up in a proper home environment in which both parents are present. Without these things the child is at a serious disadvantage and it is far more difficult for it to develop into a normal, useful citizen.

It has been shown time and again, that children with unsatisfactory home lives are far more likely to become delinquent than those brought up in a happy home. Many of the problems we face today with our young people can be traced back to their unsatisfactory early days.

In some ways, even more serious, is the problem of protein malnutrition which is far more widespread amongst the lower-socio-economic levels of our society than we like to admit. Lack of adequate food at an early stage of development leads to permanent brain damage in the child. This means that the child, when it becomes an adult will have a low standard of intelligence, will have difficulty in learning, will be able to hold down only the lowest and simplest of jobs; will be indeed a second class citizen. Can we afford to produce second class citizens?

The Jamaica Family Planning Association believes that only through the widespread adoption of family planning can we hope to produce a better life for our children and a better country. Obviously, at a national level, if we have too many people, we cannot hope to provide a better life for all. Jobs, food, education, will not be sufficient to go round. Our natural resources will fall far short.

On the individual family level, too many children means a low standard of living. The children cannot get enough attention, enough food when there are too many in the family. They get neglected and they suffer. The Jamaica Family Planning Association has always stressed that families should only have the number of children they want and can look after properly. Much of our education programme has this aim.

Many cultural factors, many mores stemming from our past need to be analysed and education programmes initiated to mitigate their harmful effects. For instance, a widespread view amongst our women is that unless a child is born to that woman before she is 24 or so, then she is a "mule".

It does not matter whether she has a permanent partner or not or whether she is in a position to bring up the child properly or decently - it is the act of childbirth which is important to her - nothing else matters.

The Jamaica Family Planning Association has long pressed for a programme of sex education in our schools and it is with gratification that we note that Government is planning to introduce the teaching of the subject in our schools under the name of Family Life Education.

The shocking cases of cruelty to children, child abandonment, and criminal abortions which come to our notice every day are sufficient testimony to the crying need for widespread easily used methods of contraception. Today, the facilities exist. What must be done is for the people to be educated to make use of them.

FOOD IMPORTS. MEAT AND DAIRY PRODUCTION
from Candidly Yours, a column by Thomas Wright,
The Daily Gleaner, May 14, 1971

Food

According to a report in the Gleaner food imports into the Island for the year 1970 were greater in value by approximately $9 million than imports in 1969. The total sum involved was nearly $70 million.

The value of food imports has more than doubled over the past ten years. Increasingly more food is imported, but a significant part of the increase has been due to higher prices.

Something will have to be done about this situation, but a proper start will never be made until we all understand the full iniquity of the manner in which the prices of our food exports - sugar, bananas, coffee, citrus and so on - are held down to artificial and outdated levels.

Then there's another thing. It will be noted that the heaviest importations were for meat and dairy products which accounted for about $22 million of the food imports for 1970. In one way this is frightening, but in another it is consoling in the sense that we could replace these imports with local production provided we knew how to go about it. There is no technical reason why Jamaica should not be fully self-supporting in meat and dairy products.

Lack of capital

What chiefly stands in the way is lack of capital and lack of enterprise. And a good deal of stupidity. And what helps to discourage capital and enterprise is price control. Were meat production and dairy farming sufficiently profitable, the needed capital would soon be attracted.

We should learn from Puerto Rico. Some years ago that country had the same problem. It was largely overcome by giving incentives, similar to industrial incentives, to investors in cattle farming, and letting prices find their own levels.

Why we, in Jamaica, should feel that we can buck the economic facts of life and still succeed is a mystery. Nobody else can. The production of an extra $22 million of meat and milk would involve, to begin with, at least five years of intensive development; by which time, of course, the goal would have extended itself to about $30 million. This in turn involves the investment of huge capital sums; and why should this investment be made if other investments are more profitable? We talk of Jamaicanizing this and that, without seeming to understand that however good it is to divert local capital into banks and insurance companies it is better to divert it into the production of food.

The Jamaicanizing of our cows is much more important; but will not take place unless agricultural investment is put at least on par with other investments. Why should a factory to manufacture, let us say, a new kind of hamburger be considered a fit subject for the grant of industrial incentives and protection, while the man who produces the meat for it is price-controlled and taxed out of his mind?

Successive governments have seemed to believe that the development of farming can be achieved by the scattering about of small loans and Subject Matter Specialists. This is nonsense. The rapid development of farming, and especially of meat and milk production, will begin only when it becomes a sound and profitable investment for large sums of private enterprise money. This could be achieved overnight by any government with the skill and shrewdness to nudge the economy of these things in the right direction.

A FULL LIFE DESPITE DIABETES

Anniversary Message to WHO from Health Minister, British Honduras.
PAHO News Release, April 21, 1971

The World Health Organization's regional office here has announced receipt of a 23rd anniversary message from the Minister of Health and Home Affairs, the Honourable C.L.B. Rogers of British Honduras.

Each year as part of its anniversary, which is marked as World Health Day on April 7, WHO highlights an important health problem through a theme. For 1971, the problem is diabetes and the theme is "A Full Life Despite Diabetes". Through the theme, WHO is making the point that the sooner diabetes is detected the sooner is the sufferer able to receive the training that leads to his mastering of the techniques of self-care. Thus, learning how to live with diabetes, is vital to a diabetic living a full life.

In his message, sent to Dr. Abraham Horwitz, director of WHO's regional office for the Americas, the Belizean Minister said:

"In the wide field of medical science, and particularly in the busy research laboratories, spectacular advances have been made over the years in the struggle to alleviate human suffering. We all know now that many cancer victims have a fighting chance if they take timely measures to seek a remedy.

Tuberculosis is no longer the great threat it used to be, malaria is very low on the list of death causes, and the miracle drugs, antibiotics, have made it possible to treat and cure venereal diseases quickly.

"This year World Health Day will be celebrated on April 7 and the theme chosen on this occasion is "A Full Life Despite Diabetes". The Anniversary itself of WHO will be its 23rd.

"A great doctor once told his medical students: "Know diabetes, and all other things clinical shall be added unto you". This means that diabetes can be so all embracing that it can affect every part of the body, and that a thorough knowledge of it would mean getting to know about every part of the body. Yet it is remarkable that a disease condition, that can develop so many complications, can be controlled in such a way as to permit a full life.

"A good many people do not realise the extent of these two extremes - how ill a person can become without treatment: and how very well one can be, with adequate and very simple treatment.

"Like a number of other illnesses, diabetes is not cured, but it is controlled if the victim so desires. I wish to stress this: There is no reason whatever to lead any sort of restricted life when the disease is properly controlled. Thus diabetics can satisfactorily be businessmen, professionals, labourers, sportsmen, clerks, just about anything.

"Here in Belize it is estimated that 750 of our citizens are afflicted with diabetes; the majority of these, however, are still at their occupations and living with their ailment. The Medical Department has recorded 596 visits in 1970 by potential victims seeking treatment of our hospitals. In Belize City there is a Physician Specialist to attend to the more delicate cases. He is assisted by qualified personnel and has the facilities of a well-equipped laboratory. So my advice especially to all those who are approaching middle age is to undergo a thorough medical examination as soon as possible to ascertain whether diabetes is present in their physical system or not and, if it is, to seek medical treatment at once. In this way they will be able to control the disease in the majority of cases and thus to live normally and be useful and productive citizens while enjoying the good things in life itself.

"That the World Health Organization has chosen as its theme for this year "A Full Life Despite Diabetes", is most commendable. At a time when it is increasingly necessary to have a wide understanding of disease conditions, so that more effective cures may be achieved, and so that a higher standard of physical well-being may be enjoyed by all people everywhere, it is heartening to see this organization playing such a prominent role in this movement."

RECENT TRENDS IN THE PUBLIC HEALTH ASPECTS OF PROTEIN-CALORIE MALNUTRITION*

by

J. M. Bengoa
Chief, Nutrition, WHO, Geneva

With population growth outstripping increases in food production, the problem of malnutrition, especially in developing countries, is a matter of constant concern to WHO. In collaboration with FAO and other agencies, WHO has been collecting information on the prevention of nutritional deficiency diseases, the development of foods to combat dietary imbalance, and the promotion of good dietary habits by health education.

Since 1959 it has been recognized that one of the most widespread nutritional disorders in developing countries is protein-calorie malnutrition (PCM). This term was originally introduced to emphasize that protein deficiency in young children leads not only to kwashiorkor - a form of extreme protein malnutrition in which oedema is the outstanding feature - but also to nutritional marasmus, a condition of extreme wasting due to a deficiency of both proteins and calories. The use of the term PCM therefore stresses the importance of calorie intake as well as of protein intake in all syndromes related to malnutrition.

Moreover, PCM covers all manifestations of these deficiences that are less serious, but more frequent, than the extremes of kwashiorkor and marasmus. Children with mild or moderate PCM may not show overt signs of malnutrition, but their physical and mental development may well be retarded. This aspect

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*Reprinted with permission from WHO Chronicle, December 1970, Vol. 12, p.552

is of great significance for two reasons. First, kwashiorkor and marasmus are merely the visible manifestations of a much more extensive malnutrition, of which governments must be made fully aware if PCM is to be effectively combated. Secondly, public health officers must be trained to recognize mild and moderate forms of PCM so that they can prevent them from developing into the only too easily recognizable extreme forms.

Although PCM is a widely used concept, it is not found in the International Classification of Diseases (1965 Revision), which has separate entries for protein malnutrition and nutritional marasmus. It is hoped, however, that the new revision now being prepared will include PCM as a separate disease. Unfortunately there is still some confusion over terminology, as the FAO/WHO Expert Committee on Nutrition* recommended the term "protein-calorie deficiency disease". This is regarded as being synonymous with PCM - both terms covering the whole range of syndromes from mild cases to the extremes of kwashiorkor and nutritional marasmus.

PCM AND MORTALITY

It is generally accepted that official statistics usually fail to reveal the influence of malnutrition on mortality rates. But as PCM is primarily a disease of very young children, infant mortality rates and mortality in preschool children aged 1-4 years are of interest. Table 1 gives currently available figures for some countries over the past 20 years. The decline in both infant and child mortality over the period is encouraging, but there still remains a very great difference between the two European examples given in the table and the other countries. In countries in which PCM is virtually unknown

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Wld Hlth Org. techn. Rep. Ser., 1962, No. 245

such as Japan, the United Kingdom, and the USA, substantially less than 10% of the total deaths recorded in any particular year are of infants or pre-school children. On the other hand, in countries in which PCM is frequent the corresponding figure may well be between 30% and 50%.

Table I: Infant and Child Mortality Rates

	Infant mortality rate per 1,000 live births			Mortality rate in children aged 1-4 years per 1,000 children of same age		
	1950-52	1960-62	1966	1950-52	1960-62	1966
Sweden	21.0	16.0	13.0[a]	1.3[b]	0.9	0.7[a]
United Kingdom	29.0	22.0	19.0[a]	1.4[b]	0.9	0.8[a]
Argentina	66.8	61.0	59.3	5.0	4.3	2.4
Chile	128.4	117.8	101.9	12.9	8.2	5.0
Colombia	118.0	92.8	81.2	20.4	15.4	10.8
Costa Rica	110.5	66.1	65.0	14.6	7.5	6.0
El Salvador	81.2	72.5	62.1	31.1	17.1	13.5
Guatemala	104.2	89.3	91.4	46.3	32.4	29.5
Jamaica	77.8	49.1	35.4	10.5	6.8	4.7
Mexico	94.5	71.4	62.9	28.6	13.8	10.9
Panama	58.8	51.1	45.0	9.5	7.9	8.0
Peru	102.7	92.9	63.0	19.8	15.7	10.5
Trinidad and Tobago	82.4	42.9	42.8	5.8	2.5	2.0
Uruguay	56.6	44.6	42.7	2.2	1.3	1.3
Venezuela	79.5	52.1	46.7	11.9	5.7	4.9

[a]1965. [b]1950.

Undoubtedly the reduction in infant and child mortality that has been achieved reflects better medical care, better nutrition, and better sanitation - possibly in that order of importance - but it is difficult to determine the influence of malnutrition alone on mortality rates. However, a study now in

progress by the Pan American Health Organization is already providing some useful information. In a pilot study in Brazil, Colombia, and Jamaica, the causes of death of some 615 children aged 6 months to 2 years were examined. This study revealed that in 8% of the cases malnutrition was the primary cause of death and in 41% of the cases it was an associated cause. When the study is complete it is expected to be one of the best sources of information on this important subject.

PCM IN HOSPITALS

Although South Africa is the only country in which kwashiorkor is a notifiable disease, valuable information on the diseases of malnutrition can be found in the hospital and outpatient clinic records of other countries. Some of this information is collected in Table 2, which indicates the very high incidence of PCM.

In South Africa itself, notifications of kwashiorkor (with nutritional marasmus specifically excluded and notifications restricted to fully developed areas) were as follows:

1963	*1964*	*1965*
16,132	14,130	12,832

Although the decline is welcome, the figures remain appallingly high, especially as the mortality is some 26%. This high mortality has, in fact, increased over recent years; it used to be 15-20%. The reason suggested for this increase is the strained hospital resources in South Africa. Population increases, combined with the flow of people to the city, have meant that only the most serious cases can be admitted, those in lesser danger being treated as outpatients. Another possible reason for the high mortality in South Africa is that kwashiorkor is known to develop at an early age there, 91% of the

cases being children less than 2 years old.

From the examples in Table 2 it is clear that in other countries, too, mortality is extremely high. For both kwashiorkor and nutritional marasmus it is between 30% and 40%. The introduction of intravenous fluid therapy for the treatment of children who were dehydrated as a result of PCM cut mortality figures by half, but in the past 10-20 years no further marked advances have been made. Probably the main causes of these high mortality rates are the development of PCM early in life, poor nursing care, and lack of hospital facilities, with resulting cross-infection.

The reliability of the figures in Table 2, however, is uncertain, because there is considerable variation in the clinical interpretation of cases, even when medical staff have had a similar training in nutritional diseases.

Table 2: Protein-Calorie Malnutrition in Hospitals and Outpatient Clinics

	No. of children examined	Proportion malnourished	Proportion with kwashiorkor	Mortality from kwashiorkor	Proportion with marasmus	Mortality from marasmus	Proportion with moderate PCM
Iran (Massoudi Hospital, 1965)	830	31%	10%	32%	20%	42%	-
Jordan (Children's Hospital of Amman)	1,131	17%	4%	35%	2.5%	35%	10.5%
Sudan (MCH centres, 1968-69)	9,642	68.5%	7.2%	-	5.5%	-	55.8%
Senegal (Dakar)	2,590	25.6%	11.6%	45%	14%	42%	-

COMMUNITY SURVEYS AND THE PREVALENCE OF PCM

Community-wide nutritional surveys are a valuable means of obtaining information regarding the prevalence of PCM. Information from these sources can be conveniently considered under three headings:

(1) the prevalence of severe PCM, including (a) kwashiorkor and nutritional marasmus, and (b) cases of children weighing less than 60% of the standard weight,

(2) the prevalence of moderate cases of PCM, and

(3) the total prevalence of severe and moderate cases of PCM.

Prevalence of kwashiorkor and nutritional marasmus

Table 3 gives the results of surveys published between 1966 and 1969 in various countries, but these data may not be wholly reliable owing to the frequent difficulty of correctly classifying cases of PCM. While both kwashiorkor and nutritional marasmus cause growth retardation and muscle wasting, the former disease may be distinguished by oedema, the retention of some subcutaneous fat and psychomotor change - characteristics that are absent in nutritional marasmus.

Confusion can arise because the clinical features of kwashiorkor vary in different parts of the world and because the degree of protein deficiency and the ratio of calories to protein in the diet can alter the clinical picture. In tropical countries, oedema associated with kwashiorkor must be distinguished from oedema arising from other causes, especially hookworm disease.

A further complication concerns the distinction between the point prevalence and the yearly or monthly prevalence of the diseases. Kwashiorkor is an acute and severe disease that is fatal within a few days or weeks if the

child does not receive medical attention. If the child does receive treatment and survives, recovery is so rapid that after a few weeks no signs of the disease can be detected. With nutritional marasmus the picture is quite different. Even in the absence of medical attention the child may languish without significant change for several months. It follows that in any particular community the turnover of cases of kwashiorkor will be significantly higher than that of marasmus. At a given time there may be, say, two cases each of kwashiorkor and nutritional marasmus, and some three or four months later there may still be two cases of each condition, but the kwashiorkor cases are probably new ones whereas the marasmus cases are probably not. Thus, although the two conditions might have the same point prevalence, the number of new cases of kwashiorkor in one year may be much greater than that of nutritional marasmus. The magnitude of the discrepancy will depend on such factors as the seasonal variation of the diseases and their respective mortalities.

Table 3: Point Prevalence of Kwashiorkor and Nutritional Marasmus in Community Surveys

Year	Country	No. of children examined	Percentage of cases of		
			Kwashiorkor	Nutritional marasmus	Total
1966	Pakistan	1,020	1.5	1.2	2.7
1967	Nigeria	432	1.6	1.6	3.2
"	Uganda (Ankole)	345	0.3	1.2	1.5
1968	Tanzania (Dodoma)	401	0	3.2	3.2
"	Zambia	1,104	-	1.7-4.4	-
1969	India	15,000	0.4-0.9	1.0-2.0	1.4-2.9
"	Malawi (South)	619	0.5	2.7	3.2
"	Tanzania (Coast)	630	0.8	6.8	7.6
"	Tanzania (Tabora)	551	0.2	0.3	0.5
"	Tanzania (West)	393	0.3	1.2	1.5

These points must be borne in mind when examining the figures given in Table 3. From this table, it may be seen that the point prevalence of kwashiorkor is 0-1.6% while the point prevalence of marasmus is 0-6.8%. However, the higher apparent prevalence of marasmus may not reflect the true position. The point prevalence of the two conditions combined for 1966-69 is in the range 0-7.6%, which is a slight improvement on the comparable figure of 0-10% for the years 1952-66.

It would be a great advantage if future studies expressed the prevalence of kwashiorkor and nutritional marasmus in terms of the number of cases per month or per year, even though it might be more difficult to obtain such data.

Prevalence of children weighing less than 60% of the standard weight

In addition to the data on kwashiorkor and nutritional marasmus, the prevalence of severe PCM can be estimated from the percentage of children who weigh less than 60% of the standard weight. There are, however, two complicating factors in such studies. One is that in cases of kwashiorkor the weight of the oedema fluid has to be taken into account. For this reason it would be desirable to amend the Gomez classification of third-degree malnutrition (which at present includes only those children weighing less than 60% of the standard weight) to include all children with oedema, regardless of their weight. This would greatly improve the accuracy of estimations of the prevalence of severe PCM. The figures given in Table 4 take no account of the presence of oedema.

The second complication concerns the question of "standard weight". Obviously, if local standards are available they should be used in preference to standards established in other countries. However, experience has shown that in the first year of life there are no great differences in weight

between adequately nourished children whether they come from developed or developing countries. In Table 4, the standards used are those of the USA, except for the data from Mexico.

From this table it will be seen that the percentage of children weighing less than 60% of the standard weight is in the range 0.5-4.6%, which is somewhat lower than the combined figure for kwashiorkor and nutritional marasmus.

Table 4: Percentage of Children Weighing Below 60 per cent of the Standard Weight in Community Surveys

Year	Country	No. of children examined	Percentage of cases below 60% of standard weight
1966	Peru (Puno)	3,313	0.5
1967	Chile	1,540	2.6
"	Costa Rica	738	1.4
"	El Salvador	574	3.3
"	Guatemala	763	4.1
"	Honduras	633	2.0
"	Nicaragua	708	1.4
"	Panama	624	0.6
"	Uganda (Ankole)	286	4.5
1968	Colombia (9 surveys)	3,378	1.7
"	Dominican Republic	10,333	2.5
"	Kenya	353	1.0
"	Mexico (rural areas)	5,765	3.4
"	Mexico (urban areas)		1.3
1969	Malawi (South)	619	4.6
"	Tanzania (Tabora)	551	1.5
"	Tanzania (West)	393	0.5
"	Windward Islands (St. Vincent)	2,490	1.5

Prevalence of moderate cases of PCM

From both the public health and the social points of view it is of great importance to assess the prevalence of moderate cases of PCM. However, the clinical limits of moderate cases are even more difficult to define than those of severe cases. Such terms as "pre-kwashiorkor", "general undernutrition", "poor nutritional status", and so on are extremely unsatisfactory for comparative studies. Table 5, which gives the most recently published data, is in most cases based on the second degree of malnutrition of the Gomez classification, covering children weighing between 60% and 75% of the standard weight. This seems to provide the most objective information. Other surveys, such as those made in Tanzania, have used the presence of three or more clinical signs of PCM as criteria. In Table 5, the range of moderate cases of PCM is 4.4-43.1% for the period 1966-69. This is a slight improvement on the range 4.4-57% found for the period 1952-66.

Total prevalence of severe and moderate cases of PCM

Among children in many developing countries, the total prevalence of PCM, including both the severe and the moderate forms, appears to be in the region of 20%. In not a few countries it is over 30%. Even admitting the uncertainties of the data and accepting that it may not, in some cases, be representative of the countries mentioned in the tables, the enormous magnitude of the PCM problem is only too apparent.

With regard to the number of children in the world who suffer from malnutrition, it has been estimated that in 1966, of the 667 million children under the age of 14 years living in developing countries, 269 million were under-nourished.

Table 5: The Prevalence of Moderate Cases of PCM in Community Surveys

Year	Country	No. of children examined	Proportion of children suffering from moderate PCM according to following criteria:		
			weight 60-75% of standard weight (%)	weight under 3rd percentile of standard weight (%)	Clinical criteria (%)
1966	Algeria	2,105			16.6
"	Peru (Puno)	3,313	4.4		
1967	Chile	1,540		32.0[a]	
"	Costa Rica	738	9.5		
"	El Salvador	574	20.9		
"	Guatemala	763	24.5		
"	Honduras	633	20.5		
"	Nicaragua	708	11.1		
"	Nigeria	1,268			5.6
"	Panama	624	11.0		
"	Uganda (Ankole)	286	27.2[b]		
1968	Colombia (9 surveys)	3,378	19.3		
"	Dominican Republic	10,333	10.9		
"	Kenya	353	25.0[b]		
"	Philippines	534		43.1[c]	
"	Tanzania (Dodoma)	401			17.8
"	Uganda	-			25.0
1969	India	15,000			16.0
"	Malawi (South)	619			25.8
"	Mexico (rural areas)	5,765	27.5		
"	Mexico (urban areas)		14.8		
"	Tanzania (Coast)	630			19.3
"	Tanzania (Tabora)	551			7.3
"	Tanzania (West)	393			10.5
"	Windward Islands (St. Vincent)	2,490	25.7[b]		

[a] Iowa standard [b] 60-79% of standard weight [c] Boston standard

To increase the accuracy of future estimates of the prevalence of PCM, it will be necessary to agree on the criteria to be used in defining severe and moderate cases of PCM and to standardize methods of survey, particularly those used in sampling. A survey should be representative of the entire country in which it is carried out, and allowance should be made for seasonal variations in the disease. It is of particular importance to express the prevalence of severe cases on a yearly basis. The WHO monograph *The Assessment of the Nutritional Status of the Community** provides a good basis for achieving some standardization of methods of survey.

As country-wide surveys are expensive and time-consuming, it may be that in some countries of high prevalence consideration might be given to making both kwashiorkor and nutritional marasmus notifiable diseases. Notification would not only serve to provide better statistics but - infinitely more important - it would also enable other children at risk within an afflicted family to be identified and given immediate help.

THE INTERACTION OF MALNUTRITION AND INFECTION

The malnutrition of children, so amply and alarmingly illustrated by the foregoing data, cannot be treated in isolation. There is a close and pernicious connexion between disease and malnutrition. Malnutrition almost invariably lowers resistance to infection, and infectious diseases exaggerate the effects of malnutrition. In 1965 a WHO Expert Committee on Nutrition and Infection concluded that:

> The amount of evidence that has accumulated on the occurrence . . . of synergism between nutrition and infection is impressive.

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*Jelliffe, D.B. (1966) *The assessment of the nutritional status of the community*, Geneva (World Health Organization: Monograph Series, No. 53).

> The Committee believes that it deserves more widespread recognition, particularly in relation to the effects of malnutrition on the morbidity and mortality attributed to infectious diseases in populations of developing countries and the frequency with which these diseases are a major contributory cause of clinical malnutrition in such populations.*

In 1968 the WHO Monograph *Interactions of Nutrition and Infection* considered this relationship in great detail.**

What cannot be emphasized too often is the urgent need for a combined approach to the problems of malnutrition and infectious disease in young children. For example, the beneficial effects of low-cost weaning foods will be largely wasted if they are not combined with simultaneous action to control infectious diseases, both by immunization and improved sanitation. In the same way the rehydration of young children suffering from diarrhoea will be of lasting benefit only if the individual cases are followed up with rehabilitation and with nutritional education of the parents. Simultaneous operations in the fields of nutrition and medical care can have much more impact on child health in developing countries than independent operations.

TRENDS AND SUGGESTIONS FOR THE FUTURE

From the nutritional point of view, developing countries may be divided into two groups.

First, there are the countries in which infant and child mortality rates are still very high - say 150-200 per 1,000 live births for infants and

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*Wld Hlth Org. techn. Rep. Ser., 1965, No. 314, 22.

**Scrimshaw, N.S., Taylor, C.E. & Gordon, J.E. (1968) *Interactions of nutrition and infection*, Geneva (World Health Organization: Monograph Series, No. 57).

more than 30 per 1,000 for children aged 1-4 years. In these countries mortality in young children caused directly or indirectly by malnutrition remains extremely high. Where malnutrition can still be measured in terms of mortality, there is a clear case for an urgent attack on the problem of undernourishment and on the closely related problem of infectious diseases. It is expected that, in these countries, general public heath measures will substantially reduce this appalling mortality within the next few years.

Secondly, there are the countries in which child mortality rates have fallen dramatically in recent years - say to 50-70 deaths per 1,000 live births for infants and 5-10 per 1,000 for children aged 1-4 years. In these countries mortality due to malnutrition is now relatively low, and it is no longer possible to measure malnutrition in terms of mortality. Nevertheless, malnutrition continues to be a serious indirect cause of both mortality and morbidity.

The decline in mortality in the second class of developing countries has been much more rapid than in the advanced countries. The reason suggested for this difference is that in developing countries the reduction in mortality has probably largely depended on specific health measures, whereas in the advanced countries it is probably more directly related to the raising of living standards. This is an important distinction that deserves further study. It seems that recent public health measures in this class of developing country - particularly the use of new drugs and better general medical care - have enabled many children to survive who not so long ago would have died.

But their mere survival is not enough. With no improvement in their standard of living and nutrition, they frequently succumb to infection, with repeated relapses, and they continue to suffer long periods of undernourishment.

It is very unfortunate that, while the gap in mortality rates between the developing countries and the advanced countries is closing, the same cannot be said of the gap in living standards. It will be extremely difficult to make further reductions in mortality rates in these countries without significantly raising standards of living, including nutrition.

In these countries a large proportion of the population eke out an existence in which extreme poverty, poor dwellings, and lack of education are the norm - it is a depressed life both psychologically and socially, aptly described as exhibiting the "social deprivation syndrome".* Although the reduction of mortality in these countries has been a notable accomplishment, it is difficult to feel great optimism about future advances in the reduction of malnutrition. It may be that in passing from an era of high child mortality these countries will be faced with an era blighted by increasing numbers of children who are socially handicapped with chronic disability.

One social problem which may be linked to this dilemma is the frightening number of drop-outs and repeaters in the primary schools of developing countries. Because progress on social development is clearly related to standards of education, this is a matter of great concern. For example, in Latin America only 26.5% of the children who start primary education complete the sixth grade: in India the average retention rate for 1955-59 was only 32.4%, in the Philippines it was 37%, and in Pakistan it was only 16%.

But it is in the first grade that the drop-outs are most tragically significant. In Pakistan in 1959 only one-third of the eligible children enrolled in primary schools, and of these 60% had dropped out by the end of

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*Ramos Galván, R. (1966) Gac. méd. Méx., 96, 929

the first year. The drop-out rate during the first year in Central America in 1961 was also 60%, and in Mexico in 1966 it was even higher - 67%. It is apparently in the rural areas that the problem is most serious.

It has been estimated that in Latin America some three million children (about 30-40%) repeat their first year at primary school. In India the figure is estimated at 40-50%. In a country of Central America during 1950-65 more than 80% of children who had enrolled in primary schools were concentrated in the first three grades.

Many factors have been suggested to account for this unhappy state of affairs. The education system itself must take some of the blame - too few schools, inadequate buildings, poor teaching, and so on. The parents, too, cannot escape responsibility; up to the age of nine children do not have much economic value, but after that age they are often taken away from school by their parents and sent to work. In India it has been estimated that 65% of children drop out for this reason. The importance of these factors is fairly obvious, but little attention has been given to the state of the children themselves. It may well be that one of the most important reasons for failure in primary schools is a background of long periods of infectious disease and severe malnutrition. In many developing countries, a large proportion of seven-year-old children starting their primary education are physically retarded by two or three years. The psychological development and learning capacity of such children are also probably lower than that of normal seven-year-old children.

This aspect of the problem requires urgent research. Current studies in Chile, Guatemala, India, and Mexico are attempting to relate mental development to standards of nutrition. These studies may explain the failure of so many children to complete even their primary education.

Table 6: Objectives and Activities in the Control of Protein-Calorie Malnutrition in Young Children

Levels of prevention	Objectives	Activities
I. GENERAL	To raise standards of living, to develop food policy and agriculture, and to improve fundamental education and environmental sanitation	Development and implementation of plans for improving the socio-economic level of the less privileged groups of the population
II. SPECIFIC		
Health promotion	To maintain good nutritional status	1. Protection of nutritional status of pregnant and lactating women (health education, supplementary foods, etc.) 2. Periodic surveillance of population at risk 3. Promotion of breast-feeding 4. Development of low-cost weaning foods and of measures to improve family diet 5. Development of nutrition education in co-operation with agricultural extension services, schools, etc.
Health protection	To reduce the prevalence of infectious diseases	6. Expansion of immunization programmes 7. Promotion of hygienic preparation of food and personal hygiene 8. Provision of domestic utensils suitable for infant feeding
Treatment and rehabilitation	To minimize the effects of infectious diseases	9. Intensification of simple programmes for early rehydration of children with diarrhoea 10. Intensification of food distribution programmes in times of epidemics 11. De-worming of heavily infested children
	To achieve the early and complete nutritional rehabilitation of malnourished children	12. Hospitalization of serious cases 13. Ambulatory treatment of moderate cases 14. Treatment through nutrition rehabilitation programmes

POSSIBLE LINES OF ACTION

The action suggested to combat protein-calorie malnutrition in developing countries is summarized in Table 6.

Among the general measures of primary prevention that may be considered, an increase of food production is of paramount importance. Environmental sanitation deserves high priority, and health education of the public is a key activity at both national and community levels.

Specific and immediate action can and should be undertaken in several directions. Optimal maternal diet during pregnancy, prolonged breastfeeding, progressive weaning with appropriate foods, and education of mothers on infant-feeding practices are the basis of good nutritional status in children.

The prevalence of infectious diseases can be reduced by immunization, by attention to the handling of foods eaten in the home, and by personal hygiene. The effects of diarrhoea can be minimized by appropriate feeding, early treatment, and oral rehydration. It is still essential to provide facilities for the early and complete nutritional rehabilitation of malnourished children.

For obvious reasons, the highest priority must be given to preventive measures. If a good nutritional status is maintained in the first years of life, successive attacks of most infectious diseases of moderate virulence will probably produce no more than mild effects. When infections are reduced and their effects minimized, there will be less damage done to nutritional status and less need for rehabilitation.

In practice, all the above measures have necessarily to be considered simultaneously, since at a given moment in a community there may be found children who require prompt action at different levels of prevention,

treatment and rehabilitation. The final and permanent answer to the problem will rest in raising the standard of living of the population through social and economic development. It is doubtful, however, whether such development will be fully successful without taking into account the need for the nutritional improvement of the present generation.

YOUR QUESTION ANSWERED*

Q. What vitamin and mineral supplements are advisable as routine prophylactic supplements for young children in the tropics?

A. The selection of routine vitamin and mineral supplements for use at young child clinics in all parts of the world can be made logically only in relation to known nutrient requirements in early childhood, to biological and dietary sources of nutrients, and to evidence of locally important deficiences.

It is usually assumed that nutrient needs in early childhood do not vary very much in different climatic areas of the world, apart from calories and vitamin D (which is obtainable by irradiation of the skin by sunshine). It may be that future work will show that different communities of man have become adapted to too 'great' or too 'little' habitual intakes of certain nutrients. At the moment and for practical purposes nutrient needs, and hence recommended dietary allowances (RDA), can be considered universal, and one of the up-to-date tables of RDA used as a basis for planning.

First year of life

Vitamin and mineral supplements will mostly be considered for young children in the first year of life, and yet it is particularly difficult to assess the cumulative nutrients available to the infant at this stage, as these will be from four sources: foetal stores, mother's milk, other food, and ultra-violet light. It may be noted that the first two of these are functions of the mother's diet and stores. Also, the assessment of food consumption, including the diet's vitamin and mineral content of the diet, is itself a notoriously difficult matter in the gradually changing and fluctuating diet of the older infant.

A major consideration must always be the known main vitamin and mineral deficiency syndromes seen in hospitals, in health centres, and (if possible) their prevalence in the community itself, together with age incidence and details of local aetiology. Plainly, it is preferable to plan a public health programme of vitamin and/or mineral supplementation which is based on reliable survey data concerning actual consumption of food (in pregnancy, lactation, and infancy); local food habits, customs and restrictions; the range of available foods; indigenous methods of preparation; together with information on the prevalence of deficiency diseases (as judged clinically and by appropriate tests, including, for example, examination of the blood).

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Sometimes some (or all) of this information may be available or obtainable; more often, it may not. In these circumstances the tropical doctor, together with his staff, may be able to ascertain some of the facts; even if the data are approximate and qualitative they can be very valuable, both as a rational guide to the scientific application of knowledge in the particular circumstances and as a stimulus to thinking and to understanding the need for 'field research'. It can also save the unnecessary waste of large amounts of money.

Feeding the young baby

A basic consideration will be the method of feeding the young baby. Traditionally, this will be undertaken by breast-feeding. If the pregnant and lactating mother is well fed on locally available foods (especially vegetable proteins in 'multimixes'), usually no vitamin or mineral supplements (or any food other than mother's milk) will be required in the first six months of life; in fact, they are often contraindicated in view of high risk of introducing alimentary infection and diarrhoea. ('Multimixes' consist of the local staple plus one or more of the following: a legume, dark green leafy vegetable, and animal protein).

In babies in tropical regions artificial feeding is highly hazardous, largely because of the interrelated dangers of marasmus and of diarrhoea. In addition, formulas of cow's milk (whether boiled or processed) lack vitamin C, and this needs to be added from about six weeks of age in the form of *locally appropriate fruit juice* (which *may* be orange, but can be guava, mango, or various forms of citrus), or in the form of actual ascorbic acid tablets, which may be cheaper and will much less likely be contaminated with bacteria.

An additional risk with artificial feeding is the danger of severe eye damage (keratomalacia) from avitaminosis A if any form of unfortified skimmed milk preparation is used.

A policy for supplements

In essence, a policy needs to be worked out with regard to the issue of vitamin and/or mineral supplements in child health services in the particular region. There may be no need for any such supplementation: this was the case for thousands of years, and one would guess that full-term breast-fed babies of well-nourished mothers in sunny Australia, correctly weaned on to a mixed diet, really require no supplements, including cod-liver oil (or other source of vitamin D) or ascorbic acid. However, even more certain 'at-risk' children exist - for example, twins and premature babies, who are born with deficient stores.

The tradition of issuing vitamin D preparations (usually cod- or other fish-liver oil) and vitamin C (most often as orange juice) developed in health services in the relatively sunless northern temperate-zone countries of Europe and North America some decades back, when rickets was a widespread problem and infantile scurvy a risk in bottle-fed babies. The spread of western-derived child health services to the tropics tended to transport whole procedures, rather than to the adaptation of universal scientific principles. Too often,

for example, the routine use of cod-liver oil and orange juice became dogma, with little consideration for need. So much so that it has now become difficult to change in areas where these items are quite unnecessary, and distract from real wants.

Another pressure that should be appreciated, avoided, and combated, is that of drug houses to promote seemingly 'low-cost' but actually expensive and unnecessary multivitamin drops. They are never required, and are a potent cause of 'budget-drain' and of unscientific public health measures based on imprecise logic.

A range of vitamin and/or mineral supplements may, then, be needed in one ecology and another. In areas where infantile beriberi is a problem thiamine may be given as a supplement in early infancy, either to the baby or preferably to the lactating mother. In tropical regions where children are *not* likely to be sufficiently exposed to sunlight (e.g. in shanty towns or because of various cultural practices) vitamin D may definitely be indicated. In many countries avitaminosis A is a major scourge, and *must* be prevented by appropriate supplementation. As in the temperate zone, bottle-fed babies should always be given ascorbic acid.

As a recent example of the need for local adaptation, a study in the West Indian island of Barbados in 1969 showed that cod-liver oil was the main supplement issued, although rickets or vitamin A deficiency was virtually non-existent. At the same time, deficiencies of iron and folic acid were common in young children. The logical supplement in these circumstances was a cheap iron-folic-acid mixture.

The main approach to supplying the vitamin and mineral needs of young children is by feeding pregnant and lactating women, and by ensuring the introduction of as wide a diet as possible in the second six months of life. In a sense, the use of vitamin and mineral supplements reflects a failure - cultural, economic, or ecological - in infant feeding. Nutrients should come in foods, both naturally and commercially enriched, not in bottles or medicaments; if they are needed in certain places it is best to think out which are required, why, when, for how long, and in what economical form.

FOOD HABITS OF INFANTS AND PRESCHOOL CHILDREN IN SURINAM*

by

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Surinam is a tropical country of nearly 58,000 square miles, situated on the northeast coast of South America, between Guyana and French Guiana. The greater part of the population of 350,000 lives in a narrow strip along the coast, with only a small group of "Amerindians" and Bushnegroes living in the interior. The population is heterogeneous, the majority (44 per cent) originating from Africa (Creoles, including Bushnegroes) and from Asia (Hindustani Indians, 35 per cent; Javanese, 15 per cent; and a smaller percentage of Chinese). Amerindians comprise only 2 per cent of the population, and there is a small group of Europeans (1 per cent).[1]

The infant mortality rate is estimated at approximately 30 per 1,000 live births among the Creoles and Hindustani and at 50 to 60 per 1,000 live births among the Javanese and other ethnic groups. Table 1 shows some comparative figures.[2] The mortality rate for preschool children one to four years of age is approximately 3 to 4 per 1,000 population; that for school children, five to fourteen years old, about 1 per 1,000 population.[3]

Table 1: Infant Mortality Rates in Four Countries

Country	Infant Mortality Rate	Year
United States	22.1	1967
Jamaica	35.4	1966
British Guiana	41.3	1966
The Netherlands	14.7	1966

SURVEY METHODS

In 1967, a team of home economists surveyed mothers regarding the food habits of their preschool children from the time of birth up to the age of two years. The survey covered six districts in Surinam, five in the coastal region and one - the Brokopondo District - in the interior. The capital, Paramaribo, was not included.

Families were selected at random by including every tenth dwelling unit. If the inhabitants proved to be a family without infants or preschool children, or if the mother was a regular attendant at health information meetings, the house was not included and the dwelling unit next to it was substituted. The data supplied were reported on the questionnaire shown on page 169. Accurately completed forms were received from 192 families, classified as follows: Hindustani, 87; Javanese, 50; Creoles, 43; and Bushnegroes in the Brokopondo District, 22. In Brokopondo, the survey team operated in villages newly built for people transmigrated from an area now transformed into a lake by a dam. At the time of the survey, these villages were still supplied with food parcels consisting of corn meal, wheat flour, milk powder, raisins, pulses, and dried fish - which, of course, influenced their food consumption.

The survey concerned food of infants up to two years of age, in most cases the youngest child in families where the wage-earner was an agricultural worker. The families, relatives, and foster-children were classified according to the number of persons (Table 2). Although no information is available, approximately one-fourth of the families were involved.

Table 2: Size of Families Surveyed, Grouped According to Ethnic Origin

Size of Family	Hindustani	Javanese	Creole	Bushnegro-Brokopondo District	Total
Small (up to 5 persons)	12	15	2	11	40
Medium (6 to 8 persons)	24	12	8	11	55
Large (9 or more persons)	17	12	14		43
Unknown	34	1	19		54
Total	87	40	43	22	192

DIETETIC PATTERN

Breast-Feeding

Generally speaking, the breast-feeding period is long in Surinam, compared with Western ideas. Only a minor percentage of the infants are not breast fed, due to special circumstances. In all ethnic groups, the majority of women terminate breast-feeding between the age of nine months and one year, although some continue until the child is two years old, or even four, according to the arrival of the next baby. Working mothers replace some breast-feeding by bottle-feeding after a comparatively short period (six weeks to three months).

The first additional food may consist of several kinds of porridge, fruit juice or soft fruits, soft rice often mixed with soft vegetables, or

enriched infant biscuits.* The mother does not always realize that during the period of growth and development, the preschool child has high nutritional requirements.

Number of Meals

Three or more meals are customarily supplied per day to a preschool child of two years of age. Only some 8 per cent eat less, and in such cases, the mother often stated that between-meal "sweets" are given in the form of several types of fruits, baked cassava, biscuits, or bread of cassava.

Before this second year, the infant shares the meals prepared for the adults in nearly three-quarters of the families. Where meat and fish are mixed in low quantities with vegetables and rice, the infant's intake may be deficient in protein.

Food Taboos

Food taboos, called *treef* in the native language, were often reported (Table 3). This word is based on the Hebrew *tereefa*, meaning forbidden food.[4] In most cases, it is a ban for life on eating a specified food (mainly meat or fish).

Table 3: Practice of "treef"

Practice	Hindustani	Javanese	Creole	Bushnegroes	Total	
					Number	Per Cent
No *treef*	56	40	30	7	133	70
Treef	10	0	13	15	38	20
Unknown	21	0	0	0	21	10

*Composition per enriched biscuit (16 gm.): protein, 1.6 gm.; fat, 1.1 gm.; vitamin A, 800 I.U.; vitamin P_3, 150 I.U.; vitamin E, 0.24 mg.; thiamin, 0.05 mg.; riboflavin, 0.05 mg.; and niacin, 0.4 mg.

Taboos are said to be based on the assumption that a specified food causes leprosy. The stringent food rules adhered to by the Jewish masters on the early estates and the fact that there was no leprosy among them would have been considered by the slaves to be interconnected, which could explain why their descendants sometimes observe food taboos identical to the Jewish food rules. A different concept of *treef* is that it should be interpreted as a sacrifice for life in order to placate evil spirits. Breach of *treef* would, in that case, be punishable by leprosy.

In other groups (both Creoles and Hindustani), *treef* involves a concept analagous to allergy. People think they fall ill when they consume a specified food item, without thinking of leprosy.

Sometimes *treef* implies an order to perform or omit special acts when consuming food. An individual, family, or a complete tribe may be subject to a particular *treef*. An incident in the family, a dream-reading, or tradition (through the paternal line) can be the motive for following a *treef*.

All of these aspects about food taboos may affect the preparation of food given to preschool children.

In most cases, the food to which *treef* is applicable was not mentioned. If it was reported, it appeared that *treef* mainly applies to pork and fish without scales.

Consumption and Price of Individual Foods

Protein-rich foods.

In Table 4, the protein content, current market price, and biologic value of various products are compared (5-7). It appeared to be important for health education teams to know which inexpensive, protein-rich foods were available, because of the large percentage of poverty-stricken in the

population. No exact figures of income could be obtained.

Table 4: Protein content, price (in U.S. value), and biologic value of various protein products in Surinam

Food	Protein	Price		Biologic Value*
		Food	Protein	
	gm./100 gm.	*¢/100 gm.*	*¢/gm.*	
Milk				
Non-fat dry**	36	**		72
Cow's	3.3	2	0.5	90
Skim	3.3	0.5	0.2	90
Ready-to-eat baby food	21	21	1.0	?
Fish				
Fresh	18	2-10	0.1-0.6	72
Dried	81.8	8	0.1	?
Beef				
Fresh	18	14	0.8	76
Salted	24.5	11	0.4	?
Poultry	20	19	0.6	?
Eggs	13	11	0.8	96
Pulses, dried	20	3	0.2	35-60

*From reference [7]

**Supplied free of charge

Fish, being abundant in Surinam[8,9] is rather inexpensive; therefore, but unfortunately, people do not appreciate that provided it is well boned, it is excellent food for preschool children. It is occasionally given to children from the age of six months. Of the Bushnegro mothers, 26 per cent fed their two-year-olds this protein-rich food, whereas only 12 per cent of the other mothers questioned did so.

QUESTIONNAIRE

Basic Data

Ethnic group _____
Number of members in the family _____
Have you at any time had food information? _____

Food for the Preschool Child

In order to make up a good and cheap diet for preschool children, we should like to know what is usually given to preschool children in your district. Hence, we kindly request you to answer the following questions in this form:

1. How long is a child breast-fed? _____

2. When does the weaning period start? _____

3. How many meals a day are given to a preschool child of about 2 years of age? _____

4. After how many years (months) is the infant sharing the food prepared for the adults? _____

5. Is your child subject to a treef? _____

6. Are the following food products occasionally or regularly given to the preschool child? If so, after how many months is this procedure started?

Food item	Not used	Used occasionally	Used regularly	After how many months?
Baby food, e.g., porridge of:				
Corn flour				
Rice meal				
Cocorie (meal of cassava)				
Meal of bananas				
Cow's milk				
Milk powder				
Orange juice or grapefruit juice				
Other fruits				
Ripe bananas				
_____				
_____				
Soft rice				
Soft vegetables				
Pulses, sieved				
Starchy tubers and roots (mashed)				
Coco yam				
Cassava				
Potatoes				
Yam				
Sweet potatoes				
Bread				
Enriched infant biscuits				
Bread of cassava				
Boiled egg				
Fish				
Fresh				
Dried				
Meat (minced)				
Other food products				
_____				
_____				
_____				

Pulses, being another inexpensive protein source, are regularly eaten. Mixed with rice, this is a favorite dish in Surinam. Intake of protein amounts to about 10 gm. per meal. The Hindustani consume the largest quantity of pulses (rice with split peas [*Pisum sativum*]); in 37 per cent of the families, this food is given to infants of twelve months and older. Next come the bushnegroes (39 per cent) in the Brokopondo District who received pulses in their food parcels.

Eggs, meat, and poultry are seldom eaten, i.e., less than once a week. They are rather expensive and, except for those who keep chickens or cows, are rarely obtainable. This also holds for cow's milk and milk powder.[10,11]

Cow's milk is consumed. Greatest use of cow's milk was reported by the Hindustani, who often own cows, and by the Creoles. Sixty-three per cent of the children nine months and older in both groups were reported to receive milk regularly. However, the Creoles consider milk as only baby food, and after the second year, porridge is served, with a resultant lower 33 per cent continuing to receive milk. Since the coastal region is suitable for animal husbandry, it is good that the value of milk is appreciated there. However, the health information centers could draw special attention to the risks of not boiling milk and allowing it to simmer at half-hot temperatures. The Milk Board has already introduced a substantial improvement in towns by selling pasteurized and sterilized milk, and it is hoped that the practice can spread.

In view of the short keeping quality of fresh milk, nonfat dry milk is a better product, provided safe water is used to prepare it. Consumption of milk powder is only of importance among the Bushnegroes in Brokopondo, where it is included in the food parcels. Eight per cent of the babies there

consume it occasionally, 19 per cent regularly. No more than 20 per cent of the other groups use milk powder regularly. It is additionally supplied at health centers, clinics, and schools. People had to be taught how to use this food item. Complaints that an overuse of milk powder would cause diarrhea is probably due to a wrong diluting process or lactose intolerance. Sometimes milk powder is even used as sandwich spread.

The reported frequent consumption of ready-made baby food is quite remarkable, for it is expensive. The practice is probably a result of wide spread publicity, causing many women to think it a most valuable product. It may well be that this food is bought as a status symbol. Furthermore, it is considered as a kind of porridge and not as milk powder. Fifty per cent of the Bushnegro-mothers give their babies between six and nine months ready-made baby food. It is an important task for the health information services to draw attention to the fact that there are other and less expensive products which are just as nutritionally valuable.

Fish, pulses, and skim milk are the cheapest sources of protein, as became apparent during the surveys of 1959 and 1962.[11,12]

Staple Foods.

In Table 5, bread, rice, tubers, and bananas are listed to compare the protein and thiamin content[5,13] and the price. As can be seen, rice is "cheap", while cassava and sweet potatoes are relatively expensive. Rice flour, as well as oatmeal, is often used to prepare porridge, but the latter must be imported and costs twice as much as ordinary rice. Comparatively, meal of bananas and plantains is very expensive.

From the age of nine months, rice is given regularly to only 60 per cent of the Hindustani infants, 55 per cent of the Javanese, 50 per cent of

the Creole, and 80 per cent of the Bushnegroes.

Table 5: Comparison of price (in U.S. value), thiamin, and protein content of six starchy products eaten in Surinam

Food	Energy Value	Protein	Thiamin	Price
	calories/ 100 gm.	*gm./100 gm.*	*mg./100 gm.*	*¢/100 gm.*
Rice	360	7.2	0.08*	2
Bread	230-300	8-9	0.10	3
Cassava	140	1.0	0.05	2
Coco yam	90	2.3	0.13	4
Sweet potatoes	116	1.3	0.11	2
Potatoes	75	2.0	0.08	2
Ripe bananas	120	1.0	0.06	3
Rice flour	365	7.2	0.08	3
Oatmeal	390	14.2	0.60	4
Meal of bananas or plantains	335	1.8	0.09	10
Cocorie (meal of cassava)	320	1.7	0.08	5
Corn flour	390	7.8	0.14	5
Maizena	340	0.3	-	6

*Much is lost in rinsing [14]

Bread consumption is rather high for a rice-growing country; at the age of twelve months, 38 per cent of the Hindustani and Creole children eat bread regularly.

Starchy tubers and edible roots are consumed by all groups. Among the Bushnegroes, 75 per cent of the infants of nine months and older are eating these foods. For the Hindustani, this percentage amounts to nearly 40 per cent for preschool children of fifteen months, whereas only a little over 10 per cent of the Creole preschool children are regularly given tubers.

Rice flour and meal of bananas are fed to children at a very early age. Already at the age of six months, nearly 40 per cent of the Hindustani infants receive dishes prepared with rice flour; the same applies to 50 per cent of the Javanese seven month-olds. Seventy-five per cent of the Bushnegro infants are given rice flour at the age of eight months. The Creoles prefer banana or cassava flour. Already at a very early age, 30 per cent of the three-month-olds and over 60 per cent of the seven-month-olds are fed these expensive products, because they are considered to be very good. It is quite a problem to change this idea.

Vegetables and Fruits

According to the survey, vegetable consumption seems to be general. After one year, more than half of the mothers in all ethnic groups regularly give their babies vegetables. Pumpkin and tanja leaves (local name *tajerblad* [*Xanthosoma sagittifolium*]) in particular are fed as soft vegetables. In addition, bitter greens (local name *bitawiwiri* [*Cestrum latifolium*]), swamp cabbage (local name *dagoblad* [*Ipomoea reptans*] with the Javanese), and amaranth (local name *klaroen* [*Amaranthus caudatus*]) are given. All these species are rich in ascorbic acid and carotene (provitamin A).

Vegetable consumption among the Bushnegro infants seems to be very high. Eighty per cent of the babies eight months old are said to eat vegetables. It would seem useful to check this statement by means of the serum carotenoids.

Surinam has a wealth of fruits. Generally speaking they are consumed by both adults and children. When a baby is six months old, some mothers give it a spoonful of orange juice as additional food, according to the survey. Ripe bananas or other fruits are fed at a later stage; mangoes and

papayas are particularly suitable because they contain much carotene as well as ascorbic acid.

Fats and Oils, Sugar

Consumption of fats and oils and sugar was not checked, because it is known that they are always used to prepare meals.

SUMMARY

In Surinam, breast-feeding is continued for a relatively long period, generally as long as nine to twelve months, sometimes up to two years.

Protein-rich foods are fed to infants and preschool children up to two years of age, but not as regularly as desirable. Pulses, in particular, are used by the Hindustani. Milk consumption by Creole preschool children rapidly diminishes after one year of age, whereas this product is still given regularly to the Hindustani children. The Javanese feed their preschool children milk much less frequently. Fish is only fed occasionally; greater consumption could well be promoted. Milk, eggs, and meat are relatively expensive protein-rich foods.

Consumption of expensive, ready-to-eat baby food is wide spread.

Soft vegetables, fruits, and fruit juices are regularly given by many mothers after the child's first year. When providing information on feeding preschool children, attention might be drawn to the importance of early use of these products.

Rice is the most important staple food in the coastal region and is cheaper than bread. Rice-flour is comparatively expensive, as is meal of bananas.

NOTE: The authors wish to acknowledge the work of the following home economists in carrying out the survey: W.A. Coronel, L. Dhir-Mahangoe, H.V. Helstone née Burnet, L. Huisden-Emanuels, G.B. Lie A Ling-Emanuelson, Y.J. Rack-Meyer, C.M. Rellum, C. Sanrochman-Sandrieman, M.I. Starke, and P.M. Starke née Franker.

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GENERAL NUTRITION NEWS AND OPINION

FLUORIDE IN DROPS

Editorial, Lancet, February 27, 1971, v. 1, p. 440

Fluoridation of the water-supply remains the most effective public-health measure available to urban communities for reducing the prevalence of dental decay. Yet resistance to such a measure is widespread throughout the world and other means of providing fluoride for children have been sought. One method advocated for the past few years in the United States has been a vitamin solution containing fluoride.[1,2] A double-blind study[3] has been completed in Sweden and it confirms the efficacy of such preparations. Up to 6 years of age the mean number of decayed teeth was about 50% lower in the fluoride group. The children were given, from birth, a solution of vitamins A and D containing sodium fluoride corresponding to 0.5 mg. of fluoride for every 10 drops of solution. Dr. Hamberg recommends the use of fluoride drops in areas where the public water-supply contains less than 0.6 p.p.m. of fluoride. The results achieved are comparable to those obtained in children of similar age in this country where fluoride has been supplied in drinking water.[4] Owing to the very slow adoption of fluoridation by British local authorities and the problem of rural communities without a piped water-supply, the possibility of giving a vitamin-fluoride preparation to young children at child-welfare centres in low-fluoride areas should obviously be considered. The announcement[5] by the Secretary of State for Social Services that welfare orange juice is to be replaced by a new preparation containing vitamins A, D, and C in the form of drops suggests that such a further change may be envisaged.

LESS DEVELOPED COUNTRIES AGRICULTURAL PRODUCTION INCREASED: POPULATION GROWTH FORESTALLS PROGRESS IN TWO REGIONS

From USDA/AID News Digest, March-April 1971

Recent Economic Research Service figures show a continuing sharp increase in less developed countries farm production; per capita production

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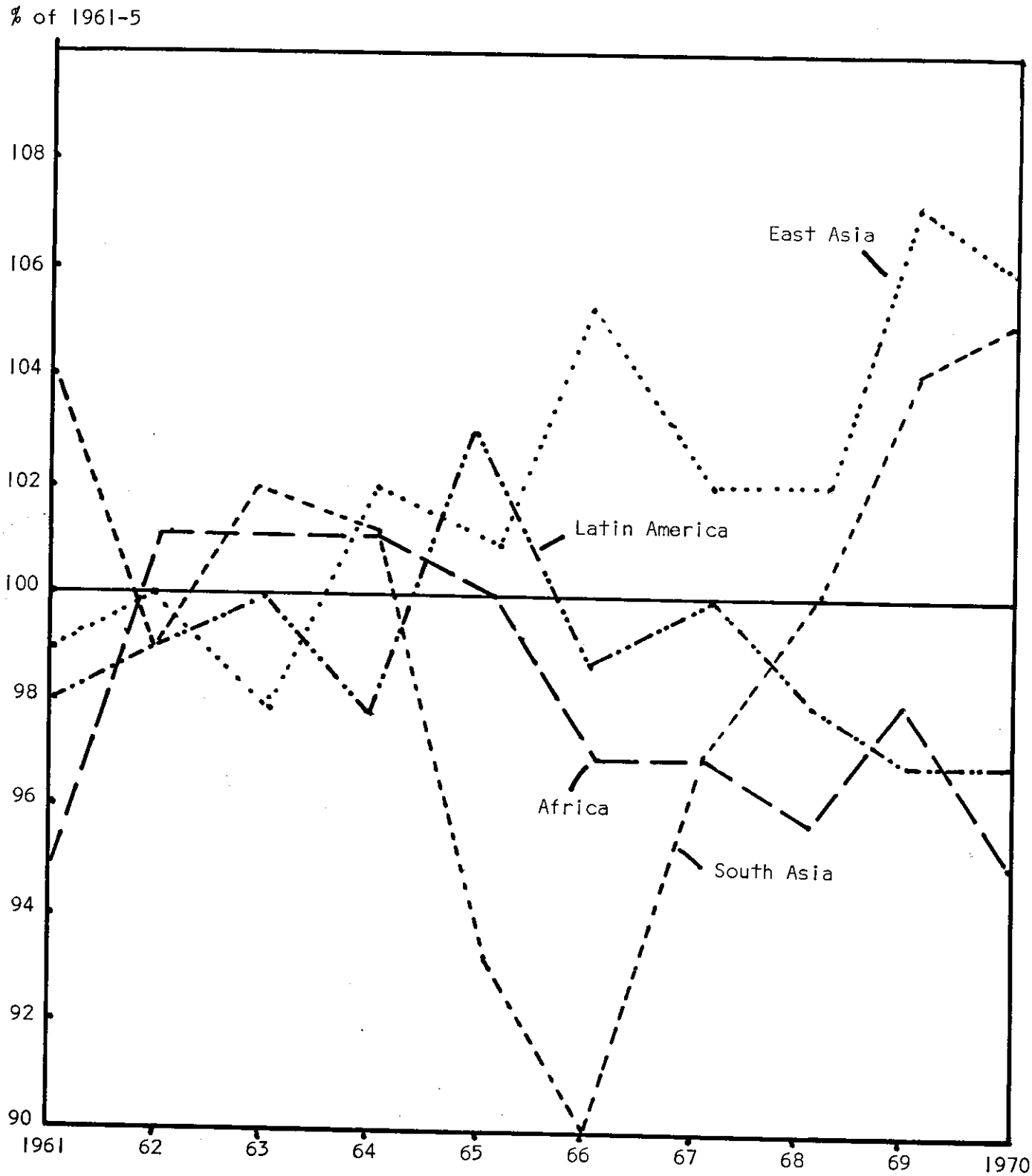
[1] *Hennon, D.K., Stookey, G.K., Muhler, J.C. J. Dent. Child. 1967, 34, 439*

[2] *Margolis, F.J., Macauley, J., Freshman, E. Am. J. Dis. Child. 1967, 113, 670*

[3] *Hamberg, L. Lancet, 1971, i, 441*

[4] *Fluoridation Studies in the United Kingdom and the Results Achieved After Eleven Years. Rep. publ. Hlth med. Subj., Lond. 1969, no. 112*

[5] *Lancet, 1970, ii, 1368*



INDICES OF PER CAPUT AGRICULTURAL PRODUCTION IN THE MAJOR LESS DEVELOPED REGIONS

from USDA/AID NEWS DIGEST MARCH-APRIL 1971

improved modestly reflecting still rapid population growth (see accompanying chart). Per capita production continued to increase in South Asia (new wheats and rices in India and Pakistan are partly responsible) while East Asia suffered a small downturn in 1970. Production per person in Latin America remained steady and low while Africa experienced a sharp decline.

PHOSPHATES: A PROMISING AGENT FOR USE IN THE CONTROL OF DENTAL CARIES

by Robert S. Harris, School of Dentistry, University of Minnesota, in Nutrition News, February 1971, Vol. 34, No. 1

Dental caries, or tooth decay, is the most common of all chronic diseases which afflict mankind.

Over 98 percent of the U.S. population is afflicted with dental decay, and the proportion is rising. Caries is most frequent in the developed countries of the world where diets are composed mostly of refined and sweetened foods. Though caries is less common in the developing countries, it still affects 40 to 60 percent of the people in areas such as Africa and Asia. (Sixty-one young people aged 16-20 years examined in the Barbados National Nutrition Survey in 1969 had an average of 7.6 decayed teeth each - *Editor, 'Cajanus'*).

Anticaries Agents

Because fluoridated public water supplies are not available to the entire population and do not fully protect against dental caries, the need exists for additional effective cariostatic agents to assist toward full control of caries in the U.S. population. A promising candidate is phosphates.

Phosphates appear not only to be strongly cariostatic, but also are able to fulfill the technical prerequisites for use in large population groups.

Scientists first observed that laboratory animals develop tooth decay when fed diets that are nutritionally deficient in phosphates nearly 40 years ago. This observation was not considered relevant to tooth decay in human beings because the diets of man are seldom deficient in phosphates. Caries usually develops in humans despite adequate phosphates in the diet because phosphates in foods are organically bound.

Effects of High Phosphate Intake

In 1950, Nizel and Harris began a series of studies that led to the identification of phosphates as anticaries agents. Upon feeding twice as much inorganic phosphate as was needed for good nutrition, they discovered that caries can be controlled in animals.

Since then, more than 150 scientific papers have recorded results of animal feeding trials conducted with at least 40 different phosphate compounds. All inorganic and organic phosphates tested significantly reduced caries development when added to caries-producing diets despite differences in laboratories, species and strains of animals, diets and the caries-scoring techniques used.

Significant Observations

In these animal studies, phosphates were most effective when fed to the young during tooth eruption. Caries control was lessened when phosphates were fed either before or some time after tooth eruption and least effective when fed before birth (*in utero*). As the amount of phosphate fed was increased, severity of caries diminished; caries was essentially prevented at high feeding levels.

Phosphates which are organically bound to amino acids, carbohydrate and lipids as in foods are not free to react as anticaries agents. Phosphate effectiveness increased significantly when the granulated salt was imbedded in melted hard fat (mp 67°C.), cooled and pulverized before addition to the diet.

Though phosphates and fluorides work together synergistically, they effect caries control in different ways. Phosphate supplements react locally on tooth surfaces as food passes through the mouth. They act to delay the start of caries, whereas fluoride retards tooth decay already started.

How phosphates prevent new caries from forming is not yet clear. The process seems to involve remodeling of tooth surfaces, reaction with cariogenic oral microorganisms and retardation of tooth maturation. Most likely, other mechanisms are involved as well.

Phosphate studies with animals have yielded additional significant observations including:

1) Present evidence indicates that cyclic sodium trimetaphosphate is the most active of all phosphates tested.

2) Phosphates with the same *cation* (e.g. sodium), but different anions, do not produce the same cariostatic activity. In order of decreasing efficiency were trimeta-, hexameta-, tripoly-, pyro- and ortho-phosphates.

3) Phosphates of the same *anion* combined with different cations differ in cariostatic activity, decreasing in the following order: hydrogen, sodium, potassium, calcium, magnesium.

4) The organic phosphates Na (sodium) glycerophosphate, Na phytate, Na sucrose phosphate are equally as active in caries prevention as Na orthophosphate.

It is important to note that phosphoric acid, orthophosphates, pyrophosphates, metaphosphates and polyphosphates are "generally recognized as safe" food additives.

Clinical vs. Animal Studies

How do phosphates affect human caries? The results of at least eight clinical studies have been published. Of these, five report significant inhibition of caries by phosphate feeding, two claim caries inhibition only in newly erupted teeth and two report no measurable arrest of tooth decay.

Why were phosphates more effective against caries in the animal studies than in those with children? This difference was to be expected since in most of the animal studies about 1 to 2 percent of the phosphate under test was added to the *entire diet*. While the level of phosphate added in the clinical studies was also approximately 1 to 2 percent, the mineral was added to only a *portion* of the total diet (in such foods as biscuits, bread, breakfast cereals, buns, cakes, flour, jam, sugar, sirups, mandioca and chewing gum). In addition, because a rodent eats 10 to 30 times a day the oral cavities of the test animals were frequently replenished with granular phosphates.

It is not possible to calculate accurately from these publications the exact intakes of animals and children to determine amounts fed per kilogram body weight or per 1,000 Calories intake. On either basis, it is likely that the human subjects obtained only one-tenth to one-half as much phosphate as the animals.

The data indicate, therefore, that phosphates are effective in reducing caries when fed in the diets of children. Because of differences in feeding levels and lack of sufficient information concerning food intake, it is impossible to say whether phosphates are equally as effective in humans as in animals.

Most of the clinical studies have also been criticized for faults in experimental design, subject control and data analysis. It is unfortunate that the clinical investigators did not use sodium trimetaphosphate in their studies, since this cyclic phosphate has been shown in animal studies to be the most active cariostatically and the most benign toxicologically.

There is urgent need for another clinical study involving: (1) larger numbers of children of identical age, (2) feedings with larger amounts of the most effective phosphate, (3) during longer periods of time, (4) paying special attention to the caries developing in newly erupted teeth, (5) with greater control of subjects to minimize variables, (6) more accurate recording of data and (7) using improved statistical methods.

If phosphates eventually prove as effective for humans as for animals, the control of tooth decay may one day require only education of people to select phosphate-fortified foods and drink fluoridated water.

INTERNATIONAL CONFERENCE ON NUTRITION, NATIONAL DEVELOPMENT AND PLANNING

A Conference on Nutrition, National Development and Planning will be held from October 19-21, 1971, in the Kresge Auditorium at the Massachusetts Institute of Technology, Cambridge, Massachusetts. The Conference will be sponsored by the U.S. National Institutes of Health and The U.S. Agency for International Development, with The World Health Organization, Food and Agriculture Organization, United Nations Children's Fund and United Nations Industrial Development Organization as participating agencies and will be open to all interested persons. The registration fee will be U.S.$35.00.

Persons desiring further information should write to:

International Conference on Nutrition,
National Development and Planning
Room 16-318
Department of Nutrition and Food Science
Massachusetts Institute of Technology
Cambridge, Massachusetts 02139
U.S.A.

READER'S LETTERS

From Mr. Th. C. Pape, Head, West Indian Section, Dutch World Broadcasting System, P.O. Box 222, Hilversum, Holland.

Dear Sir,

A few days ago I sent you a script covering the issues of 'Cajanus' published so far.

The item was also included in a broadcast beamed to Africa, and it brought us the following interesting reaction from the Rev. J. van Zealand of the Catholic Mission in Tanzania:

> "I was also given the following good advice: Keep mole rats out of your cassava patch by first planting a pigeon-pea (Cajanus Cajan) hedge. This is a shrub bearing edible and nutritious beans, but its roots are poisonous, and the mole rat gives it a wide berth. It has the same effect on termites (before the people build a home, they plant pigeon-peas around the site). Most leguminous plants have poisonous roots, but the pigeon-pea (mbaazi in Swahili) has the advantage of being a perennial."

Perhaps you might like to print the above in one of the forthcoming editions of your Journal. If so, it would be appreciated if you would mention that the Rev. van Zealand wrote in reaction to a Radio Nederland broadcast.

Yours sincerely

Th. C. Pape

29 March 1971

From Dr. Ann Ashworth, Tropical Metabolism Research Unit, University of the West Indies, Kingston 7, Jamaica

Dear Sir,

I was surprised to see in 'Your Questions Answered' (Cajanus Vol. IV, No. 1) that you include cauliflower, broccoli and endives as good sources of folic acid. Although not disputing their nutritional value, it seems strange that you should have selected these three for special mention when they are rarely grown in the Caribbean and, if available at all, are very expensive.

A classification which to me appears more in keeping with our agricultural and dietary patterns would be:

Very high:	liver, yeast, fresh dark green leafy vegetables e.g. callaloo, Indian kale, turnip tops.
High:	kidney, peanut butter, lentils and other pulses, string beans, okra, avocado pear.

Yours sincerely

Ann Ashworth

3 May 1971

CFNI NEWS

CFNI is currently engaged in assisting the Guyana Government with the Guyana National Food and Nutrition Survey. At the time of writing (early June) the survey is going well and the Rupununi portion has been completed and the teams are back in the coastal areas. Several of the CFNI staff have moved entirely to Guyana for the three months of the survey and several others are more or less permanently there. All should be complete by mid-July and a speedy analysis and report to Government is hoped for.

The report of the Barbados National Food and Nutrition Survey of 1969, (which was of course given to Government in typescript eighteen months ago) is still with PAHO Headquarters being printed, but is expected to be ready very soon.

The series of one-day seminars on Young Child Feeding, continues throughout the area, as mentioned in the last issue of 'Cajanus'. Since then, seminars have been held in Trelawny, Kingston-St. Andrew and St. Elizabeth parishes in Jamaica, and in St. Vincent, Dominica, Cayman Islands and British Virgin Islands.

Another pre-occupation of CFNI at present is the Diploma in Community Nutrition Course which commences in October. Most of the applicants for fellowships have been selected and the forms are being processed in Washington at the time of writing. There will be a few other late-comers, however. At the moment the number selected stands at twenty-one, and it is hoped to have a class a little smaller than in 1969, of about 24 or 25.

In connection with the DCN Course, a PAHO/WHO Short-Term Consultant, Miss M. Cameron, came and interviewed the graduates of the 1969 course and their supervisors, evaluating the use made by the graduates of their knowledge since their return to their own countries, and the use made of the graduates by their governments. The report was on the whole reassuring, but there are quite a few opportunities for improvement which we hope to grasp in the 1971 Course. CFNI is very grateful to Miss Cameron for the thoroughness of her evaluation.

Another PAHO/WHO Consultant was at Mona and in Trinidad and Barbados of late, in connection with the teaching of nutrition in the medical school. He was Dr. Michael Latham, Professor of International Nutrition at Cornell, who came as consultant to the medical faculty. CFNI was very happy to co-operate and provide office facilities, and we are hopeful that much benefit will eventually result from his mission.

At the Trinidad Centre the major event has been the completion of the second and final part of the report on Trinidad and Tobago Food Consumption Survey. This was carried out last year and both sections of the report have now been presented to the National Nutrition Council.

A NEW LOOK AT WEANING MULTIMIXES FOR THE CARIBBEAN - A MEANS OF IMPROVING CHILD NUTRITION

by

E. F. Patrice Jelliffe
(Nutritionist/Research Fellow,
Caribbean Food and Nutrition Institute, Jamaica)

Urgent action is needed in the field of practical nutrition education in the Commonwealth Caribbean. This statement can be supported by the existing evidence of malnutrition prevalent among infants and pre-school children in the area.[1]

The etiological factors are numerous, among them the rising cost of foods and the low incomes of a large proportion of families in this "malnutrition belt" must be considered.

Broadly speaking for maintenance of good physical health, man requires a diet which contains adequate quantities of proteins, calories including fats, vitamins, minerals and water.

It is necessary for man to obtain from food sources the amino acids of proteins (8 for adults, 10 for infants)* which cannot be synthesized in the body; thus when protein containing foods are utilized, it is necessary to know their amino acid content.

In world diets, foods can be classified into certain groups, such as animal proteins (meat, eggs, fish, milk, cheese) which contain all essential amino acids, and other protein containing foods, which lack in varying proportions one or more essential amino acids, such as cereals or tubers or legumes or dark green leaves, etc., and lastly foods containing no protein

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*Essential amino acids: isoleucine, leucine, lysine, methionine, phenylalanine, threonine, tryptophan, valine, including histidine and arginine for children.

at all, but which are excellent sources of "compact calories", such as fats and sugar.

From this simple framework and using an appropriate food composition table[2] as a guide, it is possible to devise diets based on a mixture of foods which, when eaten together will complement existing amino acids deficiencies in the foods utilized. These mixtures, termed "Multimixes" have been described in the medical literature in 1967 by Jelliffe,[3] and later in past issues of Cajanus.[4,5]

Most diets consist of a staple food, which usually forms the bulk of the meal and is often the least expensive item and to which additions of other vegetable or animal proteins are made. Depending on prevailing cooking methods (roasting, frying, steaming, etc.) and local recipes, fat or water may be added to the mixtures.

I. *BASIC FOODS USED IN MULTIMIXES*

VEGETABLE PROTEINS:

A. *Staple Foods*

In some countries a single staple may be used as the main one, or several may play at a time an important role in community nutrition. The use of a particular staple depends on its availability and its role in the cultural heritage of the country. In many areas of the world, the staple may have a social as well as a religious significance (maize in the Mayan culture --- the green plantain among the Baganda people of East Africa). Staple foods because of their nutrient composition and generic group may be roughly divided into two classes -- the cereals and the tuber-plantain-breadfruit group (T.P.B.).

(1) *The Cereals*

Countries in which the staple food is a cereal are immediately at a nutritional advantage as these foods are good sources of protein and of calories. However, they are lacking in the amino acid lysine, but contain other amino acids including methionine.

In the Caribbean, in which many ethnic groups live, several cereal staples are used concomitantly, *wheat* and wheat products (bread, *rotis*, *chappatis*, biscuits, cakes, macaroni, etc.) as well as *rice* and *maize* (cornmeal). Oats and barley are used in small amounts as porridges.

In most islands, most of these staples are imported as the whole grain (rice, wheat) which later may be milled (wheat), but some are processed and pre-packaged overseas (i.e. oats). In Table I, the average protein and calorie content of some commonly used cereals are listed.

Table I: Average Protein and Calorie Content of Common Cereal Staples per 100gm of Edible Portion (3½ oz.)

CEREAL	% PROTEIN	FOOD ENERGY (Calories)
Oats	11.2	370
Barley	11.0	348
Wheat	10.5	364
Maize	9.5	362
Rice	7.5	369

(2) *Tuber, Plantain, Breadfruit Staple (T.P.B.)*

In contrast to the cereal group, the protein content of the T.P.B. group is very low, and their amino acid pattern is much more variable. These staples are usually eaten cooked in their fresh state, and will contain a

large percentage of water and cellulose. In this form their calorific value is much inferior to that of cereals and legumes, but will improve if they are used in a concentrated powder form.

Table II: Average Protein and Calorie Content of Tuber-Plantain-Breadfruit, (T.P.B. Staples) per 100g Edible Portion (3½ oz.)

FOOD	% PROTEIN	FOOD ENERGY (Calories)
Yam	2.1	90
Irish Potato	2.0	82
Cassava Flour	1.5 - 1.7	338
Cocoyam		86
Dasheen		92
Eddo		86
Breadfruit		103
Sweet Potato	1.3 - 1.4	117
Yambean (Yampie)		55
Banana (yellow)	1.1 - 1.2	100
Banana (green)		110
Plantain		119
Turnip	0.8	27
Corn Starch	0.3 - 0.5	362
Sago Starch		352
Arrowroot Starch		355

These staples should always be used, especially in infant feeding, in conjunction with a small amount of animal protein to improve protein quality and quantity, and also with the addition of some fat or sugar which will improve their calorific value.

If the small size of a child's stomach is considered, the addition of "compact" calories to a T.P.B. mixture will reduce the quantity nutritionally needed by a young child to a more physiologically acceptable volume. This latter procedure has been used for several years, by medical personnel working

in hospitals or rehabilitation centres, when dealing with undernourihsed and anorexic infants. All the staples listed in Table II are used in the English-speaking Caribbean. Studies have shown that the Irish, or English potato (*Solanum tuberosum*) on the whole, is the most common T.P.B. staple first introduced into an infant's diet.

B. *Legumes*

The legumes listed in Table III all lack the amino acid methionine but are otherwise good sources of other amino acids especially lysine and are also excellent sources of food energy. They have the reverse amino acid pattern from cereals.

Table III: Average Protein and Calorie Content of Common Legumes per 100g Edible Portion

LEGUME	% PROTEIN	FOOD ENERGY (Calories)
Soybean (*Glycine max.*)	38.0	335
Lentil (*Lens esculenta*)	24.2	336
Cow Pea (Black Eyed Bean) (*Vigna sinensis*)	23.4	341
Red Kidney Bean (*Ph. vulgaris*)	22.8	328
Lima Bean (*Ph. lunatus*)	20.4	345
Pigeon Pea (Dry) (*Cajanus cajun*)	19.2	337
Chick Pea (*Cicer arietinum*)	18.2	364

In most islands, the least expensive legume is the yellow lentil (*Lens esculenta*) (11-13 cents per lb. - Jamaica, March 1971). Oil seeds and nuts may also have a valuable protein content, but because of their high fat

value or the need for special processing for human consumption of the oil seeds, they are either not used or the nuts are more often eaten in smaller quantities than legumes. In the Caribbean, peanuts and cashews are usually eaten as snacks, and coconut "milk" is used in the cooking of rice and desserts. Linseed (*Linum usitatissimum*) is prepared as an infant porridge in some areas, e.g. in Jamaica and Barbados.

C. *Dark Green Leafy Vegetables (D.G.L.V.)*

The nutritional value of these foods (i.e. callaloo (*amaranthus spp.*) dasheen (*colocasia antiquorum*) and pumpkin leaves, etc.) is often not appreciated. Their protein value when fresh may vary between 2-10% but can range up to 30% in their dry form. They are valuable sources of vitamin A (retinol), vitamin C, folic acid and calcium and their iron content is not insignificant (pumpkin leaves 5-8 mg., callaloo 3-0 mg. per 100 g. edible portions). The presence of these valuable nutrients outweigh by far the negligible detrimental effect of the presence of oxalates in D.G.L.V., which interfere with calcium absorption owing to the low solubility of calcium oxalates.

D.G.L.V. of the amaranthus family can be easily grown and propagated by self seeding in the home garden. Mothers are at times reluctant to give these leaves to their infants, they object to their color or think they may not be digestible. Nutrition education is required in this respect. A summary of the approximate protein content and amino acid deficiency of the main categories of vegetable foods used in multimixes are seen in Table IV.

Table IV: Approximate Protein Content and Amino Acid Deficiency of Main Categories of Vegetable Foods Used in Multimixes

TYPE OF FOOD	PROTEIN (Approximate %)	AMINO ACID DEFICIENCY
Cereal Grain	± 10	Lacking in Lysine
Legumes*	± 20	Lacking in Methionine
Dark Green Leafy Vegetables**	2 - 10	

*Soya Bean 40% **Dried: 30%

The basis of protein supplementation is summarized in Table V.

Table V: Basis of Protein Supplementation

1. Need for 10 Essential Amino Acids (Infants)
2. Animal Proteins Contain All Essential Amino Acids
3. Vegetable Proteins Lack 1 or 2 Essential Amino Acids
4. Cereal Proteins Lack Lysine
5. Legume Proteins Lack Methionine
6. Cereal-Legume Mixtures Contain All Essential Amino Acids

II. *TYPES OF MULTIMIXES*

Multimixes have been described by Jelliffe, as double mixes, triple mixes or quadrimixes according to the number of types of complementary foods in the mixture. Using cereals as the staple, examples of possible food group combinations are seen in Table VI.

Table VI: Multimixes for Infant Feeding Using Cereal Staples

MIXTURES	INGREDIENTS
Double Mix	Cereal Staple + Legume (or) Cereal Staple + Animal Protein*
Triple Mix	Cereal Staple + Legume + Animal Protein (or) Cereal Staple + Legume + D.G.L.V. (or) Cereal Staple + Animal Protein + D.G.L.V.
Quadrimix	Cereal Staple + Legume + D.G.L.V. + Animal Protein

*Mixtures with animal protein preferable in all mixes

In the following Table, the same procedure is shown for T.P.B. staples, but to each mixture a small amount of inexpensive, available protein should be added (i.e. milk, or egg or fish or meat, etc.).

Table VII: Multimixes for Infant Feeding Using T.P.B. Staples (Tuber-Plantain-Breadfruit)

MIXTURES	INGREDIENTS
Double Mix	T.P.B. + Animal Protein
Triple Mix	T.P.B. + Animal Protein + Legume (or) D.G.L.V.
Quadrimix	T.P.B. + Animal Protein + Legume + D.G.L.V.

III. *ESSENTIALS OF INFANT FEEDING MIXTURES*

Several points must be envisaged when preparing multimixes.

(1) *The Nutrient Value*

This needs to be considered in terms of proteins, calories, vitamins and minerals. When evaluating the protein content, the quantity present (i.e. grammes of total protein) as well as the quality (amino acid pattern) have to be considered.

The animal proteins, breast milk and egg which have an ideal amino acid range and have a net protein utilization of 100% (N.P.U.) have been chosen by nutrition experts as a *reference* protein against which other proteins can be assessed for their amino acid score and N.P.U. The essential amino acid which is present in a protein in the smallest amount and will thus diminish its total value, is known as the limiting amino acid (e.g. lysine in cereals).

In food mixtures, lysine and the sulphur amino acids methionine and cystine, are usually the important ones to be considered. Calories from fats and carbohydrates are required for efficient metabolism of proteins (6 calories per gram of energy). If these are not present in sufficient quantity, dietary protein will be diverted and used as a source of calories, which is extremely wasteful. It has therefore been found necessary to know *what percentage of calories is obtained from proteins in any food mixture* - the Net Dietary Protein Calories percent (ND_p Cal %). This can be determined, using a nomograph, when both protein quantity (Protein Cal %) and protein quality (protein score) are known.[6]

Breast milk has an ND_p Cal % of 8.3. It has been estimated that a diet which supplies less than 8% of calories in utilizable protein is incapable of meeting the needs of a young child.[7] As children become older this figure can be lowered to 7% and in adulthood to 5%, but in pregnant and lactating women, whose nutrient requirements are increased, an ND_p Cal % of 7% is needed.

The advantages of using homemade infant foods are great from the nutritional point of view. The foods are fresh, the quantity used is known, the nutritive quality of the mixture will be excellent if not overcooked (and no chemical additives are introduced).

Presently, much concern has been voiced regarding substances introduced by manufacturers in commercially prepared infant foods.[8] In an effort to reduce cost and increase the margin of profit, often only small amounts of animal and vegetable proteins are used, and fillers such as modified starches provide bulk, flavour enhancers monosodium glutamate (MSG) and salt, make the mixture palatable to the mother.

The use of monosodium glutamate has now been banned in U.S.A. by the Food and Drug Administration following tests on infant rats, in which large amounts of MSG caused eye and brain damage. Although no specific lesions have been reported in human infants, substances which are possible teratogenic are better avoided, though jars of such foods containing this ingredient are still, because of their three-year shelf life, possibly on sale in some islands. Baby foods are always tasted by the mother first, who professes to know the organoleptic preferences of her child whose palate as yet is quite untutored. Foman[8,9] has shown that infants up to seven months do not discriminate between bland foods or those to which salt has been added. It has been shown in laboratory animals that an increased salt intake may give rise to hypertension and it has been postulated that a high intake of salt by infants may predispose them to hypertension in later years. Dahl[10] states that commercial infant strained meats contain 5 to 6 times more salt than fresh meat, and the vegetables 6 to 60 times the content of fresh vegetables.

Sugar is also added to these foods and infants may satiate their appetite with this high caloric food to the detriment of good nutrition and may lay down at a young age numerous fat cells, the foundation of obesity in later years. The child will also acquire a taste for cariogenic sweet foods.[11] This is one of the reasons why the use of glucose in hospital nurseries is not advocated.[12] Lastly, modified food starches (MFS) used in infant foods are also under scrutiny.[13] These substances are natural starches, such as corn, rice, etc., which have been chemically altered to prevent retrogradation, and the digestibility, and appearance of the starches, is maintained during the shelf life of the product - MFS may supply from 10 to 32% of the total calories available in infant foods.

A sub-committee of the National Research Council in 1970, when reviewing the use of these items, did not recommend restricting the modified starches currently used but stated that starches differing in nature and degree of modification from these, should not be introduced into baby foods until their safety had been demonstrated.

In many countries, mothers will be unable to read, or to decipher or understand, the list of ingredients in fine type, present on the label of jars of infant foods. These foods are purchased for convenience, or as an act of blind faith in modern technology, but with no knowledge of their nutritional value.

Multimixes should complement milk feeds in young children and should be started between four to six months. Earlier introduction is not advisable, it is unnecessary, will interfere with the breast feeding pattern and allergies to new substances are more common at this early age. Between four and six months, a double mix should be used, and it will often be prepared solely for the infant, such as a cereal-milk porridge. Mothers are sometimes reluctant to introduce any foods before six months of age and in some communities it might be as late as one year. In a small percentage of infants allergies to protein, be it milk or rice or corn, etc., may occur, when this is so, the food will have to be discontinued and another one chosen in its place, under medical guidance.

Multimixes may be obtained from the "family pot" providing this in itself, contains a blend of nutritious foods. Care must be taken, that a little of each ingredient is used for the child's multimix, prior to the addition of condiments. Traditional mixtures such as puréed rice and peas and shredded codfish and flying fish and "cou cou" are excellent combinations of foods.

(2) *The Expense*

Multimixes should be as inexpensive as possible using low cost foods of good nutritional value. Mothers in the lower socio-economic groups may for prestige reasons, purchase jars of the available convenient infant foods but these are inordinately expensive. Their cost/nutrient value can only be assessed if one is able to obtain the manufacturers' food composition tables, which list the nutritive value of their mixtures, but the actual quantities of the ingredients used including water, are never stated.

Often the least expensive items, in terms of available cash, will be purchased by the low-income mother (i.e. a $4^3/_4$ oz. jar at 19 cents (Jamaican), in preference to a jar containing $3\frac{1}{2}$ oz. priced at 33 cents) whatever the ingredient and food value may be. Thus a highly expensive low-calorie, low-protein mixture, such as "strained banana and tapioca, with added starch, orange juice and citric acid" (185 calories and 0.7 gram protein per jar, costing 19 cents) will be bought in islands with a banana monoculture, where these fruits may be obtained free or at a very modest cost (2 cents for 1 banana weighing 100 g. which will provide 100 calories and 1.2 g. of protein). Fresh limes are available year round and are inexpensive.

These facts must be freely discussed with all mothers, and especially with families in which cost must override the convenience factor. Assistance must be given in order to guide them through the supermarket maze of highly advertised, costly preparations for infants, be it milks or strained foods. Labels on the containers often mislead, give incomplete information and may bewilder and confuse the purchasers; it is essential that a selection be made, which sorts out the best nutrient buys among the numerous preparations for infants currently flooding the supermarkets.

Mothers possessing a refrigerator can store in small plastic bags or in an ice tray, sufficient quantities of multimixes for one or two meals a week, which can be used at leisure, cube by cube or bag after bag, thus saving time and ensuring a varied diet for the infant. The jars, in which infant foods are sold, are too small for the storage of family staples, and when empty, are often discarded, cluttering frequently yet more, uncollected garbage heaps. Re-cycling of glass material is not as yet an established feature in the Caribbean context, thus ecological pollution is further promoted.

(3) *Availability of Local Ingredients*

It is preferable to encourage as much as possible the use of locally-grown foods, especially those available from the home garden, if such exists. "Low effort" gardens should be encouraged. In these, trees such as the mango, papaya, avocado, breadfruit, ackee, a variety of citrus, bananas, pigeon pea bushes as well as the self propagating amaranthus can be maintained with a minimum of work or care.

(4) *Cultural Acceptance*

Food prejudices which exist in the community must be known, for example, beliefs that fish gives children worms, certain foods will cause diarrhoea, etc. Some ideas may stem from misconceptions or over-emphasis by nutrition workers from overseas on the value of certain dietary items, i.e. using only the yolk of the egg, the mystique of the carrot in Jamaica, the insistence on the use of orange juice, when other sources of vitamin C are available in the Caribbean islands.

Recipes must be devised which include nutritious "cultural favorites" to which are added one or more underused or undervalued local foods.

Little can be achieved unless the mother or guardian is convinced of the suitability of the multimix for her own particular child.

(5) *Physiological Acceptability To The Child*

Reference has already been made to the need to assess the quantity of food an infant can ingest in terms of bulk in order to fulfill his nutritional requirements (the capacity of a child's stomach at six months, has been estimated to be 5 - 7 fluid ounces (150 - 210 cc.)).[14] Thus if a TPB based mixture is used, the need to enhance the calorific value yet restrict the quantity to an amount assimilable by the child must be kept in mind, and here the addition of compact calories to the mixture is most desirable. In order to permit the child to develop "tolerance" to unaccustomed foods, it is preferable to introduce new items of dietary gradually and to avoid especially irritant or indigestible items such as hot spices or the skins of legumes.

(6) *Palatability and Visual Appeal*

The mother-child unit must always be considered, and testing for consumer acceptance by both parties is necessary.

The child's immediate nutritional horizon is delineated by his mother's likes and prejudices. She must approve the multimix herself before she permits the child to partake of it. For example, when D.G.L.V. are used they are often more acceptable if mixed with a cereal food such as corn which lightens the appearance of the mixture rather than a darker-colored tuber such as the yampie (*Dioscorea trifida*).

(7) *Culinary Feasibility*

Recipes must be devised and tested in local home circumstances, using simple equipment, traditional type of fuel be it charcoal, or a wood fire, or the more sophisticated gas or electric cooking ranges, if such exist.

Many nutrition education programs flounder on the rocks of sophistication as mothers from humble home circumstances cannot translate what they have seen at demonstrations at the clinic or home economics center, into practical reality in their own environment. Advice on cleaning of equipment, storage of food and utensils to avoid contamination by insects and rodents should also be given, if necessary. Mothers should be shown how to substitute a staple or a legume or an animal food for another variety depending on seasonal availability and cost. A knowledge of the household measures commonly used is essential in order to interpret recipes to mothers.

Some "natural convenience" foods exist which are already packed in a container provided by nature. They are clean, need no cooking are easily mashed and are digestible, i.e. the ripe papaya (paw-paw), the jelly of the immature coconut, or the ripe avocado. The last item if added to a multimix, will provide per 100 g. of edible portion, 1.5 g. protein, 110 calories as well as a little calcium, iron and vitamins.

(8) *Bacteriological Safety of Multimix*

This is of prime importance - in homes in which no refrigeration facilities exist, the multimix must be used freshly prepared and not kept overnight. This will apply equally to commercial infant purées or "junior" foods. Once the jar is open - the manufacturers state that under refrigeration the shelf life will not exceed three days.

(9) *Quantity To Be Given To The Child*

This will obviously depend on the age, size of child, and other ingredients of dietary such as milk, fruit or fruit juices which are fed to the infant. Double mixes, i.e. cereal porridges with milk are usually just introduced between four and six months in small quantities, e.g. two tablespoonfuls

a day, the amount is then doubled and tripled during the following months, as the child is older and accepts the new ingredients and becomes less dependent on a milk diet.

Nutrient Requirements of Infants and Pre-school Children

In the first six months of life, breast milk is the ideal food for the infant whose requirements are among others, in terms of calories (Kilo Calories) and proteins respectively, 120 calories and 2.2 g. for each kilogram of body weight (National Research Council, 1968, revised standards).

For infants over the age of six months and for pre-school children up to the age of five years, it has been calculated that for the Caribbean area, with an average ambient temperature of 78°F or 25°C, the practical requirements, per caput, per day based on an assumption of NPU 65 of dietary protein (CFNI 1969 Barbados Survey) is as follows:

Months age	Calories	Protein g	Calcium mg	Iron mg	Vitamin A mcgms Retinol	Thiamine mg	Riboflavin mg	Niacin mg	Ascorbic acid mg
6-12	1150	17.5	600	5	300	0.46	0.63	7.6	15
12-24	1320	20.0	550	7	250	0.53	0.73	8.7	20
24-36	1475	23.0	550	7	250	0.59	0.81	9.7	20
36-48	1575	24.0	550	8	300	0.63	0.86	10.4	25
48-60	1730	27.0	550	8	300	0.69	0.95	11.4	25

RECIPE SECTIONS

The following recipes have been devised using locally available foods from markets and supermarkets in Jamaica at current prices (March 1971).

Inexpensive foods have been utilized, except for some recipes in which "prestige" animal proteins such as, turkey, chicken, and fresh fish in small quantities have been introduced into the mixtures.

Commercial brands of infant foods are sold in the islands in three main size of jars. The cost varies according to the predominance of animal protein in the mixture. Examples are shown in the following table:

Table VIII: The Cost of Commercial Infant Foods in Jamaica (March 1971)

Size of jar	Content	Cost (Jamaica cents)
3½ oz.	Animal protein mixture (example: strained beef liver)	33 cents
4½ oz.	Predominantly animal protein (example: high meat dinner, ham and vegetables)	28 cents
4½ oz.	Predominantly vegetable protein (example: strained dinner, vegetables and turkey)	19 cents
$4\frac{3}{4}$ oz.	All vegetable protein (examples: (1) strained mixed cereals (2) strained sweet potatoes)	19 cents

The costs of the homemade multimixes are based on the same criteria and will be calculated for the same quantities (3½ or 4½ oz.) in order to place in perspective the relative cheapness of these homemade preparations, with an overall superior nutrient content. (Fuel and labour costs have not been assessed or included; Appendix: I).

Nutrient Value

In the recipes which follow, various foods have been mixed together in proportions which will assure a protein value for each unit of ND_p Cal % 7 - 8% (Cameron and Hofvander 1971[13] - Appendix: 2) which meet the needs of young children. Some recipes will provide several jars of mixture. If a lesser quantity is required, all ingredients will have to be reduced in the same proportion in order to maintain protein value. Nutrient values are given in terms of edible portions of foodstuffs. In Appendix: 3 the nutrient value of foodstuffs used in these recipes is shown and the cost/nutrient value of some commonly used Caribbean foods is shown in Appendix: 4.[16]

The main nutritional deficiencies, found in infants and pre-school children in the Commonwealth Caribbean have been related to a lack of calories, protein, iron and occasionally a lack of riboflavin, Vitamins A and C. Values for these nutrients have been calculated for each recipe.

Measures

The quantities used in these recipes are expressed in terms of grams, ounces, and household measures using a cup (8 fluid ounces), a teaspoon (5 cc.), a tablespoon (15 cc.).

If no balances are available, the recipes are reproducible if kitchen utensils of a known capacity are available in the home.

Choice of Materials and Practical Cooking Hints

(1) *Rice*

In every recipe in which *rice* is used as a staple preference has been given to *parboiled* rice. The method of processing used (soaking, steaming, drying prior to milling) helps to retain water soluble vitamins especially thiamine in the interior of the grain which will not be affected by milling.

Rice is cooked in these recipes after minimal washing, and in a quantity of water (usually double that of the amount of rice) which will be absorbed completely by the rice.

(2) *Legumes*

These have been soaked overnight and the water is then discarded, as these foods when raw may contain substances such as saponins and alkaloids, antagonistic to digestion, which may inhibit the action of the enzyme trypsin. In malnourished children in whom malabsorption syndromes occur, this factor may be important. The skins of the larger legumes such as the chick pea and red bean, etc., may be removed manually after soaking or cooking, or the beans may be sieved using a fine mesh sieve. It is important that these skins be completely removed.

(3) *Fresh Vegetables*

It is advisable to cook these in a minimal amount of water to retain nutrients, in some cases they can be added to the legumes when these are almost cooked.

(4) *Fortified Margarine (with Vitamin A)*

Fortified margarine has been used in preference to the unfortified product which is also available in some islands.

(5) *Dark Brown Sugar*

Dark brown sugar has been chosen for its relative cheapness (5 cents lb.) and its calcium (78 mg per 100 g.) and iron content (5.0 mg per 100 g.),(white granulated sugar costs 10 cents a lb. and is devoid of these nutrients).

It must be explained to mother that it is in the child's interest that the mixture should be bland, i.e. not too sweet or not too salt, for the reasons given previously.

A. *DOUBLE MIXES*

(1) Wheat flour porridge

Ingredients	Quantity		
	g.	oz.	Household measures
Enriched flour	100	3½	3/4 cup
Brown sugar	10	1/3	1 packed level tablespoon
Hen's egg	25	5/6	½ of large beaten egg, or 1 small egg
Water	-	32	4 cups

This recipe yields 20 oz. of mixture

Cost per 4.5 oz. = 0.9 cents (Jamaican)*

Nutrient value: protein 13.6g.; calories 446; iron 3.3mg.; vitamin A (Retinol) 31.3 mcg; riboflavin 0.3mg.; vitamin C nil

Method of preparation

Add flour to 1 cup water, stir well so that no lumps are present, add the remainder of the water and the sugar and cook on slow fire until mixture is thick and has the consistency of porridge. Add the beaten egg, cook for 2 minutes stirring all the time. In some islands, "parched" flour porridge is used. The present recipe which provides additional calories from the egg and the sugar as well as egg protein is an inexpensive improvement on a standard sample recipe already in use but of low nutritional value. Dried skimmed milk could be added instead of egg, though it is felt that some mothers could possibly omit it because its colour and mixed consistency is so similar to that of flour, that they would feel it was unnecessary to add it to the porridge. This recipe provides no vitamin C. It is presumed the child will receive vitamin C from other sources.

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* *$1.00 Jamaican = $1.20 U.S.*

(2) *Old style linseed porridge*

Ingredients	Quantity		
	g.	oz.	Household measures
Enriched wheat flour	100	3½	3/4 cup
Linseed	10	1/3	1 packed level tablespoon
Sugar	20	2/3	2 packed level tablespoons
Vanilla bean (optional)			
Water		32	4 cups

This recipe yields 9 oz.

Cost per 4½ oz. = 1.7 cents (Jamaican)

Nutrient value: protein 12.9g; calories 484; iron 4.8mg; vitamin A 1.2 mcg; riboflavin 0.29 mg.; vitamin C nil

Method of preparation

Mix flour with 1 cup of water, stir well until a smooth paste is obtained, add the remainder of the water and the sugar and vanilla bean, cook until mixture has thickened and add to it strained boiled linseed. Remove vanilla pod and serve.

(3) *Liver Broth*

Ingredients	Quantity		
	g.	oz.	Household measures
Fresh liver	60	2	¼ cup chopped liver
Enriched wheat flour	25	5/6	3 level tablespoons
Fortified margarine	7	¼	1½ level teaspoon
Water			1 1/8 cups
Salt to taste			

This recipe yields 8 oz. of mixture

Cost per 3½ oz. = 4.3 cents (Jamaican)

Nutrient value: protein 12.6 g.; calories 224.3; iron 6 mg.; vitamin A 5,278.5 mcg; riboflavin 1.5 mg.; vitamin C 7.1 mg.

Method of preparation

Chop onion finely and fry lightly in melted margarine, add ½ cup salted water and simmer until the liver is tender. Add flour to remainder of water gradually and mix with liver and onion mixture, cook until thickened. The mixture is sieved or may be put in a blender for young infants.

(4) *Corn and Jackfish dinner*

Ingredients	Quantity		
	g.	oz.	Household measures
Cornmeal	100	3½	1/3 cup
Jackfish	25	5/6	2½ level tablespoons
Fortified margarine	7.5	¼	1½ level teaspoon
Water			1½ cups
Salt to taste			

This recipe yields 13 oz. of mixture

Cost per 4½ oz. = 1.3 cents (Jamaican)

Nutrient value: protein 12.6 g.; calories 401.4; iron 1.4 mg.; vitamin A 11.0 mcg; riboflavin 0.08 mg.; vitamin C nil

Method of preparation

Mix dry cornmeal with a small amount of water. Put remainder of salted water to boil and add cornmeal. Cook over a low fire, stirring constantly until thick. To the cooked cornmeal add pounded cooked fish, which has been flaked and to which has been added the margarine.

(5) *Green Banana and Liver dinner*

Ingredients	Quantity		
	g.	oz.	Household measures
Green Banana	100	3½	3/4 cup diced, or 1 3/4 bananas 6 inches long
Liver	20	2/3	1 tablespoon chopped liver
Vegetable oil	10	1/3	2½ level teaspoons
Lime juice			a few drops
Water			1½ cups
Salt to taste			

This recipe yields 8 oz. of mixture

Cost per 4½ oz. = 2.3 cents (Jamaican)

Nutrient value: protein 5.7 g.; calories 225; iron 2.5 mg.; vitamin A 2,112 mcg; riboflavin 0.51 mg.; vitamin C 30 mg.

Method of preparation

Boil chopped green banana until soft, in salted water, to which the oil has been added. When soft, pound with a wet spoon, sprinkle with lime juice to prevent darkening of colour. Add the liver which has been simmered in the banana cooking-water until tender, mash with fork and add to banana. Sieve mixture for young infants.

(6) *Yellow Rice dinner*

Ingredients	Quantity		
	g.	oz.	Household measures
Parboiled rice	60	2	4 rounded tablespoons
Pumpkin	40	$1\frac{1}{3}$	¼ cup chopped
Egg	30	$1\frac{1}{6}$	1 small egg, or ½ large egg
Dark brown sugar	10	$\frac{1}{3}$	1 packed level tablespoon
Water			1¼ cups

This recipe yields 12 oz.

Cost per 4½ oz. = 2.2 cents (Jamaican)

Nutrient value: protein 12.0 g.; calories 366.2; iron 3.9 mg.; vitamin A 443 mcg; riboflavin 0.06 mg.; vitamin C 6 mg.

Method of preparation

Peel and cook pumpkin in water, remove when soft. Boil rice in pumpkin water, when soft add beaten egg with sugar, and cook over fire for a few minutes. Mash ingredients together. This mixture can be sieved or put in blender for young infants. This recipe, despite the addition of the pumpkin will be classified as a "borderline" doublemix as the quantity of protein which the pumpkin provides is much inferior to that of a D.G.L.V.; it is however, an excellent source of vitamin A (retinol).

B. *TRIPLE MIXES*

(1) Rice and Chicken dinner

Ingredients	Quantity		
	g.	oz.	Household measures
Parboiled rice	75	2½	1/3 cup heaped
Lentils	30	1	3 level tablespoons
Chicken	25	5/6	2½ level tablespoons
Fortified margarine	7	¼	1½ level teaspoon
Onion	5	1/6	1½ teaspoon
Water			3 cups
Salt to taste			

This recipe yields 12 oz. of mixture

Cost per 4½ oz. = 2.2 cents (Jamaican)

Nutrient value: protein 17.3 g.; calories 491; iron 2.9 mg.; vitamin A 82.5 mcg; riboflavin 0.2 mg.; vitamin C 2.3 mg.

Method of preparation

Soak lentils overnight, discard water. Boil in fresh salted water, mash and sieve, add to lentils soft cooked rice, shredded cooked chicken. Fry finely cut onions in melted margarine until soft and translucent. Add to lentil, chicken rice mixture. Sieve or put in blender for young infants.

(2) *Jamaican Junior dinner (rice and peas and codfish)*

Ingredients	Quantity		
	g.	oz.	Household measures
Rice	65	2 1/6	1/3 cup
Codfish	30	1	2 level tablespoons
Red beans (dry)	15	½	1 heaped tablespoon
Onion	5	1/6	1½ teaspoons
Vegetable oil	5	1/6	1¼ level teaspoons
Water			2 cups
Salt, if needed			

This recipe yields 8 oz. of mixture

Cost per 4½ oz. = 2.3 cents (Jamaican)

Nutrient value: protein 22.4 g.; calories 396.1; iron 3.8 mg.; vitamin A 1.8 mcg; riboflavin 0.2 mg.; vitamin C 0.5 mg.

Method of preparation

Soak beans overnight, discard water. Boil until soft in fresh salted water. Rub through sieve to remove skins. Cook finely chopped onions in oil until soft and translucent, add finely shredded boneless cooked saltfish (which has been soaked to remove excess salt). The mixture can be sieved or put in a blender for young infants.

(3) *Cajanus special dinner*

Ingredients	Quantity		
	g.	oz.	Household measures
Rice	65	$2\frac{1}{6}$	$\frac{1}{3}$ cup
Pigeon peas (dry)	35	$1\frac{1}{4}$	2 full tablespoons
Minced beef	10	$\frac{1}{3}$	1 heaped teaspoon
Vegetable oil	5	$\frac{1}{6}$	$1\frac{1}{4}$ level teaspoon
Water			3 cups

This recipe yields 10 oz.

Cost per $4\frac{1}{2}$ oz. = 2.2 cents (Jamaican)

Nutrient value: protein 9.1 g.; calories 351.3; iron 4.0 mg.; vitamin A 8.2 mcg; riboflavin 0.09 mg.; vitamin C nil

Method of preparation

Soak peas overnight, discard water. Cook in fresh salted water until soft. Sieve. Lightly fry beef in hot oil and add to soft-cooked rice, blend mixture with sieved peas. For young infants the mixture can be sieved or put in a blender.

(4) *Baby's Christmas dinner*

Ingredients	Quantity		
	g.	oz.	Household measures
Callaloo (amaranthus)	30	1	½ cup leaves, or 20 medium size leaves (4" long)
Fine spaghetti, broken in small pieces	25	3/4	¼ cup
Carrot, finely chopped	25	3/4	2 level tablespoons
Turkey, chopped	20	2/3	2 heaped tablespoons
Dried skimmed milk	10	1/3	2 3/4 level tablespoons
Onions, chopped	10	1/3	1 level tablespoon
Water			10 oz.
Salt to taste			

This recipe yields 11 oz. of mixture

Cost per 4½ oz. = 2.3 cents (Jamaican)

Nutrient value: protein 11.7 g.; calories 199.1; iron 2.1 mg.; vitamin A 1,236.5 mcg; riboflavin 0.4 mg.; vitamin C 20.7 mg.

Method of preparation

Cook spaghetti in fast boiling salted water until soft; add to it cooked carrot and onion and finely chopped turkey meat. Add to mixture, cooked callaloo which has been chopped and sieved. Mix dried skimmed milk in 3 tablespoons of water, pour into mixture and cook for a few minutes. For young infants, the mixture can be sieved if needed, or put into a blender, to obtain a smooth purée.

(5) *Golden Blackeye purée*

Ingredients	Quantity		
	g.	oz.	Household measures
Cornmeal	65	$2\frac{1}{6}$	$\frac{1}{3}$ cup
Blackeye peas (dry cow peas)	35	$1\frac{1}{6}$	$\frac{1}{4}$ cup
Dried skimmed milk	10	$\frac{1}{3}$	$2\frac{3}{4}$ tablespoons
Margarine	10	$\frac{1}{3}$	1 heaped teaspoon
Water			2 cups
Salt to taste			

This recipe yields 18 oz.

Cost per 4½ oz. = 0.4 cents (Jamaican)

Nutrient value: protein 17.2 mg.; calories 457.9; iron 3.29 mg.; vitamin A 121.6 mcg; riboflavin 0.27 mg.; vitamin C 1.7 mg.

Method of preparation

Soak peas overnight. Cook in fresh salted water; sieve. Mix cornmeal with a small quantity of cold water, add to salted boiling water and cook till thick stirring constantly. Mix dried skimmed milk in 3 tablespoons of water, add to cornmeal-pea mixture. Sieve.

(6) *Channa Cream*

Ingredients	Quantity		
	g.	oz.	Household measures
Enriched wheat flour	65	$2^{1}/_{6}$	½ cup
Chick peas (channa)	25	$^{5}/_{6}$	$1^{3}/_{4}$ tablespoons
Dried skimmed milk	10	$^{1}/_{3}$	$2^{3}/_{4}$ tablespoons
Dark brown sugar	10	$^{1}/_{3}$	1 packed level tablespoon
Water			2¾ cups

This recipe yields 12 oz. of mixture

Cost per 4½ oz. = 1.4 cents (Jamaican)

Nutrient value: protein 15.0 g.; calories 394.6; iron 4.3 mg.; vitamin A 4.8 mcg; riboflavin 0.4 mg.; vitamin C 0.9 mg.

Method of preparation

Soak peas overnight, discard water. Cook in salted water until soft. Sieve to remove skins, until purée obtained. Add flour and dried skimmed milk and sugar to remainder of water - cook. Add sieved peas and mix well together.

(7) *Figue and Lentil dinner*

Ingredients	Quantity		
	g.	oz.	Household measures
Sweet banana (figue)	100	3½	1 medium size banana, or ½ cup chopped loosely packed
Dried skimmed milk	25	5/6	3 tablespoons
Lentils	25	5/6	2½ level tablespoons
Rice	25	5/6	2 level tablespoons
Sugar	20	2/3	2 packed level tablespoons
Water			1½ cups

This mixture yields 15½ oz.

Cost of 4½ oz. = 1.3 cents (Jamaican)

Nutrient value: protein 16.0 g.; calories 352.8; iron 3.5 mg.; vitamin A 49.8 mcg; riboflavin 0.6 mg.; vitamin C 11.5 mg.

Method of preparation

Soak lentils overnight, discard water. Cook in water; when ready, strain off boiling water and save it. Sieve peas. Cook rice in boiling water from peas. When water is absorbed add mashed banana and the milk and sugar which have been dissolved in 3 tablespoons of water. Add to mixture and cook for one minute stirring all the time. This mixture can be sieved or put in a blender if necessary.

C. *QUADRIMIXES*

(1) Sweet Potato and Cowpea dinner

Ingredients	Quantity		
	g.	oz.	Household measures
Sweet potato	120	4	3/4 cup diced potato, or 1 3/4 potatoes (size 2" x 1½")
Blackeye peas	65	2 1/6	1/3 cup
Callaloo (amaranthus)	30	1	½ cup raw leaves, or 20 medium size leaves (4" long)
Dried skimmed milk	10	1/3	2 3/4 level tablespoons
Water			2 cups
Salt to taste			

This recipe yields 7.5 oz. of mixture

Cost per 4½ oz. = 4.5 cents (Jamaican)

Nutrient value: protein 21.5 g.; calories 399.2; iron 6.1 mg.; vitamin A 958.5 mcg; riboflavin 0.3 mg.; vitamin C 48 mg.

Method of preparation

Soak peas overnight, discard water. Cook in fresh salted water until soft. Sieve to remove skins. Cook potatoes in salted water. When nearly soft add chopped callaloo leaves. Cook; add dried skimmed milk dissolved in 3 tablespoons of water to the whole mixture; cook together for one minute. Sieve together or put in blender to obtain a very smooth mixture.

(2) *Irish Cream*

Ingredients	Quantity		
	g.	oz.	Household measures
Irish potato	320	11½	2 cups diced potato
Chick pea	35	1 1/6	2 full tablespoons
Callaloo (amaranthus)	30	1	½ cup packed leaves, or 20 medium size leaves 4" long
Brown sugar	20	2/3	2 packed level tablespoons
Dried skimmed milk	10	1/3	2 3/4 level tablespoons
Water			2 3/4 cups

This recipe yields 16 oz. of mixture

Cost per 4½ oz. = 3.6 cents (Jamaican)

Nutrient value: protein 17.1 g.; calories 501.7; iron 5.5 mg.; vitamin A 41.4 mcg; riboflavin 0.4 mg.; vitamin C 51 mg.

Method of preparation

Soak peas overnight, discard water. Cook in water, sieve to remove skins. Cook potatoes in cold water; when nearly ready add chopped green leaves, cook and later add dried skimmed milk and sugar which have been dissolved in 4 tablespoons of water. Mix together and sieve.

(3) *Minestrone dinner*

Ingredients	Quantity		
	g.	oz.	Household measures
Irish potato	65	2 1/6	1/3 cup diced potato, (or 1 medium size potato, 2 x 1½")
Tomato	45	1½	2 heaped tablespoons
Callaloo (amaranthus)	45	1½	3/4 cup loose leaves, or 29 medium size leaves (4" long)
Chick pea	40	1 1/3	2½ level tablespoons
Minced beef	25	5/6	1 heaped tablespoon
Onion	10	1/3	one level tablespoon
Fortified margarine	5		1½ level teaspoons
Water			2 cups

This recipe yields 11 oz. of mixture

Cost per 4½ oz. = 4.9 cents (Jamaican)

Nutrient value: protein 14.7 g.; calories 324.6; iron 7.1 mg.; vitamin A 618.5 mcg; riboflavin 0.23 mg.; vitamin C 45.2 mg.

Method of preparation

Soak peas overnight, discard water. Cook in salted water until soft. Sieve peas. Simmer minced meat in water in which peas have been cooked. Boil potatoes in sufficient salted water to cover them; when nearly cooked add chopped tomato, onion and callaloo leaves. Mix all ingredients together, add margarine and sieve.

APPENDIX: 1 COMPARATIVE COSTS: COMMERCIAL INFANT FOODS AND HOMEMADE MULTIMIXES

Infant food	Content of jar	Cost in Jamaican cents	Ingredients	Nutritive value		Source of Information
				Calories	Protein	
A: *Commercial Baby Food* Vegetables and Turkey	4½ oz. (128 g.)	19 cents	Turkey broth, giblets, turkey, modified food starch, rice flour, potato flour - salt and seasonings (as per label, no quantities stated)	49	2-3 g.	Manufacturers' Booklet Nutritive value of Baby foods (1966)
B: *CFNI triplemix* Vegetables and Turkey	4½ oz. (128 g.)	2.2 cents	Spaghetti 25g., Turkey 20g., onion 10g., dried skimmed milk 10g., spinach 30g., carrot 25g.	81.4	4.8 g.	Present paper: Calculated from CFNI Food Composition Tables
A: *Commercial Baby Food* Strained Banana and Tapioca	4½ oz. (128 g.)	19 cents	Banana, tapioca starch, orange juice, citric acid (as per label, no quantities stated)	114	0.7 g.	Manufacturers' Booklet Nutritive value of Baby foods (1966)
B: *CFNI doublemix* Sieved Banana and Rice	4½ oz. (128 g.)	1.8 cents	Banana 100g., rice 30g., wheat flour 25g., dried skimmed milk 30g., sugar 20g., orange juice 5g.	139.1	5.1 g.	Present paper: Calculated from CFNI Food Composition Tables

APPENDIX: 1 (cont'd.)

Infant food	Content of jar	Cost in Jamaican cents	Ingredients	Nutritive value		Source of Information
				Calories	Protein	
A: *Commercial Baby Food* Strained dinner Vegetables and liver with bacon	4½ oz. (128 g.)	19 cents	Water, pork liver, carrots, bacon, modified food starch, tomato puree, potato flour, salt, onion powder (as per label, no quantities stated)	76	3.8 g.	Manufacturers' Booklet Nutritive value of Baby foods (1966)
B: *CFNI triplemix* Vegetables and liver with bacon	4½ oz. (128 g.)	5.3 cents	Water, liver 25g., carrot 10g., bacon 5g., tomato 45g., irish potato 65g., spinach 45g., chick pea 40g., margarine 5g., salt	130.9	6.3 g.	Present paper: Calculated from CFNI Food Composition Tables
A: *Commercial Baby Food* Strained Beef liver and beef liver broth	3½ oz. (99 g.)	33 cents	Cooked beef liver, beef liver broth and salt (as per label, no quantities stated)	94	14.0 g.	Manufacturers' Booklet Nutritive value of Baby foods (1966)
B: *CFNI doublemix* Beef liver and liver wheat flour broth	3½ oz. (99 g.)	5.6 cents	Beef liver 90g., Enriched wheat flour 35g., dried skimmed milk 25g., rice 25g., margarine 7g., liver gravy and salt	214.2	14.4 g.	Present paper: Calculated from CFNI Food Composition Tables

APPENDIX: 2a

Double Mixes

Protein value of each mix is ND_pCal 7-8 %

TO 100 g. staple food, ADD weight of supplementary food shown

(From Cameron and Hofvander 1971)

Supplements		Oats	Wheat	Rice	Sorghum	Pennisetum Millet	Maize	Potato	Sweet Potato	Yam (fresh)	Taro/Cocoyam	Banana	Plantain	Cassava Flour
Egg	g	10	25	25	25	25	30	5	15	10	10	15	20	55
DSM*	g	5	5	15	10	10	15	5	10	5	10	10	15	30
DWM**	g	5	10	25	15	20	30	5	15	10	15	20	25	55
Fresh fish	g	5	10	20	15	20	25	5	15	10	10	15	20	45
Chicken or lean meat	g	5	10	25	15	20	25	5	15	10	10	15	20	50
Soy bean or equiv.	g	5	10	20	15	20	25	5	15	10	15	15	20	45
Average Legume	g	10	10	25	25	25	25	25	25	25	25	25	25	NP***

*DSM is Dried Skimmed Milk

**DWM is Dried Whole Milk

***NP means Not Possible

APPENDIX: 2b

Double Mixes
(Adjusted for bulk)

With the suggested amount of oil and/or sugar each mix provides

360 Calories with ND_pCal 7-8 %

(From Cameron and Hofvander 1971)

	Oats	Wheat	Rice	Pennisetum and sorghum	Maize	Potato	Sweet Potato	Yam	Taro/Cocoyam	Banana	Plantain	Cassava flour
Egg	60 / 20	65 / 25	60 / 30	60 / 30	60 / 30	300 / 25	175 / 45	210 / 20	190 / 30	190 / 40	150 / 50	55 / 55
DSM	60 / 10	65 / 10	60 / 15	60 / 15	60 / 15	380 / 15	175 / 20	190 / 20	175 / 20	160 / 25	140 / 25	55 / 25
DWM	45 / 20	50 / 20	40 / 30	40 / 25	35 / 30	175 / 25	100 / 30	100 / 35	100 / 30	90 / 35	70 / 35	30 / 35
Fish	65 / 15	65 / 20	70 / 30	70 / 30	70 / 35	330 / 30	210 / 40	240 / 35	210 / 45	210 / 45	180 / 50	75 / 50
Chicken	65 / 15	65 / 20	65 / 30	65 / 30	60 / 35	300 / 30	180 / 40	210 / 35	185 / 45	185 / 45	155 / 50	65 / 50
Soybean	55 / 15	55 / 20	50 / 25	50 / 25	50 / 25	240 / 20	140 / 30	160 / 25	140 / 30	140 / 30	110 / 35	45 / 35
Legume	55 / 40	100 / 10	65 / 35	70 / 30	50 / 50	320 / 35	120 / 65	160 / 55	145 / 55	100 / 70	80 / 75	x)

Use the amount of staple + supplement as shown <u>with</u> 10g oil

<u>OR</u> 5g oil and 10g sugar

<u>OR</u> 20g sugar

(No oil is allowed for with the legumes)

x) Not possible to obtain ND_pCal of 7-8 %

APPENDIX: 3 NUTRIENT VALUE OF FOODS USED

(per 100g. edible portion)

FOOD	PROTEIN g	CALORIES	IRON mg	VITAMIN (Retinol) mcg	RIBOFLAVIN mg	ASCORBIC ACID mg
FOODS FROM ANIMAL SOURCES						
Dried Skimmed Milk	36.0	306	0.9	10	1.80	6.0
Egg	12.4	163	2.5	125	0.30	-
Minced Beef	17.9	268	2.7	12	0.16	0
Chicken	18.1	246	1.8	6	0.14	2
Liver	19.8	134	8.8	8,660	2.37	11.0
Dried Codfish	46.9	203	3.6	0	0.45	0
Fresh fish	18.8	132	1.0	5	0.15	0
Turkey	20.1	268	3.8	0	0.14	0
STAPLES						
1: Cereals						
Cornmeal	7.9	363	1.1	27	0.05	0
Spaghetti	12.0	377	5.0	0	0.37	0
Wheat flour enriched	10.5	364	2.9	0	0.26	0
Parboiled Rice	7.4	369	2.9	0	0.03	0
2: Tuber-Plantain-Breadfruit (T.P.B.)						
Irish Potato	2.0	82	3.0	0	0.03	10.0
Sweet Potato	1.3	117	1.0	500	0.05	23.0
Banana (yellow)	1.2	100	0.8	45	0.04	9.0
Banana (green)	1.2	110	0.8	380	0.04	28.0

APPENDIX: 3 NUTRIENT VALUE OF FOODS USED (cont'd.)

FOOD	PROTEIN g	CALORIES	IRON mg	VITAMIN (Retinol) mcg	RIBOFLAVIN mg	ASCORBIC ACID mg
			LEGUMES			
Lentil	23.7	336	7.0	10	0.30	4
Blackeye Peas (Cow Peas)	24.1	341	7.2	10	0.23	3
Red Peas (dry)	22.8	328	5.4	5	0.11	0
Chick Pea (dry)	18.2	364	7.3	15	0.16	1
Pigeon Peas (dry)	19.2	337	5.0	20	0.17	0
			OIL SEEDS			
Linseed	24.0	476	9.0	12	0.35	0
			DARK GREEN LEAFY VEGETABLES (D.G.L.V.)			
Spinach (Amaranthus; callaloo)	2.2	22	3.0	1,170	0.20	59.0
			OTHER VEGETABLES			
Carrot	1.1	40	0.8	3,530	0.04	6.0
Onion	1.4	40	0.5	20	0.04	9.0
Pumpkin	0.6	30	0.5	920	0.04	15.0
Tomato	1.1	20	0.6	180	0.04	24.0
			SUGARS			
Brown Sugar	0	351	5.0	0	0	0
			FATS AND OILS			
Margarine with Vitamin A	0.6	720	0	1,100	0	0
Oil	0	884	0	0	0	0

APPENDIX: 4

AVERAGE COST OF FOODS IN THE CARIBBEAN AS SOURCES OF PROTEIN AND CALORIES*

$ E.C. Per 1,000 Calories**		$ E.C. Per 20 Grams of Protein**
.25	Dry Skim Milk	.05
.22	Pulses	.06
.10	Cornmeal - Wheat Flour	.08
1.20	Salt Fish	.10
.13	Rice	.12
.25	Macaroni - Rolled Oats	.15
.60	Sardines	.18
.55	Fresh Milk	.20
.60	(Fresh Beef, Goat, Mutton) (Cheddar Cheese)	.20
1.80	Fresh Fish	.20
.25	Bread	.20
1.10	Chicken Necks and Backs	.20
1.20	Corned Beef	.20
.55	Dry Whole Milk	.23
.25	Sweetened Condensed Milk	.23
.55	Evaporated Milk	.25
.90	Minced Beef	.25
.25	Ground Provisions	.28
.40	Fresh Pork	.35
2.20	Broiler Meat	.35
.60	Irish Potatoes	.40
1.10	Frankfurters, Sausages	.40
1.60	Fresh Eggs	.40

*Based on 1967 (pre-devaluation) prices obtained in Antigua, Barbados, Dominica, Guyana, Jamaica, Montserrat, St. Lucia, St. Vincent, Trinidad.

**Recommended daily allowance for a 1 year old (10 Kg.) child.

APPENDIX: 4 (cont'd.)

$ E.C. Per 1,000 Calories		$ E.C. Per 20 Grams of Protein
.80	(Milk-Based, Cereal-Based) (Infant Foods)	.51
.80	"Health Promoting" Foods	.56
.29	(Plantain, Green Bananas) (Ripe Bananas)	.59
4.87	Infant Foods - Strained Meats	.69
4.58	(Infant Foods - Strained Vegetables) (and Meat)	2.08
.55	Arrowroot	13.00
.09	Sugar	INFINITY
.15	Margarine, Cooking Oil	INFINITY
.80	Glucose	INFINITY

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THE GREEN REVOLUTION, PEACE, AND HUMANITY*

by

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Civilization as it is known today could not have evolved, nor can it survive, without an adequate food supply. Yet food is something that is taken for granted by most world leaders despite the fact that more than half of the population of the world is hungry. Man seems to insist on ignoring the lessons available from history.

Man's survival, from the time of Adam and Eve until the invention of agriculture must have been precarious because of his inability to ensure his food supply. During the long, obscure, dimly defined prehistoric period when man lived as a wandering hunter and food gatherer, frequent food shortages must have prevented the development of village civilizations. Under these conditions the growth of human population was also automatically limited by the limitations of food supplies.

In the misty, hazy past, as the Mesolithic Age gave way to the Neolithic, there suddenly appeared in widely separated geographic areas the most highly successful group of inventors and revolutionaries that the world has ever known. This group of Neolithic men and women, and in all probability largely the latter, domesticated all the major cereals, legumes, and root crops, as well

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**This is the Lecture which was given by Dr. Borlaug on the Occasion of his receiving the Nobel Peace Prize for 1970, and is reprinted with the kind permission of Dr. Borlaug and the Nobel Foundation,*

as all of the most important animals that to this day remain man's principal source of food. Apparently, nine thousand years ago, in the foothills of the Zagros Mountains, man had already become both agriculturist and animal husbandryman, which, in turn, soon led to the specialization of labor and the development of village life. Similar discoveries and developments elsewhere soon laid the groundwork from which all modern agriculture and animal industry and, indeed, all of the world's subsequent civilizations have evolved. Despite the tremendous value of their contributions we know none of these benefactors of mankind by name. In fact it has only been within the past century, and especially within the last 15 years - since the development of the effective radio-carbon dating system, that we have begun even vaguely to understand the timing of these epochal events which have shaped the world's destiny.

The invention of agriculture, however, did not permanently emancipate man from the fear of food shortages, hunger, and famine. Even in prehistoric times population growth often must have threatened or exceeded man's ability to produce enough food. Then, when droughts or outbreaks of diseases and insect pests ravaged crops, famine resulted.

That such catastrophes occurred periodically in ancient times is amply clear from numerous biblical references. Thus, the Lord said: "I have smitten you with blasting and mildew" (Amos 4: 9); "The seed is rotten under their clods, the garners are laid desolate, the barns are broken down; for the corn is withered... The beasts of the fields cry also unto thee: for the rivers of waters are dried up, and the fire hath devoured the pastures of the wilderness" (Joel 1: 17, 20).

Plant diseases, drought, desolation, despair - were recurrent catastrophes during the ages. And the ancient remedies: supplications to supernatural spirits or Gods. And yet, the concept of the "Ever-normal granary" appeared in

elementary form, as is clear from Pharaoh's dreams, and Joseph's interpretation of imminent famine and his preparation for it, as indicated by this quotation from Genesis: "... And the seven years of dearth began to come, according as Joseph had said: and the dearth was in all lands; but in all the land of Egypt there was bread..." (Genesis 41: 54). For his time, Joseph was wise, with the help of his God.

But today we should be far wiser; with the help of our Gods and our science we must not only increase our food supplies but also insure them against biological and physical catastrophes by international efforts to provide international granaries of reserve food for use in case of need. And these food reserves must be made available to all who need them - and before famine strikes, not afterwards. Man can and must prevent the tragedy of famine in the future instead of merely trying with pious regret to salvage the human wreckage of the famine, as he has so often done in the past. We will be guilty of criminal negligence, without extenuation, if we permit future famines. Humanity cannot tolerate that guilt.

Alfred Nobel was also very conscious of the importance of food, for he once wrote: "I would rather take care of the stomachs of the living than the glory of the departed in the form of monuments".

The destiny of world civilization depends upon providing a decent standard of living for all mankind. The guiding principles of the recipient of the 1969 Nobel Peace Prize, the International Labor Organization, are expressed in its charter in the words, "Universal and lasting peace can be established only if it is based upon social justice. If you desire peace, cultivate justice". This is magnificient; no one can disagree with this lofty principle.

Almost certainly, however, the first essential component of social justice is adequate food for all mankind. Food is the moral right of all who

are born into this world. Yet today 50 percent of the world's population goes hungry. Without food man at most can live but a few weeks; without it, all other components of social justice are meaningless. Therefore I feel that the aforementioned guiding principle must be modified to read: If you desire peace, cultivate justice, but at the same time cultivate the fields to produce more bread; otherwise there will be no peace.

The recognition that hunger and social strife are linked is not new, for it is evidenced by the old testament passage "... and it shall come to pass that when they shall be hungry, they shall fret themselves and curse their King and their God..." (Isaiah 8: 21).

Perhaps no one in recent times has more pungently expressed the interrelationship of food and peace than Nobel Laureate, Lord John Boyd Orr, the great crusader against hunger and the first director general of the Food and Agriculture Organization, with his famous words, "You can't build peace on empty stomachs". These simple words of wisdom spoken twenty one years ago are as valid today as when they were spoken. They will become even more meaningful in the future as world population skyrockets and as crowding, social pressures, and stresses increase. To ignore Lord Orr's admonition would result in worldwide disorders and social chaos, for it is a fundamental biological law that when the life of living organisms is threatened by shortage of food they tend to swarm and use violence to obtain their means of sustenance.

It is a sad fact that on this earth at this late date there are still two worlds, "the privileged world" and "the forgotten world". The privileged world consists of the affluent, developed nations, comprising 25 to 30 percent of the world population, in which most of the people live in a luxury never before experienced by man outside of the Garden of Eden. The forgotten world is made

up primarily of the developing nations, where most of the people, comprising more than 50 percent of the total world population, live in poverty, with hunger as a constant companion and fear of famine a continual meance.

When the Nobel Peace Prize Committee designated me the recipient of the 1970 award for my contribution to the Green Revolution, they were in effect, I believe, selecting an individual to symbolize the vital role of agriculture and food production in a world that is hungry, both for bread and for peace. I am but one member of a vast team made up of many organizations, officials, thousands of scientists, and millions of farmers - mostly small and humble - who for many years have been fighting a quiet, often-times losing war on the food production front.

During the past three years spectacular progress has been made in increasing wheat, rice, and maize production in several of the most populous developing countries of southern Asia, where widespread famine appeared inevitable only five years ago. Most of the increase in production has resulted from increased yields of grain per hectare, a particularly important development because there is little possibility of expanding the cultivated area in the densely populated areas of Asia.

The term "The Green Revolution" has been used by the popular press to describe the spectacular increase in cereal-grain production during the past three years. Perhaps the term Green Revolution, as commonly used, is premature, too optimistic, or too broad in scope. Too often it seems to convey the impression of a general revolution in yields per hectare and in total production of all crops throughout vast areas comprising many countries. Sometimes it also implies that all farmers are uniformly benefited by the breakthrough in production.

These implications both oversimplify and distort the facts. The only crops which have been appreciably affected up to the present time are wheat, rice, and maize. Yields of other important cereals, such as sorghums, millets and barley, have been only slightly affected; nor has there been any appreciable increase in yield or production of the pulse or legume crops, which are essential in the diets of cereal consuming populations. Moreover, it must be emphasized that thus far the great increase in production has been in irrigated areas. Nor have all cereal farmers in the irrigated areas adopted and benefited from the use of the new seed and the new technology. Nevertheless, the number of farmers, small as well as large, who are adopting the new seeds and new technology is increasing very rapidly, and the increase in numbers during the past three years has been phenomenal. Cereal production in the rainfed areas still remains relatively unaffected by the impact of the Green Revolution, but significant change and progress are now becoming evident in several countries.

Despite these qualifications, however, tremendous progress has been made in increasing cereal production in India, Pakistan, and the Philippines during the past three years. Other countries that are beginning to show significant increases in production include Afghanistan, Ceylon, Indonesia, Iran, Kenya, Malaya, Morocco, Thailand, Tunisia, and Turkey.

Before attempting to evaluate the significance of the Green Revolution one must establish the point of view of the appraiser. The Green Revolution has an entirely different meaning to most people in the affluent nations of the privileged world than to those in the developing nations of the forgotten world. In the affluent, industrialized nations giant surpluses of wheat, maize and sorghum are commonplace; cattle, swine, and poultry are fed and fattened on cereal grains; meat, milk, eggs, fruits and vegetables are within the economic reach

of most of the population; well balanced diets are more or less automatically achieved, and cereal products constitute only a modest portion of the "daily bread". Consequently, most of the people in such societies have difficulty in comprehending and appreciating the vital significance of providing high yielding strains of wheat, rice, maize, sorghum, and millet for the people of the developing nations. Understandably then, the majority of the urbanites in the industrialized nations have forgotten the significance of the words they learned as youngsters, "Give us this day our daily bread". They know that food comes from the super-market, but only a few see beyond to the necessary investments, the toil, struggle, and frustrations on the farms and ranches that provide their daily bread. Since the urbanites have lost their contact with the soil, they take food for granted and fail to appreciate the tremendous efficiency of their farmers and ranchers, who, although constituting only five percent of the labor force in a country such as the United States, produce more than enough food for their nation.

Even worse, urbanites often vociferously criticize their government for attempting to bring into balance the agricultural production of its farmers with the domestic and foreign market demands for farm products, and which is attempting thereby to provide the consumer an abundant food supply at reasonable cost and also to assure a reasonable return to the farmer and rancher.

Contrasting sharply, in the developing countries, represented by India, Pakistan, and most of the countries in Asia and Africa, 70 to 80 percent of the population is engaged in agriculture, mostly at the subsistence level. The land is tired, worn out, depleted of plant nutrients, and often eroded, crop yields have been low, near starvation level, and stagnant for centuries. Hunger prevails and survival depends largely upon the annual success or failure of the

cereal crops. In these nations both undernutrition and malnutrition are widespread and are a constant threat to survival and to the attainment of the genetic potential for mental and physical development. The diets consist primarily of cereals, which provide from 70 to 80 percent of the calories and 65 to 70 percent of the protein intake. Animal proteins are so scarce and expensive as to be beyond the economic reach of the vast majority of the population. Although many of these nations were self-sufficient and some were exporters of cereals before the second world war, they are now net importers, victims of population growth outrunning agricultural production. There is little possibility in these countries of expanding the cultivated area to cope with the growing demand. The situation worsens as crop yields remain stagnant while human numbers continue to increase at frightening rates.

For the underprivileged billions in the forgotten world, hunger has been a constant companion and starvation has all too often lurked in the nearby shadows. To millions of these unfortunates, who have long lived in despair, the Green Revolution seems like a miracle that has generated new hope for the future.

The significance and magnitude of the impact of the so-called Green Revolution is best illustrated by changes in cereal production in India, Pakistan, and the Philippines. In both India and Pakistan the rapid increase in yields per hectare of wheat has been the major thrust of the Green Revolution. Increases in rice yield also have played a major role in West Pakistan but hitherto only a minor role in India. Increases in maize production have played a modest but significant role in expanded cereal production in both India and Pakistan; and increases in rice yields and production have been largely responsible for the change in cereal production up to now in the Philippines, Ceylon, and Indonesia.

The Green Revolution in India and Pakistan, which is still largely the result of a breakthrough in wheat production, is neither a stroke of luck nor an accident of nature. Its success is based on sound research, the importance of which is not self-evident at first glance. For, behind the scenes, halfway around the world in Mexico, were two decades of aggressive research on wheat that not only enabled Mexico to become self-sufficient with respect to wheat production but also paved the way to rapid increase in its production in other countries. It was in Mexico that the high-yielding, Mexican dwarf varieties were designed, bred, and developed. There, also, was developed the new production technology which permits these varieties, when properly cultivated, to express their high genetic grain-yield potential - in general, double or triple that of the best yielders among older, tall-strawed varieties.

There are no miracles in agricultural production. Nor is there such a thing as a miracle variety of wheat, rice, or maize which can serve as an elixir to cure all ills of a stagnant, traditional agriculture. Nevertheless, it is the Mexican dwarf wheat varieties, and their more recent Indian and Pakistani derivatives, that have been the principal catalyst in triggering off the Green Revolution. It is the unusual breadth of adaptation, combined with high genetic yield potential, short straw, a strong responsiveness and high efficiency in the use of heavy doses of fertilizers, and a broad spectrum of disease resistance that has made the Mexican dwarf varieties the powerful catalyst that they have become in launching the Green Revolution. They have caught the farmers' fancy, and during the 1969-70 crop season 55 percent of the 6 million hectares sown to wheat in Pakistan and 35 percent of the 14 million hectares in India were sown to Mexican varieties or their derivatives. This rapid increase in wheat production was not based solely on the use of Mexican dwarf varieties; it involved the

transfer from Mexico to Pakistan and India of a whole new production technology that enables these varieties to attain their high yield potential. Perhaps 75 percent of the results of research done in Mexico in developing the package of recommended cultural practices, including fertilizer recommendations, were directly applicable in Pakistan and India. As concerns the remaining 25 percent, the excellent adaptive research done in India and Pakistan by Indian and Pakistani scientists while the imported seed was being multiplied, provided the necessary information for modifying the Mexican procedures to suit Pakistani and Indian conditions more precisely.

Equally, as important as the transfer of the new seed and new technology from Mexico to India and Pakistan was the introduction from Mexico of a crop-production campaign strategy. This strategy harnessed the high grain-yield potential of the new seed and new technology to sound governmental economic policy which would assure the farmer a fair price for his grain, the availability of the necessary inputs - seed, fertilizers, insecticides, weed killers and machinery - and the credit with which to buy them. Collectively these inputs and strategy became the base from which the Green Revolution evolved.

Never before in the history of agriculture has a transplantation of high-yielding varieties coupled with an entirely new technology and strategy been achieved on such a massive scale, in so short a period of time, and with such great success. The success of this transplantation is an event of both great scientific and social significance. Its success depended upon good organization of the production program combined with skilful execution by courageous and experienced scientific leaders.

Experimentation with dwarf Mexican varieties was initiated in both India and Pakistan in 1963 and continued in 1964. Results in both countries were

highly promising. Consequently, in 1965, 350 and 250 tons of seed of the Mexican dwarf wheat varieties were imported into Pakistan and India, respectively, for wide-scale testing on farms. Again, the results were highly promising, and India reacted by importing 18 thousand tons during 1966. A year later Pakistan imported 42 thousand tons. With these importations, the revolution in wheat production got underway in both countries. It was the first time in history that such huge quantities of seed had been imported from distant lands and grown successfully in their new home. These importations saved from three to five years' time in reaping the benefits from the Green Revolution.

During the past three years wheat production has risen spectacularly in both countries. Using as a base the pre-Green Revolution crop year 1964-65, which produced an all-time record harvest in both countries, the production in Pakistan increased from the 1965 base figure of 4.6 million tons to 6.7, 7.2 and 8.4 million tons respectively, in 1968, 1969, and 1970. West Pakistan became self-sufficient in wheat production for the first time in the 1968 harvest season, two years ahead of our predictions. Indian wheat production has risen from the 1964-65 pre-Green Revolution record crop of 12.3 million tons to 16.5, 18.7 and 20.0 million tons during 1968, 1969 and 1970 harvests, respectively. India is approaching self-sufficiency and probably would have attained it by now if rice production had risen more rapidly, because, with a continuing shortage of rice, considerable wheat is being substituted for it.

The introduction into West Pakistan of the high-yielding dwarf rice variety IR8, developed by the International Rice Research Institute (IRRI) in the Philippines, together with the new technology that makes it highly productive, has also resulted in phenomenal increases in yield and production during the past two years. Unfortunately, this variety has been less well adapted to

climatic conditions in the monsoon areas of India and in East Pakistan and therefore has had only a modest and occasional impact there. Newer varieties which are now being multiplied promise to correct this situation.

The revolution in wheat and rice production in India and Pakistan has not only greatly increased food production, but it also has had many indirect effects on both the farmer and the economy. It is estimated that Indian and Pakistani farmers who are cultivating the new Mexican dwarf wheat varieties under the recommended management practices have increased their net income from 37 dollars per hectare with the local varieties to 162 dollars with the dwarf Mexican varieties. During the past three harvests a total of 1.4 billion dollars and 640 million dollars have been added to the gross national product (G.N.P) of India and Pakistan, respectively, from the increase in wheat production above the record 1965 base. The injection of this large increase in purchasing power into the economies has had many effects.

Large numbers of tubewells are being sunk by farmers in both India and Pakistan in order to expand the irrigated area and improve the control of irrigation water. It is estimated that a total of 70 thousand private tubewells were sunk during the 1969-70 crop season in India, which brings about 1.4 million hectares of additional land under controlled irrigation, thereby greatly expanding the food production potential. It is estimated that at present less than half of the irrigation potential of India has been developed.

If the high-yielding dwarf wheat and rice varieties are the catalysts that have ignited the Green Revolution, then chemical fertilizer is the fuel that has powered its forward thrust. The responsiveness of the high-yielding varieties has greatly increased fertilizer consumption. The new varieties not only respond to much heavier dosages of fertilizer than the old ones but are

also much more efficient in its use. The old tall-strawed varieties would produce only 10 kilos of additional grain for each kilo of nitrogen applied, while the new varieties can produce 20 to 25 kilos or more of additional grain per kilo of nitrogen applied. Consumption of nitrogen fertilizer in India has increased from 58 thousand metric tons of nutrients in 1950-51 to 538 thousand and 1.2 million metric tons in 1964-65 and 1969-70 crop cycles, respectively; and about 60 percent of this amount was produced domestically. Phosphate consumption is approximately half that of nitrogen. A large part of the fertilizer currently being used is for wheat. The targeted consumption and domestic production needs of nitrogen for 1973-74 are 3 million and 2.5 million metric tons, respectively, a fantastic threefold increase in consumption and a fivefold increase in production. These fertilizer targets must be attained if a targeted production of 129 million metric tons of cereal is to be realized.

Mechanization of agriculture is rapidly following the breakthrough in wheat production. Prior to the first big wheat crop in 1968, unsold tractors accumulated at the two factories then in production; at present, prospective purchasers must make written application for them and wait one or two years for delivery. Although five factories with an output of 18 thousand units per year, are now producing tractors, 35 thousand units were imported in 1969-70.

The traditional method of threshing by treading out the grain with bullocks, followed by winnowing, is now inadequate for threshing the increased volume of wheat before the onset of the monsoon rains. Consequently, hundreds of thousands of small threshing machines have been produced and sold by hundreds of small village machine shops during the past three years, thus avoiding the loss of much of the crop after harvest and also providing additional employment in many new, small-village industries.

Moreover, mechanization has had another very important indirect effect on the intensification of cereal production. When small mechanical threshers replace bullocks for threshing, the bullocks are released for use in the timely preparation of the land for the next (summer) crop. This need for timely preparation of land is also one of the main reasons for the surge in demand for tractors. Before the adoption of the new wheat and rice varieties, in combination with heavy applications of chemical fertilizer, the time of sowing was relatively unimportant because yields were limited primarily by low level of available plant nutrients. Most farmers would expect to harvest about one metric ton of wheat during the winter (rabi) season and about 1.5 metric tons of rice during the summer (kharif) season, or a total of 2.5 metric tons of grain per hectare per year. But by using the high-yielding varieties, fertilizing heavily, sowing at the right time, and managing the fields properly the same farmer can now harvest 5 tons of wheat and 7 tons of rice per hectare from the same land, a total of 12 metric tons of food grain per hectare per year, as contrasted with the 2.5 tons which he obtained with the old varieties and methods. If plantings are not done at the optimum time, however, the yield of wheat may drop to 3 tons and that of rice to 4 tons per hectare, a total production of 7 tons per year instead of the 12 tons when all operations are proper and timely. A few of the most progressive farmers now use triple cropping, involving wheat-mung beans-rice, wheat-rice-potato, or three consecutive crops of rice during the same year. By increasing the intensity of cropping, both food production potential and employment are increased. Yields must then be calculated on the basis of kilos per hectare per year rather than on the basis of kilos per hectare per crop.

The increased mechanization in cereal production has tended thus far to increase rather than decrease the employment opportunities for labor, and above all it has helped to reduce drudgery and increase the efficiency of human energy, speaking especially of India.

Millions of farmers who have successfully grown the new wheat, rice, and maize varieties have greatly increased their income. And this has stimulated the rapid growth of agro-industry by increasing the demand for fertilizers, pumps, machinery and other materials and services.

Farmers in many villages are investing in better storage facilities. In some locations brick houses are beginning to replace those made of rammed earth. More electricity is being used to light the houses and to drive the motors on the wells. There also has been a rapid increase in demand for consumer goods. The purchase of transistors and radios for use in the villages has increased rapidly, and thereby the government for the first time can effectively reach the remote villages with educational programs. Sewing machines, bicycles, motor scooters, and motorcycles are coming to the villages, and truck and bus service between villages is improving.

The Green Revolution has forced the Indian government to improve many of its public services. Although there was an extreme shortage of regular storage space for the first record-breaking wheat crop in 1968, the government improvised satisfactorily and very little grain was lost. During the past two years, stimulated in part by criticism by farmers and the press, warehouse capacity has been expanded greatly to provide adequate storage for the increasing grain production. The villages are demanding better roads, better public transportation and better schools; and they are beginning to get them. Thus the divorce between intellect and labor, which the great Indian leader Mahatma Ghandhi, over 40 years

ago, regarded as the bane of India's agriculture, is coming to an end.

The changes wrought by the Green Revolution, which I have illustrated by the vast improvement of wheat production in India, have had similar effects in West Pakistan, Ceylon, the Philippines, and Thailand, although the effects in different countries were produced by changes in different crops or combinations of crops.

Although the contributions of the Green Revolution to increased food production are considerable and highly significant, they are nonetheless modest in comparison with the magnitude of present global needs. The greatest obvious achievement is the rapid increase in cereal production during the past three years, and the generation of a climate of confidence in the developing nations with regard to their capabilities of achieving food self-sufficiency. Perhaps even more significant, however, is the change in organizations and attitudes which have accompanied the increases in cereal production.

The All-India Coordinated Wheat Improvement Program, which is largely responsible for the wheat revolution in India, has developed one of the most extensive and widely diversified wheat research programs in the world. Its success has generated confidence, a sense of purpose, and determination. The current agronomic research on wheat in India equals the best in the world. The breeding program is huge, diversified, and aggressive; already it has produced several varieties which surpass those originally introduced from Mexico in 1965. The first group of new Indian varieties, already in extensive commercial production, were derived from selections made in India from partially selected materials received from Mexico. A second group of varieties, now being multiplied, are selections from crosses made in India between Indian and Mexican varieties. The rapidity of creation and distribution of these new varieties has already

diversified the type of resistance to diseases and therefore minimizes the menace of destructive disease epidemics if and when changes occur in parasitic races of the pathogens.

Contrary to a widespread and erroneous opinion, the original dwarf wheats imported from Mexico definitely carried a wider spectrum of disease resistance than the local Indian types that they replaced. But the newer Indian varieties are even better in resistance and of a different genetic type than the original introductions. This greater diversity reduces the danger from disease epidemics, but cannot completely eliminate the dangers of disease epidemics, as has become vividly evident from the unexpected and destructive epidemic of southern leaf blight of maize over vast areas of the U.S.A. during the summer of 1970. The only protection against such epidemics, in all countries, is through resistant varieties developed by an intelligent, persistent and diversified breeding program, such as that being currently carried on in India, coupled with a broad disease-surveillance system and a sound plant pathology program to support the breeding program. From such a program a constant flow of new high-yielding disease-resistant varieties can be developed to checkmate any important changes in the pathogens. The Indian program is also developing competence in research on the biochemical, industrial, and nutritional properties of wheat.

Perhaps the most important contribution of all is that the methods and tactics used so successfully in making the production breakthrough in wheat, first in Mexico and now in India and Pakistan, can serve as a model for production programs with many other crops and in many other countries.

West Pakistan has already used the wheat model to revolutionize its rice production. Although the Indian rice program has not yet achieved a nationwide breakthrough in production, rapid progress is now being made in several areas

and it seems probable that the area sown to the new seed and technology will be large enough to produce a strong impact on national production within another year. Varieties and new technology are also available for launching effective campaigns to increase the production of sorghum, millet, barley, soybeans and cotton in many developing countries of Asia, Africa and Latin America. What is still needed is the will and commitment of governments to support national production campaigns, both politically and financially, and the services of a few competent and dedicated agricultural scientists as leaders.

The quality of scientific leadership is certainly a vital factor in the success of any production campaign. It is deplorable but true that many agricultural scientists in some advanced countries have renounced their allegiance to agriculture, for reasons of expediency and presumed prestige. And some institutions have furnished them a curtain behind which to hide. Some educational and research institutions have even restricted the amount of basic research that can be done under the aegis of its agricultural departments, however basic these researches may be to progress in increasing and insuring food production. Let the individuals live with their own motivations; let them serve science and themselves if they wish. But the institutions have the moral obligation to serve agriculture and society also; and to discharge that obligation honorably, they must try to help educate scientists and scientific leaders whose primary motivation is to serve humanity.

I want to reiterate emphatically that there now are available materials and techniques of great potential value for expanding the Green Revolution into additional fields of agriculture. But to convert these potential values into actual values requires scientific and organizational leadership. Where are those leaders: where are the leaders who have the necessary scientific competence,

the vision, the common sense, the social consciousness, the qualities of leadership, and the persistent determination to convert the potential benefactions into real benefactions for mankind in general and for the hungry in particular? There are not enough of them now; therefore we must try to identify and develop them in our educational systems and we must utilize them in our campaigns for food production. We need them, and need them badly, for it is tragic to let potential values languish for want of leadership in capitalizing the potential. This is not theory; this is reality, as illustrated by the fact that the leadership has been the determining factor in the relative success of parallel but different crop production programs within the same country.

But let no one think that we can relax our efforts in research. All successful action programs must be preceded and accompanied by research. It has been pointed out that the rapid change in wheat production in both India and Pakistan was in part made possible by two decades of research in Mexico. How did this come about?

In 1943, several years before the establishment of the Food and Agriculture Organization (FAO) of the United Nations, a cooperative agricultural research and training program was launched in Mexico. This was a pioneer cooperative project between the Mexican Ministry of Agriculture and The Rockefeller Foundation, initiated at the request of the Mexican government for assistance in increasing the production of maize, wheat, and beans.

At that time Mexico was importing more than 50 percent of the wheat that it consumed, as well as a considerable percentage of its maize. Wheat yields were low and static, with a national average yield of 750 kilos per hectare, even though most of the wheat was grown on irrigated land. This situation was very similar to that in India and Pakistan before the recent advent of the Green

Revolution. Mexican soils were impoverished and chemical fertilizer virtually unknown. Mexico's need was urgent and so a simple research program was started to increase production. The philosophy of The Rockefeller Foundation was "to help Mexico to help itself" in solving its food production problems, and in the process work itself out of a job. I have had the privilege and good fortune to have been associated with the wheat program almost from the beginning, and have remained a part of it for the past 26 years. From the outset all factors limiting wheat production were studied; consequently there were interdisciplinary researches between genetics and plant breeding, agronomy, soil fertility, plant pathology and entomology. Cereal chemistry and biochemistry were added later.

After preliminary work in 1943, plant breeders, soil scientists, plant pathologists and entomologists working as a team, began a concentrated attack on the various aspects of wheat production in 1944.

An in-service (intern) training component was added to the research program to train a new generation of Mexican scientists - while they were assisting with the development of the research program. Provision was also made for fellowships to enable the most promising of these young scientists to study abroad for advanced degrees, hopefully in preparation for positions of leadership in Mexican agriculture.

Research from the outset was production-oriented and restricted to that which was relevant to increasing wheat production. Researches in pursuit of irrelevant academic butterflies were discouraged, both because of the acute shortage of scientific manpower and because of the need to have data and materials available as soon as possible for use in the production program.

To accelerate progress in varietal development, two generations of all segregating materials were grown each year. One generation was sown close to

sea level in Sonora at 28 degrees north latitude in the fall when the days were progressively shorter; the second was sown near Toluca, at 18 degrees latitude and 2,500 meters above sea level during the summer when days were progressively longer. Through the use of this technique we developed high-yielding, day-length insensitive varieties with a wide range of ecologic adaptation and a broad spectrum of disease resistance - a new combination of uniquely valuable characters in wheat varieties.

These characters were valuable in increasing wheat production in Mexico and neighboring countries, but were to prove even more valuable 20 years later when the Mexican varieties were introduced into Pakistan and India. Without this combination of characters the successful transplantation of the Mexican varieties into Pakistan and India would have been impossible; and the advent of the Green Revolution would almost certainly have been delayed many years.

In Mexico, as soon as significant improvements were made by research, whether in varieties, fertilizer recommendations, or cultural practices, they were taken to farms and incorporated into the production programs. We never waited for perfection in varieties or methods but used the best available each year and modified them as further improvement came to hand. This simple principle is too often disregarded by scientific perfectionists who spend a lifetime searching for the unattainable in biological perfection, and consequently during a lifetime of frustration contribute nothing to increasing food production.

Farm demonstrations of new varieties and technology were made by the research scientists who had developed them. Indeed, the revolution in wheat production in Mexico was accomplished before the extension service came into being. This forced the research scientists themselves to consider the obstacles to production that confronted the farmers. The same philosophy and tactic were

used effectively to bring researchers in contact with the farmers' problems in the early years of the wheat improvement programs in India and West Pakistan. Later, however, the extension services were brought into the production programs in both countries.

Mexican wheat yields began to climb by 1948 and have continued their upward trend to the present time. During the past 26 years the national average has risen from 750 kilos per hectare to only slightly less than 3,000 kilos during the past harvest, approximately a fourfold increase. During the same period total production has increased sevenfold. Mexico became self-sufficient in wheat production for the first time in 1956, and has remained self-sufficient since. This "Quiet Revolution" in wheat production in Mexico became the progenitor of the Green Revolution in India and Pakistan a decade later.

As the use of fertilizer increased and yields climbed to 4.5 thousand kilos per hectare, lodging (falling over of the plant) began to limit further increases in yields. A search was therefore made among wheats from different areas of the world to locate a suitable source of genetic dwarfness to overcome this barrier. Norin 10, an extremely dwarf wheat from Japan, proved to be a suitable source. Through a series of crosses and recrosses, begun in 1954, dwarfness was incorporated into the superior, new-combination Mexican types, finally giving rise to a group of so-called dwarf Mexican wheat varieties. With this new development the potential yield of the new varieties, under ideal conditions, increased from the previous high of 4.5 thousand kilos per hectare to nine thousand kilos per hectare. The dwarf Mexican wheats were first distributed in Mexico in 1961, and the best farmers began to harvest 5, 6, 7 and even 8 tons or more per hectare, and within seven years the national average yields doubled. It was these same dwarf Mexican wheats from the Quiet Revolution that served as

catalysts to trigger off the Green Revolution in India and Pakistan.

From the outset the Mexican Agricultural Program was watched with interest by many other countries. As progress became evident, The Rockefeller Foundation was besieged by requests from many countries for assistance in agricultural improvement programs. The Cooperative Mexican Agricultural Program had become a model. The Cooperative Colombian Agricultural Program, devoted largely to maize, wheat, potatoes, forage and livestock, was established in 1950. Similarly, the Cooperative Chilean Agricultural Program was established in 1955 to work on wheat and forage. The Cooperative Indian Agricultural Program was established in 1956 to improve maize, sorghum, and millet production and to assist in the development of post-graduate agricultural education. Each of these programs subsequently played an important role in improving agricultural production and education in different parts of the world.

Meanwhile, back in Mexico, the program that had originally been confined to maize, wheat and beans, and soon thereafter potatoes, was expanded to include many other crops. Larger numbers of young Mexican scientists were added to the research and training programs. Progress in research was generally good, and the training program also bore fruit. Between the years 1943-1963 a total of 550 interns participated in the overall agricultural research and training programs, of whom about 200 received a Master of Science degree and others the Doctor of Philosophy degree while on fellowships for study abroad. With this corps of trained scientists a new National Institute of Agricultural Research was born in 1961. The Rockefeller Foundation "had worked itself out of a job", which was one of its original objectives.

The Mexican experience indicated that one of the greatest obstacles to the improvement of agriculture in the developing countries is the scarcity of

trained people. This experience indicated clearly that training is a slow process. Where no corps of trained scientists exists, as was the case in Mexico 27 years ago and remains the case in many countries of Asia, Africa and Latin America today, it requires 18 to 25 years to develop enough competent research scientists and educators to meet a country's needs. So great is the urgency of the food shortage in many underdeveloped and emerging countries that there is not enough time to develop an adequate corps of scientists before attacking food production problems. A short-cut and organizational change had to be invented to meet the needs. And so was born the first truly international research and training institute - The International Rice Research Institute (IRRI) - at Los Baños, the Philippines, in 1960, to work exclusively on the regionally all-important but too long neglected rice crop. The institute was jointly financed by The Ford and Rockefeller Foundations in collaboration with the government of the Philippines.

The research activities on wheat, maize, and potatoes in Mexico were informally internationalized in 1959 and organized as a second international center in 1963. This International Center for Maize and Wheat Improvement (CIMMYT), is supported also by The Ford and Rockefeller Foundations, in collaboration with the government of Mexico. More recently, additional financial support has benn provided by the U.S. Agency for International Development U.S. AID), United Nations Development Program (UNDP), and the Inter-American Development Bank (BID).

A third center, The International Center of Tropical Agriculture (CIAT), in Colombia, and the International Institute of Tropical Agriculture (IITA), in Nigeria, the most recent, have been established to study problems and stimulate production of certain tropical crops and animal species, as well as to help

train scientific specialists. CIAT is financed by The Ford, Rockefeller, and W.K. Kellogg Foundations in cooperation with the government of Colombia. The Ford and Rockefeller Foundations, and The Canadian International Development Agency (CIDA) are supporting IITA, in collaboration with the government of Nigeria.

These four international institutes represent a significant but modest start toward the construction of a worldwide network of international, national, and local research and training centers. This network will help solve problems and disseminate the benefits of science to all mankind in the shortest possible time and at minimum costs.

The impact of such integrated approach is already evident in the Green Revolution. New varieties and the new technologies that make them highly productive have been the thrust behind the Green Revolution. In the Philippines, Ceylon, Malaysia and West Pakistan it was IR8 rice, developed at the International Rice Research Institute. The dwarf Mexican wheats, partly produced by CIMMYT, have provided the thrust in India and Pakistan and this is now spreading to Turkey, Afghanistan, Iran, Morocco and Tunisia. Contributing equally, or perhaps even more, to the evolution of the Green Revolution was the talented supporting leadership that has been provided by the Centers to the national programs through temporary assignments of mature scientists skilled in organizing crop production programs to assist in the development of the national production campaigns.

The international centers were developed to supplement national agricultural research, production, and training programs, not to replace them. The centers are but one link in the worldwide network of organizations attacking basic food crop production problems on a worldwide, regional, national and local

level. The backbone of this network is now and must continue to be the national programs. These must be given greater financial support and strengthened staff-wise to meet the challenge of rapidly expanding food needs for the future.

The international centers, however, are in a unique position to assist the national programs. They are independent, non-political international organizations, which, although originally funded by private foundations, now receive support from many diverse sources. Their scientific staffs are also international and comprise outstanding scientists representing the various scientific disciplines affecting crop production. Included on their staff are a number of crop production experts who have the scientific competence and broad experience to assist national agencies in organizing and launching crop production programs.

The centers collaborate not only with the national agencies from many different countries but also with other international organizations such as The Food and Agriculture Organization (FAO) of the United Nations, The United Nations Development Program (UNDP), and international development banks. Each year the centers have been collaborating with an increasing number of countries of all political spectra.

I am convinced that the international agricultural research institutes are developing a bond of understanding among nations, based upon the common need for increasing food production. We must all strive to strengthen this bond in the spirit of Alfred Nobel "... to promote brotherhood among the nations".

The international centers are uniquely equipped to do fundamental, long-time researches of worldwide importance. For example, the opportunity for plant breeders, pathologists and entomologists to operate on a worldwide basis permits them to develop well-conceived, diverse gene pools of the important crop species. The final crop varieties are not currently generally selected at the centers but

sent to collaborators in national programs in many parts of the world, who in turn make the selections that best suit their needs; and many eventually become commercial varieties. Similarly, the centers prepare a series of international crop yield tests, which include representatives of the best commercial varieties from the world and a few of the most promising experimental lines from collaborators. These are sent to collaborators in 35 countries for growing at 80 locations. The data from collaborators are returned to CIMMYT for summarizing and for subsequent distribution to scientists in all parts of the world. The data obtained on yield, adaptation, disease and insect resistance in one year in such tests are often more meaningful and valuable to scientists engaged in crop research and production programs than data obtained by independent testing at one location for a period of 10 or 15 years.

The international centers also are in a unique position to contribute to practical or internship type of training in all of the scientific disciplines affecting crop production. This type of training is particularly valuable for young scientists from the developing countries because it prepares them for initiating research work upon return to their native country and will also be of value if they subsequently continue their education at the graduate level.

In summarizing the accomplishments of the Green Revolution during the past three years, I wish to restate that the increase in cereal production, rice, maize and wheat, and especially in wheat, has been spectacular and highly significant to the welfare of millions of human beings. It is still modest in terms of total needs. Recalling that 50 percent of the present world population is undernourished and that an even larger percentage, perhaps 65 percent, is malnourished, no room is left for complacency. It is not enough to prevent the currently bad situation from getting worse as population increases. Our aim

must be to produce enough food to eradicate all present hunger while at the same time striving to correct malnutrition. To eliminate hunger now in the developing nations, we would need to expand world cereal production by 30 percent. If it were, however, as simple as increasing the total world production by 30 percent, regardless of where the production is to be expanded, it could be accomplished rather rapidly by expanding it in the United States, Canada, Australia, Argentina, and Russia. But this would not necessarily solve the hunger problem of the developing world, because their weak economies will not permit them to expand their food imports by 30 percent. Worse still, even if present production could be expanded rapidly by 30 percent in the developing countries - which I believe is possible based on recent progress of the Green Revolution - so as theoretically to eliminate hunger, the hunger problem as it now exists still would not be solved. There remains the unsolved social-economic problem of finding effective ways to distribute the needed additional food to the vast underprivileged masses who have little or no purchasing power. This is still the great unsolved problem with which the economists, sociologists, and political leaders must now come to grips.

I am convinced that if all policy-makers would take sufficient interest in population control and in aggressively employing and exploiting agricultural development as a potent instrument of agrarian prosperity and economic advancement, many of the social ills of the present day could soon become problems of the past. The tropics and sub-tropics have abundant sunlight and other great biological assets and it will be criminal to delay further the conversion of these assets into wealth meaningful to the poor and hungry.

Some critics have said that the Green Revolution has created more problems than it has solved. This I cannot accept, for I believe it is far better for

mankind to be struggling with new problems caused by abundance rather than with the old problem of famine. Certainly, loyalty to the status quo in food production - when being pressured by population growth - cannot break the chains that have bound the peasant to poverty and hunger. One must ask: is it just to criticize the Green Revolution, with its recognized accomplishments, for failure to correct all the social-economic ills of the world that have accumulated from the days of Adam and Eve up to the present? Change we must, or we will perish as a species, just as did the dinosaurs in the late Cretaceous.

The Green Revolution is a change in the right direction, but it has not transformed the world into Utopia. None are more keenly aware of its limitations than those who started it and fought for its success. But there has been solid accomplishment, as I have already shown by concrete examples. I have also tried to indicate the various opportunities for capitalizing more fully on the new materials that were produced and the new methods that were devised. And, above all, I cannot emphasize too strongly the fact that further progress depends on intelligent, integrated, and persistent effort by government leaders, statesmen, tradesmen, scientists, educators, and communication agencies, including the press, radio and television.

But progress is continuous and we can and must make continuous progress. Better varieties of wheat and other cereals with not only higher yield potential but also with higher content of protein are already in the process of creation.

We need also to explore more fully the feasibility of producing new man-made cereal species with greater production potential and better nutritional quality than those now in existence. Triticale, a man-made species, derived from a cross between wheat and rye, now shows promise of becoming such a crop.

During the past six years the International Corn and Wheat Center in Mexico, cooperating with the University of Manitoba, has developed a large breeding program to improve Triticale. Within the past three years we have developed highly fertile lines and the results up to the present indicate the possibility of combining the desirable characteristics now present in different lines into a single line, thereby creating a new kind of cereal that is superior to wheat in productivity and nutritional quality.

The rapid progress achieved in Triticale improvement suggests the desirability of initiating basic studies to determine the feasibility of developing other cereal species from wide crosses between different existing species or their wild relatives. Recent improvements in individual cell, tissue and embryo-culture techniques, in the development of culture media with additions of hormones and nutrients that foster cell and tissue differentiations, in achieving hybridization between somatic cells and in the methods of inducing polyploidy and mutations, offer many fascinating possibilities of achieving crosses between species that were formerly uncrossable. Even the possibility of using protoplasmic and cell hybridization, followed by manipulation to promote cell differentiation for plant improvement, appears to be nearer.

I propose therefore that a bold program of wide crosses be initiated to improve both cereals and legumes (pulses). It should include attempts to make numerous intergeneric crosses among cereals, employing all of the modern techniques to consumate fertilization, and propagate the hybrids. If a series of new combinations can be made and doubled, such as for example between maize and sorghum, wheat and barley, or wheat and rice, it would open the door to the possibilities for vast subsequent improvement by conventional methods.

Unfortunately, all cereals are deficient in one or more of the essential amino acids, especially lysine, which is essential for normal body growth and for the maintenance of health. Protein malnutrition is widespread, especially among children, and many of its victims die or are maimed both physically and mentally for life.

Although food supplements can alleviate this situation, the development of high-yielding varieties of cereal grains that have high levels of protein and better amino acid balance, would be the ideal solution, since this would not involve added expense or special educational efforts, and there are good possibilities of producing them. The now famous opaque-2 gene in maize doubles the production of the amino acid lysine which is essential to growth and health in man and many other animals. Similarly, an Ethiopian strain of barley, and some lines of Triticale have genes for extraordinary production of essential nutrient materials. Plant breeders are trying to combine such genes with the best genes now available for productivity and other desirable characters, thus increasing not only the tonnage of food, but also its essential nutrient quality. As we are now striving to emancipate ourselves from dependence on artificial food supplements, I have a dream that we can likewise emancipate ourselves to some extent from our dependence on artificial nutrients for the cereal plants themselves, thus lightening the financial burden that now oppresses the small farmer and handicaps his efforts to participate fully in the new technologies.

In my dream I see green, vigorous, high-yielding fields of wheat, rice, maize, sorghums, and millets, which are obtaining, free of expense, 100 kilograms of nitrogen per hectare from nodule-forming, nitrogen-fixing bacteria. These mutant strains of "*Rhizobium cerealis*" were developed in 1990 by a massive mutation breeding program with strains of *Rhizobium* sp. obtained from roots of

legumes and other nodule-bearing plants. This scientific discovery has revolutionized agricultural production for the hundreds of millions of humble farmers throughout the world; for they now receive much of the needed fertilizer for their crops directly from these little wondrous microbes that are taking nitrogen from the air and fixing it without cost in the roots of cereals, from which it is transformed into grain ...

Then I wake up and become disillusioned to find that mutation genetics programs are still engaged mostly in such minutiae as putting beards on wheat plants and taking off the hairs.

If we are to capitalize fully on the past biological accomplishments and realize the prospective accomplishments, as exemplified in my dream, there must be far greater investments in research and education in the future than in the past.

Few investments, if any, can match the economic and social returns from the wheat research in Mexico. The investment from 1943 to 1964 was estimated to have yielded an annual return of 750 percent. This study was made prior to the full impact of dwarf wheats on the national production. If the benefits were calculated now, with the inclusion of the returns from the increased wheat production in Pakistan, India, and other Asian and African countries, they would be fantistically high.

Nevertheless, vast sums are now being spent in all countries, developed and developing, on armaments and new nuclear and other lethal weapons, while pitifully small sums are being spent on agricultural research and education designed to sustain and humanize life rather than to degrade and destroy it.

The Green Revolution has won a temporary success in man's war against hunger and deprivation; it has given man a breathing space. If fully

implemented, the Revolution can provide sufficient food for sustenance during the next three decades. But the frightening power of human reproduction must also be curbed; otherwise the success of the Green Revolution will be ephemeral only.

Most people still fail to comprehend the magnitude and menace of the "Population Monster". In the beginning there were but two, Adam and Eve; when they appeared on this earth is still questionable. By the time of Christ world population had probably reached 250 million. But between then and now population has grown to 3.5 billion. Growth has been especially fast since the advent of modern medicine. If it continues to increase at the estimated present rate of two percent a year the world population will reach 6.5 billion by the year 2000. Currently, with each second, or tick of the clock, by 2.2 additional people are added to the world population. The rhythm of increase will accelerate to 2.7, 3.3 and 4.0 for each tick of the clock by 1980, 1990, and 2000, respectively, unless man becomes more realistic and preoccupied about this impending doom. The tic-toc of the clock will continually grow louder and more menacing each decade. Where will it all end?

Malthus signaled the danger a century and a half ago. But he emphasized principally the danger that population would increase faster than food supplies. In his time he could not foresee the tremendous increase in man's food production potential. Nor could he have foreseen the disturbing and destructive physical and mental consequences of the grotesque concentration of human beings into the poisoned and clangorous environment of pathologically hypertrophied megalopoles. Can human beings endure the strain? Abnormal stresses and strains tend to accentuate man's animal instincts and provike irrational and socially disruptive behavior among the less stable individuals in the maddening crowd.

We must recognize the fact that adequate food is only the first requisite for life. For a decent and humane life we must also provide an opportunity for good education, remunerative employment, comfortable housing, good clothing, and effective and compassionate medical care. Unless we can do this, man may degenerate sooner from environmental diseases than from hunger.

And yet, I am optimistic for the future of mankind; for in all biological populations there are innate devices to adjust population growth to the carrying capacity of the environment. Undoubtedly, some such device exists in man, presumably Homo sapiens, but so far it has not asserted itself to bring into balance population growth and the carrying capacity of the environment on a worldwide scale. It would be disastrous for the species to continue to increase our human numbers madly until such innate devices take over. It is a test of the validity of sapiens as a species epithet.

Since man is potentially a rational being, however, I am confident that within the next two decades he will recognize the self-destructive course he steers along the road of irresponsible population growth and will adjust the growth rate to levels which will permit a decent standard of living for all mankind. If man is wise enough to make this decision and if all nations abandon their idolatry of Ares, Mars, and Thor, then Mankind itself should be the recipient of a Nobel Peace Prize, which is "to be awarded to the person who has done most to promote brotherhood among the nations".

Then, by developing and applying the scientific and technological skills of the 20th century for "the well being of mankind throughout the world", he may still see Isaiah's prophesies come true: Isaiah 35: 1, 7: "... And the desert shall rejoice, and blossom as the rose ... And the parched ground shall become a pool, and the thirsty land springs of water ..."

And may these words come true!

NUTRITION NEWS AND OPINION FROM THE CARIBBEAN

UN SURVEY LOCATES NEW CARIBBEAN FISHING AREAS
by Monty Parrott in the Sunday Graphic, Guyana, June 13, 1971

The discovery of two major sources of fish in the Caribbean region has been the main result of a United Nations fisheries survey which is drawing to an end after six years' work.

Scientists connected with the survey estimate that if these resources are exploited in the manner they suggest they will meet the needs of the region, on present demand, for the next 10 or 15 years. Such exploitation would mean an immense saving in foreign exchange because the Caribbean, one of the biggest fish-eating areas in the world, at present imports two-thirds of its requirements. These imports, valued at about $88,000,000, come mainly from North America and also Europe. Development of these new resources would also mean new jobs for Caribbean nationals not only in the manning and equipping of fishing vessels but also in the provision of port and storage facilities and in the marketing and distribution of the catch.

One of the areas which the survey has located and assessed is off the north-eastern coast of South America stretching from Trinidad to the border of Brazil. The other area is in two parts, the first to the west of Jamaica and the second in the northern Leeward Islands. Trawl fish resources in the area off the South American coast are estimated to produce 200,000 tons of fish a year and the yield of snapper and varied bottom fish from the west and north Caribbean is expected to total another 100,000 tons.

On world standards, the Caribbean region is not a highly productive area for fish and the new resources were only discovered after years of patient exploratory work over 1,500,000 square miles ranging from the Continental shelf of Central America to the Brazilian border with French Guiana. Three multi-purpose fishing vessels, the Calamar and the Alycon, both 86 feet overall, and the Fregata, of 56 feet, have been engaged in the survey from the outset while in the latter stages of the project two additional charter vessels have been used to test the commercial potential of the new areas.

The need to investigate the fishing potential of the Caribbean on an expert and comprehensive scale was increasingly realised during the 1950s, and was a matter considered by the now defunct West Indies Federation which broke up in 1962. Individual islands and territories had earlier tinkered with the idea of developing their local fishing industries but their resources were limited and their horizons short. The view grew in many minds that exploratory work and subsequent development of the fishing industry must be tackled on a regional basis with intra-regional markets and more trained fisheries personnel, from administrators to seamen.

Eventually a number of governments approached the United Nations for assistance in fisheries development and a mission visited countries of the

region including Puerto Rico, Trinidad, Guyana, Surinam, The Netherlands Antilles, Barbados, Antigua, Jamaica, Haiti and the Dominican Republic. The mission recommended support from the United Nations Special Fund (now the United Nations Development Programme) for a regional fisheries project in the Caribbean consisting of three parts: exploratory fishing, market research and training. The project with headquarters in Barbados, became operational in August 1965, and the first phase of four years was followed by a second phase of two years which ends next August. Piloting the project before and after it became operational was Mr. Harry Winsor, now the director of operations in the FAO Fisheries Department in Rome. He was succeeded in the Caribbean post in July 1968, by his deputy, Mr. John Dibbs, an Australian with nine years' experience on fisheries development in West, Central and East Africa.

During the first phase of the project United Nations Special Fund contributed $3,551,200 and the 15 participating governments gave $1,545,600 and considerable amounts in kind. The United Nations contribution in the second phase was $2,343,400 and the governments $1,052,780 with in-kind assistance assessed at $207,400. Twenty-two international scientific and technical staff have been employed on the project as well as many Caribbean nationals as general staff and ships' crews. Concurrently with the exploratory side, the United Nations Mission has run a training programme to teach fishermen modern deep-sea fishing operations and fishing administration. Much emphasis in the later stages of the project has also been put on marketing which has included the handling, processing and distribution of bulk catches far larger than had been handled in the past.

Referring to the newly discovered fishing areas, Mr. A.M. Anderson, chief marketing and training officer, said that "Our job in the past two years has been to promote the investment in primary industry and in developing marketing. It is no use catching the fish without getting rid of them," he said, "and it has been our job to show how to market them and how to handle large shipments". Mr. Anderson, who is a Scot, said the mission was also trying to promote more investment. Interest, he said, was slow at the start but was now growing. It is estimated that the fishing fleet in the region could eventually build up to around 400 vessels. This is in addition to the existing shrimp fleet which at present also numbers about 400, mainly American. But, as Mr. Dibbs admits, the investor needs trained people to feel secure in his investment, so many more operational personnel must be trained in all sectors of the industry. This, he said, must be a government responsibility and because of lack of financial resources the governments will need additional international and bilateral assistance. Possible action to the end of obtaining more trained staff would be to retain a small cadre of the international staff as a nucleus for a regional training institute.

DESCRIBES ARGUMENTS AGAINST WATER FLUORIDATION AS SCIENTIFICALLY UNSUPPORTED
From The Daily Gleaner, Jamaica, June 21, 1971

A Puerto Rican Professor and Consultant to the Pan American Health Organization, Dr. Ramon M. Guzman, has described the arguments adduced against

water fluoridation as scientifically unsupported, and said that too much weight was being placed on opposition minority groups.

Speaking on the economic aspects of a water fluoridation programme in Kingston, aboard the hospital ship Hope on Wednesday night, Dr. Guzman said that the reason for non-implementation of fluoridation schemes in many developing countries, was mainly opposition from minority groups. He said, in his opinion, too much weight was given to this opposition, particularly when it is considered that there is no scientific evidence to support the claims made by these groups.

Most of the countries of Latin America and the Caribbean do not have the number of Odontologists needed to carry out a good dental health programme, Dr. Guzman said. The incidences of dental caries among the population run very high. Furthermore, he said, the poor habits of dental care are also a disadvantage for the maintenance of healthy teeth. Thus, he said, these countries definitely needed preventive measures to reduce the incidences of tooth decay.

In his experience, Dr. Guzman said, it was the tendency to devote public funds allotted to public health to curative programmes rather than preventive. The preventive programmes apparently go to a secondary level, the result of non-defined programmes of preventive medicine. According to his estimate, Dr. Guzman said, the water supply of the city of Kingston could be fluoridated at a cost of some $30,000 during the first year and $12,000 annually in subsequent years.

Great benefit

Fluoridation, if adopted, he said, could be a public health measure that would bring great benefit to the island. "We are talking about a relatively low amount of public funds. The amount of funds needed will not sacrifice or jeopardize any other programme of either curative or preventive medicine," Dr. Guzman said. Professional groups and the community should encourage a programme of fluoridation at this time, Dr. Guzman said. The Dental Association, the Medical Association, the Engineer Association, Public Health Groups and the community as a whole should agitate for a programme of fluoridation, he said.

Continuing, Dr. Guzman said that the organization which he represented could provide technical guidance for the performance of epidemiological surveys for dental caries, water operators, chemists and other related personnel. These services can be provided at no cost to government, he added. Dr. Guzman said he had visited several countries in Central and South America and the Caribbean and spoken to directors of Odontology, directors of water companies, sanitary engineers, personnel in the field of public health, and civic groups. All these officials and groups favoured the additon of artificial fluorides to the public water supplies, he said.

Concluding, Dr. Guzman said, "May I urge this group to take a positive and forward looking approach towards a fast implementation of this preventive measure, whose benefits have been satisfactorily proved in 26 years of plant

experience, and that could result in a reduction of 65 per cent in the index for dental caries of the population of this country".

The lecture was sponsored by the Dental Association of Jamaica.

THE COST-OF-LIVING DIFFERENCES
From the Guyana Graphic, July 2, 1971

Your basket of weekend groceries which in Guyana would cost you $25.63 will in Antigua, for exactly the same items, cost you $36.08. Those are the two extremes. In between are the other costs: Barbados $27.77; Trinidad (San Fernando) $28.64; Dominica (Roseau) $29.50; Jamaica (Kingston) $12.37 (J) ($30.92 BWI); Anguilla $30.86; Grenada $31.83; St. Vincent $33.20 and St. Kitts $34.01. We know this because this is the kind of information we get from the Caribbean Food and Nutrition Institute.

The Institute's work goes on at two centres - Mona in Jamaica and the St. Augustine campus of UWI in Trinidad, and is in progress in all the countries. Nutritional surveys have been undertaken in Barbados and currently in Guyana where members of CFNI staff are interviewing households throughout the country. The kind of information gathered about the cost and nutrition value of local foods is important to everyone in the area who wants to stretch his dollar.

This year the five-year agreement under which CFNI was set up is being extended for another five years. Now being set up is a regional association of Nutritionists and Dieticians. Since the setting up of the Institute in 1967, the nutritional problems of the region have been brought more sharply into focus. According to Barbados Health Minister, Edwin Taima, the governments of the region are now more aware of the areas in need of urgent attention and are so enabled to plan more effectively for correction of deficiencies.

INFANT FEEDING SEMINAR
From the Caymanian Weekly, July 1, 1971

A seminar on Infant Feeding was conducted by Dr. D. Jelliffe, Director of the Caribbean Food and Nutrition Institute, and Mrs. P. Jelliffe on the 18th June, 1971 in the Truth for Youth School which was kindly put at their disposal by Miss Wilma Moffatt.

Much important information was imparted. The vital importance of breast feeding for the first six months of life was emphasized. Breast milk is the perfect nourishment for the infant. Not only is it the best balanced food but also it is not liable to become infected as are artificial foods. If artificial

foods are necessary, the best and cheapest foods were indicated. A most important feature was the preparation of a list of locally grown foods, showing the cheapest and most nutritious for the child after weaning. Some of these foods were prepared and cooked by Mrs. Jelliffe.

Anyone wishing for further more detailed information can obtain this from the Government Medical office.

EVALUATION OF TWO WORKSHOPS

by

Thomas J. Marchione
Sociologist, CFNI

Introduction

One basic activity of the Caribbean Food and Nutrition Institute is the dissemination of information. One way in which this is attempted is through group meetings held in various places throughout the Caribbean. These include conferences, seminars, and workshops lasting from one to five days. To date, CFNI has been involved in planning for over fifteen meetings.

Considering the investment in the success of these meetings, some form of continuing evaluation must be done. What follows is an example of one way in which workshops can be evaluated.

The Workshops

In October of 1970, two workshops entitled "Food, Nutrition & Development" were held under the auspices of CFNI. One was hosted by the Antiguan Government which included participants from Antigua, Anguilla, Dominica, Montserrat and St. Kitts-Nevis. The other was hosted by the Grenadian Government and included participants from Grenada, St. Lucia and St. Vincent. Also included were CFNI staff and a few other technical people from various Caribbean states. In all 233 individuals registered at the conference sites, 122 in Antigua and 111 in Grenada. Based on the titles and work places of participants, the following occupational types were represented:

Type	Antigua	Grenada	Overall
Health	41%	37%	39%
Education	28%	29%	29%
Agriculture	7%	10%	8%
Welfare	5%	3%	4%
Nutrition	3%	3%	3%
Other or unknown	16%	18%	17%
Total	100%	100%	100%

Both workshops were held on three consecutive weekdays. In each case all of the sessions were held in one large meeting hall. One conference day consisted of morning and afternoon sessions of three hours in length. Normally a session was composed of four, twenty minute, lecture-type presentations. Either each session or each presentation was followed by discussion. In addition, a question-answer period of one hour was scheduled at the end of each workshop, when questions from the question box would be answered. Both workshops included the following presentations:

Session I: Nature, Scope & Etiology of Malnutrition

1. Nutrition problem: Magnitude and severity of PCM.
2. Effects of malnutrition on the individual and community.
3. Multifactorial causation of malnutrition.
4. Functions of CFNI.

Session II: *Food, Nutrition and Human Development*

1. Early detection of malnutrition.

   The at risk child.

   Weight charts and their interpretation.

2. Case histories of malnourished children with discussion of nutrition education needed.

3. How can health staff assist malnourished children?

Session III: *Food, Nutrition and Economic Development*

1. Nutrition, health and productivity.
2. Cost nutrient values of food.
3. Home food production.
4. The scientific basis of food mixtures.

Session IV: *Feeding of Mother and Young Child*

1. Maternal nutrition.
2. Nutrition of the newborn.
3. Artificial feeding.
4. Weaning and transition to family diet.
5. General discussion on implementation of the principles involved.

Session V: *Better Nutritional Value for Money*

1. Budgeting and consumer education.
2. Improvement of family diets.
3. Nutrition in the school curriculum.

Session VI: Day Care and Any Questions

1. Panel on day care - need, type, costs, criteria of admission, training of staff, involvement of parents, problems.
2. Any questions.

The Evaluation

In January of 1971, following the workshops, all the registered delegates were sent a three-page closed response questionnaire by mail. By the end of February 59 questionnaires were returned. Forty questionnaires were returned by the Antigua workshop participants and 19 were received from the Grenada participants. In all 25% of the questionnaires were returned.* The respondents were engaged in the following fields of work:

37%	Education
35%	Health
8%	Welfare
8%	Agriculture
5%	Nutrition
7%	Other or unknown
100%	

The evaluation is divided into three basic parts:

(A) *The Organization*, or the attendance, participation, and other indications of the satisfaction of the participants with the way the workshop was conducted;

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*An essay type questionnaire was also sent. Only 10% of these were returned. For this reason, and for reasons of space these results are not included here.

(B) *The Content*, or the opinion of the delegates regarding the relevance and importance of the topics discussed;

(C) *The Impact*, or the possible social and cultural influences and changes which resulted from the meeting.

A. *ORGANIZATION*

Questions	Responses	Grenada	Antigua	Overall
Were you prepared to attend the workshop? (Notified, request for presentation, schedule received, objective understood)		n* = 60	n = 134	n = 203
	Well in advance	77%	70%	72%
	Less than one week before	8%	14%	12%
	During	15%	16%	16%
Were you satisfied with these aspects of the workshop? (Length, daily scheduling, place, time of year, accommodations, other)		n* = 80	n = 198	n = 278
	Yes	76%	86%	83%
	Not completely	23%	8%	12%
	No	1%	6%	5%
(Average attendance out of six sessions)		N = 17	N = 40	N = 57
		3.6 sessions	5.2 sessions	4.6 sessions
Did you ask questions during discussions?		N = 18	N = 37	N = 55
	No	33%	51%	45%
	Yes, many times, or just yes	67%	49%	55%
Were all important persons present at workshop?		N = 17	N = 29	N = 48
	Yes	29%	55%	46%
	No	70%	45%	54%

*n here represents the number of responses. Up to five per person were accepted. Otherwise N is the number of individuals responding.

Questions	Responses	Grenada	Antigua	Overall
		N = 17	N = 38	N = 55
Would have small group discussion improved the workshop?	Yes	33%	34%	34%
	No, or very qualified yes	37%	39%	38%
	Maybe	29%	26%	27%
		(N = 15)	(N = 38)	N = 53
Did many delegates *not* participate sufficiently in discussion?	Yes	80%	71%	74%
	No	20%	29%	26%
Why not?		(N = 18)	(N = 25)	N = 43
	Organization (i.e. too large a group, not enough discussion time)	78%	64%	70%
	Fault of delegate (intimidated, nothing to say, etc.)	23%	35%	30%
		N = 17	N = 40	N = 57
Were hosts, nationals given ample say in planning?	Yes	24%	25%	25%
	No	0%	13%	8%
	Don't know	76%	62%	67%
(Excluding those who didn't know)	Yes	100%	67%	74%
	No	0%	33%	26%

B. CONTENT

Questions	Responses	Grenada	Antigua	Overall
Were the discussions of young child malnutrition really needed?		N = 19	N = 37	N = 58
	Yes	26%	38%	34%
	Yes, in fact more open and direct discussions were needed	68%	43%	52%
	No, or (negative yes)	5%	19%	14%
Was the workshop relevant to your countries' needs?		N = 18	N = 38	N = 56
	Yes	78%	61%	66%
	Yes, (qualified, "in part")	22%	34%	30%
	No	0%	5%	4%
Did you get practical information for your work?		N = 18	N = 38	N = 56
	Yes	78%	61%	66%
	Yes, but not presently applicable	17%	21%	20%
	No	6%	18%	14%
Were your objectives for attending achieved?		N = 18	N = 38	N = 56
	Yes	44%	63%	57%
	Yes, in part	55%	37%	43%
	No	0%	0%	0%

Questions	Responses	Grenada	Antigua	Overall
		(Rank order is given. 1 is highest rank.)		
		n* = 60	n = 83	n = 143
Which presentation impressed you least? Which most?	**I. "Opening, Nature, Scope & Etiology of Malnutrition"	1	4	4
	II. "Food, Nutrition & Human Development"	3	3	3
	III. "Food, Nutrition & Economic Development"	2	1	1
	IV. "Feeding of Mother & Young Child"	4	5	5
	V. "Better Nutritional Value for Money"	3	2	2
	VI. "Day Care & Any Questions"	5	6	6

*n here represents the number of responses given, at least two responses per respondent.

**These titles are sessions, each session has at least two sub-sessions or presentations of twenty minutes. A scale was used to rank sessions:-

$$\left[\frac{\text{(most liked) - (least liked)}}{\text{total responses}}\right]$$

Questions	Responses	Grenada	Antigua	Overall
		(Percentage of respondents agreeing)		
		N = 19	N = 40	N = 59
In which sectors should attention be given to food & nutrition?	Agriculture?	89%	83%	85%
	Health?	95%	85%	88%
	Community development?	79%	88%	85%
	Education?	89%	90%	92%
	Econ. development?	84%	73%	76%
	Others	5%	10%	8%
		N = 19	N = 40	N = 59
What are causes of infant malnutrition?	Too much dependence on foreign foods.	21%	40%	34%
	Lack of knowledge about proper feeding or faulty knowledge	80%	98%	94%
	Poverty	53%	67%	63%
	Disorganized family life	53%	63%	59%
	Mal-distribution of food in the family	42%	33%	36%
	Others	0%	15%	10%

C. IMPACT

Questions	Responses	Grenada	Antigua	Overall
		N = 19	N = 40	N = 59
Have you seen or heard news releases? Before the workshop?	Yes	-	-	66%
	No	-	-	34%
After the workshop?	Yes	-	-	73%
	No	-	-	27%
Least number of releases reported per caput were		1.4/person	2.2/person	2.0/person
		n* = 60	n = 83	n = 143
Releases were:-	seen on Tele.	0%	16%	1.3%
	heard on Radio	63%	64%	64%
	seen in a news-paper	37%	20%	24%
		N = 15	N = 30	N = 45
News releases were initiated by:	Government	67%	71%	69%
	Myself	7%	8%	8%
	Unknown	26%	21%	23%
		N = 15	N = 30	N = 45
Have you taken action as a result of the workshop to date? (Approximately 3 mos. after the workshop)	Yes	60%	53%	56%
	No	40%	47%	44%
		N = 6	N = 14	N = 20
If not, do you intend to take action?	Yes	100%	85%	89%
	No	0%	7%	5%
	Don't know	0%	7%	5%

*n here represents the total number of media exposures reported.

If yes, describe briefly

Twenty individuals listed activities indicating action in the nutrition field such as -

(1) more nutrition in curricula for nursing education, adult education and home economics;

(2) organization of nutrition workshops;

(3) creation and resuscitation of nutrition committees;

(4) more home visiting by welfare and health personnel to households which are nutritionally at risk.

Impact of Diploma in Community Nutrition (DCN) Graduates

[These are local nationals trained by CFNI in 1969-70. They played an important role in the Workshops]

Questions	Responses	Grenada	Antigua	Overall
Do you know the DCN graduates?		N = 17	N = 50	N = 57
	Yes	65%	73%	70%
	No	35%	38%	30%
Have DCN graduates had helpful impact?		N = 15	N = 35	N = 50
	Yes	13%	20%	18%
	Some	13%	6%	8%
	No, but will	7%	20%	18%
	No	13%	20%	18%
	Don't know	53%	34%	38%

Discussion

The more outstanding results of this evaluation of the nutrition workshops were:

(1) All individuals responding felt they fulfilled their objectives, in full or in part, for attending the workshop. Generally, it was felt that material presented was relevant to their work and national problems.

(2) 83% expressed satisfaction with the structure of the workshop in regard to accommodation, timing, and duration.

(3) 74% of those responding felt more participation of delegates was needed. 70% agreed that the reasons for poor participation was due to improper group size or discussion time. 62% suggested that small group discussions would or might improve the workshop.

(4) 86% said that discussions of young child malnutrition were needed. 52% agreed that "in fact, more open and direct discussions were needed".

(5) The most important causes of malnutrition were thought to be lack of, or fallacious knowledge, about proper feeding, and poverty.

(6) Over half said they had taken action as a result of the workshops, and more claimed they intended to take action in the future.

One should be cautioned when reading these results in that they represent the answers of only one-fourth of the participants of the two workshops. Only through some kind of follow-up of the non-respondents could all possible sample bias be removed. Nevertheless, the bias is limited by the fact that the responses do represent a reasonably good occupational cross-section of workshop participants (see figure):

Type	Participants at Workshops	Respondents to Questionnaire
	N = 233	N = 59
Health	39%	35%
Education	29%	37%
Agriculture	8%	8%
Welfare	4%	8%
Nutrition	3%	5%
Other or unknown	17%	7%
Total	100%	100%

In addition, one can say that the questionnaire is somewhat reliable in that the results from two very similar workshops yielded very similar results.

Recommendations

Based on the results of this evaluation it is suggested that future meetings should be organized to encourage more participation of all people in attendance. This could be accomplished by small group discussions or other techniques depending on the size, subject, and duration of the meeting. In particular, *more discussion* on young child malnutrition would be desirable when this problem is included as part of a workshop of this type.

As a general practice a standard brief evaluation form should be prepared which could be easily filled out at the conclusion of CFNI workshops and conferences. Most importantly is that results of these continual evaluations be integrated into the planning of future meetings to improve their organization, relevance, and impact.

GENERAL NUTRITION NEWS AND OPINION

UP THE GARDEN PATH WITH POPEYE

The following is reproduced from The Lancet in view of the real relevance of Dark Green Leafy Vegetables (D.G.L.V.) in Caribbean diets. - Editor.

1. Why Popeye Took Spinach - Richard Hunter

When in the early 1930s Max Fleischer, the creator of Popeye, cast around for an instant restorative and vital energiser to assure his sailor hero's triumph over adversity and survival for next week's thrilling episode, his choice almost inevitably fell on spinach. Americans began eating it in quantity from about 1920, when it was shown to contain body-building calcium and iron. They ate even more when they learnt that it was also rich in vitamins A and C. Within a couple of decades demand for spinach grew so much that its cultivation was increased from 5,000 to 105,000 acres. It declined only with the war and the advent of vitamin pills and "reinforced" foods. A few years ago it was hinted that eating spinach may not be an unmixed blessing: "Though traditionally regarded as a healthy and even invigorating vegetable", commented a leading medical weekly, "spinach may have some hazards after all". Its high nitrate content, which is readily reduced to nitrite on storage, may cause vomiting and diarrhoea and, more dangerously, methaemoglobinaemia in infants.

The use of spinach in medicine dates back almost to its introduction as a kitchen green when diet was an integral part of treatment, and revolves chiefly around its irritant effect on the gastrointestinal tract. The origins of the plant itself are obscure. "Spinache", wrote an 18th century medical encyclopaedist, "which is now so celebrated and useful a Green, seems unmention'd and unknown to the Antients. It is so called by the Moderns, from its spinous Seed ... We are not certain where it grows spontaneously ... but it refuses no Soil or Climate, and is in Use in almost all Parts of Europe". According to the more modern authority it was introduced from Persia in the 15th century and rapidly established itself as a staple article of diet because of its succulent leaves. The fact that is is not indexed in *The Englishman's Food* suggests that it was perhaps never as popular in this country as abroad.

Recently it has been reported that folic acid may cause nervous and gastrointestinal symptoms in susceptible subjects which resembled in mild form those caused by sympatheticomimetic agents. A possible mechamism for this effect is suggested by the fact that brain-amine synthesis requires a pteridine cofactor. Since excess folic acid inhibits the enzyme dihydrofolic-acid reductase, which converts dietary folate to the biologically active tetrahydrofolate derivative, high tissue concentrations of folic acid could theoretically cause a fall in available cofactor. Such a reaction would depend on the ratio between exogenous folate and the original level of dihydrofolic-acid reductase, an inducible enzyme and probably subject to individual variation. Evidence has now come to light that folic acid may indeed interfere with brain-amine metabolism because it has been shown that large single doses

reduce the level of the dopamine metabolite homovanillic acid in cerebrospinal fluid. The sequence of biochemical reactions leading to this fall remain conjectural, but, if it is due to impaired dopamine breakdown rather than impaired synthesis, then the concentration of dopamine in the central nervous system should rise. This event is known from animal experiments to be associated with physiological alerting. Such an effect has also been observed in man when single doses of 30 mg. folic acid were given to a group of apathetic patients in a geriatric ward.

To return to Popeye. His adventures may belong to the cinematographic thrills of another generation, but spinach lives on, linked with his name as an approved health food and a diet for prize-fighters. Yet it must be admitted that not one of its constituents, mineral or vitamin, or at least none recognised in the 1930s, could possibly account for his astonishing feats of vigor. Their effect through haemopoietic mechanisms, for instance, would have been far too slow. Against this must be set the undoubted fact that a can of it saved him every time. Evidence now forthcoming, if confirmed, suggests that folic acid, in which the vegetable is rich, by its effect on brain-amine metabolism, was the rapidly acting activating agent, and the reason why Popeye chose spinach.

2. *Popeye's Influence Overseas?*

Sir: The witty and knowledgeable comment by Dr. Richard Hunter (April 10, p. 746) entitled Why Popeye Took Spinach has wider significance in world nutrition, especially for mothers and children in less developed regions.

Basically, most of the world's population are obligatory vegetarians, and, as far as the infant is concerned, breast-milk is often the only food taken, which by itself will supply the full range of essential amino acids. Apart from this, protein derived from animal sources plays only a small part in infant feeding in most communities, and the transitional weaning diet is of necessity based on food mixtures of vegetable origin. In fact, protein consumed by most of the world comes from cereal staples, such as rice, wheat, and maize. However, the protein quality is deficient in cereals and also lacking in a variety of vitamins and minerals. A logical approach to home-prepared infant weaning foods can, therefore, be made by the "principle of multimixes" - that is, by combining lysine-deficient cereal with methionine-deficient legume, to which can be added small quantities of various different dark-green leafy vegetables (D.G.L.V.) as rich sources of iron, beta-carotene, calcium, &c., as well as folic acid.

Variations of this simple-seeming approach are the basis of most village-level "triple mixes", so that the question of the status, cultural image, and modern knowledge of the nutritional value of spinach can have an influence on the question of the use of a range of D.G.L.V. in the diet of young children, pregnant and lactating women, and, indeed, whole communities in less developed, largely tropical regions.

The world-wide range of edible D.G.L.V. is very large, including various species of amaranthus and other tropical spinaches, and the leaves of pumpkin,

sweet potato, cassava, &c. In fact, a search of traditional food patterns usually shows that D.G.L.V. are consumed, frequently collected wild or semi-cultivated in casual home gardens. This was the case in Britain until recent decades - for example, sorrel, nettle, and "Good King Henry" (*Chenopodium bonus-henricus*).

The importance of D.G.L.V. in infant feeding in most developing countries can be considerable, and it is therefore unfortunate to note the apparent decline in their use in many areas of the world and also the relative lack of emphasis often given to these foods by nutritionists. The reasons for the decreasing emphasis on D.G.L.V. are various. Firstly, there is a world-wide trend away from the home-grown towards the purchased. Even in many tropical areas the home garden is regarded as old-fashioned, with country-bumpkin, peasant overtones, while the "cult of the can" has become statusful. The blandishments and persuasion of more-or-less irresponsible hucksters of expensive vitamin preparations, misleadingly labelled tonics, and culturally and economically irrelevant infant foods have too often tended to be the doubtful blessings of the technology and marketing enterprise of the food industry. As part of the same trend, in many areas of the world the fruits and vegetables of prestige and status are those that are imported. This can lead to decreasing emphasis on production of local items, while the imports are always expensive and very often nutritionally much less valuable than more easily available indigenous foods. For example, in some tropical countries the imported apple has status and the local papaya is under-used "poor man's food". Similarly, D.G.L.V. are outclassed in the status-rating when compared with sometimes imported, "anaemic" light-green leafy vegetables of much less nutritional value, such as lettuce and cabbage.

Despite ethnic and nationalistic emphasis on traditional items of the diet in some places - as, for example, with "soul food" among black Americans - the pattern for modern living, including infant feeding, still tends to strive towards that of industrialised countries in Western Europe and North America. It is therefore of great interest to follow Dr. Hunter's account of the varied fortunes and vicissitude of spinach, the best known European D.G.L.V. It is apparent that spinach has had a very fluctuant reputation and image in the past two or three decades, moving from mystic "tonic" food to a depressing watery mass to be eaten as punishment, to an over-emphasis on ill-effects from nitrates and oxalates.

Dr. Hunter's comment on folic acid's relation to brain-amine metabolism may perhaps add much-needed modern scientific glamour to such rather prosaic-seeming items as spinach and other D.G.L.V. This would, indeed, be most timely since, without in any way being cultist ("the beans and greens school of tropical nutrition"). I believe the significance of D.G.L.V. in many traditional diet patterns has been underappreciated by many nutritionists. In fact, in many communities they can be correctly considered as village-level vitamin and mineral supplements. In addition, their protein content is not negligible, especially dried leaves, with, what is more, an amino acid range which is complementary to that of cereal staples.

Nutritionally it is indeed unfortunate that the Popeye saga is no longer with us. However, with the present nostalgic, escapist trend towards the diversions of a few decades back, it may well be that these cartoons will be revived. If so, they would seem to have built-in nutrition education, not only in relation to D.G.L.V. for feeding infants and mothers in less developed countries, but also possibly in relation to Olive Oyl (low-cholesterol diet) and even to Wimpy (with the hamburger epitomising a logical animal-protein/cereal "double-mix" extender of expensive meat and as a cultural disguiser of otherwise less acceptable bits of beef muscle).

D.B. Jelliffe
Caribbean Food and Nutrition Institute
P.O. Box 140, Kingston, Jamaica

3. *Popeye's Influence Overseas?*

Sir: Professor Jelliffe's letter (June 12, p. 1245) is a timely reminder of the considerable value of dark-green leafy vegetables in the diet of young children and others in areas where nutrition walks a tightrope. Indeed, it may well be relevant for us all.

But I fear a revival of the Popeye films would not be helpful, for, if my memory serves me right, Popeye's spinach came not from the garden or the bush - but from a tin. The object of the series was the promotion of the "cult of the can", which Dr. Jelliffe rightly deplores.

Joyce Leeson
Department of Social and Preventive Medicine
University of Manchester, Manchester 13

DRY BEAN PRODUCTS
From the Newsletter of the League for International Food Education, July 1971

Joseph R. Wagner and Samuel Kon
Western Regional Research Laboratory
U.S. Department of Agriculture
Albany, California, U.S.A.

The above mentioned laboratory has conducted research on the utilization of dry edible beans for many years. A number of products evolved from this program, some of which may be of interest in developing areas to supply needed protein and ready adaptability to acceptable native dishes.

Two types of powders have been prepared. One, a legume powder *which retains the flavor characteristics of the whole cooked legumes*, is prepared by simply soaking the beans, cooking thoroughly, making a slurry and drying

the slurry on a drum dryer. The flaky or powdered dry product can be reconstituted very easily with hot water. *It is suitable for conventional bean dishes such as soups and refried beans* or can be used in many other recipes to enhance the protein content.

A flake or powder of very low flavor intensity can be made by grinding the raw seeds under conditions that avoid the induction of oxidative enzyme activity. This can be done effectively by acidifying slurries of the raw beans below pH 3.85 until the enzymic activity can be eliminated by heating. Grinding and acid slurrying the beans in the raw state facilitates the breakage of cell walls to improve digestibility. Preferably the heated slurry is adjusted to pH 6.7 for completion of the cooking and prior to drum drying. *Because of the high proportion of broken cell walls this product contains a lot of free starch and is much like a flour. It is easily incorporated into flour-containing recipes as a means of increasing the protein content.*

Both drum dried products are readily amenable to supplementation with the amino acid methionine during manufacture to improve the quality of the protein. Supplementation with 200 mgm of DL methionine per gram of bean nitrogen, in rat feeding studies, resulted in PER values equal or superior to casein. This level of methionine supplementation did not adversely affect the organoleptic properties of the dry products, nor slurries nor other products prepared from them.

In vitro studies indicate that a high percent of the starch content of both types of drum dried products is digestible. However, they differ with regard to their rates of carbohydrate digestion. Some hydrolysis of the starch occurs in the preparation of the acid-slurried product. The remaining polysaccharides are more rapidly converted to maltose by amylase than the carbohydrate fraction of the powder or flakes prepared from whole cooked beans. *The greater ease of digestion and the bland flavor characteristics may be advantageous in the use of the acid-slurried product in the diets of children.*

Detailed information on these processes can be obtained from the authors. A general reference list, "Precooked Bean Products", is available free of charge upon written request to L.I.F.E.

CULINARY ARTS 1971

by

Enid Smith
D.C.N. Graduate
Senior Festival Officer, Culinary Arts

Culinary Arts is indeed one of the most popular features of the Annual Independence Celebrations which take the form of a Festival of Arts. Over the nine years of the existence of the Jamaica Festival, the Culinary Arts Competition has shown marked improvement in standards and has involved in increasing numbers, a wide cross section of the Jamaican Society.

With these factors in view it was finally decided by the Culinary Arts Committee that the Competition could be extended to include a vital programme of nutrition which would assist even in a small measure to combat the incidence of malnutrition present in the infant population of Jamaica. The Committee was divided on the issue as some felt that Festival was not intended for any such innovation and that such arrangement could be better handled elsewhere. Dr. Reddy of the Caribbean Food and Nutrition Institute suggested that the vast amount of money spent on the Competition could serve a two-fold purpose - in fulfilling the original idea as well as teaching all strata of society to use local food to the best advantage, especially in the area of young child feeding. This was eventually accepted and when introduced at the Festival Evaluation Seminar held in October last, received great approval. Dr. Robert Cook from the Institute was asked to address the Seminar and and gave revealing information on the actual picture of Protein Calorie Malnutrition existing in the Island. This information was derived from data collected from surveys and other statistical sources and proved to by an eye-opener to the participants present.

Having established the need for combating malnutrition, it was decided to ask competitors in the 1971 competition to devise a meal for a family of 4, consisting of all nutrients required to suffice one-third of the day's minimum requirement and suitable for an infant of 9 months to 3 years - the pre-school age. The cost of this should not exceed $1.00, and ingredients should be primarily indigenous foods.

At the Parish Seminars commencing in January, and conducted throughout the island, special emphasis was placed on this subject. Demonstrations were given on One-Pot meals, which was the class selected in the Competition for nutritional assessment. These demonstrations clearly depicted the use of multimixes, giving consideration to the protein, calorie, vitamin and mineral content for all members of the family. Where extra seasoning was desired for the palate of the elders, the infant's was taken out before such addition, and made palatable, attractive and suitable. There were lectures on infant feeding, showing of slides, posters, and pictures, as well as distribution of related literature. The Scientific Research Council assisted greatly in these activities and a senior member of their staff, Mrs. Sadie Campbell, showed very keen interest. The importance of proper feeding of infants even in the foetal stages was stressed very forcibly and clearly and the advantage of local foods vis-a-vis imported foods in cost and value for money was proved. People were also encouraged, where, possible, to grow vegetables in their back-yards and to rear small stock and poultry for the benefit of their families. Two such Seminars were held in each parish and people expressed their deep appreciation and felt they had gained much information.

The exercise was a tremendous success. Entries in this category, Class 8 - One-Pot and other combination, far exceeded entries in other

categories. There were 83 dishes and the adjudicators thought that all had some potential in the role of infant feeding although only 20 were selected for presentation at the National Finals. One could conclude that the seeds sown at the Seminars were now bearing fruit at parish level. The National Finals held at the Sheraton-Kingston Hotel on the 21st July were of a high standard and the One-Pot dishes were even of a better standard of preparation and presentation than at parish level. The cream of the parish Competitions was displayed.

The casserole dish awarded the trophy donated by C.F.N.I. was called "Bansha" and measured up to the standard of requirements. This was entered by Mrs. Verona Young of Water Lane in Clarendon, who also won a silver medal and cash award of $40.00 for the presentation. Thirteen other dishes in this category won bronze medals, certificates of merit and other awards. The Scientific Research Council kindly volunteered to make slides of the One-Pot dishes presented at the National Finals and took samples of each for analysis. This data will be made available as soon as it is ready and will be used to further the cause of young child feeding.

The attempt to introduce nutrition in the Competition has proved that the Jamaican populace is ready to accept changes that will be beneficial in the final analysis. The need for better nutrition is established and every avenue should be used to convey this to the public. If preventative measures are employed, it will be evident that Jamaica will be producing a more healthy nation in the long run, with the available resources. This will certainly not be an overnight achievement but if a proper foundation is laid, and the right guidelines in nutrition given, the final goal will be achieved.

The Department of Public Health, the Scientific Research Council and the Caribbean Food and Nutrition Institute are playing a great part in the dissemination of these guidelines. Success will ultimately depend on co-operation from all disciplines and in this endeavour, Culinary Arts in the Jamaica Festival will continue to give the necessary support. This particular phase can now be considered a permanent feature in Culinary Arts and it is hoped that there will be greater expansion in the future.

Thanks are duly extended to all who contributed to the success of nutrition in its experimental stage in the Competition, Dr. Reddy a former staff member of the Caribbean Food and Nutrition Institute and an ardent supporter of the cause of nutrition will be pleased to hear of this development. The Competition will in future not only be used as a channel for people to express themselves in the Culinary Arts, but also to champion nutrition as an integral part in the development of a nation.

Below is the winning recipe in the Nutrition Category:

ONE POT MEAL - "BANSHA"
C.F.N.I. Trophy - $40.00 Cash Award
Silver Medal

INGREDIENTS:

4 cups coconut milk (1g. coconut)
Bag of pimento and annatto seeds
1 lb. shad soaked overnight
1 medium onion, chopped
1 hot green pepper, chopped
3 cooking tomatoes
1 tbsp. lime juice or vinegar
2 doz. small green bananas (cooked)
¼ cup skimmed milk powder

METHOD:

Place bag with pimento and annatto seeds in coconut milk and cook until near oil stage; stir constantly. Put shad into pot of cold water, bring to boil, remove and cool. Pick out all bones. Add shad to coconut gravy, remove

annatto bag and season well with pepper, tomato and onion. Simmer until well done. Cream bananas with milk. Cover the bottom of a casserole with creamed bananas. Remove excess fat from run down and pour over creamed bananas. Pipe rest of bananas on top. Brush with fat; push in oven to reheat. Garnish and serve hot. Serves four.

READER'S LETTER

From Dr. Ann Ashworth, Tropical Metabolism Research Unit, University of the West Indies, Kingston 7, Jamaica.

Dear Sir:

On page 102 of "Cajanus" Vol. IV No. 2, 1971, Sobee is listed as a milk-based infant food. In fact, Sobee is a milk-free preparation, the chief constituents being soya flour and dextri-maltose: it is intended for infants allergic to cow's milk.

Yours faithfully

A. Ashworth

NUTRITION EDUCATION IN THE HOSPITAL*

by

E.F. Patrice Jelliffe
(Research Fellow/Nutritionist, CFNI)

The role of the dietitian in a hospital is an extremely important one, but at times, especially in developing countries, it may not be fully appreciated by other hospital staff. This may occur through a lack of knowledge, because of the frequent imperfections of human relationships, or because of the narrow interpretation by the dietitian herself, or by the medical, nursing and administrative staff, of the scope of her responsibilities.

A hospital should be considered by all as a community project especially as a centre for education and not as an isolated medical enclave with a subsidiary division, dealing with diet sheets and food service.

In order to be maximally effective in her work, the dietitian newly appointed to a hospital must first put her kitchen in order. In this she can only succeed if the hospital administrator appreciates her needs which will permit her to give efficient service. She will need a good supporting staff - food supervisors, cooks and other auxiliary staff, equipment which actually works, and can be repaired locally and speedily, and an efficient system of ordering foodstuffs, which will assure a reliable supply of good quality fresh foods, at a reasonable price, so that the kitchen attendants do not waste their time and that of the dietitian, as so often occurs, searching for meat

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*Presented at a Technical Group Meeting on "Food and Dietary Services in the Contemporary Caribbean", Barbados, November 19 to 22, 1970.

among pieces of bone and endlessly and wastefully trimming poor quality vegetables.

Accurate inventory records are needed, permitting an improved purchasing pattern of processed foods of good cost nutrient value.

In many hospitals which have not benefitted from the services of a dietitian or a nutritionist, only haphazard menus may be available, which were devised in the past by transient interested physicians, or senior nurses, with little nutritional background, or were inherited and handed down through the ages by various hospital administrators.

In such a challenging situation, the dietitian will be ideally placed in some ways, in that she can devise within the same budgetary framework up-to-date, nutritionally and culturally acceptable recipes, utilizing as much as possible, seasonally available local foods.

The dietitian can also consider preparing a short questionnaire directed to both hospital staff and patients which could acquaint her of the food preferences of the community she intends to serve.

For the efficient implementation of advance menu planning, the cooperation between doctors, who will order special therapeutic dietaries and who need the dietitian's expert advice, and senior nursing staff, who are responsible for the ordering of all dietaries, is essential. Regular meetings between members of these groups would improve their working relationship and their understanding of existing problems, as well as promote a better standard of nutrition in the hospital.

The area of nutritional influence of the dietitian could be defined under the following headings:-

1. *Food preparation*

   (a) For healthy consumers;

   (b) For sick consumers, which takes into account patients who partake of the full dietary and infant and special diets;

   (c) Foods prepared for demonstration purposes, in clinics and wards.

2. *Training*

   (a) Kitchen staff at all levels;

   (b) Orientation of physicians and senior nursing staff;

   (c) Teaching in the curriculum of medical students, nurses and midwives in training.

   (d) Teaching of patients in wards, in clinics, and in homes, with the help of dietetic aides and nutrition auxiliaries.

3. *Liaison visits*

   This implies close coordination with medical and nursing staff, home economists in the area and also with agricultural extension officers and community development workers.

These activities may seem for the already overworked dietitian, an impossibility, but by projecting her desire to improve the nutritional status of the community, by offering her skills and by training others to help in her activities, her full potential will at last be appreciated.

Food preparation

In order to have an efficiently operating hospital, the healthy consumers must be well fed. Hospital workers are an unusual breed of people who have in many cases accepted a rather unphysiological and indeed highly stressful mode of existence. Most dietitians will be aware of the great expenditure of energy required by doctors and nurses, their long spells of duty and often

exhausting conditions of service, which includes daily contact with infection, requiring them to be at their peak of personal physical fitness.

Meals for these groups must be not only nutritionally satisfying, but must be attractive and aesthetically served, in order to tempt the appetite of often very tired and emotionally harassed people who witness daily the ravages caused by disease and death, to which no one can ever become fully reconciled.

In countries, in which a choice of medical and nursing training schools exist, it would be interesting to note how much the reputation of good food, as well as other criteria, has influenced the students in their choice of a particular hospital.

A very special effort for night staff should be made. Their normal life rhythm is altered, with frequent staff shortages they are often under pressure, and if they anticipate cold unappetising meals, they may forego this unpleasant experience, and will make do with some small nutritionally unbalanced snack in the ward kitchen. The meagre salaries of junior nurses and doctors should not have to be spent purchasing food during their off duty hours.

The time when micro-ovens will be available in hospitals permitting night staff to heat their own meals is not with us, as yet, in the Caribbean, but practical efforts should be made to ensure and promote better services for night workers.

In the Commonwealth Caribbean, where problems of obesity exist, the cultural practice of preparing at one meal several calorie rich foods, such as rice, plantain, sweet potato or yams should be avoided, as it would benefit both hospital staff and patients physically and would educate them in the concept of a balanced dietary.

If a good understanding exists between medical, nursing and dietetic staff, much can be achieved to promote the well-being of the patients. It should be remembered, that the word hospital is derived from the Latin *hospes*, which means guest, but one may wonder at times whether the feeling of friendly hospitality is extended to patients. In an alien, lonely, and often frightening world, the serving of accustomed food may be a welcome and reassuring feature of the hospital stay. But how much of the food served is actually consumed? Florence Nightingale,[1] a most enlightened nurse who appreciated the value of a balanced assimilable diet in illness, mentioned four points which could promote a lack of appetite in sick people.

A defect in cooking, a defect in the choice of diet, a defect in the choice of hours in taking diet, and a defect in appetite of the patient. Of course, to these basic defects, others come to mind, defects in the attitude of nursing staff, their indifference or attempts to hurry paitents who must be fed, defects in presentation of the meal, defects in the appearance, taste and cultural acceptability, defects in physical surrounds [proximity of other seriously ill patients,(odours, sounds etc.,)] defects in the psychological make up of the patient [depression, anxiety], and of course defects in the physical well-being of the patient causing anorexia, vomiting or inability to masticate or swallow foods.

In a study carried out by Platt, Eddy and Pellett[2] in 1963, covering 152 hospitals in England and Wales, it was found that the best food service was available in hospitals of less than 60 beds. In the larger hospitals, plate waste from breakfast foods was of the order of 25% whilst lunch and evening meals accounted for 35% to 40% of rejected food.

It is presumed that the dietaries in these hospitals had taken into account the daily nutrient requirements of the patients. Thus it could be deduced that the majority of the patients existed on insufficient food intakes at a time when their nutritional needs were critically high. What is the situation in our hospitals in the West Indies?

All dietitians need to be fully aware of the importance of nutrition in illness and much research has been undertaken in this area.[3] Illnesses and stresses of all kinds, both mental and physical ones such as fractures, burns, arthritis as well as fevers, vomiting and diarrhoea, will contribute to malnutrition states.

As well as decreased food intake due to anorexia, losses may occur of essential nutrients, such as nitrogen and potassium, leading to muscle wasting and electrolyte disturbances.

Kinney et al, studying patients who had undergone major surgery, found an average weight loss in them of 6% within 10 days after operation, due in part to pre-operative procedures such as reduced calorie intake and catharsis.

From all these studies, a clear message emerges, *feeding the patient with calories and proteins and other nutrients as part of a balanced diet can minimize protein losses* and will promote wound healing in surgical cases. Ascorbic acid is also thought to be useful in this context because of its relation to collagen formation.

Thus, it is of the utmost importance that the dietitian, who has scientifically and conscientiously devised and planned hospital dietaries, should ensure that they are consumed by the patients. When possible, a choice of menus should be available. In the wards, with the assistance of sisters, the nurses or auxiliary staff serving the meals, should be made aware of their

important responsibilities in the matter of feeding patients.

Junior nurses often consider the serving of meals as a routine chore to be discharged swiftly, but they should be made to appreciate that the daily dosage of calories, proteins, vitamins and minerals is as essential as the more dramatic-seeming blood transfusions, or injections of drugs. The dietitian, ward sisters and tutors in teaching the nurses should make them "nutrient conscious", so that they should be as concerned if a patient rejects his food as they are when a medicine is refused or vomited.

In paediatric wards, often overcrowded with cases of severe or marginal malnutrition, "feeding hands" are usually at a premium, yet "rehabilitation by food" is the medicine required by these children.

If parents, auxiliary or voluntary staff are helping to feed the children, the advice regarding quantity to be served to the child, etc., by a member of the dietetic staff would prove valuable, and charts of quantities of food to be served to children of different age groups would be useful and would minimize plate waste.

With the unfortunate trend away from breast feeding, a large number of children admitted to the wards are completely or partially bottle fed, yet it is rare indeed for the nursing staff, or at times even the physicians, to know the calorific and protein, mineral and vitamin content of the feeds given. The magic formula "give 2½ oz. of milk per lb. of body weight" is used with success, but how much more meaningful it would be to know, the *actual nutrient* dosage related to the daily requirements of the infants.

Preparation of foods

It is well known, that nutrient losses occur during the cooking of foods. Within the institutions in the Caribbean, how prevalent is the custom of

over-cooking fresh foods? In the British study previously mentioned, in over one-third of the hospitals observed, green leafy vegetables were cooked for 55 minutes or more routinely, and in two hospitals for over 115 minutes with an obvious loss of valuable nutrients. It is most important that the cooks realize the importance of their job in promoting good health in the hospital. A hospital which has the reputation of serving fresh appetising vegetables will be not only a credit to the dietitian, but also a valuable tool for educating the public and promoting better dietary habits in the community.

Training. Content of nutrition education

It has been widely acknowledged that, although hospitals should be the centre of excellent nutrition education, often inadequate or indifferent teaching and advice is given to staff and patients within its precincts. This may be due to multiple causes the primary one being a lack of coordinated nutrition education policy. With a well trained competent and experienced nutritionist dietitian, this unfortunate situation could be much improved.

In the larger hospital library, books and journals dealing with the subjects of nutrition and dietetics should find their place beside medical texts, and if activities such as journal clubs exist, the dietitian should participate and bring to the notice of her colleagues relevant up-to-date articles in the field of nutrition.

A realistic appraisal of the content of practical nutrition classes to nurses should be made. They should use their intelligence, time and energy to a better purpose than making beef tea or barley water. During their training visits to the kitchen should be made, so they can appreciate the amount of work and the intricacies involved in preparing staff and patient dietaries. They should be asked to make an evaluation of what they have learnt during

these visits. Teaching to other cadres of personnel should also be realistic in its content.

In the clinics and wards, nutrition education can be introduced through talks given by trained staff and auxiliaries to patients and their relatives (at least at visiting times), especially to mothers of sick children and the vulnerable pregnant and lactating women. These talks could be usefully illustrated by demonstrating portions of seasonally available cooked local foods and nutritious food mixtures, stressing their cost nutrient value. If donated foods are distributed, special demonstrations on the use of these is very important. Ideally if feasible, the foods should be cooked in front of the audience. Simple recipe leaflets should be available for participants to take home.

These activities should be a cooperative effort between the disciplines of nursing (hospital and public health) dietetics and home economics and suitably trained auxiliary personnel could be usefully employed.

As well as therapeutic nutrition clinics available for patients with specific metabolic disorders, orientation clinics for the obese and for the elderly should be considered.

Close cooperation with public health nurses visiting families "at risk" in the community is yet another valuable extension of the hospital dietetic service. Such projects using nutrition and home economics aides have been developed in some cities in the U.S.A.[4 & 5] If hospital demonstration gardens exist or are adjacent to a nutritional rehabilitation centre, these are of an educational value to the recuperating ambulant patient and the parents of malnourished children. Again cooperation is required between the dietitian, agricultural extension staff, medical, nursing and administrative staff

of the hospital.

Isolated efforts by *one discipline alone* will *not* improve radically the nutrition awareness of hospital consumers, or indeed, their nutritional status. An interdisciplinary team effort using both fully trained and auxiliary personnel could transform the hospital stay of patients - often a dreaded and dreary episode - into a meaningful, learning experience which would prove of value to them when they resume their normal life in the community.

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CFNI NEWS

The Guyana National Food and Nutrition Survey which was carried out during the months April, May and June has now been completed. The results are being processed and we hope that the preliminary "raw data" will be ready for the Guyana Government by November.

The Institute is happy to welcome another new member to its staff, Dr. Kenneth Antrobus, who has taken up a post at the Jamaica Centre as a Medical Nutritionist. Dr. Antrobus, who is from St. Vincent, was formerly attached to Save The Children Fund in that country. He has recently completed a one-year course at the London School of Hygiene and Tropical Medicine, from which he obtained the Diploma in Tropical Public Health.

On July 14 another one-day seminar on Young Child Feeding was held in Bermuda. To date, these have been held in most of the islands in the Caribbean area and it is anticipated that the other islands will be covered in the near future.

THE FUTURE OF SOYABEAN IN THE CARIBBEAN*

by

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Experiments on soyabean have been in progress in the Faculty of Agriculture of the University of the West Indies since 1967, and we have now reached that difficult stage in the development of any new crop - the stage between small-plot research and large-scale commercial planting.

Considerable quantities of soyabean oil and soyabean meal are currently imported by the territories of the Commonwealth Caribbean, so that the possibility of reducing importation by local production is attractive. As an oilseed crop soyabean is not a crop for the small farmer. Economic production of soyabean would have to be undertaken on relatively large farms and must be fully mechanised.

Satisfactory yields of soyabean, in the order of one to 1.5 ton per acre, have been obtained in Trinidad and Jamaica respectively from experimental plots. This level of yield compares favourably with that found in many parts of U.S.A., the principal soyabean producing country. Experimental plots however, receive a great deal of care and attention. Yields from small plots are not an accurate guide to the level of yield of commercial plantings where much less care can be lavished on the crop and yields are inevitably lower.

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Although the agronomic requirements of the crop in the Caribbean are by no means fully known, sufficient data on varieties, row spacings, plant population, sowing dates and fertilizer response are available to enable sound interim recommendations to be made. Research on these and other topics will have to be continued if soyabean is developed as a commercial oil-seed crop.

Information Needed

Information on the cost of production of soyabean grown on a field scale in the Caribbean is virtually non-existent. So far, very few attempts at "non-experimental" production have been made and in those plantings modern methods of mechanised production were not utilized. Costings from such plantings are no guide to production costs of a fully mechanised system. Realistic production costs can be obtained only by growing relatively large acreages - a minimum of say 20 acres - under commercial conditions with full mechanisation. Such a study is an essential prerequisite in determining the feasibility of introducing soyabean as an oil seed crop.

Large Areas

If soyabean proves an economical proposition as a commercial oil-seed crop in the Caribbean, the question of land availability arises. The area required will be determined by (a) the production requirements of a single territory or of the CARIFTA region - this can be estimated from the average yield obtained in large scale plantings, (b) the minimum quantity required to justify investment by the local processors in extraction equipment. For mechanised production the land must be in large blocks and reasonably level. Texturally, it should be a well-drained medium to heavy loam. Any form of

surface drainings must be such as will not impede the operation of machinery - particularly combine harvesters. A supply of irrigation water will be needed to ensure full utilization of the land. Techniques and regimes of water application will need to be examined to ensure economical and efficient use of water. It will be necessary to grow soyabean in rotation with maize or other crops which can be mechanised. Because of its relatively long growing period (4-4½ months) and the need to mechanise, soyabean cannot be intercropped with cane or other crops.

Farming Techniques

The modern techniques that will need to be exploited if production costs are to be kept down include the following:-

(i) Drilling to a stand with tractor tool-bar mounted precision seeders.

(ii) Chemical weed control with a residual soil-acting herbicide, probably band-sprayed at the time of drilling. Tractor-hoeing or shielded sprays will be needed for inter-row weed control, and post-emergence directed or overall sprays may be necessary to achieve a sufficient duration of control.

(iii) Minimal insecticide treatments to control leaf-eating and leaf webbing insects. Since a series of sprays is likely to be necessary, the crop may need to be grown with tractor wheel-ways at appropriate intervals to minimise mechanical damage to established plants.

(iv) Mechanical harvesting by combine harvesters. The harvesting of crops maturing during wet periods is likely to pose problems. Planting at such times as will minimise the

likelihood of wet harvests is an obvious move, and foliar desiccants may be useful in those cases where harvests are unexpectedly wet.

(v) Artificial drying facilities may be needed, since soyabean can be safely stored without rapid deterioration only at a moisture content of 12% or less.

There is a need to develop suitable and reasonably profitable crop rotations - maize/soyabean rotations have been proposed for Trinidad (Radley, 1968*). Dry beans might be a suitable crop in rotations in Jamaica and Belize. Soyabeans show limited and uncertain responses to direct fertilizer applications, but applications elsewhere in the rotation may be effective in improving soyabean yields. Rotations must take into account expected rainfall patterns - in regard to satisfactory sowing dates, to minimise the need for irrigation and to avoid excessively wet harvesting conditions with the dangers of seed sprouting and seed decay.

Equipment

The investment in machinery for large commercial plantings is considerable. Radley (1968) listed the requirements for 450-500 acres as follows:

1 Combine harvester, self propelled
1 Corn attachment for above
2 Tractors (60 h.p.)
2 Disc ploughs
2 Disc harrows
2 Rotavators

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*Radley, R.W. (1968) *The prospects for soyabean production in Trinidad and Tobago. J. Agricultural Society Trinidad & Tobago.*

2 Toolbars, each with four (or more) precision seeder units

2 Sprayers, tractor-mounted.

This equipment could also be used for corn, although a high-clearance tractor for insecticide application might be required. To this list should be added band spraying equipment for the seeder units, hoe legs for the toolbars, or separate steerage hoes. On certain soils a rotavator might not be necessary and could be replaced by tine harrows. Furrow formers or ridging bodies would be necessary for surface irrigation. Such an inventory is likely to cost J$30-40,000. In addition drying facilities would be necessary. An important point is that carefully scheduled staggered plantings would be essential to ensure proper utilisation of the combine, without shattering losses, and of the drying facilities. An investment of J$40,000 per 500 acres is J$80 per acre. Written off over 5 years, this is a depreciation charge of J$16 per acre per annum. Repairs, maintenance, replacement and running costs would be additional fixed overhead charges.

For investigational purposes a less extensive machinery budget would be required. For 20 acres the following would be sufficient, assuming that basic cultivation equipment and tractors were available on hire or loan. The inventory might be as follows:

1 Combine harvester, trailed and P.T.O. driven (about 5 ft. cut)

1 Toolbar with four precision seeder units

1 Set band spraying equipment

1 Steerage hoe

1 Sprayer, tractor mounted

This would probably cost about J$7,000 and is a minimum machinery investment.

In the Commonwealth Caribbean, only Belize, Guyana, Jamaica and Trinidad & Tobago have large tracts of "mechanisable" land. In Belize and Guyana large areas of uncropped land are available which, if found suitable for soyabeans, and if irrigation can be made available, give these two territories considerable potential for soyabean production. The Ministries of Agriculture of these two territories are currently engaged in trials on soyabeans. In Jamaica and Trinidad, suitable lands are currently under sugar cane. Soyabean production on a commercial scale would depend therefore on a change of land use which involves policy decisions. Such policy decisions must be based on reliable data from investigations along the lines outlined above which should take into account the entire rotation.

Although the above account has considered soyabeans as an oil-seed, it must be borne in mind that the protein-rich residue after oil extraction is an important feeding-stuff for livestock. Soyabeans also can be processed to make attractive protein supplements for young children - and indeed to make nutritious and acceptable meat substitutes. The value of soya protein in the Caribbean therefore is an additional factor to be borne in mind in decision-making on commercial production of the crop.

BETTER NUTRITION STUDIES*

by

F. Barbara Orlans

Nutrition experiments. What is the first thing that comes to mind when you hear those words? Do you think of *deprivation* studies or something else? Those teachers and students who equate nutrition experiments with deprivation studies betray a decided lack of imagination. Unfortunately, various commercial bodies have so successfully promoted inadequate-diet experiments on animals (by providing free animals and "deprivation kits") that high school teachers have been conditioned to accept these studies in the curriculum and as suitable science-fair projects, often to the exclusion of more revealing experiments. This heavy reliance on improper-feeding experiments should be replaced by nutrition studies that are more humane and more relevant to society's needs.

What's Wrong with Deprivation Studies

Present guidelines for the use of animals in science fairs require that deprivation-of-nutrients experiments "proceed only to the point where symptoms of the deficiency appear" (National Society for Medical Research Ad Hoc Committee, 1969). However, this caution has proved ineffective because inexperienced youngsters working at home (and even teachers, if untrained in pathology) cannot identify that "point". The lingering death of deprived animals has been reported at several science fairs, and yet the students have said they had no idea the animals were so sick.

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These guidelines also require that after disease symptoms appear the dietary deficiency shall, if possible, be corrected; otherwise the animals must be humanely put to death. As most youngsters do not have the experience, the equipment, or the knowledge of the symptoms and doses needed to fulfill these requirements, they should not undertake diet-deficiency experiments for science competitions.

In addition to the technical difficulties of conducting these experiments properly, there are moral, psychologic, and social objections to deprivation studies in elementary and secondary schools. Is it morally justifiable to demonstrate established facts over and over again when animal suffering is involved? If the intentional infliction of crippling disease is tolerated, then with as much justification the effects of bad driving could be portrayed by squashing animals between metal and concrete until their bodies are crushed. Plainly, the adverse effects of such demonstrations outweigh their possible educational benefits. Surely the many alternative ways of conveying the same information - movies, discussions, and the like - are preferable to those that harm animals.

How readily do students relate their own food habits and human nutritive problems to the experience of watching rats slowly losing their hair and developing swollen eyes, bloody nostrils, and pneumonia? A youngster may not be persuaded by the teacher's directive, "Well, now go and eat a good breakfast".

Hurting Animals Has Hardening Effects

It is of paramount importance that the child first develop a positive attitude to life and be protected from violent experiences. A youngster is not asked to put an animal to death; nor should he be required to hurt one.

Yet insensitiveness to these issues has led the National Dairy Council (1968) to promote *second*-grade class demonstrations of growth retardation in chickens not fed milk products. Such activities can be emotionally upsetting or - even worse - emotionally desensitizing or hardening, to immature minds. It is wrong to condition children from an early age to watch or participate in hurting animals. How much better it would be to have second-graders undertake studies suggested in the *Kindness Club Project Manual* (National Humane Education Center, 1969).

A manual produced by another commercial enterprise to promote inadequate-diet experiments on animals by young students states, "One who loves animals will deeply sympathize with the [diseased] animals when their symptoms appear but he must realize that this is the result we have been working for. ..." (General Biological Supply House, 1937). But should we help children to overcome or, on the other hand, to preserve their reluctance to hurt animals? Sensitive youngsters turn away from deliberate infliction of pain and disease on helpless animals. They do not want to be responsible for causing animals to become blind, unable to walk, or retarded in growth. There are many accounts of teenagers sabotaging class demonstrations of inadequate-diet effects by slipping the mice wholesome nourishment when the teacher wasn't looking. In these formative years, should not kindly instincts be fostered rather than suppressed?

Disproportionate Emphasis on Vitamins

The U.S. Food and Drug Administration has said, "Vitamins and minerals are supplied in abundant amounts by commonly available foods. Except for persons with special medical needs, there is no scientific basis for recommending routine use of dietary supplements" (*Federal Register*, Dec. 14,

1966: 31 FR 15746). Many food and drug company advertisements, however, prefer to suggest that large numbers of affluent, overfed Americans may suffer vitamin deficiencies, and too many teachers unwittingly promote this fancy by undue attention to vitamin-deficiency experiments. James L. Goddard, former commissioner of the U.S. Food and Drug Administration, has declared, "We may *already* have achieved an optimum of *mis*understanding about the nature and value of [vitamin] products" (Goddard, 1968; italics in original).

Attention should be directed, instead, to the real American problem: obesity. As many as 23% of teenage girls and 18% of teenage boys are obese - and obese youngsters are less likely to be accepted at high-ranking colleges (Canning and Mayer, 1966). Among the middle-aged, obesity is accompanied by a threefold rise in heart disease. Among the poor, some 44% of women and 34% of men are obese (Goldblatt, Moore, and Stunkard, 1965). How instructive and constructive it would be, if youngsters (especially those from impoverished homes) were told to purchase a week's breakfast of high nutritive value for a small sum, recording the relative costs of protein, carbohydrates, and fats. Constructive advice about fad foods and the factors that result in obesity would constitute practical education in nutrition. Sound, scientific facts and answers to commonly asked questions about obesity are provided by the professor of nutrition at Harvard University in an excellent book, *Overweight* (Mayer, 1968).

Sound Ways of Teaching Nutrition

Of course, there are many ways to learn about the deleterious effects of poor diet without harming or killing animals. Clive M. McCay, professor of nutrition at Cornell University, has pointed out that "hundreds of good

nutritional experiments....can be done without any suffering of the animal(s)" (McCay, 1956). For instance, compare the rates of growth of animals kept on (i) standard laboratory chow given *ad lib.* with those kept on (ii) a varied diet comprising many different kinds and tastes of foods and those on (iii) a varied diet with high protein content. Does diet affect their social behavior? Demonstrate in class how animals, when offered both suitable and unsuitable foods, will select a balanced diet of correct proportions and amounts. The lesson is, if rats can do this, so perhaps can teenagers! Measure the metabolic rates of animals and human beings. Show photographs or movies of well-conducted demonstrations of improper animal diet. (See references for movies.) Make chemical analyses of foods for mineral content.

Keep a detailed record of students' eating habits and assess the nutritive values. Elicit reaction time, decision-making ability, and work ability of a group of students who have regularly omitted breakfast for four weeks; then have them eat a good breakfast and retest, comparing the results. (A simple, standard psychologic test, which could be used, is the time taken to sort a deck of cards into suits and rank. The results may comport with recent professional findings that made use of a variety of tests: when breakfast was omitted students took longer to make decisions, had less neuromuscular control, and did less work.) Collect data on the school-lunch and milk programs: does the availability of hot lunches and milk coincide with distribution to the neediest children?

Study newspaper accounts of famine in Biafra or India. Read the recent HEW national survey of malnutrition in the United States, by Arnold E. Schaefer (1969). Make a study of local welfare distribution to the

indigent and try to assess its adequacy. Study the objectives of the National Council on Hunger and Malnutrition in the United States and read its Action Reports (available from the Council, 1211 Connecticut Ave., N.W., Washington, D.C. 20036). Ponder the concise book, *Still Hungry in America*, by Coles and Clayton (1969).

Check local shops for fortified or enriched foods; for example, milk or bread to which vitamins and other nutrients have been added, and iodized salt. (A recent national survey found that 5% of people examined had an enlarged thyroid gland, indicating iodine deficiency; yet 40% of food markets surveyed in Texas failed to stock iodized salt and the shopkeepers were unfamiliar with its purpose [Schaefer, 1969].) Compare the cost of milk fortified with vitamin D with the cost of unfortified milk. Currently there is no law governing the enrichment of foods; discuss the advisability of such a law.

The following examples are taken from interesting nutrition pamphlets issued by the U.S. Food and Drug Administration (see references). Ask the students to make a list of food additives on labels of foods that have been purchased for use at home and determine which are useful and which are useless and even potentially harmful. Check labels from a variety of foods and classify all label statements according to which requirements of the Food, Drug, and Cosmetic Act the statements are intended to meet. Give three students an identical shopping list (for example, bread, orange juice, cheese, and canned peas) and have them shop individually, without adult help. Compare their purchases and have them explain how they decided on each purchase. Compare methods of food preparation and preservation 50 or more years ago with present-day methods. Visit a grocery warehouse, a

food-processing plant, or a farmer's grain bin.

Many other studies could be added, but enough suggestions have been offered to indicate the range of pertinent and compassionate investigations that will inform students about current problems while providing a sound education in nutrition.

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U.S. FOOD AND DRUG ADMINISTRATION. 1968c. *Identity of synthetic colors in foods.* ("Science project" series pub. 57.) Superintendent of Documents, Washington, D.C.

The following films describe the role of vitamins and the effects of deficiency. Names of firms that lend the films without rental charge are given in parentheses.

Foods and nutrition, b/w, 11 min.; Encyclopaedia Britannica Films, Wilmette, Ill.

Vitamins, b/w, 14 min. (Medical Motion Pictures, Merck Sharpe & Dohme, West Point, Pa.)

Vitamins and some deficiency diseases, color, 35 min. (Lederle Laboratories, Pearl River, N.Y.)

Vitamins and your health, color, 20 min. (Eli Lilly Co., Indianapolis, Ind.)

GENERAL NUTRITION NEWS AND OPINION

FAO SEES GREATER DEMAND FOR MEAT
From the Trinidad Guardian, August 7, 1971

World demand for meat will continue to be greater than supplies during the next 10 years, it was predicted here today in a study presented to a newly-created international Study Group on meat at the Food and Agriculture Organisation.

The meeting of 59 meat producing and consuming countries predicted that world demand for the four principal categories of meat - beef, veal, poultry and pork - is "likely to remain strong and prices of most meats will probably average higher" during the remainder of 1971 and 1972.

Beyond that, the FAO report said, assuming constant prices, "the rising living standards and the expected population increases would raise world demand in 1980 for the four major categories of meat by about 35 million tons, or some 40 per cent above the estimated 1970 actual consumption levels".

Most of the demand in the world is for beef and veal - 40 per cent of the total - followed by pork and poultry, accounting for about 30 per cent each. A significant point in the FAO study was the predominance of beef, veal and sheep meat in the consumption pattern of developing countries.

Nearly 70 per cent of the meat eaten in the developing countries comes from cattle and sheep, compared with less than 50 per cent in the developed, industrial countries and somewhat over a third in the centrally planned countries of East Europe and the Soviet Union.

North America, Europe and the Soviet Union, said the report, will continue to meet most of the increases in demand from domestic production. However, the amount they must still import - a relatively small percentage - is, in fact, very large in quantity. Import needs will be greatest for beef, veal, mutton and lamb.

Statements by delegates from developing countries at the meeting, the largest single group, showed that strong efforts are being made in these countries to increase meat production, with national and foreign investments growing larger. Thailand, United Arab Republic and Upper Volta said their aim was to meet ever greater domestic demands for meat while Argentina, Botswana, Brazil, Kenya, Romania and Sudan said they were increasing both consumption and exports. Argentina, one of the world's principal meat producers and exporters, said it expected to increase production in the next year following a slow-down caused by recent drought conditions.

PRINCESS GRACE URGES BREAST-FEEDING
From the Advocate-News, Barbados, July 20, 1971

Princess Grace of Monaco has urged mothers to breast-feed their babies to help encourage the family relationship and thereby combat what she called "this current wave of public indecency".

The royal mother of three came to Chicago to address La Leche League International, an organisation found by a group of mothers in Franklin Park, Illinois, 15 years ago to encourage other women in breastfeeding.

Her serene Highness, looking as slim and youthful as she did in her film career as Grace Kelly, told a news conference Friday she believed all women and particularly mothers could do something about decadence in society.

"Really just watching some of the television commercials, hearing some of the songs being sung, magazines, films, everything, it seems to me nothing is sacred anymore," Princess Grace said.

"It's kind of difficult, I think, in bringing up children to try to give them a sense of values with all this exposure to everything being debased and made ridiculous.

"When other children in a family can watch a mother breast-feeding a little baby and being able to do this without embarrassment this helps them to realise the wholesomeness of sex and the naturalness of it all.

"This helps prepare them for what they are exposed to outside of the home and they don't get the wrong ideas and put sex in the wrong proportion."

She cited an excerpt from the speech she delivered to the League Friday night which said:

"I wasn't influenced (to breast-feed) by anyone except my own feelings on the subject. I couldn't think of having a baby without feeding him myself. It made it more complete."

MALNUTRITION AND DEVELOPMENT
From the address of Robert S. McNamara, President, World Bank Group, to its Board of Governors, September 27, 1971

Much of the most significant knowledge dealing with nutritional deficiencies - and most particularly the implications for development - has been discovered only recently. Even now the full extent of these deficiencies in the less-advantaged countries and the degree to which they seriously limit economic and social progress is only beginning to become apparent. And we have hardly even begun to develop plans to deal with the problem.

The argument I shall make is that:

(a) Malnutrition is widespread.

(b) It is a major cause of high mortality among young children.

(c) It limits the physical - and often the mental - growth of hundreds of millions of those who survive.

(d) It reduces their productivity as adults.

(e) It is therefore a major barrier to human development.

And yet, despite the evidence that with a relatively small per capita expenditure of resources major gains can be achieved, there is scarcely a country in the developing world where a concerted attack on the problem is underway.

The number of childhood deaths is enormous in the poorer countries. Malnourishment severely lowers immunity to infection, and tens of millions of children succumb each year to preventable fatalities simply because they have no reserves of resistance. The Food and Agriculture Organization states that "malnutrition is the biggest single contributor to child mortality in the developing countries". And that contention is borne out by the Pan American Health Organization's reports of studies in Latin America which show malnutrition to be either the primary cause, or a major contributing factor, in 50 to 75% of the deaths of one- to four-year-olds.

Clearly, the first result of widespread malnutrition is high child mortality. But not all malnourished children die. Hundreds of millions of those who live - and the FAO and WHO estimate that as many as two-thirds of all surviving children in the less-developed countries have been malnourished - suffer serious deprivation of the opportunity to realize their full human potential.

The deprivation often begins before the child is born. In the last three months of pregnancy, and the first two years after birth, a child's brain reaches nearly 90% of its structural development. During this critical period, a deficit of protein can impair the brain's growth. Autopsies have revealed that young children who die of protein-calorie malnutrition may have less than half the number of brain cells of adequately nourished children in the same age group.

While it is difficult to distinguish the effects of protein deficiency on child development from other aspects of poverty in the child's environment, there can be no serious doubt that there is a relationship between severe malnutrition in infancy and mental retardation - mental retardation which more and more scientists are concluding is irreversible.

But malnutrition attacks not only the mind but the body as well. Protein deficiency seriously limits physical growth. The Director of the National Institute of Nutrition in India reports that 80% of the nation's

children suffer from "malnutrition dwarfism". Low-income populations almost universally have a smaller body size. The FAO estimates that more than 300 million children from these groups suffer "grossly retarded physical growth".

Prolonged into adulthood, the poor mental and physical growth characteristics of the early years can greatly impair the range of human capacities. Add to that the current low standards of nutrition for grown adults in much of the developing world, and it is clear why there are adverse effects on the ability to work. Workers who are easily fatigued and have low resistance to chronic illness not only are inefficient, but add substantially to the accident rate, absenteeism, and unnecessary medical expenditure. More serious still, to the extent that their mental capacity has been impaired by malnutrition in childhood, their ability to perform technical tasks is reduced. Dexterity, alertness, initiative: these are the qualities that malnutrition attacks and diminishes.

We are not speaking here of dietetic nuances, or the fancies of food faddists. We are speaking, instead, of basic nutritional deficiencies which affect the minds and bodies of human beings. But the problem is so dimly perceived, so readily dismissed under the pressure of other priorities that we have neither applied the knowledge now at hand, nor mobilized the resources required to broaden that knowledge further.

In one sense, of course, the ultimate cause of malnutrition is poverty. But this does not mean that we either must, or can even afford, to wait for full economic development to take place before we begin to attack the problem. On the contrary, reducing the ravages of serious malnutrition will itself accelerate economic development and thus contribute to the amelioration of poverty. And there are a number of practical steps which can be taken even within the limitations of our current knowledge and economic priorities.

As in the case of the population problem, the nutrition problem represents less a need for new and immense amounts of development capital, than a need for realistic understanding of the situation. What we already know suggests that to meet basic nutritional deficiencies of hundreds of millions of the developing peoples will not entail unacceptable costs. It has been estimated, for example, that at a cost of $8 per child per year one could make up the deficiencies of a diet that now deprives him of one-fourth of his protein need and one-third of his caloric need.

There are, in fact, many promising possibilities for increasing the nutritional value of food through low-cost agricultural and industrial solutions:

(a) Crop shifts - through appropriate pricing policies - from low-protein cereals to high-protein pulses.

(b) The introduction of higher nutritive strains of conventional cereals, such as the new high-lysine corn which doubles protein value.

(c) The fortification of existing basic foods to improve their nutritional value, such as the protein fortification of cereals, and the vitamin and iron fortification of wheat flour.

(d) The development and distribution of wholly new low-cost processed foods, particularly for the feeding of young children, using available oilseed protein.

There are, of course, many other solutions - some already available, some near at hand on the research horizon - which deserve support. But the central conclusion I wish to propose to you is that the international development community and the individual governments of the countries concerned must face up to the importance and implications of the nutrition problem.

DEVELOPED NATIONS COMMERCIAL POLICIES ATTACKED
From The Daily Gleaner, November 10, 1971

Kenyan Agriculture Minister Jeremiah Nyagah has attacked the commercial policies of rich countries, which he said caused serious problems for the developing nations.

Nyagah, who was addressing the 16th governing conference of the United Nations Food and Agriculture Organization (FAO), said inflation, which the rich nations had not stabilized, inevitably affected the trade of the poorer nations and caused continuous rises in the prices of agricultural imports.

"We also have the menace of synthetic development in which most of the developed nations have vested interests and which slowly and surely curtails the growth of our primary products," Nyagah said.

"Furthermore, we see the developed nations becoming more and more protectionist in their trade policies thereby killing our hopes for growing exports," he added.

"Prices of capital goods soar upwards while prices of our primary products repeatedly suffer wide fluctuations."

Nyagah went on to express his country's full support for the speech of Dr. Norman Borlaug, American Nobel Prize winner, who defended the use of DDT, in a lecture at the opening of the FAO conference.

FISH FLOUR: PROTEIN SUPPLEMENT HAS YET TO FULFILL EXPECTATIONS*

by

Constance Holden

Fish flour, or fish protein concentrate (FPC), was hailed during the days of the New Frontier as the possible miracle solution to the world's nutrition problems. Since then, its development has bogged down in a morass of economic and technical realities, and interest in the product has been kept alive in the United States almost solely by continuing research efforts on the part of the federal government. The day private enterprise will decide to undertake a serious commitment seems distant.

Fish protein concentrate is a refined version of fish meal, which has long been produced in massive quantities for animal feed. In 1950, the VioBin Corporation of Monticello, Illinois, came up with a process to make FPC palatable to human beings, and the government has further developed it. Although FPC potentially comes in many forms, the basic product at present is a fine, grayish powder made from grinding up whole fish and extracting the fats and water from the proteinaceous material with a solvent of isopropyl alcohol. The result is almost completely tasteless and odorless and is extremely high in animal proteins: Government scientists say that 10 grams of FPC a day could fill the animal protein needs of the average human being.

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Furthermore, the stuff is stable, it does not require refrigeration, and its characterlessness renders it inoffensive as an additive to a variety of foods. It was for these reasons, in addition to the general belief that the world's supply of fish was inexhaustible (FPC usually contains the kinds of fish that ordinarily would not find their way to the dinner table), that FPC caused such a stir.

However, because of the expense involved in its production and the general unavailability of FPC - only two companies in the world are set up for commercial manufacture - international agencies concerned with spreading nourishment to the world's starving millions have bypassed it in favor of other sources of protein, such as the cheap and adaptable soy bean. In the United States, incentives for manufacturing the product have been hobbled by strict regulations levied by the Food and Drug Administration, as well as by fish flour's lack of versatility and the uncertain economics involved in manufacturing it.

Excitement about FPC may be justified, but the fact that it was premature has most recently been documented by the collapse of Alpine Marine Protein Industries, Inc., of New Bedford, Massachusetts. The company was set into operation 3 years ago with "great visions", according to its director Henry De Sandre, about turning seemingly abundant supplies of East Coast hake into a commodity that could be marketed experimentally at home and sold to underdeveloped countries abroad.

Alpine, a subsidiary of Alpine Geophysical Associates, was given a contract with the Agency for International Development (AID) to produce some 2 million pounds of FPC (at $0.42 per pound) for distribution in Chile and other Latin American countries, where it would be used on an experimental

basis in pasta and bread products. But problems plagued the operation from the start. Hake, the only fish Alpine was licensed to use, proved to be sporadically available (for one thing, the Russians have been moving in on the fishing grounds), and the company, which uses the VioBin process, was unable to meet stringent FDA standards relating to protein quality and micro-organism content. Only about 20 percent of the contracted amount was found acceptable by AID, and the deal was canceled.

The Alpine people are now suing VioBin, which built the New Bedford plant, for having misrepresented the adequacy of its process, and VioBin has repossessed the plant. VioBin's president Ezra Levin, the 79-year-old "grandfather of FPC", stoutly defends his process (which varies somewhat from the government's) and says Alpine's problems are Alpine's fault. Thus has ended the only commercial venture to make FPC in the United States.

Meanwhile, the government has been plugging along in its research and has come up with a basic product that satisfies all government requirements. The research, conducted within the National Marine Fisheries Service (NMFS) of the Commerce Department at the University of Maryland, has benefited from the hoopla that attended FPC in the early 1960's - it is now being funded at the rate of $2 million per year. Last April, the NMFS opened the government's first experimental $2 million plant in Aberdeen, Washington. The plant is expected to grind up 50 tons a day of boned hake, which, minus fat and water, will produce about 7 tons of FPC. The purpose of the plant, according to George M. Knobl, who runs the Maryland research program, will be to supply FPC to domestic companies interested in experimental marketing and to agencies who want to distribute it abroad. But its primary raison d'être, says Knobl, will be to furnish a demonstration of how to run an FPC plant, in

order to encourage private firms to get into the act.

In part because of squeamishness within the FDA, FPC has had a difficult history over the last decade. To be produced economically here, the substance must be made from whole fish, including heads, tails, viscera, and sometimes bones. But the FDA in 1962 refused to hear of such a product, which it labeled "filthy", unless the fish were cleaned and eviscerated. Finally in 1967, after pressure from Congress and a favorable report from a committee of the National Academy of Sciences, the FDA certified the product as nutritious and safe; however, it categorized FPC as an additive rather than as a food, which meant that FPC, unlike other protein supplements, is surrounded by a forest of restrictions that are normally applied to potentially toxic chemical additives. Among these restrictions is the stipulation that children under 8 should not consume more than 20 grams daily (fluoride, which is concentrated in fish bones, can, in great quantities, mottle young teeth).

But the real rub has been the provision that fish flour can only be sold in packages of 1 pound or less. This rule has had the desired effect of keeping FPC out of processed foods because no food manufacturer wants to buy it in 1-pound lots. It is for this reason that Ezra Levin says "the FDA is responsible for FPC's failing in the U.S.".

In fact, the FDA has not single-handedly accomplished this feat; but its restrictions have succeeded in turning FPC into what one government researcher calls "a much more emotional issue than *any* protein supplement should be". The rationale for the FDA policy is that it takes the cultural and esthetic inclinations of the American public, as well as considerations of health, into account in decision-making. Virgil Wodicka, director of the Bureau of Foods, agrees that gelatin made from hooves or sausage made with

ears and snouts might also be psychologically repellent, but says that these products have been around for a long time and are culturally acceptable. The idea of eating whole fish, though, is new, and the FDA, as "technical representative of the consumer", believes in protecting its charges from surprises.

But FPC has many other problems. Although a couple of hundred tons of FPC have been shipped to Latin America (the packaging restriction is void outside the country), an AID official points out that its cost keeps it out of competition with vegetable and milk proteins, even though vegetables don't have certain essential amino acids. A pessimistic view of FPC's ability to compete in the marketplace is also expressed in a 1970 report prepared at the Massachusetts Institute of Technology for the National Council on Marine Resources and Engineering Development. The AID and the U.N. agencies concerned with nutrition want to encourage some fish-rich and protein-poor countries to develop a degree of nutritional independence by building their own FPC factories, but until successful large-scale projects have been established elsewhere, these agencies have little to offer in the way of guidance.

Domestic food-distribution programs are even less interested in FPC. An employee of the Office of Economic Opportunity notes that it would be impolitic to distribute a normally unavailable "test food" to the nation's poor, and besides, he says, soy is "cheaper and just as good". A scientist at the Department of Agriculture believes that FPC has been ignored "for good reason" and believes its usefulness will be limited to countries low in indigenous sources of protein.

The chief disadvantage of FPC, and one that government scientists are now working to ameliorate, is its lack of "functional" properties. That is, it has nothing to recommend it as a flavoring, texturizer, binder, or

preservative, unlike soy and milk products, which have been incorporated into various foods that have a character of their own. If poured into a glass of Kool-Aid, for instance, FPC would simply lie on the top.

The scope of FPC's future role also hangs on the world's fish supply. J. W. Devanney, who headed the M.I.T. study, is among the most pessimistic about FPC's future. He believes the world's fish resources are already reaching the state of maximum annual exploitation without being depleted. But estimates vary widely. A 1968 government report speculated that the annual world fish harvest of 64 million metric tons could safely be expanded to 180 million, and other scientists, basing their estimates on improved fishing techniques, believe the potential harvest is far higher.

Because of the present uncertainties, it is perhaps understandable that American food processors, many of whom displayed avid interest in the new product during the early 1960's, are waiting for someone else to show them it's worthwhile. H.M. Burgess, director of technical applications for General Foods, says interest in the food industry is "rather minimal at the moment". It was "one of those things that look awfully attractive on the surface", but "limitations have emerged" which were not previously apparent - as Alpine's rocky experiment amply demonstrates. Burgess believes that a change in FDA regulations might give companies an incentive for exploring the field and that an American market for FPC would begin in "so-called poor man's food", finding its public through the same channels - Indian reservations, urban ghettos, and school lunch programs - that General Foods has been using to try out a low-cost pasta rich in vegetable protein.

Devanney of M.I.T. believes, to the contrary, that FPC may only be able to find acceptance as a specialty item, incorporated into cocktail

snacks, medical diets, and pet food (item: the M.I.T. report says fish protein in pet food should be top quality, since an estimated 25 percent of American pet food is consumed by people).

Other ideas are cherished by the National Biscuit Company, which is, at present, the only American firm actively interested in FPC. Nabisco has formed a development corporation with a Swedish company, Astra Nutrition, that is presently manufacturing a high quality product, EFP-90 (with over 90 percent protein), from cleaned and eviscerated fish. Nabisco-Astra is approaching the market as a whole - that is, it is working on a product which, from the standpoint of cost, palatability, and versatility, would find a market both in underdeveloped and in highly industrialized countries. Being "clean", the product would not be snagged by FDA restrictions in the United States. Nabisco-Astra is now test-marketing Astra products here, and Harry Watson, the corporation's vice president, says Nabisco may eventually develop a separate line of high-protein bread and cereal products.

Otherwise, prospects for a domestic market for FPC seem to be at an impasse - the FDA is waiting for business to beat its doors down asking for looser restrictions, and business is waiting for the government to show that it's worth the trouble.

Depsite limited efforts to exploit the world's fish in this form (Cardinal Proteins, Inc., in Nova Scotia is the only other commercial firm working on it), Knobl believes that "the day will come" when the needs of the exploding population will force a heavy reliance on FPC. He argues that present production is too experimental to be damned on the basis of not being cheap enough to compete with other protein supplements.

On the regulatory front, Knobl says, overcautiousness by the government has been "very, very frustrating", but adds that there are signs that the FDA is coming around. Last year, the agency allowed sardines and menhaden (an oily fish used almost exclusively for animal feed meal) to be added to the list of accpetable fish, and West Coast anchovy may soon join this select company. As the number of acceptable species increases, the advantages to the fishing industry may become greater, and the resulting political pressures may help things along. More important, the FDA has finally taken under consideration a petition submitted 2 years ago by Alpine, which asks, among other things, that the 1-pound packaging limitation be removed. Wodicka, who believes FPC should be allowed to stand or fall on its own merits, says "the petition is likely to be favorably considered".

Making FPC functional remains the chief goal of American researchers. Knobl's team has already demonstrated in its test kitchens that the stuff can be palatably cooked into breads, pastas, cereals, and cookies, in ratios ranging from 5 to 25 percent FPC (*Science* sampled an FPC pretzel and found it tastier and crunchier than normal pretzels. The bread was unexciting but breadlike). The NMFS is experimenting with numerous forms of FPC, such as pastes and wettable powders, and Knobl believes that other properties could be built into FPC. These properties might, for example, give an FPC product a longer shelf life or decrease brittleness, thus enabling cracker-type products to maintain their integrity during shipping.

The immediate future of FPC in overfed countries like the United States - which already produces 4 times as much protein as the population needs - is chancy; but FPC seems bound for a significant place in the world

food picture. Nabisco's Watson points out that it will not be long before we are all eating things whose protein sources - seaweed, grass, molds, petroleum and sewage - are "far less pleasing" than dead fish.

YOUR QUESTIONS ANSWERED

Q. I would like to follow up a point dealt with in the article "Some Misconceptions About Nutrition Which Are Common In The West Indies" by S.K. Reddy, which appeared in your Vol. IV, No. 2 issue. I refer specifically to Misconception No. 9. While I am certainly not one of those who hold such a view, I have learned from long experience that dried skimmed milk does cause, if not diarrhoea, at least a loose bowel among many children and adults in Dominica. Perhaps this has contributed to its reputation as an inferior food. I wonder whether you would be able to say how this food should be prepared in order to remove the abovementioned undesirable side effect? Is it merely a matter of using it until one's stomach becomes accustomed to it? Perhaps some research is necessary in that direction.

A. It is a well known fact that bacterial contamination of food may cause diarrhoea. Milk is a medium favourable to bacterial growth. Contamination may occur in storage, handling or in reconstitution of the milk with contaminated water or utensils.

In dried skim milk (DSM) the fat has been removed; fat delays the digestive process thus the absence of fat (if milk is taken as a single food) means the milk passes more quickly through the gastro-intestinal tract, thus absorption may be inadequate.

The high protein concentration in relation to calories does not facilitate maximum utilization when fed in the absence of fat or carbohydrate.

Skim milk powder is not a suitable milk for feeding of babies. If so used it should be modified by the addition of fat and carbohydrate. For older children it is usually used in combination with porridge, dumplings, bakes, or along with a snack or meal.

Skim milk powder is an inexpensive source of protein yet we must be aware of the importance of sanitation and method of use. Since the vitamin A is removed along with the fat, another source of this vitamin must be supplied, unless Vitamin A levels have been restored in processing, which is rare with shop-bought DSM.

There is another aspect to this problem - for some years studies have been done regarding milk intolerance in various population groups. Lactase is the enzyme involved in the breakdown of lactose or milk sugar during digestion.

In animals a sufficient level of lactase is maintained as long as there is maternal dependence, followed by a sharp decline at the time of weaning. Observations in young children appear to conclude that this

decline in lactase level may occur at around 3-4 years of age. Milk intolerance is not common in healthy infants even in populations where there is a high prevalence of lactase deficiency in adults. Malnutrition in young children does affect the activity or levels of enzymes.

Adult human populations show that lactase deficiency varies with ethnic groups. The prevalence is lowest among Caucasians; it is frequently prevalent among African Bantus, Orientals and American negroes. Those who exhibit a low rate of lactase deficiency reside or are descendants from countries where milk or milk products consumption is a general custom carried into adulthood.

In countries where cheese or cultured milks are used these forms are generally well tolerated as the lactose has been converted to lactic acid.

Not everyone with a low level of lactase is bothered with milk intolerance. Tolerance of milk by an individual may vary with the amount ingested and if it is taken alone or with other foods. It is suggested by some that a low lactase level is an inherited characteristic with delayed expression of clinical symptoms.

There is need for further research on this subject. On the basis of present knowledge there is no need to discourage the use of milk unless there are symptoms. It is well to be aware of the possibility of intolerance. It is also suggested that it may be difficult to separate the physiologic symptoms from cultural acceptance. We might reduce the amount taken at one time or combine powdered milk into food mixtures or drink along with a snack or meal.

The entire problem raises the question of introduction of milk into population groups unaccustomed to this food.

The Protein Advisory Group of United Nations has recommended that a study group look further into this subject.

*Q. I find that in preventing kwashiorkor it is essential to be exact about which foods to advise the mother to use, and to keep these within her budget. Therefore the vagueness in textbooks as to whether animal protein is indispensable or not is a great difficulty. Some suggest that a mixture of high-protein plants alone will supply a complete range of amino-acids. Is this so? If not, is it possible to state the minimum quantity of animal protein which must be added to the 'plant mixture' and how often this protein should be given?**

A. The main need in the prevention of kwashiorkor is for the mother to give her child a diet having adequate amounts of both calories and protein, containing the essential amino-acids.

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*This Question and Answer first appeared in 'Tropical Doctor', October 1971, Vol. 1, No. 4, p.187-188.

The basic question has already been answered experimentally by the fact that kwashiorkor, at least at some stages, can be cured without animal protein, with the use of either vegetable protein mixtures or even appropriate mixtures of synthetic essential amino-acids. Examples of commercially produced vegetable food mixtures for the prevention of protein-calorie malnutrition include Haitian AK-1,000 (two-thirds maize, one-third red bean flour)[1] and Incaparina (maize, cottonseed, sorghum).[2]

Likewise, in the United Kingdom Professor John Yudkin and his colleagues at Queen Elizabeth College, London have shown that individuals living exclusively on vegetable foods with no milk products or other animal food (vegans) are able to grow and live apparently normal and healthy lives. The only necessary supplement is vitamin B_{12}.

As to protein requirement the need is to supply the complete range of essential amino-acids. They can be derived from animal foods, *or* from vegetable protein mixtures combining foods with complementary amino-acid composition, *or* from mixtures of vegetable and animal protein foods.

This approach has been termed the 'principle of multimixes', in which the amino-acid requirements are met by combinations of foods.[3,4] The basis of this is that vegetable protein foods are always deficient in one or more of the essential amino-acids, but that combinations or multimixes can give the complete range.

Table I: Approximate protein content and amino-acid deficiency of main categories of vegetable foods used in multimixes

Type of food	Protein content (g/100g of food) with approximate ranges of values	Amino-acid deficiency
Cereal grains	10 (7-12)	Relatively deficient in lysine
Legumes (raw, dry, uncooked)	20 (18-24)	
Soya beans	> 40	Relatively deficient in methionine
Dark green leafy vegetables (dried)	4-10 (30%)	

It is useful to consider four common types of food found in most communities: the staple (a cereal or tuber), legumes, dark green leafy vegetables, and foods of animal origin. The amino-acid deficiency in some vegetable foods is shown in Table I.

By combining the staple (preferably a relatively protein-rich, compact-calorie cereal) with one, two, or three of the other types of food mentioned, the essential amino-acids are provided.

Although kwashiorkor can be prevented by combinations of vegetable foods, it seems wisest to play for safety and to include small quantities of animal protein in these multimixes when this is economically and culturally possible. These can also serve as sources of other often deficient nutrients, such as vitamin B_{12}, riboflavin, iron, and calcium, depending on the particular animal food. Iron is best absorbed from vegetable sources when eaten with small quantities of animal protein. (Incidentally, dark green leafy vegetables can also be considered as village-level vitamin and mineral supplements in readily available economical form.)

The different possible combinations of these four types of food are given in Table II.

Table II: Village-level multimixes

Mix	Ingredient
Double	Cereal staple + legume (or) Cereal staple + animal protein (or) Cereal staple + dark green leafy vegetable
Triple	Cereal staple + legume + animal protein (or) Cereal staple + legume + dark green leafy vegetable (or) Cereal staple + dark green leafy vegetable + animal protein
Quadrimix	Cereal staple + legume + dark green leafy vegetable + animal protein

Recipes must be developed for such multimix weaning mixtures in every area,[5] based on local foods, cooking equipment, and cultural attitudes. Special attention must be given to obtaining compact calories and to the preparation and cooking of relatively indigestible legumes by soaking, skinning, mashing, and so on. Also it is well to start with the legume 'diluted' by the cereal ingredient (I:4), gradually increasing the proportion to I:2 later.

Complementary 'double mixes' eaten in different parts of the world are the rice and peas of Jamaica, the tortillas and frijoles of Mexico, the dhal and rice of India, and the traditional succotash (green corn and beans) of some North American Indians, through to such extensive multimixes as minestrone or North African cus-cus, and to such 'urban food technology' cereal-legume mixtures as the homely peanut butter sandwich of modern-day America, and the nutritionally unappreciated 'low-caste' beans on toast of the Briton.

Derrick B. Jelliffe, M.D., F.R.C.P.

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LACTOSE INTOLERANCE IN SURINAM*

by

R. Luyken, F.W.M. Luyken-Koning, and M.J.T. Immikhuizen

Introduction

Lactose intolerance is characterized by a "low" blood sugar curve after oral loading with lactose. In the fasting subject 50 g of lactose is given orally and the glucose content in the blood is determined each half hour. The dosage for children is 2 g/kg. Some authors regard the blood sugar curve as "low" if the maximum increase is less than 30 mg/100 ml. Others take a lower limit.[1] Complaints and symptoms, such as a bloated sensation and diarrhoea usually develop after the ingestion of lactose or after milk consumption. The cause is the absence or low level of lactase in the small intestine. This enzyme splits lactose into glucose and galactose which are subsequently absorbed. Loading with glucose and galactose does give normal blood sugar curves in persons with lactose intolerance. In case of intolerance the lactose passes unsplit from the small intestine into the large intestine and causes fermentation.

Lactose intolerance apparently occurs frequently in the tropics. DEAN[2] pointed out in 1956 that lactose can cause diarrhoea in African children. Children fed on breast milk have sufficient lactase, but after one to two years the activity rapidly declines. COOK[3] determined the blood glucose increase after lactose loading in three different age groups of 72 Baganda children in Uganda. The maximum increase in children in the first week

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after birth was 63 mg/100 ml, in children of six months 24 mg/100 ml, in seven year old children only 7 mg/100 ml.

COOK AND LEE[4] thought that the occurrence of lactose intolerance was different in certain African groups. Baganda children showed a low blood sugar curve after lactose loading whereas Bahutu children had a more or less normal curve. They consider it a congenital phenomenon. DAVIS AND BOLIN[5] also come to this conclusion. They found an average increase in blood sugar of 34 mg/100 ml after loading with 80 g of lactose in Australian students in Sydney, whereas in Chinese and Indian students it was only 8 mg/100 ml.

BAYLESS AND ROSENSWEIG[6] also think that lactose intolerance is a congenital quality. It appeared that 70 per cent of the Negroids examined by them in the U.S. showed lactose intolerance, but only 5 to 10 per cent of the Caucasians. They do not exclude the possibility of adaptation caused by preceding generations in Africa not consuming milk.

CUATRECASES *et al.*[7] favour external factors. They showed a negative correlation between lactose intolerance and a diet containing little milk in 60 adult U.S. patients.

Lactose intolerance also occurs in East Asia. FLATZ *et al.*[8] found an average increase of only 2.2 mg% of blood glucose after lactose intake in 75 out of 114 adult Thais. In children of over four years this was 4.8 mg%. They consider normal the deficiency situation in East Asia, contrasting with the intensive lactase activity in Europeans as a consequence of protracted milk consumption. CRAWFORD[9] too thinks that the disappearance of the lactase at the age of one to two is normal: "Our curious habit of lifelong suckling by remote control could perpetuate the enzyme. It may be more useful to think of Caucasians as being odd".

KUENSCH *et al.*[10] made fifty Thai marines consume 25 g of lactose twice a day. The average increase of blood glucose was 9.6 mg/100 ml at the beginning, later on 8.4 mg. After one month of lactose consumption the lactase activity in intestinal biopsies was only 2.1 units, in Americans it was 37.5 units.

Lactose intolerance is also observed in Indians, Greeks, Australian aborigines and Formosans. Isolated cases have been frequently described in Western Europe and North America[11] but never an affection of large parts of a healthy population.

In cases of lactose intolerance there are changes in the villi. According to COOK AND LEE,[4] they are essentially smaller. The most plausible explanation may be that the superficial epithelium of the intestine of many inhabitants of tropical areas is so often affected by infections. Lactase is the one enzyme which is localised most superficially and therefore the first to disappear.

Of practical importance are the findings that kwashiorkor patients are often intolerant.[4,12] According to CHANDRA[1] a large number of patients, once they are cured, may become tolerant again.

With respect to feeding far-reaching conclusions have been drawn. COOK AND LEE[4] consider that calories given as milk or lactose are of no value. SHI SHUNG HUANG AND BAYLESS[13] stated that we should re-evaluate the importance of milk as a source of nutrition and protein during adult life at planning diets for Asians. The subject reached the headline of papers as "No milk for Asians".

We investigated the occurrence of lactose intolerance in Surinam. It is claimed there that school children often suffer from diarrhoea after

consuming school milk prepared from powder. In young Surinam children, fed with a milk diet, there are inexplicable cases of diarrhoea. There even exists a congenital taboo ("treef") for milk, which may be more than an incidental superstition.

Investigations in Surinam

We had to make certain that the persons tested were fasting at the time the lactose was given and therefore had to recur to inmates of institutions. The following groups were tested:

Bushnegroes (29), mostly adults. The test was carried out in patients and members of the staff of a rural hospital at Djoemoe (Upper Surinam). Their diet consisted mainly of cassava, rice and fish. Except for hospital patients milk was never consumed.

Urban Creoles (19), patients of the State Mental Institute. The milk consumption of the urban Creole is somewhat higher than that of the Bushnegro. About 1950 the average milk consumption of the Urban Creole was about 150 ml/day (14); in the institute 200 ml/day was supplied during the investigation.

Creole soldiers (12), in service for 8-12 months. Their rations include much more milk than in the average Creole. Complaints after milk consumption were frequent.

Creole children of 1-3 years (20); recovering from serious malnutrition and housed in a rehabilitation center. They were fed a Western type diet in which milk formed an important part. Diarrhoea for which there was no apparent cause regularly occurred.

Hindustani children of 7-12 years (27) in a boarding school fed on rice, bread, pulses and vegetables, the normal Hindustani diet

in Surinam. A cocoa drink with some milk was supplied once per day.

Dutch soldiers (14), two of whom had been in Surinam for a few weeks, the others for 8-10 months. Their diet was a European type. Large quantities of milk were available daily.

Adults received 50 g lactose, children 2 g per kg body weight. The blood glucose was determined before, half an hour and one hour after the oral dose. According to the curves of DAVIS AND BOLIN[5] chances are slight that the initial raise of blood glucose occurs after one hour. The glucose level was determined by enzymatic procedure. To determine the group average the maximum increase of the blood glucose of each person was used.

Results (Tables I and II)

In Bushnegroes the average maximum increase of blood glucose was 3 mg/100 ml. In three the increase was more than 10 mg/100 ml, but less than 20 mg. No rise at all was noticed in a leprosy patient who had been in hospital for 4 years. In a child of 3½ years admitted for 6 months the maximum increase was 9 mg/100 ml. In a similar case of 4½ years the blood glucose rose by 2 mg/100 ml. Almost all those tested had diarrhoea the day after the intake of lactose.

In *Urban Creoles* the average maximum increase was 14 mg/100 ml; in *Creole soldiers* 12 mg/100 ml, in *Creole children* 16 mg/100 ml.

In *Hindustani children* the average maximum increase of blood glucose was 12 mg/100 ml.

Dutch soldiers: average maximum increase 33 mg/100 ml.

Table I: Maximum Average Level of Blood Glucose (in mg/100 ml) after Loading with Lactose, in Various Surinam Population Groups

Bushnegores (adults and children)	3 ± 3.3	(29)
Urban Creoles (adults)	14 ± 13.6	(19)
Creole soldiers	12 ± 12.6	(12)
Creole children of 1-3 years	16 ± 9.2	(20)
Hindustani children of 7-12 years	12 ± 9.2	(27)
Dutch soldiers	33 ± 12.0	(14)

All differences between the various groups and Dutch soldiers are highly significant ($P \ll 0.01$).

Table II shows that 97 per cent of the Bushnegroes had an increase of less than 10 mg/100 ml, and that this did not exceed 30 mg/100 ml in anyone. On the other hand, in 64 per cent of the Dutch soldiers blood glucose rose to over 30 mg. None of them showed an increase of less than 10 mg. In the other groups an increase of 0-10 mg was noted in 30-67 per cent whilst only 4-16 per cent showed an increase of more than 30 mg.

Lactose intolerance, which is defined here as no or insufficient increase in blood glucose after oral loading with lactose thus proved to occur very frequently in Surinam.

Table II: Range of Blood Glucose Levels in Maximum Increase After a Lactose Load Test, in Diverse Suriname Population Groups, in Per Cent

	max. increase in blood glucose mg/100 ml		
	0-10	10-30	>30
Bushnegroes	97	3	0
Urban Creoles	42	42	16
Creoles soldiers	67	25	8
Creole children of 1-3 years	30	60	10
Hindustani children of 7-12 years	41	55	4
Dutch soldiers	0	36	64

Discussion

Lactose intolerance could be a reason for the objections to milk mentioned earlier and for the complaints which result after consumption of milk-powder. The frequent occurrence of diarrhoea in the children's home could also be attributed to lactose intolerance. We proved that diarrhoea occurred less when the milk was replaced by a vegetable source of protein.[15]

We cannot conclude whether lactose intolerance in Surinam is a congenital or an acquired phenomenon. The prevalence in Bushnegroes, even in those who consumed milk regularly in hospital, could indicate a congenital quality. In Urban Creoles the frequency of lactose intolerance is somewhat less. They consume more milk than do Bushnegroes but are racially heterogeneous. The Hindustani children are a more homogeneous group. The Hindustani consume small quantities of milk regularly, the Bushnegroes nothing. The lesser occurrence in Hindustani could be ascribed to adaptation. These observations in Surinam correspond fairly well to those in other parts of the tropics.

In the interpretation of the results, it should be taken into account that a dose of 50 g lactose for an adult physiologically is excessive. This quantity is present in about 1.25 l of milk, a quantity which is only seldom consumed at any one time. This also applies to the quantity (80 g) used by the Australian investigators.[5]

Must then the milk situation of tropical countries be re-evaluated as some authors seem to think? In our opinion such a conclusion would be premature.

A too harsh condemnation of milk would be contrary to the experience of treatment of child malnutrition with milk. On the other hand, the death

rate among kwashiorkor patients is often high; a number of them may be lactose intolerant but still are treated with milk. CHAUMURI compared a group of children suffering from kwashiorkor treated with legume flour as a source of protein, with a second group with milk. The latter continued to suffer from diarrhoea much longer than the former. Some caution in supplying large quantities of milk to children above one or two years is perhaps advisable.

A thorough investigation is necessary to determine the proper place of milk in the tropical diet. The principal points may be the reaction to less massive and more physiological quantities of lactose and the possible disturbance in the utilization of essential milk constituents such as proteins. If such disturbance is only slight, it may be overridden by the beneficial effect. Finally, it should be studied whether an adaptation to regular milk consumption may be achieved.

Acknowledgement

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NUTRITION NEWS AND OPINION FROM THE CARIBBEAN

WE ARE WINNING THE FIGHT TO SAVE OUR CHILDREN
From an Editorial in the Advocate-News, Barbados, September 16, 1971

Earlier this week a trend was pinpointed which shows the improvement our nation is enjoying in its health standards. It was announced in Panama that an assessment done of the Alliance for Progress by the Organisation of American States has shown that only Barbados and Honduras had come close to cutting by half the mortality rate in children from 1 to 4 years of age. This goal was set for all the OAS member states at Punta del Este and although we might not be minded to raise any shouts about this achievement, it is nonetheless something of which we can all be proud.

Recent statistics from the Barbados Ministry of Health have shown that the death rate of children between the ages of one year and four years of age has shown a steady decline from 1966 when it was 2.4 per thousand to 1968 when it dropped to 1.8 per thousand, and then reached 1.3 per thousand in 1969. The figure for 1970 puts it back to 1.8. We can at once see that even with the fluctuation from 1.3 in 1969 to 1.8 in 1970 that we are maintaining on the whole a drop in child deaths that reflects our improved health services, better housing and better understanding about child care on the part of mothers.

VICE-CHANCELLOR GIVES REASONS FOR INCREASING IMPORTANCE OF NUTRITION TRAINING
From The Daily Gleaner, October 6, 1971

The Vice-Chancellor of the U.W.I., Professor Roy Marshall, has stated that the increasing importance of good nutritional practices stems from the fact that we possess both a rapidly increasing population, and severe limitations in our capacity to feed that population.

The Vice-Chancellor who was addressing the participants in the second Course for the Diploma in Community Nutrition, at the Social Welfare Centre, Mona, on the morning of October 4, said that in a developing country like Jamaica, the decline in agricultural production, and the high birth rate, make the problem even more acute, by underscoring the importance of exploiting the highest nutritional value from the food we eat.

Continuing, Professor Marshall said that the work undertaken by the Caribbean Food and Nutrition Institute in that area of Community Nutrition, offered an opportunity for academic discipline to be brought to bear on problems that affect the whole society, a means of bridging the gap between Campus and Country, as it was in these areas that the University would be of most importance.

The role of the University, he commented, should be to produce graduates who have developed critical faculties and are able to arrive at decisions on the basis of reason and analysis.

Another role which the Vice-Chancellor spoke of was that of undertaking research and developing hypotheses and theories that benefitted the entire society. He also referred to the research programmes being undertaken by different faculties of the U.W.I.

The Course, a brainchild of the Caribbean Food and Nutrition Institute, is the second of its kind to be undertaken by the U.W.I. The first, which was conducted in 1969, was supported by the Pan American Health Organization, the U.N. Food and Agriculture Organization, the U.W.I., the governments of Jamaica and Trinidad & Tobago, and the Research Corporation of New York.

The Director of the Institute, Dr. D. B. Jelliffe, who is a PAHO staff member, said that Diplomas in Community Nutrition would be awarded to the successful participants at the end of the Course, and that the Course would last for nine months.

Dr. R. Cook, the Course coordinator, gave the following outline of the stages of the programme: (1) The Background to Nutrition in the Caribbean; (2) Human Diet; (3) Malnutrition; (4) Assessment of Nutritional Status; (5) Programmes to Combat Malnutrition.

Dr. Cook described the second leg of the Course which will be held in Trinidad, as the "Practical Stage". The Jamaican segment of the Course will run to December 18; in Trinidad it will run from January 14 to 20, 1972, in Grenada from January 21 to February 3, and back to Trinidad from February 4 to March 25.

A committee comprising three elected students, and three of the Institute's staff members - Dr. Y.H. Yang, Dr. R. Cook and Mrs. E.M. Irvine, has been formed and meets regularly to sort out any problems that arise.

Countries involved with the Course are: Jamaica, Antigua, Barbados, Bahamas, Dominica, Grenada, Guyana, St. Lucia, St. Vincent and Trinidad & Tobago.

CONSULTATION ON AGRICULTURAL DEVELOPMENT PROBLEMS IN THE CARIBBEAN AREA - NUTRITION

From Vol. 76, Nos. 4-5, The Farmer, Journal of The Jamaica Agricultural Society

The Consultation noted the significant progress being made by the Caribbean Food and Nutrition Institute in elucidating a number of the more pressing problems common to the Caribbean area. While noting with satisfaction the decrease in mortality rates and the reduced incidence of

kwashiorkor in the 0-4 year age group which has been secured in recent years, the Consultation noted that relatively high incidence of anaemia specially among pregnant and lactating mothers and pre-school children, of gastro enteritis and moderate forms of protein-calorie malnutrition still persist.

Factors which contribute to these problems are low income earnings and poor education. The following measures were suggested for alleviating the situation:

(1) Promotion of home vegetable gardens to reduce dependence on purchased food.

(2) Promotion of wider use of less expensive highly nutritious sources of food elements.

(3) Encouragement of mothers to breast feed babies.

The Consultation also recommended that -

(i) Research efforts be intensified in order to define more precisely the ways in which sound planning, production policies and programmes, and educational efforts can serve to improve general levels of nutrition in the countries of the Caribbean.

(ii) Governments through their Ministries responsible for education and extension work in the areas of Agriculture, Health Education, Home Economics and Welfare, and farm and other organizations interested in community welfare, co-operate to ensure wider dissemination of nutritional information amongst the population in the region.

(iii) In planning their programmes, Governments take full account of the nutritional needs of their respective countries and take appropriate steps for satisfying these needs.

NUTRITION IN GRENADA

From the Throne Speech delivered by H.E. The Governor Dame Hilda Bynoe on the occasion of the State Opening of the Parliament of Grenada, 30 November 1970

The importance of nutrition as a means of securing and maintaining good health and well-being, and so contributing to a high degree of productivity, has been fully recognised by my Government, and practical steps have been taken towards achievement of these ends by establishing a Nutrition Committee to co-ordinate the activities of all official and unofficial agencies dealing with subjects, having a bearing on Nutrition. The Health,

Agricultural, Education and the Social Welfare Departments through their Extension Services, along with voluntary groups, have varying contributions to make towards attainment of the conditions necessary for an adequate nutritional status. By joining these forces in a co-ordinated structure, duplication of effort would be avoided with saving in time, effort and finance. This farsighted, integrated approach to the correction of factors tending to cause malnutrition, may have influenced the Caribbean Food and Nutrition Institute to select this State as the site of a recent seminar including participants from St. Lucia and St. Vincent. In this workshop not only research and academic questions were discussed, but also the practical day-to-day problems militating against the attainment of the nutritional well-being of the citizens of these States.

THE MANY-FACETED MYSTIQUE OF MONOSODIUM GLUTAMATE*

by

Dr. M.E. Rubini

The use of seaweeds, sea tangles, and soy sauces as condiments has a history in the Orient of at least a thousand years. All contain monosodium glutamate and to this substance is ascribed their palate-pleasing properties. In the student home economics class and in the Cordon Bleu demonstration course, the gourmet cook-to-be is taught that freshness and flavor are enhanced by adding monosodium glutamate to his choice recipe. The food processor is similarly inclined, and tons of this chemical have found their way into canned and frozen foods to make them more tasty. It is on the GRAS list (the FDA's Generally-Regarded-As-Safe designation). The chemical that is utilized as a food additive is now usually prepared by fermentation, but extraction of beet residues is still used by some manufacturers and accounts for 10% of production. As might be expected, the greatest production capacity is in Japan.

Now in the wake of cyclamate publicity, monosodium glutamate came to new attention when several major baby food manufacturers (Gerber, Beech-Nut, and Heinz) announced their intention to desist adding this compound to processed baby food, at least until more is known about its safety.

Presumably, the manufacturer has become concerned that the taste of baby food may be less critical than its safety. Although monosodium glutamate is known to be a toxic material when given intravenously, the basis of

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action is inconclusive that oral glutamate poses a threat to human infants because it was reported toxic to infant rodents. Others, especially the chemical companies making glutamate and the competing baby food packers, but also some scientists, have questioned the scientific basis of such action. They have pointed to its long use as a food additive, its presence in natural protein, and even to the testimonial of the Far East cultures which, because they are ancient, must be wise. They argue that glutamate is nearly innocuous when fed orally and because it means better taste to food some infinitesimal and nebulous hazard can be neglected until more data are available. How much pleasure can be equated with how little safety or how much risk is not defined. The first step in doing so might be to try to quantitate the pleasure obtained from adding glutamate to food.

Despite the wide public acceptance that glutamate enhances the pleasure of eating, it is difficult to prove that glutamate improves flavor, or changes taste or really does anything at all. Despite the many millions of dollars spent on this substance, the mechanism of its action in making eating more pleasurable, as is true of most physiologic properties, is unknown. Most commercial usage depends upon taste analysis, and the subjective enhancement of flavor is said to be distinctly different from alteration or accentuation of taste. Efforts to demonstrate changes in taste threshold by the addition of monosodium glutamate to dilute solutions of test substances have been generally unsuccessful - (shades of the Emperor's new clothes....).

Then there is the so-called "Chinese Restaurant Syndrome" that has been recently brought to medical attention.[1] The burning, chest pain, headache, and abdominal distress that some people experience after eating Chinese food seem to be due to the monosodium glutamate content of their dinner.

But even this is not a clearly predictable drug effect. Different individuals react differently to monosodium glutamate. Some persons react vigorously to 1- or 2-g doses, but many people develop no symptoms even if given 12 g. In a previous era, when glutamate and glutamine were thought to be beneficial in individuals with mental disease, and were even ascribed an intelligence-raising capacity, some patients were apparently given as much as 45-75 g/day without symptoms. The L isomer of glutamates evokes symptoms, but the D isomer does not. Previous ingestion of foods appeared to block symptomatology, but no known drug is effective - sympathetic blockades, parasympathomimetics, vasoactive compounds, et cetera.

Thus far the biochemists' knowledge of the metabolism of glutamates is of little help in explaining the basis of toxicity. Glutamate is a nonessential amino acid with a function as an amino carrier between L-ketoglutamate and glutamine. It is an important precursor of glutathione and insulin, as well as a critical source of urinary ammonium. Curiously, glutamate is unique among amino acids by virtue of its direct utilization as an energy source by cerebral tissue.

Real experimental evidence that glutamate is toxic orally is nebulous. Turgull reported that even small amounts of monosodium glutamate fed orally to rabbits for 1 month induced fetal resorption or malformations. But other studies in which rabbits were given glutamate in amounts up to 100 times this quantity did not duplicate these findings.

Even in the Chinese Restaurant Syndrome it is difficult to incriminate glutamate specifically and there is sound reason to believe that at least in some persons a food allergy is operative. Over 20 years ago, Randolph and Collins demonstrated that headaches, leg and abdominal cramps, urticaria,

pruritus, coughing, heartburn, mental confusion, and fatigue may occur in individuals ingesting 2-5 g monosodium glutamate prepared from the sugar beet residue following sugar extraction. Because monosodium glutamate prepared from wheat gluten did not evoke the syndrome, they considered the symptoms to be allergic. Some individuals sensitive to wheat protein had similar sensitivity to monosodium glutamate prepared from wheat. A high protein diet contains more natural glutamate than the 1-2% added to food. Beets and borscht have been the focus of an amusing defense by Bessman and Hochstein.[3] For a compound ubiquitous in protein-containing natural foods, this late discovery of a pharmacologic activity by oral feeding is surprising.

It seems unequivocal that glutamic acid, monosodium glutamate, and glutamine are toxic compounds when given parenterally. Aspartate acts similarly at equivalent dosages, although apparently aspartate is benign when fed. Ketoglutarate, given intravenously, is benign, at least in regard to certain early protein hydrolysates. Perhaps it is just as well that these proved clinically unpopular, because young mice injected with glutamate develop brain lesions, obesity, sterility, and are stunted in growth.[2] Chicks given glutamate parenterally develop striking skeletal malformations. Rabbits consistently develop retinal lesions when given only modest amounts of glutamate systemically. Fortunately, there are no chronic toxicity data on man, although acute intravenous administration of glutamate makes men and dogs vomit.

It is difficult to understand how a simple substance that is readily absorbed is so much more toxic when given by vein than by mouth. Some authors have tried to correlate plasma levels with toxicity but these data are difficult to interpret, as plasma clearance is rapid. Blood levels of glutamate

vary substantially in different persons after oral ingestion and basal levels are generally reached after 3 hr even after high doses. Injected or fed glutamate is thought to be readily metabolized to bicarbonate while adding its amino nitrogen to the labile transamination pool. Some have suggested that high levels of glutamate may inhibit glutaminase activity and cause glutamate to accumulate intracellularly. Little is known about the specific metabolism of glutamate and especially the inhibition of formation or metabolism of glutamate-containing compounds when glutamate is available in excess. Although glutamate-aspartate transaminase activity is increased when glutamate is administered, this may not be protective at some biochemical site where transamination is not available.

More knowledge is needed for a rational understanding of what monosodium glutamate offers, both as advantage and as risk. Although it can be argued that the removal of glutamate from baby foods was premature and not based on sound scientific evidence, perhaps one should also ask why it was added in the first place. There seems to be reasonable evidence that changes in the taste of food (according to an adult taster) do influence infant behavioral response, but whether this is taste in the same sense that an older child experiences taste is uncertain. If the baby can taste, its taste must be atrocious. Was the taste or flavor of a slurry of pureed apricots and minced veal - or a gruel of powdered bone cereal and sieved liver - really improved by the addition of monosodium glutamate? For the infant? For its mother? Ugh.

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BREAKFAST CEREALS - COSTLY CONVENIENCE NOT BETTER NUTRITION*

by

Dr. Michael C. Latham
Professor of International Nutrition
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I am honored to be invited to testify before this distinguished Committee. I think that I am speaking for most of my colleagues in nutrition when I tell you how delighted we are that the U.S. Senate is increasingly recognizing the importance of good nutrition for the health and welfare of the American people. I testified in December 1968 on the first day of the hearings of the Senate Select Committee on Nutrition and Human Needs. As you know, that committee has thoroughly investigated many of the problems of hunger and malnutrition as they relate to poverty in this country. Their work created a new awareness of these problems and has been a stimulus to legislative and executive action.

I am pleased that the Subcommittee on the Consumer of the U.S. Senate Committee on Commerce is now looking at another important aspect of this same problem. I believe that the objectives of these committee hearings, and I hope also of all nutritionists, are to improve the nutritional status, the health and the well-being of the citizens of this country.

Introduction

My testimony today will not have as its thesis that breakfast cereals are a worthless or even a poor food. They are not. It is a fact, however,

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**Based on Senate testimony and appears in "Hearings Before the Committee on Commerce, U.S. Senate 91st Congress", printed by U.S. Government Printing Office 1970.*

that those breakfast cereals sold in greatest quantity are not nutritionally superior and in many respects are nutritionally inferior to many very common and much cheaper foods such as bread, rice, beans and corn products. The public are unaware of this for the advertising tactics of the industry have in an indirect and subtle way misled the consumer. A special advertising onslaught has been made on our children. It seems that the less nutritious breakfast cereals and those that are sweet are especially being peddled to the young. In a country where there is a considerable amount of malnutrition among the poor and where the rates of infant mortality are disgracefully high, this advertising may be indirectly contributing to ill health and mortality.

My belief in the morality of big business has been undermined by learning that five major drug firms for years rigged the price of one of the world's most effective antibiotics. This callous act resulted in the unnecessary death of many children and adults in my care during those years. I am also alarmed that advertising of products for the bottle feeding of infants has led to a reduction of breast feeding in developing countries and has in this way been a major contributor to deaths from malnutrition and gastroenteritis in these countries.

Controversy among nutritionists

The controversy over the nutritive value of breakfast cereals can serve a very useful purpose by providing nutrition information to the public. It can help teach the consumer how to distinguish between the nutritionally more valuable foods and can assist the poor in learning what are good buys in terms of nutrients per scarce dollar. With luck these hearings might stimulate industry to improve further the nutritional quality of their

products and perhaps even to provide some sound nutrition education in their advertising.

There is a tendency when these controversies arise for both nutritionists and physicians to take sides and for their testimony, though based on the same facts, to appear completely opposing. There are, I suppose, in any profession those who are on the side of big business, who believe that social problems can be solved mainly by technology, and who label those who take up the social causes of the underprivileged either as "do-gooders" or "communist inspired". These same people often hold the view that the majority of the poor are poor because they are feckless and lazy.

On the other side, there are in most professional groups, those who believe that the large corporations are not playing an adequate role in solving domestic problems and in certain respects are aggravating them, who think that government and industry should take a more humane approach to the social problems of the nation and the world, and who consider that the poor are poor because they have not been given an opportunity or because they are an oppressed minority.

Inevitably, those who support the former position, will state that the testimony of Robert Choate was full of errors, that the breakfast cereal industry is supplying highly nutritious products, and that these companies have every right to spend huge sums of advertising money in any way they like. Those who support the latter philosophy will praise Robert Choate for his testimony, will agree that he has clearly shown that breakfast cereals are much less nutritious than they are claimed to be, and that the advertising is not only misleading but that the huge sums involved should be spent for some better purpose.

Like my colleagues, it is difficult for me not to let my political philosophy influence my nutritional judgment over this issue. There are, however, some facts available which cannot be disputed. I will try to provide some of these in the next part of my testimony. Once these have been stated, then other aspects of the problem deserve a political opinion, even from a nutritionist.

Nutritive value of breakfast cereals no better than bread, rice or grits

The majority of people in the world get most of their calories, protein and other essential nutrients from cereals - not from dry breakfast cereals but from rice, wheat and corn. Cereals are good foods, but even if eaten in quantities to provide for total calorie needs, they will leave the subject, especially the growing child, deficient in certain essential nutrients. Most breakfast cereals contain rather similar nutritive values to their parent cereal grains.

I do not consider that breakfast cereals are "empty calories" reminiscent of sugar or alcohol. Breakfast cereals vary greatly in their nutrient content, but most of them do provide reasonable quantities of certain nutrients as well as calories. However, they are more expensive, and on the whole, not nutritionally superior to bread, rice or grits. It is perhaps regrettable that the term "cereal" has come to mean "dry breakfast cereal", when cereals can more properly be defined as plants yielding farinaceous seeds suitable for food. I object to the advertising implications which have led the consumer to believe that the ordinary breakfast cereals are nutritionally superior to other wheat, rice and corn products. They are not.

If you, or any of the lay public were told of a child in India getting nothing but a bowl of rice for breakfast, you would probably conclude that

this was nutritionally a very poor breakfast. However, one ounce of dry rice contains about twice as much protein, and more calcium, iron and thiamine than does one ounce of a puffed rice breakfast cereal. The only one of 8 common nutrients in which the puffed rice is richer than the ordinary rice, is in its niacin content. Yet in the local supermarket, puffed rice costs 93 cents per pound and rice only 18 cents per pound. Puffed rice is therefore five times as expensive yet provides smaller amounts of most nutrients than ordinary rice. It can be argued that one ounce of puffed rice is ordinarily eaten with four ounces of milk. This makes little difference to these comparisons. There is no reason why the poor child should not drink four ounces of milk with his rice or have the rice mixed with milk and sugar in the form of a rice pudding. The comparisons remain valid. The great advantage of the puffed rice, is that it is more convenient, for it does not require cooking. The manufacturer of the puffed rice is selling convenience, yet advertising nutrition.

Let us turn to wheat products. The food industry has led us to believe that a child whose only food eaten before going to school in the morning was bread or toast, is a sad figure of a child. In contrast the child who ate shredded wheat would be thought of as having had a reasonably nutritious breakfast. Bread or toast, however, is richer in 6 out of 8 of my listed nutrients and shredded wheat is richer only in niacin and iron. The cost of the shredded wheat in the supermarket ounce for ounce is more than twice that of the bread. The convenience of each is similar.

Take our third common cereal which is corn. We think of the Mexican American who had breakfasted just on corn tortillas or the black child from the south who had just hominy grits, as being poorly fed, whereas our

middle class connotation of the well fed white suburban child is one who had that good old American standby, corn flakes, for breakfast. Yet hominy or corn grits are twice as rich in protein as corn flakes; the grits have more vitamin A, thiamine, riboflavin and niacin than do the corn flakes. The corn flakes are richer than the corn grits only in calcium, and in this nutrient are not richer than the tortilla. Again the price of the corn flakes is about twice as high as the hominy or corn grits. Both are likely to be eaten with milk. The corn flakes are, of course, more convenient for the housewife because, unlike the grits, they require no cooking.

In Table I, I have compared the nutrient content of these 6 products. I think it is easiest and most rewarding to compare the two wheat based products with one another, then the two corn based products, and finally, the two rice based products. In each pair, the dry breakfast cereal is listed second. When listing these food items, I purposely did not take proprietary products - like my nutritional colleagues from the universities I might some day be seeking a research grant from Kelloggs, Quaker, General Mills or one of the other manufacturers. I took these figures from Agricultural Handbook Number 8 published by the U.S. Department of Agriculture. This publication is the bible of all nutritionists and others, when ascertaining the nutrient content of foods in the American diet. This handbook,lists corn flakes, puffed rice and shredded wheat, without giving brand names. In Table II, I have shown the prices of these 6 products per pound. The prices I have used are from the grocery shelves of my local supermarket. Here, it was necessary to get the prices of proprietary brands, but there seems little benefit in identifying the manufacturer. It can be seen that the breakfast cereals are considerably more expensive yet less nutritious than the common foods with which I have compared them.

TABLE I

Composition of Foods per 100 Grams Edible Portion

From U.S.D.A. "Composition of Foods"

	Calories	Protein (grams)	Calcium (mg.)	Iron (mg.)	Vitamin A Value (I.U.)	Thia-mine (mg.)	Ribo-flavin (mg.)	Niacin (mg.)	Vitamin C (mg.)
Toast - made from white enriched bread	314	10.1	81	2.8	Trace	0.23	0.20	2.7	Trace
Shredded Wheat without salt or other ingredients	354	9.9	43	3.5	0	0.22	0.11	4.4	0
Corn or hominy grits - enriched dry form	362	8.7	4	2.9	440	0.44	0.26	3.5	0
Corn flakes with added nutrients, sugar-covered	386	4.4	12	1.0	0	0.41	.04	1.9	0
Rice - long grained, dry parboiled	369	7.4	60	2.9	0	0.44	-	3.5	0
Puffed Rice Honey and added nutrients	388	4.2	46	0.9	0	0.33	-	4.6	0

TABLE II

Supermarket Price per Pound (16 ounces) of Selected Dry Breakfast Cereals Compared with Other Cereals or Cereal Products

	Price per pound in U.S. cents	Notes*
Wheat products		
Bread - white enriched	21	Bread richer than shredded wheat in 5 out of 7 nutrients
Shredded wheat	43	Shredded wheat richer than bread in iron and thiamine only
Corn products		
Corn or hominy grits	18	Corn grits richer than corn flakes in 5 out of 7 nutrients Corn grits and corn flakes equal in containing no vitamin A
Corn flakes - added nutrients sugar-coated	35	Corn flakes richer than corn grits in calcium only
Rice products		
Rice - long grained, parboiled	18	Rice richer than puffed rice in 4 out of 7 nutrients Rice equal to puffed rice in 2 nutrients
Puffed rice	93	Puffed rice richer than rice in niacin only

*Vitamin C not included because in U.S.D.A. Handbook no vitamin C present in any of these products except for bread (a trace).

The prices are from a small town supermarket in the Northeast. I feel certain that items like hominy grits, beans and rice, could be obtained very much more cheaply in many poverty areas of the country. If anything, therefore, I have weighted my prices in favor of the breakfast cereals and against the other foods.

My main thesis here is that the consumer has been led to believe that ordinary dry breakfast cereals have a nutritive value superior to common foods such as bread, hominy grits, rice, spaghetti, baked beans, potatoes, pizza, etc. This is not true. The public are being deceived. Bread is an excellent food, so are wheat krispies, but both need to be supplemented with many other foods each day to provide a balanced diet. Rice is a good food and so is puffed rice, but in whatever quantities taken neither of these products provide all the nutrients necessary for health and growth.

Mr. Robert Choate in his testimony used an unorthodox way to rate or to score the cumulative nutrient content of cereals. He did this because there is no universally accepted way of doing this. It was not a dishonest, or a particularly inaccurate way of doing it, although there are some errors in his data. The method he used is not the one that I or most of my colleagues would have used. However, although the rating is unorthodox, I do not think that a different system which somehow used protein, vitamin and mineral content, would alter very much the relative positions of the breakfast cereals on the list.

But the press at large, the cereal industry, and others, have been trying to get nutritionists to say things that they don't want to say. A CBS reporter asked me a few days ago, if the industries' claim that cereals were more nutritious than eggs was true. I, and I think any nutritionist

worth his salt, will not answer that question "yes" or "no". Instead we will ask, "more nutritious in what?". You see, a person living on a diet of eggs alone or of a cereal alone would develop malnutrition. A nutritionist cannot say that orange juice is a better food than eggs. Orange juice is richer in vitamin C and eggs are richer in protein. It is possible to say that weight for weight guavas are richer in vitamin C than oranges, soya beans are richer in protein than cereals, and so on. Foods have to be looked at nutrient by nutrient, and a diet has to be looked at in terms of the foods in that diet. It should be recalled that it is the breakfast cereal industry that has been responsible for advertising its products in terms of percentages of recommended dietary allowances of nutrients that the cereal provides. With some alterations Mr. Choate has been playing their own game.

For the consumer, however, the important thing to remember is that on the whole, if we eat a variety of foods containing a variety of nutrients, or from different food groups, then we are more likely to satisfy our nutrient requirements than if we eat a very few different foods from a limited number of the food groups.

Protein content of cereals

Of all the nutrients to be considered in cereals, both the dry breakfast cereals and the commonly eaten cereal products like bread, rice, corn products, spaghetti, etc., I believe that protein is the most important. Protein is a nutrient which is essential for health and is especially important for the growth of children.

In his testimony Robert Choate gave equal weight to 9 different nutrients in rating the nutritional value of 60 breakfast cereals. I have

not been able to make comparisons of the protein content of these 60 cereals.

TABLE III

Grams of Protein that can be Purchased for 10 U.S. cents for 8 selected foods

	Grams of protein for 10 cents
Breakfast cereals[1]	
General Foods Raisin Bran	9.5
General Mills Wheaties	7.3
Quaker Oats Puffed Wheat	5.4
Kelloggs Product 19	4.6
Mean or average	6.7
Other foods[2]	
Navy beans	50.2
Corn grits (enriched)	21.9
Rice, long grained parboiled	19.2
White enriched bread	19.1
Mean or average	27.35

[1] Values and prices taken from Testimony of R. Choate.

[2] Values taken from U.S.D.A. Composition of Food Handbook, prices taken from local supermarket.

In Table III I have listed four breakfast cereals (General Foods Raisin Bran, General Mills Wheaties, Quaker Oats Puffed Wheat, and Kelloggs Product 19), and four other foods (red beans, corn grits, long-grained parboiled rice, and white enriched bread). I have then compared in each product how much protein can be bought for 10 cents. You can see from this table that your dime would, in the local supermarket, buy an average of only 6.7 grams of protein if used for the 4 breakfast cereals, but would buy an average of 27.35 grams of protein

if used to purchase these other four foods. Therefore, taking these averages, a dime buys four times as much protein when bread, rice, corn grits and beans are purchased, compared with when these 4 breakfast cereals are bought. Yet all of these 4 cereals are in the top half of Choate's rating of the dry breakfast cereals.

There are, of course, many other foods that contain protein and in these figures I have not considered protein quality. However, the quality of the protein in most dry cereals is not superior to that in these other foods. The protein of many foods of animal origin such as meat, fish, eggs and milk is, on the whole, better than that of cereals, legumes or vegetable products. However, it is possible to satisfy our protein needs without eating animal products. A mixture of vegetable proteins used simultaneously enhances the value of the protein in each product.

Advertising breakfast cereals

The manufacturers of these products might well state that they have never claimed that breakfast cereals are nutritionally superior to these other cheaper foods. Perhaps they have not claimed this in so many words, but they have implied it in their advertising. Breakfast cereals are no more the food of champions than are bread and corn and rice. Yet ask any 8 year old on your block or almost any suburban housewife, and you will be told that breakfast cereals are better nutritionally than bread or rice or baked beans. These consumers did not get this idea from their health education classes, or nutrition textbooks, or news articles; they got it from the skilful advertising of the breakfast cereal manufacturers. It is Tony the Tiger of certain frosted flakes saying "Go, go, go"; it is Kelloggs sugar pops claiming to be

a wild cat of a cereal while showing a handsome cowboy on his horse; it is Cheerios advertising itself as the cereal with protein and energy with a visual background of a healthy youngster on a trampoline; it is "super power with sugar crisps" with the cartoon hero parting the iron bars of a window indicating the strength it gives; it is all these kinds of claims which give the public a false idea of the superior nutritional qualities of the breakfast cereals. They imply that, more than other foods, these products provide energy and strength.

The American people are continually being asked to support Radio Free Europe, because we are informed that children in communist eastern Europe are being brainwashed with propaganda. I sometimes wonder if the advertising that our children see on TV is not an equally harmful propaganda.

It is these subtleties of advertising and these sly visual suggestions that mislead the public. As a Subcommittee on the Consumer, this is where you have a difficult and important task. You have to suggest where advertising is deliberately misleading the consumer.

I believe that Robert Choate's research into cereal advertising and his testimony in this respect was most valuable. In Africa, the Caribbean, and other developing regions of the world, the advertising of proprietary products for bottle feeding babies is an important cause of illness and death of young children. When you have seen, as I have done, infants die because advertising has led their mothers to feed their children expensive manufactured foods instead of human breast milk, you become angered by this advertising, you become enraged by the callousness of big business. I would hate to think that in a more subtle way, that is happening here too.

Money spent on advertising

I have not investigated the costs of cereal advertising but I have no reason to disbelieve Mr. Choate's testimony in this regard.

I think it bad that the TV networks make an annual profit of about 20 million dollars from Saturday morning children's programs. I am appalled to learn that 50 percent of all the nation's 2 to 11 year olds are in place before their TV sets every Saturday morning instead of in parks, woods or beaches, or doing something intellectually stimulating; and I think it terrible that three companies spent over 42 million dollars on TV advertising of dry breakfast cereals in 1969. One is inescapably led to think how the money of these firms and the time of American children could be put to better use.

What does $42,000,000 spent on TV advertising of breakfast cereals mean? It connotes different things to different people. As for me, I think in terms of the budget of the Ministry of Health of a country of 10,000,000 people in Africa. For about $11,000,000 a year, free medical care and hospitalization was provided, 50 hospitals were kept running and 22,000,000 hospital visits were made a year. The TV advertising budget for one year for three major manufacturers could, therefore, keep this health service running for 4 years. I worked for that health service in Tanzania for some years. My priorities might therefore differ in this regard from the priorities of others in American public life.

Many of the leading manufacturers of dry cereals contribute substantially to nutrition research. It is therefore disheartening to learn that our children are being deliberately influenced to demand the less nutritious and especially the sweeter products, when we know that malnutrition exists

in this land, and that in many poor areas of the country the average child has six decayed and rotten teeth and little hope of dental care.

The dry cereal industry can argue that they are no worse in these respects than other sectors of the food industry. This is like the auto industry defending itself with regard to air pollution by saying that they are no more guilty than certain other industries. The spotlight is on the dry cereal industry and hopefully it will be put on other food industries. This does not exonerate the cereal industry. I only hope that the leaders in this industry are magnanimous enough to admit their shortcomings, and with the help of nutritionists, to undertake more enlightened business and advertising practices.

Why is it that we see so little of this type of advertising of spaghetti or rice or beans? These foods are as good, often better, than breakfast cereals and they are half the price. Would the U.S. public, the U.S. children, be any worse off next year, if in 1971 no money was spent for advertising breakfast cereals? Could not our poor be much better off in 5 years if 200 million dollars was diverted to programs for the poor instead of advertising breakfast cereals? There would probably be very little reduction in the consumption of breakfast cereals and little change in the relative profits of the major manufacturers. But then, I do not believe in the innate goodness of this part of the capitalist system; I think that our values have been misplaced. I think we should concentrate a little more on the quality of life.

Perhaps you wonder why my testimony at times casts doubts on the morality of big business. Although not relevant to cereals, the antibiotic scandal which was inadequately reported in the news media last year is, I think, a matter which is relevant to the work of this committee, and it did personally affect and enrage me. You may remember that five major drug firms were

accused of reaping huge profits by rigging the price of the common and effective antibiotic, tetracycline. The Justice Department said that tetracycline was produced for as little as 1.6 cents per capsule but retailed for 51 cents. In February 1969 these five firms, all leaders in the drug industry, offered to pay 20 million dollars in civil suits brought against them over this issue. This was mainly retribution to states, local governments and hospitals who had been grossly overcharged. However, the consumer who paid 20 dollars for a course of treatment that cost the manufacturer less than a dollar, will find it difficult to get retribution. Worse than this, however, are the many thousands of people all over the world who died unnecessarily because the drug was too expensive. During part of the time that this price rigging was going on (and it lasted for years), I was running the hospital and health services for a district with 150,000 inhabitants in East Africa. We could not afford adequate quantities of tetracycline because of its high price. Many children and adults who could have been saved died of pneumonia, gastro-intestinal infections, sepsis and other infections, because these drug companies had no conscience but were mainly concerned with their profits. I believe that this scandal should not end merely with civil suits, and a gentlemanly out of court settlement. This is a consumer matter and warrants a full investigation. I find it difficult not to feel bitter when I think of those little children in my care who died unnecessarily because of the callousness of big business.

The quality of life

How could we measure the benefits, if part of the large sums spent on advertising, and part of the vast corporate profits, were harnessed to improve social conditions? How does one judge the quality of life? Infant mortality

rates provide an excellent measure, a very good indicator of the social well-being of a people or of a country. Too often, however, in this country, the state and health of the nation have been judged purely in terms of Gross National Product or mean annual incomes. We have been brainwashed by big business through the medium of advertising. The U.S. in these terms, comes out as the richest, the best off country on earth. However, when we look at Infant Mortality Rates (that is the number of deaths in the first year of life per 1000 live births), the United States is about seventeenth on the list. Of those countries which keep good statistics there are twelve that do better in this regard than the United States. They include East Germany, Japan, Australia and New Zealand, all four Scandinavian countries, Great Britain, France and Switzerland.

In Sweden, only 12.9 infants per thousand die in their first year of life, whereas in the United States 21.8 per thousand die. If we did as well as Sweden we could save 9 lives in a thousand. The infant mortality rate for black Americans is over 40 per 1000. These rates are a good indicator of the social health of a country or a community. Those who live in the culture of poverty always have higher infant mortality rates and a larger proportion of low birth weight babies than those who are more affluent. The relief of social and economic disadvantages in this country would have a marked effect on the high infant mortality rates that persist among the American poor. As an undergraduate remarked to me a few days ago, "If the food industry worked diligently to keep people alive longer, there would be more people around and fatter profits for the industry".

Improved nutrition of the mother and the child (and here I would include the promotion of breast rather than formula feeding), is one of many

factors that could reduce these unnecessarily high death rates.

A part of the program to improve the lot of the people should be an honest, moral and positive policy by the food industry towards the consumer. Industry has to make a profit to stay in business. However, like other sectors of the economy, the food industry should also harness its resources to improve the well-being of the American people. I do not say that the food industry has not made some contribution, for it undoubtedly has; but like most other industries it has not made sufficient effort.

Too often the public has been told that this is the best fed country on earth. This is not true. It is only necessary to look at the statistics from Texas from the first phase of the National Nutrition Survey. There is much malnutrition and undernutrition, and some hunger in this most wealthy of nations. If advertising is leading a poor woman in Texas to buy a one pound packet of breakfast cereal for 50 cents for her poorly nourished children when for that sum of money she could purchase more than three pounds of beans which contain far more of every nutrient, then advertising of breakfast cereals is contributing to malnutrition in Texas. A solution to the problem does not lie entirely with the food industry. It lies with the central and local governments, with those involved in nutrition education, and with persons responsible for shaping the social and political philosophy of the country.

Recommendation

There are a number of recommendations that I would make to improve the picture that I have painted in relation to cereals. I would recommend that:

(1) Mandatory legislation be introduced to ensure fortification of breakfast (and other cereal products) back to at least the original

content of nutrients in the parent whole-grain cereals on a calorie basis. A recommendation similar to this was adopted at the White House Conference on Food, Nutrition and Health.

(2) Encouragement be given to allow breakfast cereals manufacturers to increase the quantity and quality of protein in their products.

(3) Restrictions be imposed (or maintained) on the content of vitamin A and vitamin D in breakfast cereals. These vitamins are not easily excreted from the body and excessive intakes can lead to illness.

(4) Truthful disclosure of nutrient content of breakfast cereals and other foods on a per weight basis. To assist this, breakfast cereals (and many other products) should be packaged in weights which are multiples of 4 ounces (that is packages of 4, 8, 12, 16 ounces, etc.), and not as at present in every conceivable weight, including 7, 9, 13, and 18 ounce packages. This makes it difficult, deliberately perhaps, for the consumer to determine either the price per ounce or the nutrient content per dollar spent. Of course, a switch to the metric system for all things would provide a great long term advantage to the consumer.

(5) Voluntary restriction by the cereal manufacturers of advertising of the sugary cereals directed at children.

(6) An investigation, and hopefully a restriction, of the subtle false claims being made by breakfast cereal advertisers, which lead the public to believe that these foods have nutritional qualities which are superior to many cheaper and often more nutritious ordinary foods, such as bread.

(7) Effort by the food industry to provide in its advertising and by other means, sound nutrition education to the consumer, including minority groups and children.

Conclusion

In conclusion, I would ask whether we are going to continue for another generation to mollycoddle the rich and over-protect corporate enterprises, while at the same time withholding opportunities from our minorities and failing to provide adequately for the poor. If so, then there will be no peace in this great land.

CFNI NEWS

The second course for the Diploma in Community Nutrition began on October 4th. Now and henceforth it lasts a normal academic year, with the first term in Jamaica, the second term in Trinidad (except for a 2-week nutrition survey in a Grenadian village) and the third term will be spent by the students in their home country, carrying out a research project, the report on which is with an examination, an essential part of the requirements. As formerly, the students are mature middle- or senior-grade government personnel from all over the English-speaking Caribbean, from Guyana to the Bahamas, and come from departments of health, education, community development and agricultural extension. In addition there are two others, a doctor from the Philippines on a WHO fellowship, and a sister from Catholic Social Welfare from Dominica.

Action continues with another aspect of our training, in Food and Dietary Services for institutions. As well as the within-country courses, preparations are in hand to train with four-month courses, a category of workers called Food Service Supervisors, (known in some countries as Catering Officers). These should relieve dieticians (few in number in any case) of many of their less appropriate supervisory duties and free them more for the exercise of their true professional skills.

The proceedings of the technical group meeting of 1970 on Young Child Feeding in the Contemporary Caribbean, have been published in a special issue (September 1971) of the West Indies Medical Journal, along with the Guidelines themselves.

The one-day seminars on Young Child Feeding, for public health workers and midwives mainly, are almost completed now. They have been running for the past year. They were intended to be held in Jamaica and each of its parishes, in Barbados, all the Associated States and Bahamas, Cayman Isles, Bermuda and Turks & Caicos. Only two parishes in Jamaica and two of the Associated States remain still to have these seminars.

As regards CFNI publications, we have completed the revision of the 'Cajanus' mailing list. As this is a newsletter distributed gratis, we needed to be able in some way to correct all the addresses, to drop from the list the names of those who had moved away or were no longer interested sufficiently in the newsletter to trouble to reply to a form we sent out, (with a reminder for those who did not reply at first). The result has been

very satisfactory to us, and we were able to reduce the list by 537 to 1,763 (as of October 31, 1971). The economies are considerable. *We do, however, remain very willing to add to the mailing list any institution or person in any part of the world who will make a written request to the editor.* Our current mailing list is directed 70 percent to the English-speaking Caribbean, 13 percent to the USA and 17 percent to other countries.

Stocks of the Interim Food Composition Table for the English-speaking Caribbean, published in 1969 have now run out. We expect to publish soon a definitive revised version with almost twice as many foods as previously.

COMMERCIOGENIC MALNUTRITION*

by

D.B. Jelliffe

The prevalence of malnutrition in young children in less developed areas of the world is now well recognized and has been highlighted and publicized by the recent civil war in Nigeria. In too many countries, severe malnutrition is common, while clinically unrecognized lesser degrees (with all their potential for permanent brain damage) are rampant, often affecting more than half the young child population.

Solutions to these problems obviously will vary with particular circumstances in the area concerned. Approaches are always difficult, as the causation of child malnutrition is never simple, but inevitably the result of many cumulative factors. Economics, geography, climate, cultural attitudes, level of parental education, and the availability and quality of health services may be mentioned as a few of the aspects of life that have to be considered in any logical preventive program.

Infant Feeding Significant

Nevertheless, in all parts of the world, a major influence on young child nutrition is plainly infant feeding - so that the forces that persuade parents to feed their children in one way or another and the foods available are key matters.

The large scale problem of young child malnutrition in less developed regions of the world has only become fully appreciated since World War II.

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During this time, various new molding forces have become increasingly operative.

Nutrition Education

The influence of nutrition education has been of obvious importance, flowing through the health services as well as other extension agencies, such as agriculture, education and community development. Much of this has been helpful, but particularly in early years, a great deal of the content of this nutrition education was made up of inappropriate cultural exports from Europe and North America.

Too frequently one found the pediatrician in a tropical, sun-drenched country, exhorting mothers to use cod liver oil to prevent non-existent rickets. Or, one found the public health nurse from Europe advising mothers to feed their babies on orange juice when infantile scurvy did not exist, when oranges were unobtainable, when there was a real danger of unclean orange juice producing diarrhea and when the infant would be receiving adequate ascorbic acid through his mother's milk.

Likewise, the earnest unaculturated Western home economist could be demonstrating the preparation of infant foods with no consideration of their cost or of the limited kitchen possibilities in the mothers' homes.

Fortunately, this has changed to some extent, so that advice on infant feeding tends more and more to be related to local realities - that is too little money, poor storage facilities, different cultural concepts, and other real life circumstances.

Advertising by Industry

In the last 25 years, another major force has increasingly entered the field as a determinant of infant practices in less developed areas of the world. This is advertising by the commerical infant food industry, and it is, perhaps, timely to view the effects, beneficial and harmful, that these well-meaning concerns have achieved and may achieve in the future.

In Western, so-called developed countries, it is quite plain that the infant food industry has been one of the main forces assisting in producing the tremendous improvement in child morbidity from malnutrition, and mortality in the present century. At the same time, it must be appreciated that the technological advances (and parallel promotional campaigns) by these concerns, have taken place in areas of Europe and North America where there have been simultaneous improvements in economic level, in public hygiene and in education. They have also fitted into the cultural main-stream of beliefs, attitudes and actions of these communities.

The circumstances in less developed areas of the world, especially those in the tropics and sub-tropics, are quite different. In general, the majority of populations in these areas have very low incomes, live in poorly sanitated houses and possess limited education.

The advantages that food technology has brought to less developed areas of the world must not be underestimated. The enrichment of certain staples (notably wheat flour), the availability of low cost canned foods, such as sardines, and many other examples may be quoted.

Harmful Effects

In the field of infant feeding, the situation is far less happy. In brief, commercial concerns of excellent worldwide reputation, have exported

infant foods of various sorts to countries where they may do more harm than good because of great differences of economic level, hygiene and maternal education.

Three main groups of food may be particularly mentioned:

Firstly, the wide variety of inherently-excellent, but highly-expensive infant milk preparations have been flooding the market competitively, in many if not all tropical countries, especially in urban areas. The damage that these products may do in communities that are still successfully breast-feeding their infants is readily apparent, when it is appreciated that in one area of East Africa it would have cost a laborer one-third of his salary to be able to use one of these milks in an adequate quantity to feed his 3-month old baby.

In other words, these products have a disruptive effect on the pattern of breast feeding - without supplying an attainable substitute. They are totally beyond the economic range of the group to whom they are supplied. In addition, the possibility of producing an uncontaminated feed is almost nil, when a mother may have only one feeding bottle and nipple, no storage space (let alone electricity or a refrigerator) water from a near-by pond or stream, and because of minimal education, difficulty in following advice on preparing feeds properly. Under these circumstances in very many cases homeopathic doses of milk are administered with large quantities of bacteria - the result is starvation and diarrhea, too often leading to death with the label of marasmus.

It is harsh, but correct, to consider some of these children as suffering from "commerciogenic malnutrition" - that is caused by the thoughtless promotion of these milks and infant foods.

Secondly, a large number of semi-solid infant "weaning" foods are being marketed increasingly widely all over the world. They are convenient, attractive, and almost totally inappropriate for less developed regions. They are extremely costly, not only in themselves, but in relation to their nutrient content. They can well form part of the diet for the well-to-do. For the less privileged, less affluent, they are a wasteful deviation of most limited resources, and with no refrigerator, they have no better keeping properties than home cooked mixtures.

Lastly, the mysteriously termed "tonic" foods, must be noted, although one wonders what is particularly "toned" and how this is achieved. The very term has a quaintly medieval alchemist ring to it. Again, for the affluent, these tonic foods form pleasant flavorings and do little harm, and perhaps may help psychologically. For the less well-to-do - that is, the majority of the world and especially for their children, they are a disastrous waste of money. High-pressure advertising gives them a mystical quality, so that they are highly prized and used in minute and inappropriate quantities.

The content of advertising and the techniques used are those widely employed in the Western world, with emphasis on status and convenience. The tropical mother is in many cases even more vulnerable to these motivating forces. She needs and appreciates convenience foods in

> her "three-stone" kitchen even more than does her sister in Manhattan. She is as anxious to emulate the well-to-do elite, both local and foreign, as is any Western mother. Parents can subconsciously regard these modern foods as a method of instantaneous transport into the 21st century of satellites, moon probes and heart transplants.

Re-examine Education & Persuasion

It seems, therefore, that an objective outside observer could make a case that Western nutrition influence, both from health services and from the much more potent forces of advertising, have done little good in many less developed tropical areas in the past quarter century, and indeed probably on balance have produced more harm than benefit. There is a real need to re-consider where nutrition education and persuasion is going, and this includes both the medical fraternity and also the world of commerce.

For example, is it ethical to advertise, using modern techniques of motivation and persuasion, infant foods in a population that has no chance financially or hygienically of being able to use them in adequate quantities? Should infant milk foods be widely advertised in regions where breast feeding is currently practiced?

Working Relationship Needed

With the increasing unbalanced precipitate urbanization involving the whole world, including less developed areas, and with the easier spread of communications to rural areas all over the world, especially via the transistor radio and the small village shop, it is surely timely for the tropical pediatric nutritionist and the commercial infant food industry to sit down together and to exchange ideas on this increasingly important area of overlap.

The pediatric nutritionist increasingly realizes his reliance on the food industry and appreciates the vast body of technical know-how that they have acquired, as well as the immense forces available for nutritional persuasion in the form of advertising. He also realizes that commercial concerns live in a hard, competitive world and that a successful industry is a profitable one.

The over-riding need is for a dialogue between these two groups, and for the production and promotion of infant foods truly designed for the economic, cultural and hygienic circumstances of less developed areas - including those within the United States and Europe - which both benefit the nutritional level of the child community and also are successful business ventures.

Notes on the style and contents of the list

The purpose of this list is to provide a reference for the names of common food plants in use in each of the Commonwealth Caribbean territories where they are known to occur.

The territories are listed alphabetically in the left-hand column of each page with their names abbreviated as follows:-

Antigua	- Ant.	Guyana	- Guy.
Bahamas	- Bah.	Jamaica	- Jam.
Barbados	- Barb.	Montserrat	- Mont.
British Virgin Islands	- B.V.I.	St. Kitts	- St.K.
Cayman Islands	- Caym.	St. Lucia	- St.L.
Dominica	- Dom.	St. Vincent	- St.V.
Grenada	- Gren.	Trinidad & Tobago	- Trin.

It is beyond our present scope to set down the names of all the varieties in certain complex groups such as mangoes or yams, but those believed to be correctly applied to the main species-groups are given.

The names are presented in two parts. Part I (pages 2-17) has the names of fruits and spices; Part II (pages 18-32) has the names of pulses, root crops, vegetables and herbs. With such a division the placing of some names has been arbitrary and fruits and non-fruits, in the strict botanical sense, occur in both parts. Nevertheless most members of the same family will be found together unless the mode of use of the product clearly indicates otherwise. The tomato is an obvious example of a fruit mostly used as a vegetable and cinnamon is a product of bark.

Acknowledgements

The material on which this list is based was published originally by the Division of Natural Resources, Caribbean Organization in 1965 under the title "List of Fruit Crops, etc. "

This source of names and the cooperation of government departments, other organizations and individuals in the various territories who have provided additional data are gratefully acknowledged.

Revisions

Comments and suggestions for the improvement of this list are invited. If you know of names of food plants which are in common use in your territory which have been entered incorrectly or omitted from the list, please write in the first instance to:-

Dr. C. D. Adams, Department of Botany, University of the West Indies, Mona, Kingston 7, Jamaica, with a copy of your letter to C.F.N.I.

Correspondents may be asked to provide voucher specimens (or seeds, etc.) so that identifications can be verified.

Family	ANACARDIACEAE				
Genus species	Anacardium occidentale	Mangifera indica	Spondias dulcis	S. mombin	S. purpurea
Ant.	Cashew maw (fruit) or Cashew nut	Mango	Golden apple	Hog plum	
Bah.	Cashew	Mango	Golden apple		
Barb.	Cashew	Mango	Golden apple	Hog plum	Jamaican plum
Berm.	Cashew nut	Mango		Hog plum	
B.V.I.	Cherry	Mango		Ghut plum Hog plum	Jamaica plum
Caym.	Cashew	Mango			
Dom.	Cashew	Mango	Golden apple June plum Pomme cythere		
Gren.	Cashew Kushu	Mango	Golden apple	Hog plum Mombain	Chili plum Jamaica plum
Guy.	Cashew	Mango	Golden apple	Plum or Hog plum	
Jam.	Cashew or Cashew nut	Mango	Jew plum June plum	Hog plum	Jamaican plum or Sweet plum
Mont.	Cashew or Cherry	Mango	Golden apple		
St.K.	Cashew or Cherry nut	Mango	Golden apple		
St.L.	Cashew or Pomme or Nois	Mango	Golden apple or Pomme cythere		
St.V.	Cashew	Mango	Golden apple		
Trin.	Cashew	Mango	Golden apple or Pomme cythere	Hog plum	Jamaican plum

Family	ANNONACEAE				BIXACEAE
Genus species	Annona cherimola	A. muricata	A. reticulata	A. squamosa	Bixa orellana
Ant.		Soursop	Custard apple	Sugar apple Sweetsop	Annatto
Bah.		Soursop	Custard apple	Sugar apple	
Barb.		Soursop	Custard apple	Sugar apple	Anatto
Berm.	Cherimoya	Soursop	Custard apple	Sugar apple	Annatto or Arnotto
B.V.I.		Soursop	Custard apple	Sugar apple	
Caym.		Soursop	Custard apple	Sweetsop	Annotto
Dom.		Soursop or Corasol	Custard apple	Sugar apple Cashiment Pomme canelle	Roucou
Gren.	Cherimoya	Soursop	Custard apple or Che Boeuf	Sugar apple	Anatto or Roucou
Guy.		Soursop	Custard apple	Sugar apple	Annatto or Parwah
Jam.	Cherimoya	Soursop	Custard apple	Sugar apple or Sweetsop	Anatto
Mont.		Soursop	Custard apple	Sugar apple	
St.K.		Soursop	Custard apple	Sugar apple	
St.L.		Soursop or Corosol	Custard apple or Cashiment	Sugar apple	Roucou
St.V.		Soursop	Custard apple or Bullock's Heart	Sugar apple	
Trin.		Soursop	Custard apple	Sugar apple or Sweetsop	Anatto or Roucou

Family	BROMELIACEAE	CACTACEAE	CAESALPINIACEAE	CARICACEAE	COMBRETACEAE
Genus species	Ananas comosus	Pereskia aculeata	Tamarindus indica	Carica papaya	Terminalia catappa
Ant.	Pineapple or Pine		Tamarind or Tambrand	Papaw Papaya	Indian Almond
Bah.	Pineapple or Pine		Tamarind	Papaya Pawpaw	
Barb.	Pineapple or Pine	Gooseberry	Tamarind	Pawpaw	Barbados or Indian Almond
Berm.	Pineapple	Barbados gooseberry	Tamarind	Papaw	Demarara or West Indian Almond
B.V.I.	Pineapple		Tamarind	Papai Pawpaw	Almond
Caym.	Pineapple		Tamarind	Pawpaw	Almond
Dom.	Pineapple or Pine		Tamarind	Pawpaw	
Gren.	Pineapple		Tamarind or Tambrand	Papaw Papaye	
Guy.	Pineapple or Pine		Tamarind or Tambran	Papaw Pawpaw	Almond or West Indian Almond
Jam.	Pineapple or Pine	West Indian gooseberry	Tamarind or Tambrun	Papaw Pawpaw	Almond
Mont.	Pineapple or Pine		Tamarind	Pawpaw	
St.K.	Pineapple or Pine		Tamarind	Pawpaw Popoy	
St.L.	Pineapple or Zanana		Tamarind or Tamarin	Papaw Papaye	
St.V.	Pineapple		Tamarind or Tambrand	Pawpaw	
Trin.	Pineapple or Pine		Tamarind Tambran Tambrand	Papaw Pawpoi	Almond

Family	EUPHORBIACEAE	FLACOURTIACEAE	GUTTIFERAE		LAURACEAE
Genus species	Phyllanthus acidus	Flacourtia indica	Garcinia mangostana	Mammea americana	Cinnamomum zeylanicum
Ant.				Mamey or Mammee apple	Cinnamon
Bah.		Governor plum		Mammee	Cinnamon
Barb.			Mangosteen	Mammee apple	Cinnamon
Berm.		Governor plum		Mammee apple	
B.V.I.	Gooseberry tree			Mammee apple	
Caym.				Mammee	Cinnamon
Dom.		Governor plum	Mangostain	Apricot or Marmee apple	Cinnamon or Spice
Gren.	Damsel		Mangostain	Mammee apple or 'Zaboucaud	Cinnamon Celement Spice
Guy.	Gooseberry	Governor plum or Psidium		Mamey	Cinnamon
Jam.	Cherimina Jimbling Otaheite goose-berry	Governor plum	Mangosteen	Mammee apple or Mammy	Cinnamon
Mont.		Governor plum		Mammee apple	Cinnamon
St.K.				Mammy apple	
St.L.		Meerese	Mangosteen	Apricot Mammy apple Z'Abricot	Canelle
St.V.			Mangosteen	Mammee apple	Cinnamon
Trin.	Damsel Otaheite gooseberry	Ceres or Governor plum	Mangosteen	Mammy apple	Cinnamon or Cinnement

Family	LAURACEAE	MALPIGHIACEAE	MALVACEAE	MORACEAE	
Genus species	Persea americana	Malpighia punicifolia	Hibiscus sabdariffa	Artocarpus altilis	A. altilis seeded var.
Ant.	Avocado or Pear	Barbados or West Indian cherry	Sorrel	Breadfruit	Breadnut
Bah.	Avocado pear or Pear	Barbados cherry or Cherry		Breadfruit	
Barb.	Avocado or Pear	Barbados cherry or Cherry	Sorrel	Breadfruit	Breadnut
Berm.	Avocado pear	West Indian cherry		Breadfruit	
B.V.I.	Pear	Barbados cherry	Sorrel	Breadfruit	Breadnut
Caym.	Pear	Cherry	Sorrel	Breadfruit	
Dom.	Avocado pear Pear Zaboca	Cerise or Cherry	Sorrel	Breadfruit	Breadnut
Gren.	Alligator pear Avocado pear Zabooka	Barbados cherry	Sorrel	Breadfruit or Cow	Breadnut or Chataigne
Guy.	Avocado pear Pear	Barbados or West Indian cherry	Roselle or Sorrel	Breadfruit	Breadnut or Katahar
Jam.	Alligator pear Avocado Pear	Acerola Barbados, W.I., Garden cherry	Roselle or Sorrel	Breadfruit	Breadnut
Mont.	Avocado pear Pear Zabooka	Barbados cherry	Sorrel	Breadfruit	Breadnut
St.K.	Alligator Avocado Pear	Barbados cherry or Cherry	Sorrel	Breadfruit or Canaan fruit	Breadnut
St.L.	Avocat Pear Zaboca	Cerise Miouse W.I. cherry	L'Oseille L'Ozeille	Bois pain or Breadfruit	Breadnut or Chataigne
St.V.	Avocado pear Pear Zaboca	Barbados or Sour cherry	Sorrel	Breadfruit	Breadnut
Trin.	Avocado pear Zaboca	Barbados or West Indian cherry or Cherry	Sorrel	Breadfruit or Pembwa	Breadnut or Chataigne

Family	MORACEAE	MUSACEAE		MYRISTICACEAE	MYRTACEAE
Genus species	Artocarpus heterophyllus	'Musa paradisiaca'	'M. sapientum'	Myristica fragrans	Eugenia uniflora
Ant.	Jackfruit	Plantain	Banana or Fig	Nutmeg	
Bah.		Plantain	Banana	Nutmeg	
Barb.		Plantain	Banana	Nutmeg	
Berm.		Plantain	Banana		Surinam cherry
B.V.I.					
Caym.	Jackfruit	Plantain	Banana	Nutmeg	Surinam cherry
Dom.	Jackfruit	Plantain	Banana or Fig	Nutmeg	
Gren.	Monkey apple	Plantain	Banana or Fig	Nutmeg	
Guy.	Jackfruit	Plantain	Banana	Nutmeg	Surinam cherry
Jam.	Jackfruit	Plantain	Banana	Nutmeg	Pitanga or Surinam cherry
Mont,		Plantain	Banana or Fig	Nutmeg	
St.K.		Plantain	Banana or Fig	Nutmeg	Cherry
St.L.	Chataigne coolie or Jackfruit	Plantain	Banana or Fig	Muscade	
St.V.	Jackfruit	Plantain	Banana	Nutmeg	Surinam cherry
Trin.	Jackfruit	Plantain	Banana or Fig	Nutmeg	Pitanga or Surinam cherry

Family	MYRTACEAE				
Genus species	Pimenta dioica	P. racemosa	Psidium guajava	Syzygium cumini	S. jambos
Ant.			Guava	Java plum	Rose apple
Bah.	Pimento	Bay	Guava		
Barb.		Bay leaf	Guava		Rose apple
Berm.	Allspice	Bay Rum tree	Guava		Rose apple
B.V.I.		Bay Rum tree	Guava		
Caym.	Pimento		Guava		Rose apple
Dom.			Guava		Java plum Primrose
Gren.	Allspice Pimento	Bay berry Bay tree	Guava		Pomme rose
Guy.		Bay leaf Spice leaf	Guava	Jamoon	Plum rose Rose apple
Jam.	Allspice Pimento	Bay Rum tree	Guava	Damson tree Java plum	Rose apple
Mont.		Bay tree	Guava		Java plum Rose apple
St.K.			Guava		
St.L.		Bois d'Inde	Goyave or Gouyave		Pomme rose Rose apple
St.V.			Guava		Java plum
Trin.	Allspice or Pimento or Jamaica pepper	Bay leaf	Guava		Pomme rose Rose apple

Family	MYRTACEAE	ORCHIDACEAE	OXALIDACEAE		PALMAE
Genus species	Syzygium malaccense	Vanilla planifolia	Averrhoa bilimbi	A. carambola	Cocos nucifera
Ant.	Malacca apple	Vanilla			Coconut
Bah.					Coconut
Barb.		Vanilla		Chinese starapple	Coconut
Berm.	Malay apple				Coconut
B.V.I.					Coconut
Caym.	Otaheite apple				Coconut
Dom.	Pomerac Pomme rose	Vanilla			Coco or Coconut
Gren.	French Kushu	Vanilla	Blimbing Condicion	Coolie Tamarind	Coconut
Guy.	Cashew or French cashew Malacca apple	Vanilla	Bilimbi Kamaranga Sourie	Carambola Five Finger	Coconut or Narial
Jam.	Otaheite apple	Vanilla	Bilimbi Long Jimbelin	Carambola	Coconut
Mont.		Vanilla		Five Finger	Coconut
St.K.					Coconut
St.L.	Pomme d'amour Love apple Pomme rose	Vanilla		Carambola or Pomme canelle	Coco or Coconut
St.V.	Plum rose			Carambola	Coconut
Trin.	Pommerac or Plum rose	Vanilla		Coolie Tamarind or Five Finger	Coconut or Naryar

Family	PAPILIONACEAE	PASSIFLORACEAE			
Genus species	Dipteryx odorata	Passiflora edulis	P. laurifolia	P. ligularis	P. maliformis
Ant.					
Bah.		Egg fruit or Passion fruit			
Barb.		Passion fruit	Water lemon		
Berm.		Passion fruit	Water lemon		
B.V.I.					
Caym.					
Dom.		Passion fruit	Water lemon		
Gren.	Tonka bean	Passion fruit	Water lemon		
Guy.		Forbidden fruit or Passion fruit	Bell apple or Semitoe		
Jam.		Mountain sweet cup or Passion fruit	Golden apple	Granaditta	Sweet Cup
Mont.		Passion fruit			
St.K.		Cocktail fruit or Passion fruit			
St.L.		Passion fruit or Pomme de liane			
St.V.		Passion fruit			Belle apple
Trin.	Tonka bean	Pomme de liane	Water lemon		

Family	PASSIFLORACEAE	PIPERACEAE	POLYGONACEAE	PUNICACEAE	RHAMNACEAE
Genus species	Passiflora quadrangularis	Piper nigrum	Coccoloba uvifera	Punica granatum	Ziziphus mauritiana
Ant.		Black pepper	Sea grape	Pomegranate	Dumbs Stink tree
Bah.		Black pepper	Sea grape	Pomegranate	Juju or Jurjue
Barb.	Granadilla	Black pepper	Sea grape Seaside grape	Pomegranate	Dunks
Berm.	Granadilla		Bay grape Sea grape	Pomegranate	Indian jujube
B.V.I.			Sea grape	Pomegranate	
Caym.	Granadilla		Grape	Pomegranate	
Dom.	Barbadine or Granadilla	Black pepper	Sea grape	Grinard or Pomegranate	Dunks
Gren.	Granadilla	Black pepper	Seaside grape	Pomegranate	
Guy.	Granadilla	Black pepper	Seaside grape	Pomegranate	Bhyre or Dunks
Jam.	Granadilla	Black pepper	Sea grape Seaside grape	Pomegranate	Collie plum Crab apple or Jujube
Mont.		Black pepper	Seaside grape	Pomegranate	
St.K.	Granadilla			Pomegranate	
St.L.	Barbadine or Granadilla	Poivre noir	Raisin bord la mer	Grenade or Grinard or Pomegranate	
St.V.	Granadilla	Black pepper	Seaside grape	Pomegranate	
Trin.	Barbadine or Granadilla	Black pepper	Seaside grape	Pomegranate	Dunks

Family	ROSACEAE		RUBIACEAE		RUTACEAE
Genue species	Chrysobalanus icaco	Eriobotrya japonica	Coffea arabica	C. liberica	Citrus aurantifolia
Ant.	Coco plum		Coffee	Coffee	Lime
Bah.			Coffee	Coffee	Lime
Barb.			Coffee		Lime
Berm.	Porkfat apple	Loquat	Coffee		Lime
B.V.I.	Coco plum		Coffee		Lime
Caym.					Lime
Dom.			Coffee	Coffee	Lime
Gren.			Coffee	Coffee	Lime
Guy.			Coffee	Coffee	Lime
Jam.	Coco plum	Loquat	Coffee	Coffee	Lime
Mont.			Coffee	Coffee	Lime
St.K.					Lime
St. L.			Cafe	Cafe	Lime or Citron
St.V.			Coffee	Coffee	Lime
Trin.	Cacao plum Fat pork	Japanese Mediar or Loquat	Coffee	Coffee	Lime

Family | RUTACEAE

Genus species	Citrus aurantium	C. limon	C. maxima	C. medica	C. paradisi
Ant.	Bitter orange Seville sweet	Lemon	Shaddock		Grapefruit
Bah.	Bitter sweet Sour orange	Lemon	Shaddock	Citron	Grapefruit
Barb.	Bitter or Seville orange	Lemon	Pomelo or Shaddock	Citron	Grapefruit
Berm.	Sour orange	Lemon	Shaddock	Citron	Grapefruit
B.V.I.	Bitter orange				Grapefruit
Caym.	Seville orange	Lemon	Shaddock	Citron	Grapefruit
Dom.	Gospo or Seville orange	Lemon	Shaddock	Citron	Grapefruit
Gren.	Seville or Sour orange or Swivel sweet	Lemon	Forbidden fruit Shaddock	Citron	Grapefruit
Guy.	Seville sweet or Sour orange	Lemon	Forbidden fruit, Pomelo or Shaddock	Citron	Grapefruit
Jam.	Seville or Sour orange	Lemon	Shaddock	Citron	Grapefruit
Mont.	Seville sweet	Lemon	Shaddock	Citron	Grapefruit
St.K.	Souringe or Sour orange	Lemon	Shaddock		Grapefruit
St.L.	Seville sweet Sour orange or Z'orange sur	Lemon or Limon	Fruit defendu Shadette or Shaddock	Citron	Grapefruit or Grapp foot
St.V.	Seville sweet or Sour orange	Lemon	Shaddock	Citron	Grapefruit
Trin.	Sour orange	Lemon	Forbidden fruit, Pomelo or Shaddock	Citron	Grapefruit

Family	RUTACEAE				SAPINDACEAE
Genus species	Citrus reticulata	C. sinensis	C. 'putative X'	Fortunella margarita	Blighia sapida
Ant.	Tangerine	Grafted or Sweet orange or Orange			Ackee
Bah.	Tangerine	Orange		Kumkwat	Ackee
Barb.	King orange or Mandarin or Tangerine	Grafted or Sweet orange or Orange			
Berm.	Mandarin orange or Tangerine	Orange		Kumquat	Ackee
B.V.I.		Sweet orange			
Caym.	Tangerine	King orange or Orange	Ortanique		Ackee
Dom.	Mandarin or Tangerine	Grafted orange or Orange			
Gren.	Mandarin or Tangerine	Sweet orange	Ortanique		Ackee or Akee
Guy.	Tangerine	Sweet orange or Orange			Akee
Jam.	Tangerine	King or Sweet orange	Ortanique	Kumkwat	Ackee
Mont.	Tangerine	Orange			Ackee
St.K.	King orange or Tangerine	Orange	Ortanique		Ackee
St.L.	Mandarin or Tangerine or Or. de Grenadine	Orange or Orange de chine	Ortanique		
St.V.	Tangerine	King orange or Mallya Mandarin	Ortanique		Ackee or Jamaica Ackee
Trin.	Mandarin or Tangerine or Portugal	Orange		Kumkwat or Kumqua'	

Family	SAPINDACEAE		SAPOTACEAE		
Genus species	Litchi chinensis	Melicoccus bijugatus	Chrysophyllum cainito	Manilkara zapota	Pouteria campechiana
Ant.		Genip or Guinep	Star apple	Sapodilla	
Bah.		Genip Kinip	Star apple	Sapidilla	
Barb.		Ackee	Star apple	Sapodilla	
Berm.		Genip	Star apple	Sapodilla	
B.V.I.		Genip	Star apple	Mesple	
Caym.		Ginep	Star apple	Naseberry	Egg fruit
Dom.		Chenette or Ginep or Kenip	Star apple	Chapotee or Sapodilla	
Gren.	Litchi	Chenip or Skinup	Star apple	Chicle or Sapodilla	
Guy.		Genip or Kinnup	Star apple	Chicle gum Sapodilla	
Jam.	Litchi	Guinep	Star apple	Naseberry	Canistal
Mont.		Ginep	Star apple	Sapodilla	
St.K.		Genip or Kinip or Skinip	Star apple	Sapodilla	
St.L.		Ackee or Chennette or Quennette	Caimite	Chapotee or Sapotie or Sapodilla	
St.V.		Guinep	Star apple	Sapodilla	
Trin.		Chennette or Ginep or Mapo	Caimite or Star apple	Sapodilla	

Family	SAPOTACEAE	STERCULIACEAE		ZINGIBERACEAE	
Genus species	Pouteria sapota	Cola acuminata	Theobroma cacao	Curcuma domestica	Zingiber officinale
Ant.	Mammee support		Cacao		Ginger
Bah.				Turmeric	Ginger
Barb.			Cocoa	Turmeric	Ginger
Berm.	Mammee sapota				Ginger
B.V.I.			Cocoa		
Caym.					
Dom.			Cocoa		Ginger
Gren.	Sapote	Kola nut	Cocoa		Ginger
Guy.			Cacao or Cocoa	Dye or Turmeric	Ginger
Jam.	Mammee sapota	Bissy or Cola	Cocoa	Tambric or Turmeric	Ginger
Mont.	Mammee support		Cocoa		Ginger
St.K.	Mamsoport				
St.L.		Kola	Cacao	Chichima	Gingembre
St.V.			Cocoa		Ginger
Trin.	Mammy sapote		Cacao or Cocoa		Ginger

Part II

PULSES, ROOT CROPS, VEGETABLES AND HERBS

Family	AMARANTHACEAE	ARACEAE		BASELLACEAE	CANNACEAE
Genus species	Amaranthus spp.	Colocasia esculenta vars.	Xanthosoma spp.	Basella alba	Canna edulis
Ant.	Spinach	Dasheen Eddo	Tannia		
Bah.	Spinach				
Barb.	Spinach	White Eddo	Tannia		
Berm.		Dasheen Eddoe	Tanier	Basella	Tous-les-mois
B.V.I.	Caterpillar			Ceylon spinach	
Caym.	Spinach				
Dom.	Callaloo Spinach Zipina	Dasheen	Chou		
Gren.	Callaloo	Barbados or Chinese Eddo or Dasheen	Tannia	Spinach Vine	Queensland arrowroot or Tous-les-mois
Guy.	Bhajee Calaloo Caterpillar	Dasheen Eddoe Slip-and-dip	Tannia		
Jam.	Calaloo Spinach	Coco Dasheen	Badoo Tannia Taya	Country spinach	Queensland or Spanish arrowroot
Mont.	Spinach	Dasheen	Tannia		
St.K.	Bush or Spinach	Dashen	Tannia		
St.L.	Agonment Kallaloo Z'herbage	Chou Bouton Dashen	Chou caraibe		Toulomois
St.V.	Calaloo	Dasheen	Tannia		
Trin.	Bhagi Spinach	Chinese Eddoe or Dasheen	Tannia	Poi spinach	Queensland arrowroot

Family	CHENOPODIACEAE	COMPOSITAE		CONVOLVULACEAE	CRUCIFERAE
Genus species	Beta vulgaris	Cichorium intybus	Lactuca sativa	Ipomoea batatas	Brassica caulorapa
Ant.	Beet		Lettuce	Potato or Sweet potato	Kohl rabi
Bah.	Beetroot or Beets		Lettuce	Potato or Sweet potato	Kohl rabi
Barb.	Beetroot or Beets		Greens Lettuce Salad	Sweet potato	Kohl rabi
Berm.	Beet	Chicory	Lettuce	Sweet potato	Kohl rabi
B.V.I.			Lettuce	Potato	
Caym.	Beetroot		Lettuce	Sweet potato	
Dom.	Beet		Lettuce	Sweet potato	
Gren.	Beet		Greens or Lettuce	Sweet potato	Kohl rabi
Guy.	Beet or Beetroot		Lettuce Salad	Sweet potato	
Jam.	Beet or Beetroot	Chicory	Lettuce	Sweet potato	Kohl rabi
Mont.	Beet		Lettuce	Potato or Sweet potato	
St.K.			Lettuce	Sweet potato	Kohl rabi
St.L.	Betterave		Laiti Laitue Laytee	Patate Sweet potato	Kohl rabi
St.V.			Lettuce	Sweet potato	
Trin.	Beet	Chicory	Lettuce	Potato or Sweet potato	Kohl rabi

Family CRUCIFERAE

Genus species	Brassica juncea	B. oleracea var. oleracea	B. oleracea var. botrytis	B. oleracea var. gemmifera	B. pekinensis
Ant.		Cabbage	Cauliflower		
Bah.		Cabbage	Cauliflower	Brussels sprouts	Chinese cabbage
Barb.		Cabbage	Cauliflower		
Berm.	Mustard greens	Cabbage	Cauliflower	Brussels sprouts	Chinese cabbage
B.V.I.		Cabbage			Chinese cabbage
Caym.		Cabbage	Cauliflower		
Dom.	Mustard	Cabbage	Cauliflower		Chinese cabbage
Gren.		Cabbage	Cauliflower		Pakchoi
Guy.	Mustard	Cabbage Head cabbage	Cauliflower		Chinese cabbage or Pakchoi
Jam.	Mustard	Cabbage	Cauliflower	Brussels sprouts	Chinese cabbage or Pakchoi
Mont.	Mustard	Cabbage	Cauliflower	Brussels sprouts	
St.K.					Chinese cabbage
St.L.	Moutard	Choux a pomme			Chinese cabbage
St.V.		Cabbage	Cauliflower		
Trin.	Mustard	Cabbage	Cauliflower	Brussels sprouts	Chinese cabbage or Pakchoi or Patchoi

Family	CRUCIFERAE			CUCURBITACEAE	
Genus species	Brassica rapa	Nasturtium officinale	Raphanus sativus	Citrullus lanatus	Cucumis anguria
Ant.		Watercress	Radish	Water melon	
Bah.		Watercress	Radish	Water melon	Gherkin
Barb.		Watercress	Radish	Water melon	
Berm.	Turnip	Watercress	Garden radish	Water melon	
B.V.I.	Turnip		Radish	Water melon	Wild cucumber
Caym.			Radish	Melon	
Dom.		Coussan or Watercress	Radish	Water melon	Cocombre chien
Gren.		Watercress	Radish	Water melon	Gherkin Wild cucumber
Guy.		Watercress	Radish	Water melon	Gherkin
Jam.	Turnip	Watercress	Radish	Melon or Water melon	West Indian gherkin Wild cucumber
Mont.		Watercress	Radish	Melon or Water melon	
St.K.		Watercress	Radish	Water melon	
St.L.		Cousson or Watercress	Radis or Radish	Melon d'eau Moulon or Water melon	Ti cocombre
St.V.		Watercress	Radish	Water melon	
Trin.		Crestles or Watercress	Mourai or Radish	Belle Apple Water melon	West Indian gherkin

Family CUCURBITACEAE

Genus species	Cucumis melo & vars.	C. sativus	Cucurbita maxima	C. pepo	Lagenaria siceraria
Ant.	Cantaloupe Musk melon Sweet melon	Cucumber Cossi or smooth	Pumpkin		
Bah.	Cantaloupe Musk melon	Cucumber	Pumpkin	Marrow or Squash	
Barb.	Cantaloupe Melon or Musk melon	Cucumber	Pumpkin	Marrow or Vegetable marrow	
Berm.	Melon or Musk melon	Cucumber	Pumpkin	Marrow or Squash	
B.V.I.		Cucumber			Gourdie Sweet Gourd
Caym.	Musk melon	Cucumber	Pumpkin	Marrow	
Dom.	Melon	Cucumber	Pumpkin	Gourd	
Gren.	Musk melon	Cucumber	Pumpkin	Squash	
Guy.	Melon or Musk melon	Cucumber	Pumpkin		
Jam.	Cantaloupe Musk melon	Cucumber	Pumpkin	Marrow or Vegetable marrow, Squash	Bottle Gourd
Mont.	Cantaloupe Melon or Musk melon	Cucumber	Pumpkin	Squash	
St.K.	Melon	Cucumber	Pumpkin		
St.L.	Cantaloupe Melon	Cocomme Concombre Cucumber	Giraumon Jarmou Pumpkin	Gourge Marrow	
St.V.	Cantaloupe	Cucumber	Pumpkin		
Trin.	Melon or Musk melon	Cucumber	Courba Pumpkin	Squash Vegetable marrow	Gouge Gourd

Family	CUCURBITACEAE		DIOSCOREACEAE		
Genus species	Momordica charantia	Sechium edule	Dioscorea alata	D. cayonensis	D. rotundata
Ant.	Maidens bush	Christophine		Yellow yam	
Bah.					White yam
Barb.	Cerasee Miraculous vine	Christophine			
Berm.		Christophine			
B.V.I.	Maiden apple Bitter bark	Christophine			
Caym.				Yellow yam	
Dom.		Christophine		Yellow yam	
Gren.	Carilla	Christophine		a tous temps	
Guy.	Baan Carilla	Christophine Squash		Dye yam Hard yam Yellow yam	White yam
Jam.	Cerasee Foo-gah	Cho cho	Greater yam Water yam	Yellow yam	Guinea yam White yam
Mont.		Christophine			
St.K.					
St.L.		Christophine	Lisbon yam	Yam a tous temps Yellow yam	
St.V.		Christophine	Water yam	Dominica yam	White yam
Trin.	Carilla	Christophine	Greater Asiatic yam	Afou or Yellow yam Yam a tout tan	Guinea yam

Family	DIOSCOREACEAE	EUPHORBIACEAE	LABIATAE	LILIACEAE	
Genus species	Dioscorea trifida	Manihot esculenta	Thymus vulgaris	Allium ascalonicum	A. cepa
Ant.		Cassava Manioc	Thyme		Onion
Bah.		Cassava	Thyme	Shallot	Onion
Barb.		Cassava	Thyme	Eschallot or Shallot	Onion
Berm.		Cassava	Thyme	Shallot	Onion
B.V.I.		Cassava	Thyme		
Caym.	Yampie	Cassava	Thyme		Onion
Dom.	Cush-cush	Cassava	Thyme		Onion
Gren.	Cush-cush	Cassava Manioc	Thyme	Shallot	Onion
Guy.	Bell yam Buck yam Cush-cush	Cassava	Thyme	Eschallot Shallot or Seasoning	Onion
Jam.	Indian Yam Yampie	Cassava Tapioca	Thyme	Eschallot Shallot	Onion
Mont.		Cassava	Thyme	Shallot	Onion
St.K.					
St.L.	Couche couche	Manioc	Di Thin	Shallot	L'onion
St.V.	Cush-cush	Cassava	Thyme	Shallot	Onion
Trin.	Cush-cush	Cassava Manioc	Thyme		Onion

Family	LILIACEAE				MALVACEAE
Genus species	Allium fistulosum	A. porrum	A. sativum	A. schoenoprasum	Abelmoschus esculentus
Ant.			Garlic	Chive	Ochro or Okra or Ladies finger
Bah.		Leek	Garlic		Ochra
Barb.		Leek	Garlic	Seasoning	Ochro or Okra
Berm.	Spring Onion	Leek	Garlic	Chives	Okra
B.V.I.					Okra
Caym.	Skellion				Okra
Dom.		Leek	Garlic	Chive	Okra
Gren.			Garlic	Syve	Okra or Okro
Guy.			Garlic	Chives	Ochro or Okra
Jam.	Escallion Skellion	Leek	Garlic	Chives	Ochro or Okra
Mont.			Garlic		Ochro or Okra
St.K.					Okra
St.L.	Ti l'onion		L'aile	Ti l'onion pays	Gumbo or Ochro
St.V.			Garlic	Chives	Okra
Trin.	Skallion	Leek	Garlic	Chives	Lady fingers Ochro or Six week or Salian

Family	MARANTACEAE		MORINGACEAE	PAPILIONACEAE	
Genus species	Calathea allouia	Maranta arundinacea	Moringa oleifera	Arachis hypogaea	Cajanus cajan
Ant.		Arrowroot	Horse-radish	Groundnut Peanut	Pigeon pea
Bah.		Arrowroot		Peanut	Pigeon pea
Barb.		Arrowroot	Horse-radish tree	Groundnut Peanut	Green pea Pigeon pea
Berm.		Arrowroot	Horse-radish tree	Peanut	Pigeon pea
B.V.I.			Horse-radish tree	Peanut	Pigeon pea
Caym.		Arrowroot		Peanut	Congo pea Pigeon pea
Dom.	Topi Tambu			Groundnut Peanut Pistache	Pigeon pea Pois angole
Gren.	Topi Tambo	Arrowroot		Groundnut	Green pea Pigeon pea
Guy.		Arrowroot	Si-jan	Groundnut Peanut	Green pea Pigeon pea
Jam.		Arrowroot	Ben nut tree Horse-radish tree	Peanut	Gungo pea Pigeon pea
Mont.		Arrowroot		Groundnut Peanut	Pigeon pea
St.K.					Pigeon pea
St.L.	Touple nambours	Mouchasse or Barbade		Pistache	Pigeon pea Pois dangole
St.V.		Arrowroot		Peanut	Pigeon pea
Trin.	Topi Tambu	Arrowroot	Horse-radish tree	Groundnut Peanut	Green pea Pigeon pea Rahar

Family PAPILIONACEAE

Genus species	Canavalia ensiformis	Cicer arietinum	Glycine max	Lablab purpureus	Phaseolus lunatus
Ant.		Garbanzo	Soya bean	Bonavist Hyacinth bean Lubia	Lima bean White bean
Bah.			Soya bean	Butter bean	Lima bean
Barb.	Horse bean		Soya bean	Bonavist	Lima bean White bean
Berm.			Soybean	Hyacinth bean	Lima bean
B.V.I.				Bonavist bean	Lima bean
Caym.				Bonavist bean	
Dom.	Horse bean		Soya bean	Butter bean Pois Bourcosson	White pea
Gren.	Grudge pea Maljoe	Chick pea Gram		Bonavist bean Bunabis	Lima bean
Guy.	Sword bean	Channa Chick pea	Soya bean	Bannabees Butter bean Saeme	Lima bean
Jam.	Horse bean Jack bean Overlook bean	Chick pea	Soya bean	Bonavist Bonavis Lablab bean	Broad bean Lima bean White bean
Mont.				White bean	Lima bean
St.K.	Horse bean			Bonabis or Bonavis	Butter bean Lima bean White bean
St.L.	Bengal bean	Pois chicke		Bonavis Pois Bourcosson, Saeme	Lima bean Pois soure White bean
St.V.				Bonavist	Broad bean Butter bean White bean
Trin.	Horse bean Jack bean Maljoe	Channa Chick pea	Soya bean	Bonavis pea Sem White bean	Lima bean

Family	PAPILIONACEAE				
Genus species	Phaseolus mungo	P. vulgaris	Pisum sativum	Vicia faba	Vigna sesquipedalis
Ant.		Common bean String bean		Horse bean	Six weeks
Bah.		Kidney bean	Green pea	Broad bean	
Barb.	Woolly pyrol	Red bean String bean			Increase pea Rounceval pea
Berm.		String bean	Pea	Broad bean	
B.V.I.		Red bean			
Caym.		String bean			
Dom.		Red bean Red peas	Green pea	Broad bean	Six weeks
Gren.		String bean			Bodi bean Yard bean
Guy.	Mung bean	Bisoloma Green bean			Asparagus bean Yard bean
Jam.	Mung bean	Kidney bean Red peas String bean	Green pea	Broad bean	Yard long
Mont.		String bean			
St.K.					Six weeks
St.L.		Pois rouge			Bodi bean Boucouson
St.V.		String bean	Green pea	Broad bean	Bodi bean
Trin.	Mung bean Woolly pyrol Urdi	Kidney bean Salad bean String bean	Field pea Garden pea Green pea		Bodi bean Yard bean

Family	PAPILIONACEAE	SOLANACEAE			
Genus species	Vigna unguiculata	Capsicum annuum	C. frutescens	Cyphomandra betacea	Lycopersicon esculentum
Ant.	Blackeye pea	Sweet pepper	Peppers		Tomato
Bah.	Blackeye pea Cow pea	Green pepper Sweet pepper	Hot pepper Red peppper		Tomato
Barb.	Blackeye pea	Bonny pepper Sweet pepper	Bird pepper Finger pepper Spur pepper		Tomato
Berm.	Cow pea	Spanish pepper	Guinea pepper	Tree tomato	Tomato
B.V.I.	Blackeye pea		Bird pepper Jumbie pepper		Tomato
Caym.	Blackeye pea Cow pea		Peppers		Tomato
Dom.	Blackeye pea		Pimentoiseau		Tomados Tomato
Gren.	Blackeye pea		Peppers Chillies		Creole tomato or Tomato
Guy.	Blackeye pea	Bell pepper Burgoman or Sweet pepper	Bird pepper		Tomato
Jam.	Blackeye pea Cow pea	Sweet pepper	Bird pepper Chilli	Tree tomato	Tomato
Mont.	Blackeye pea		Bird or Hot pepper		Tomato
St.K.	Blackeye pea	Sweet pepper	Hot pepper		Tomato
St.L.	Blackeye pea Pois zeux noir	Piment or Pimient	Pepper		Tomados or Tomate or Tomato
St.V.	Blackeye pea	Sweet pepper	Hot pepper		Tomato
Trin.	Blackeye pea Gub-gub	Sweet pepper	Bird pepper Chilli Hot pepper		Love Apple Tomato

Family	SOLANACEAE				UMBELLIFERAE
Genus species	Physalis peruviana	Solanum melongena	S. torvum	S. tuberosum	Apium graveolens
Ant.		Antrovers Aubergine Egg plant			Celery
Bah.		Egg plant			Celery
Barb.		Bolanger Boulanger Egg plant	Trubba	English potato	Celery
Berm.	Cape gooseberry	Egg plant		Potato	Celery
B.V.I.		Egg plant Melongae	Shoo shoo bush	Irish potato	
Caym.		Egg plant Garden egg			
Dom.		Balangene Egg plant Melongene			Celery
Gren.	Cape gooseberry	Aubergine Balangene Egg plant	Sussuba		Celery
Guy.		Baigan Boulanger Egg plant		Alu English or Irish potato	Celery
Jam.	Cape gooseberry	Egg plant Garden egg	Susumber	Irish potato	Celery
Mont.		Boulanger Egg plant			Celery
St.K.		Chuber Egg plant Melonger			
St.L.		Boulanger Egg fruit Melongene			Celery
St.V.		Balanger Egg plant			Celery
Trin.		Egg plant Bigan Melongene	Shushumber	English or Irish potato	Celery

Family	UMBELLIFERAE				
Genus species	Daucus carota	Foeniculum vulgare	Petroselinum crispum		
Ant.	Carrot		Parsley		
Bah.	Carrot		Parsley		
Barb.	Carrot	Fennel	Parsley		
Berm.	Carrot		Parsley		
B.V.I.	Carrot	Wild Fennel	Parsley		
Caym.	Carrot				
Dom.	Carrot		Parsley Persi		
Gren.	Carrot		Parsley		
Guy.	Carrot		Parsley		
Jam.	Carrot	Fennel	Parsley		
Mont.	Carrot		Parsley		
St.K.					
St.L.	Carotte		Persil		
St.V.	Carrot				
Trin.	Carrot		Parsley		