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PRESENT STATUS OF NUTRITIONAL RESEARCH IN CHILE

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PRESENT STATUS OF NUTRITIONAL RESEARCH IN CHILE

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PRESENT STATUS OF NUTRITIONAL RESEARCH IN CHILE

GENERAL NUTRITION AND HEALTH INFORMATION

During the last twenty years there has been a continuous improvement in health conditions and nutrition for Chile's infant population. This trend has accentuated strikingly during the past five years. At the present time, significant advances are shown by both direct and indirect indicators. While problems persist, the situation is far better than in the Region as a whole.

Infant mortality, nearly per cent in 1965 had dropped to 31 per cent by 1980. Similarly, mortality among preschoolers fell from 5 per cent in 1965 to 0.5 per cent by 1980 (Figure 1).

Deaths from diarrhea in the under-one age group, which numbered 4,200 in 1969, declined to 483 in 1980 (Figure 2), while deaths from broncopneumonia were decreasing from 7,300 to 962 per year (Figure 2).

A reduction in infant malnutrition is even more apparent, as evidenced by weight-for-age figures. A nutrition survey was carried out in 1965 in a representative province of the central zone of the country (Curicó Province), where more than 80 per cent of the Chile's population lived. Examination of 10 per cent of children under-six showed that 65.9 per cent of them were suffering from malnutrition in one degree or another (mild, medium or severe) (Table 1). This proportion has now declined to 14 per cent in the same province, with individual figures of 10 per cent for mild, 3.4 per cent for medium, and 0.6 per cent for severe malnutrition.

Weight-for-age information on 90 per cent of the country's under-six population (1,350 children) has been available periodically (at six-month intervals) from the health agencies for the last four years. According to this information, 11.4 per cent are suffering from some degree of malnutrition, 9.5 per cent from mild, 1.7 per cent from medium, and 0.2 per cent from severe malnutrition (Table 1).

UNDERDEVELOPMENT AND MALNUTRITION

Malnutrition is a consequence of poverty, which is in turn a sequela of underdevelopment. The existence of undernourished children is explained by many factors: poor sanitary conditions, illiteracy, low school enrollment rates, ignorance, overcrowding, etc. But the leading cause is beyond a doubt low family income, which does not allow for the purchase of food in the necessary quantity or quality. (1). If this assumption is valid, progress in the prevention of malnutrition should run parallel to the country's economic and social development. However, the country's economic growth in the last twenty years has been very slow, averaging only 1.5 per cent per capita per year. Even today, families on the average spend 50.2 per cent of their income on food, which is an indication that average income is still very low (in the United States 16.8 per cent of family income is spent on food). Moreover, 20 per cent of the population is still at extreme poverty levels and this proportion does not appear to have changed significantly for the last twenty years. Accordingly, there have to be other reasons for the obvious change in the health and nutrition levels of the child population (1).

There is a parallel and constant relationship between malnutrition and underdevelopment. If the degree of development attained by countries is examined on the basis of existing information, it is found to be very closely related to the nutrition status of the infant population. Figure 3 is an attempt to correlate these two factors in a group of selected countries. An indirect parameter in which infant mortality and pre-school mortality was chosen as the basis for quantifying malnutrition. It was found that when malnutrition ceases to be a cause of death (as in developed countries) the ratio between infant mortality and pre-school mortality settles within a fairly fixed range. In the developed countries, for each 20 or 25 infants below age one who die (congenital malformations, metabolic diseases, or problems of partum) one pre-school-age child dies. In the underdeveloped countries, where malnutrition is prevalent and an important cause of death, proportionally more pre-schoolers die and the ratio is 1:5 or 1:10. Accordingly, this ratio

can be used to obtain overall information on the nutrition status of the under-four population in a given country.

The United Nations Development Institute has prepared a development index based on 80 different items, including, for instance, kilometers of paved road per inhabitant, energy intake per inhabitant, newspapers, radios and television sets per inhabitant, drinking water consumption, housing, etc. Figure 3 indicates a very close relationship between this development index and nutrition status as measured by the parameter described above. The countries included in the graph were not especially selected, but were those for which all the information was available.

Chile's situation as shown in the graph is remarkable for the fact that considering these parameters the nutrition status of the infant population is very high for the attained degree of economic development. This makes it evident that, as previously noted, the progress achieved is not only a consequence of the country's economic development. Figure 4 analyzes the correlation between economic development and the nutrition status of the infant population during the period from 1940 to 1979. It will be noted that in 1940 the ratio between the two factors was consistent with the pattern for the other countries. In the same year, in which the degree of economic development was low, the nutrition index was also low. Thereafter, particularly since 1960, the two parameters come progressively closer together, with a striking improvement in nutrition status and lesser progress in economic development. This coincides with the improvement in health and nutrition activities, which actually began in 1951.

HEALTH AND NUTRITION ACTIVITIES

The information examined above makes it necessary to accept that the progress in health and nutrition during recent decades cannot be attributed exclusively to the process of economic development. Other direct factors must necessarily be playing a part. We believe that at least two other factors have been important: a) the development of the

health and education systems, which in the intervening period have gradually expanded their coverage, improved their efficiency, and increasingly penetrated into every strata of society; and b) the development of nutrition research, which, on the one hand has strongly influenced the awareness of nutrition problems, thereby making it necessary to assign resources for treatment and prevention, and, on the other, has permitted the design and implementation of scientifically-conceived interventions.

Health and education structures: Prior to 1951, health activities were rare and of slight significance in relation to needs. Beginning in that year, a new stage emerged with the establishment of the National Health Service and the implementation of a socialized system of medicine for the entire country. Since then, health activities have been progressively improved and extended, to a point where at the present time they cover 80 per cent of the population, with priority given to low-income people who cannot afford privately-practiced medicine.

The health service now has a budget of nearly a one billion dollars a year and 230 hospitals, with a ration of 3.1 beds per 1,000 inhabitants. It covers the entire country, with 1,420 health centers and posts. Ninety-two per cent of all childbirths now take place in hospitals and are attended to by professional personnel, and tetanus neonatorum, malaria and poliomyelitis have been eradicated.

Over the same period, 7,200 primary schools have been opened or improved, and pre-school education has been initiated, with efforts focused on the areas of greatest poverty. Illiteracy is now at 8 per cent, and the school dropout rate has been drastically reduced (2).

Using the education and health structures, a number of nutrition interventions have been developed and perfected, with efforts concentrated on the 0-6 age group, especially in extreme poverty areas. The major interventions currently under way include notably the following:

1. Distribution of powdered milk (26 per cent butterfat content) to all unweaned infants from 0 to 2 years of age. Almost 95 per cent of this age group is now being covered.

2. Distribution of enriched infant formulas (20 per cent protein content, with a biological value similar to that of cassein) for children from 2 to 6 years of age. Here, 85 per cent of this age group is being covered.

3. Families with undernourished children are supplied with an extra amount of nonperishable foods, which help to improve the family diet (agreement with OFASA).

4. Distribution of powdered milk (3 kilos per month) for pregnant women and midwives, 65 per cent of whom are now being covered. The regular health infrastructure is utilized for these nutrition intervention programs. Mothers coming to the various health centers for this food must be accompanied by the baby, and this has led to an appreciable increase in the examination of healthy children, in the vaccination program, in pregnancy checkups and in nutrition education activities. It has also made it possible to perfect the system of nutrition surveillance, which accounts for the availability of periodic information on the weight-for-age of nearly all of the country's pre-schoolers.

The same health structure has also made it possible to improve family planning programs. Natural population growth in Chile has declined substantially (from 2.8 per cent in 1965 to 1.5 per cent at present).

5. For children with severe malnutrition, nearly all of whom are marasmic infants below age one, there is a special recovery program at hospital centers specializing in their treatment. For this program, a private not-for profit foundation, the Child Nutrition Corporation (CONIN), has constructed and equipped, using community resources, 32 hospital centers with a total of 1,340 beds throughout the country. The infants remain in the hospital until their recovery is complete, which on the average takes 4.5 months. The treatment includes not only nutritional recovery but also psychomotor and effective stimulation. During this period the mother is included in the treatment and a program of nutrition education and child care is conducted. A parallel team works with the family in programs of education, self-construction of housing, family mini-farms and environmental sanitation.

6. In order to reduce the perinatal risk in highly rural areas, a program known as "Homes for Peasant Mothers" has been developed. Pregnant peasants can enter these institutions prior to partum and prepare for it. They can remain there for a number of days after partum and are taught how to care for the child, encouraged to breast-feed, and receive nutritional education. There are 46 such homes, all located near rural hospitals.

7. A program for the comprehensive care of pre-schoolers has been going forward in recent years in poverty areas. Kindergartens are being constructed and equipped, and 80,000 children from 2 to 6 years of age are now enrolled in these institutions, where they are receiving every day a nutritionally-complete diet together with a program of psychomotor stimulation aimed at the integral development of their personality so as to prevent the "biological sociogenic" damage stemming from poverty and malnutrition.

It is estimated that there are 120,000 children in the country who are at risk of this damage and would therefore require this program.

This makes it necessary to extend the program by 60 per cent in the next three years.

8. The care of children living under irregular conditions is also being improved. There are now children's homes caring for 35,000 such children between 2 and 14 years of age.

9. Finally, the school food program for children between 6 and 15 (basic schooling) has been oriented toward those areas with a low socioeconomic level. A total of 220,000 school lunches (800 calories) and 850,000 school breakfasts or snacks (400 calories) is being distributed daily.

NUTRITION RESEARCH

The past 20 years have seen steady qualitative and quantitative progress in the area of nutrition research, especially in applied and

operations research. This has had a significant influence on the advances described above. Nutrition research has been developed primarily at the university centers, from where it has extended its area of influence during the various stages of the process. Pediatric departments were strongly influential at the initial stage, conducting a large number of descriptive clinical and physiopathological investigations or research projects on therapeutic procedures. At a subsequent stage there was an increase in the number of nutrition evaluation surveys of the infant populations in various parts of the country. The continuous flow of information, not only in scientific circles but also through the mass media, was a fundamental factor in developing awareness of the significance and seriousness of the infant malnutrition problem. As a result of this awareness, the solution of the nutrition problem gradually became a political objective. In 1960, or perhaps even earlier, the nutritional health parameters (percentage of children with malnutrition, mortality and/or morbidity rates, etc.) became a customary plank in the platforms of those seeking office. Similarly, these parameters became basic elements in assessments of governmental actions. This awareness, in which nutrition was a powerful influence, obliged the authorities to assign a priority status to nutrition policies and programs and allocate significant amounts of funds for them. The political importance acquired by the nutrition problem explains why in recent decades governments have made drastic changes in economic policies but have not reduced, and indeed have increased, the emphasis on nutrition.

In 1974, the National Food and Nutrition Council (CONPAN) was established as an interministerial government body responsible for developing a food and nutrition policy, coordinating it in the various sectors and monitoring its enforcement (3). This was decisive in the subsequent development of applied and operations research. The investigations that emerged made it possible to design appropriate interventions aimed at the most vulnerable groups and follow them up with the operations research needed for their effective implementation.

ANALYSIS OF NUTRITION RESEARCH IN CHILE

An overall view of the evolution of nutrition research in Chile and its present status can be gleaned from an analysis of the scientific publications produced in Chile during the last 20 years (4).

Table 1, based on compilations by the Nutrition and Food Technology Institute (INTA), shows the number of publications and technical reports issued during the period between 1965 and 1979. Counting not only research on food and nutrition but also that on specific foods, the number of publications increased from 151 during the period 1960-64 to 518 during 1970-74 and 481 during 1974-79 (Table 2).

When the figures are segregated by item and so analyzed, it is found that the publications preceded the various stages described above.

The publications are categorized in six groups in Table 2:

1. Basic nutrition, a group including all bionutritional research done in laboratories with experimental animals or in vitro.
2. Clinical research, including research with human subjects, generally hospitalized patients, with reference to clinical patterns, therapeutic effects, or the influence of nutrition factors on organs or systems.
3. Bromatology and food science and technology, including research on the composition, preservation, or preparation of foods.
4. Nutrition assessments of population groups, research on nutrition intervention programs, and reports on the availability of foods, or research on nutrition policies.
5. Animal nutrition, including mainly research on the use of diets or methods to increase animal production and animal food for human consumption.
6. Research in the area of programming, evaluation or expansion of food production and marketing.

Analysis of each of these items shows changes which occurred gradually during the period under analysis and which coincided with the changes in nutritional conditions during the same period of time.

Thus, for instance, during the first five years of the period under analysis, research on clinical nutrition was predominant. Most of this research dealt with small children suffering from severe malnutrition; there was very little research on basic nutrition during that time. Conversely, in examining the last five years, an increase in basic research and a substantial change in clinical research is apparent. With the decline in severe malnutrition cases in pediatric hospitals, the research on these diseases also declined substantially, while the clinical study of nutrition diseases such as obesity, diabetes, arteriosclerosis, alcoholism and specific deficiencies of minerals and tracer elements increased. This is evident from the figures for the last five years of the period.

A change in research related to population nutrition may also be observed. In the first five years nutrition evaluation research was predominant, which coincided with the high incidence of malnutrition in all its forms and variations. In subsequent years, research related to nutritional interventions and the design of nutrition programs and policies increased, so that publications relating to these aspects accounted for nearly half the research publications in the food and nutrition area in the last five-year period.

Research pertaining to the production and marketing of food --both crop and livestock-- also increased, though to a lesser extent. The number of publications on this type of research rose from 11 in 1960-64 to 65 in 1974-79.

Finally, food science and technology research also increased, the number of publications rising from 28 in the first five years of the period to 56 in the last five years.

Perhaps of even greater interest is the fact that with the passage of time, closer ties are being formed between the agencies conducting activities in the food and nutrition area and the purely academic

researchers, who have gradually become increasingly involved in the solution of nutrition problems. This shift is reflected in the publications, which 20 years ago were concerned with nutrition evaluations or descriptions of nefarious effects of under-nutrition and malnutrition, and at present are focused essentially on the search for pragmatic solutions and on prevention and operations research. Furthermore, the agencies in charge of nutrition interventions, whether public or private, have gradually become increasingly receptive to intervention designs resulting from university research and, even more important, an increasingly greater number of them are commissioning operations or evaluation research for cost-benefit studies.

This explains the basic role that food and nutrition research has played in decision-making and the implementation of intervention programs. Such research led to the political decision that assigned priority to nutrition intervention and subsequently to determining the best types of interventions and evaluating them on an ongoing basis. Chile's experience in the nutritional area provides additional confirmation of the need for scientific research as the fundamental tool for resolving the problem of underdevelopment. The mere absorption of knowledge is not enough; it is also essential to generate knowledge for the accurate diagnosis of problems and their subsequent correction. Underestimation or ignorance of the value of scientific research in the developing countries is perhaps the most serious obstacle to development.

NUTRITION RESEARCH STRUCTURE IN CHILE

Analysis and description of the existing structures requires separate analysis under at least two major headings: a) food and nutrition research, as such; and b) research on foods (production, preparation, preservation, and marketing).

a. Food and Nutrition Research Structures - The changes over the last two decades described above were accompanied by changes in the structures of the agencies doing the research over that period. The first research

studies, in 1960 or even earlier, were prompted by the concern of pediatricians, who were observing the disastrous effects of child malnutrition as reflected in hospital statistics. In 1960, nearly 75 per cent of the pediatric beds in Chilean hospitals were occupied by children suffering from severe malnutrition and associated pathologies (5). University pediatric departments concentrated all their research effort on clinical problems associated with child malnutrition, devoting themselves either to describing clinical and/or metabolic alterations or examining therapeutic procedures.

At a subsequent stage, but still in the pediatric departments, various population assessment studies and studies of contributing factors were initiated. The experience acquired accentuated the concept that the causes of the problem were multiple, going far beyond the health area. With the initiation of the stage of applied, solution-oriented research, it gradually became necessary to conduct multidisciplinary research. Isolated studies by researchers in a single field therefore gave way to studies conducted by teams including other professions as well --psychologists, anthropologists, sociologists, economists, educators, food engineers, agricultural economists, etc.

This requirement, spurred later by an increased demand for applied research, led to the establishment at the University of Chile in 1972 of a Nutrition and Food Technology Department, independent of the faculties and including researchers in different areas. In 1974, based on that department and in view of its important growth, the INTA was created. The institute now has a staff of 120 professionals, including physicians, biophysicists, sociologists, public health specialists, educators, food engineers, veterinarians, agricultural engineers, etc. In 1978 it became an institution associated with the United Nations University.

The central concern of INTA is research on nutrition in Chile, extending gradually to the entire region. This ranges from studies on the causative factors of nutrition problems to investigations of possible solutions consistent with economic and social realities. It includes basic, applied, and operations research.

The Institute has reached a high level of proficiency and performance. Multidisciplinary work based on specific projects is the rule. Administratively, the Institute has five divisions:

1. Basic Nutrition
2. Clinical Nutrition (for which the Institute has a 50-bed hospital)
3. Animal Nutrition
4. Food Science
5. Nutrition Policy and Programs

INIA is now a fundamental support element for governmental and private executing agencies, doing more than 80 per cent of the food and nutrition research carried out in the country (during 1980 it contributed 120 scientific articles to national or foreign specialized journals) (6). Approximately 50 per cent of the budget is provided by the university, with the remaining 50 per cent of the funding generated by the research staff through grants, sales of services to state or private agencies, patients and royalties. Almost all the equipment has been financed through projects generated and carried out by the researchers.

In education, the Institute has concentrated on the graduate level, awarding master's degrees in two fields:

- a) Clinical nutrition, and
- b) Nutrition policies.

Nevertheless, it provides undergraduate instruction to 3,000 students in nearly all the faculties of the University of Chile.

There are also other university centers doing research in food and nutrition, but these are included within the schools of medicine or pediatrics and their research is confined almost entirely to these areas. With the reduction of severe malnutrition in children, malnutrition and its associated clinical pathologies (broncopneumonia, diarrhea, infections, etc.) have ceased to be relevant. In pediatrics, it has been replaced primarily by research on metabolic and genetic diseases or

nutrition problems of the newborn. In regard to older children and adults, there has been an increase in studies pertaining to disease associated with excessive nutritional intake (obesity, arteriosclerosis, diabetes) or alcoholism. The principal groups are in the school of medicine and/or pediatrics of the University of Chile (Santiago), the Catholic University (Santiago), Concepción University (Concepción), and Southern University (Valdivia).

The only non-university organization doing food and nutrition research is CONIN, which has 32 hospital centers devoted to recovery of infants suffering from severe malnutrition. In its five years of existence CONIN has published or financed 85 research projects in the areas.

b. During the past 20 years there has been an increase in research on foods, including research on food production, preservation or preparation. A study commissioned by CONPAN in 1976 detected 21 centers that were doing research in these areas (7). Four of them were centers attached to the Ministry of Agriculture, and 17 were university centers. These centers have a total of 212 professionals and a total budget estimated at four million dollars.

The report concluded that there was an underutilization of resources, stemming from a shortage of operating funds and highly skilled manpower and from the limited demand for research in this area. The research was repetitive and overly detailed. There were too many projects, and they did not follow well-defined lines consistent with the national needs. Serious gaps were found to exist in areas of great importance for the country, such as cereals, potatoes, fruits and produce, wines, meat, energy sources, and support items such as packaging and quality control.

Analysis of the human resources showed that there were very few centers with the necessary critical mass of researchers and that the training of those available was deficient. As an indicator, only 15 professionals had a graduate degree.

The demand for technology was also negligible. The food industry was not requesting it and preferred to acquire it abroad, owing to lack of interest and confidence in the home product. In this regard, the few research studies that had given successful results were those commissioned by state programs, namely:

- a. Development of enriched infant formulas (INTA, INTEC)
- b. Modified milk with an additive of bioavailable iron (INTA, Milk Institute)
- c. Utilization of hemoglobin in human nutrition (INTA)
- d. Development of prepared meals for use in schools lunch and breakfast programs.

Only four technologies resulting from all the research carried out may be regarded as original and developed in the country. The rest were adaptations or repetitions.

The shortage of scientific and technological infrastructure in this area is obviously a serious bottleneck, not only to increasing the availability of foods but also to improving the utilization of the country's farm and livestock resources.

A foundation (the Chile Foundation) was established recently (in 1977) with a capital of US\$ 50 million under an agreement between the Government of Chile and the International Telephone and Telegraph Corporation (IT&T) for the purpose of promoting applied research and adapting and introducing technology originating in Chile and elsewhere to the country's industry. This covers two areas, telecommunications and food.

While the Foundation is already in full operation and has adequate physical facilities and staff, it is too soon to form a judgement on its results and impact.

COMMENTS ON THE CHILEAN EXPERIENCE AND ITS PROJECTION TO OTHER COUNTRIES OF THE REGION

One of the basic factors in the fight against malnutrition and its sequelae is undoubtedly the development of scientific research in the

food and nutrition areas. The obstacles to bringing this about are serious but not insurmountable.

One of the most serious obstacles may lie in achieving adequate recognition of the importance of research, as many governments are not convinced of its necessity and usefulness. They very often ask such questions as: Why lose time instead of concentrating on feeding those who are suffering from malnutrition?

It is hard to convince the political decision-making levels that the answers cannot be simplistic. Unless the causes of malnutrition and the damage it wreaks on individuals and society are understood, a reliable alternative cannot be determined, much less an efficient intervention. There are countless examples of failed interventions, which have resulted in wasteful use of resources and time and led to discouragement. Most of them are simply the result of political pressure and fail to benefit those in greatest need.

In order that applied and operations research may be developed, it is essential to create a demand for it. This demand has to come from the governments themselves. Demand is created when there is nutritional planning. That is to say, the starting point is the existence of an agency placed at an adequate decision-making level and capable of developing a comprehensive nutrition policy to be coordinated and implemented through the various sectors. In the case of Chile, two factors were of fundamental importance in the development of applied research: the political decision to tackle the problem, and the development of a food and nutrition policy through CONPAN. This created the demand for research and provided feedback to the system in the form of projects and programs developed by the researchers themselves.

The other basic factor for the development of research is the availability of the human and material resources required for this purpose. Experience indicates that the food and non-food factors affecting the state of nutrition and health are so complex that multidisciplinary work is essential. While basic research generally requires only certain areas of knowledge, applied research must of

necessity be multidisciplinary. In Latin America there are few institutions that can tackle a problem from a multidisciplinary approach. Any nutrition intervention requires research encompassing biochemistry, medicine, anthropology, sociology, economics, food engineering, agronomy, etc.

Above all, it requires a leadership with a comprehensive view to bring together all these disciplines in forming a homogeneous team that has common objectives and is prepared to take risks.

Applied research must be done in all the countries. Two or three centers will not suffice for the entire region. Each country has different problems and realities, and the work should not be done in centers and laboratories only, but also in the field. Moreover, it is necessary that the common pool of experience be widely utilized, especially in the training of personnel that will later work in their respective countries.

In Latin America the scarce manpower capable of doing research is concentrated basically in the universities. Unfortunately, knowledge in the universities is segregated by faculties, and coordinated work is difficult to achieve. A prime necessity for increasing applied research is the development of institutions where multisectoral research is possible. Ideally, such institutions would also have a solid infrastructure for applied research. Basic and applied research are mutually-reinforcing: when work is being done on a given problem it is difficult to distinguish where that problem ends and another begins.

Finally, there is often a harmful divorce between those doing applied research and those responsible for carrying out the interventions derived from it. The former are scientists, while the latter are usually professionals working for the government. This divorce impedes the development of programs and tends to place them in competition with one another. Avoiding this requires a merging of roles to make everyone a participant, which is not easy to do. The lead in this is played by the government agency responsible for nutrition policy and programs.

A separate comment should be devoted to research on foods, their production, preservation, preparation and marketing. The situation in

Chile is applicable to Latin America in general. This type of research has been dangerously neglected, which not only affects the availability of foods but also hampers efficient utilization of the agricultural and livestock resources essential for the development of the countries. It would seem that institutions specializing in particular areas or products would be preferable to generalized institutions. Though multidisciplinary research is also required, experience shows that higher efficiency is attained if the institutions focus their efforts on a particular line of research: meat, milk, aquaculture, potatoes, cereals, seafood, packaging, etc.

In summary, institutional interventions have proven useful when addressed to the most vulnerable groups. Their effectiveness is enhanced through maximum utilization of agricultural and livestock resources. Institutional interventions are only palliative measures that make it possible to safeguard a country's human resources. The definitive solution is genuine comprehensive economic and social development.

Table I

PERCENTAGE OF CHILDREN UNDER SIX YEARS OF AGE SUFFERING FROM
DEGREE OF MALNUTRITION IN THE PROVINCE OF CURICO
1965-1980

	Curicó Province 1975	Curicó Province 1980	Total for the country/1980
Percentage of children with mild malnutrition	42.2	10.0	9.5
Percentage of children with medium malnutrition	18.3	3.4	1.7
Percentage of children with severe malnutrition	5.4	0.6	0.2
TOTAL	65.9	14.0	11.4

Table 2

SCIENTIFIC STUDIES PERFORMED BY CHILEAN RESEARCHERS IN THE FOOD AND
NUTRITION AREA - 1960-1979

	Number of Studies			
	1960-64	1965-69	1970-74	1974-79
1. Basic nutrition	10	47	56	68
2. Clinical nutrition	49	42	118	52
3. Bromatology, food science and technology	28	46	95	86
4. Nutritional evaluation, nutrition policies and programs	52	100	191	220
5. Animal nutrition	9	15	11	25
6. Food production and marketing	3	26	47	40
Total	151	276	518	481

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