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IMPROVEMENT OF SALT FORTIFICATION PROGRAMS IN SELECTED LATIN AMERICAN COUNTRIES THROUGH MULTI-SECTORAL DIALOGUE AND TECHNICAL ASSISTANCE IN QUALITY ASSURANCE AND MONITORING

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Project Profile

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Executive Summary

Iodine deficiency has long been identified as the world's single major cause of preventable brain damage and mental retardation. The elimination of iodine deficiency has also been recognized as an attainable goal, with salt iodization as the intervention of choice. In the Region of the Americas, all countries at risk of iodine deficiency (ID) have implemented national salt iodization programs, and during the last decade the countries of Latin America and the Caribbean have shown significant improvements in the control and prevention of iodine deficiency disorders (IDD).

However, in spite of the remarkable progress being made in these on-going salt iodization programs in the Region, certain populations are still at risk of suffering from IDD and other iodine related health problems. While some populations lack access to adequately iodized salt and fail to meet the required levels of iodine, others are exposed to excessive levels of the mineral. The main underlying reasons for these situations are the lack of established quality control and monitoring and surveillance systems, as well as the varying levels of political commitment and the different technical capacities of the salt industry in each country. For the most part, the quality control of the salt iodization process and the inspections for quality standards are not regularly taking place. Moreover, there is a lack of establishment and proper functioning of the quality assurance, monitoring and surveillance systems, from the production of iodized salt to its consumption at the household level.

Due to the fundamental fact that ID results mainly from geological conditions and is a constant underlying risk innate in the environment, the sustainability of the IDD control programs is crucial. Thus, continuous support and efforts are needed to maintain the intervention programs. The commitments of the government and private sector to the program need to be reinforced. Comprehensive and sustainable quality control systems for the assurance of continuous adherence to national standards, regular supervision and monitoring of the process by the state, quality control of the iodized salt at the consumer level, and surveillance of the iodine status of the population need to be established and maintained as permanent components of the program.

In light of the aforementioned concerns and in consideration of the pledges and goals established by seventy Heads of State at the World Summit for Children of 1990 and the International Conference on Nutrition of 1992, the Food and Nutrition Program (HPN) of the Division of Health Promotion and Protection (HPP) of the Pan American Health Organization (PAHO) and the Micronutrient Initiative (MI), in collaboration with the International Council for the Control of Iodine Deficiency Disorders (ICCIDD), the United Nation's Children Fund (UNICEF) and other international agencies, joined to conduct a situation analysis of on-going national IDD control and salt iodization programs in four Latin American countries in order to identify the obstacles and constraints and contribute to the design and implementation of limited, short-termed interventions for each of the selected countries in order to enhance the individual IDD control programs.

Background

In order to advance and support the progress towards reaching the goals and commitments made by the Heads of State in the Region, HPN began to carry out a series of activities prior to obtaining the funds destined for the present project (April 2000 – April 2001). During the period of March 1999 – March 2000, HPN performed the following activities related to the IDD control programs in the Region:

1. In conjunction with MI and UNICEF, establishment of a Steering Committee to review and evaluate the progress of the national IDD control programs in the countries of the Americas. The committee consisted of representatives from various relevant international support agencies and met three times during the year (May, July and November 1999). The purpose of these were to: a) determine the instruments and implementation methodology for the Regional assessment and reinforcement of IDD control programs; b) collect country-specific information and classify the countries according to their progress following the WHO criteria; and, c) plan and co-organize with UNICEF and MI, a Regional meeting involving representatives from both the public and private sectors from the countries in the Americas.
2. Adaptation of the WHO questionnaire to the reality of the Region and dissemination of it in order to collect and systematize country-specific information regarding the situation of the national IDD control programs.
3. Analysis of country-specific data gathered in order to obtain a general view of the status of the IDD control programs in the Region and identify potential countries as possible beneficiaries of intervention projects.
4. Co-organization with UNICEF, MI, and other international agencies to plan, prepare and carry out the "Latin America and Caribbean Regional Meeting for Universal Salt Iodization and Elimination of IDD, SALT 2000," held November 28 – December 1, 1999 in Bogota, Colombia. The main objectives of the meeting were to: 1) reinforce the alliances between the private and public sectors and international agencies committed to universal salt iodization (USI) and the elimination of iodine deficiency disorders; and 2) develop collaborative activities and project plans for the improvement and sustainability of the national IDD programs beyond the year 2000. A total of 181 participants attended the meeting, 42 were representatives from the public sector, 48 participants represented the different international agencies present, and 91 participants were representatives from the salt industry.

The aforementioned activities served to renew the commitments and interest of both the public and private sectors, to support the national IDD control programs, and to strive for their sustainability.

Objectives Revisited

Due to the fact that the project funds were not available until April 2000 and that the aforementioned activities took place prior to obtaining the funds, the original objectives were revised and adapted. However, the project purpose remained unchanged.

Project Purpose

To make sustainable the salt iodization programs in the Region of the Americas by assessing the current situation of IDD control programs to identify follow-up activities and reinforce programs, i.e. the quality assurance, monitoring and surveillance systems in four countries in the Americas.

Project Objectives

1. Collect all existing country-based information regarding the national IDD control programs in order to select four countries as beneficiaries.
2. Identify program constraints and elaborate plans of activities including technical assistance in the specific areas of quality assurance, program monitoring and surveillance, and salt production technology (the elaboration of each country-based plan of activities is to be undertaken in collaboration with national counterparts from the private and public sector).
3. Contribute to the design and implementation of limited, short-term interventions for each of the selected countries in order to enhance the individual IDD control programs.

Procedure

Phase I – Country selection and initial assessment visits

Objectives 1 and 2 were attained during Phase I of the project. Briefly, four countries were selected based on the data obtained from the potential countries and the specific problems reported by each. The beneficiaries selected were Bolivia, Chile, Panama and the Dominican Republic. Upon selecting the countries and communicating with the PAHO local offices, a second copy of the WHO adapted questionnaire was distributed in order to collect any recent information on the IDD situation that may have risen since the first data collection in 1999. A team composed of the Food and Nutrition Program Coordinator, the Project Manager, a representative from ICCIDD, and a representative from INCAP for the case of Panama, was established and local PAHO, UNICEF and government authorities were contacted in order to determine travel dates and working agendas for the initial visits to the four countries.

The initial visits were carried out in order to: 1) establish contact with PAHO and UNICEF local offices, the private sector and the government; 2) reinforce compromises and encourage continuous support with the IDD and salt iodization programs from authorities from the Ministry of Health and private sector representatives; and, 3) conduct an in-depth analysis of the program situation, meeting with members of the national IDD control programs, or micronutrient committees, with technical/political personnel, as well as with the private sector, to identify critical points for intervention and plan activities to be executed.

The Phase I travel schedule, team members and working agendas were as follows:

Bolivia

June 4-7, 2000 (included visit to Oruro to attend salt producers' workshop)

Team members:	Wilma B. Freire	(PAHO/HQ)
	Natalia M. Leon	(PAHO/HQ)
	Ana Maria Higa	(ICCIDD)
	Maria del Carmen Daroca	(PAHO/BOL)
	Magali de Yale	(UNICEF/BOL)

Chile

June 7-10, 2000 (included visit to salt producing/iodization plant, LOBOS)

Team members:	Wilma B. Freire	(PAHO/HQ)
	Natalia M. Leon	(PAHO/HQ)
	Ana Maria Higa	(ICCIDD)
	Roxana Moncayo	(PAHO/CHI)

Panama

July 30 – August 3, 2000 (included visit to two salt producing/iodization plants)

Team members:	Wilma B. Freire	(PAHO/HQ)
	Natalia M. Leon	(PAHO/HQ)
	Eduardo Pretell	(ICCIDD)
	Omar Dary	(INCAP)
	Victoria Valdes	(INCAP/PAN)
	Fernando Ferreira Lima	(UNICEF/PAN)

Dominican Republic

August 6-10, 2000 (included visit to two salt producing/iodization plants)

Team members:	Wilma B. Freire	(PAHO/HQ)
	Natalia M. Leon	(PAHO/HQ)
	Eduardo Pretell	(ICCIDD)
	Ilsa Nina	(UNICEF/DOR)

Phase II -- Project implementation and follow-up activities

While Phase I of the project involved the selection of the four countries and the initial assessment visits to identify obstacles and possible solutions, Phase II was characterized by the implementation of the activities identified to improve and support the sustainability of the IDD control programs. Due to the slow response time at the country level in preparing a detailed plan of follow-up activities, the initiation of Phase II of the project was delayed and the expected timeline to complete the implementation stage was extended. However, objective 3 was met under this phase of the project and each of the programmed activities was executed in accordance with the project proposal; i.e., to make sustainable the salt iodization and IDD control programs.

During the second phase of the project, financial and technical support was given to the countries in order to contribute to their activities. In the case of Panama and the Dominican Republic, follow-up visits were performed by a team composed of the Project Manager and a representative from ICCIDD, in order to provide support with the design and implementation of quality control and epidemiological and surveillance systems, conduct workshops on proper salt production and iodization techniques, and evaluate the process of implementing the recommendations and progressing towards sustainable national IDD control programs. In the case of Chile, PAHO local offices were given the responsibility of directly monitoring the process of ensuring that the activities toward the control of overexposure will be corrected. In the case of both Bolivia and the Dominican Republic, although the funds destined for the follow-up activities were transferred, on-going socio-political unrest and political instability in the countries obstructed and delayed the completion of the programmed activities. For this reason, two no-cost extensions were requested and granted for this project.

The Phase II travel schedule, team members and agendas were as follows:

Panama

December 3-6, 2000

Team members:	Natalia M. Leon	(PAHO/HQ)
	Victoria Valdés	(INCAP/PAN)
	Fernando Ferreira Lima	(UNICEF/PAN)

Dominican Republic

December 6-9, 2000

Team members:	Natalia M. Leon	(PAHO/HQ)
	Ana María Higa	(ICCIDD)
	Oscar Suriel	(PAHO/DOR)

Project Activities and Outputs

The outputs and results, along with the revisited project objectives, are presented in the following table:

Table 1. Project Activities and Outputs

ACTIVITIES	OUTPUTS
OBJECTIVE 1: COLLECT ALL EXISTING COUNTRY-BASED INFORMATION	
1-1 Obtain latest country IDD situation information	Sent adapted WHO questionnaire to countries in order to obtain information regarding IDD situation
1-2 Analyze data obtained	Collected data from potential countries, analyzed it and selected four potential countries as beneficiaries
1-3 Contact selected countries	Determined potential beneficiaries and contacted four selected countries: Bolivia, Chile, Panama and Dominican Republic

OBJECTIVE 2: IDENTIFY OBSTACLES AND ELABORATE PLAN OF ACTIVITIES IN BOLIVIA, CHILE, PANAMA AND DOMINICAN REPUBLIC	
2-1 Identify limitations and obstacles	Through close communications with PAHO and UNICEF representatives in each selected country, identified major limitations and obstacles to the sustainability of the national IDD control programs
2-2 Establish an assessment team	A team composed of the Food and Nutrition Program Coordinator, the Project Manager, a representative from ICCIDD and a representative from INCAP (for the case of Panama) was established.
2-3 Travel to selected countries	Trips were carried out to each of the selected countries to assess the IDD control program situation
2-4 Meetings with Ministry of Health, Salt Industry and other agencies	Meetings with Ministry of Health, salt producers, UNICEF and other international agencies were carried out in the countries to: 1) advocate the importance of the IDD control programs; 2) determine limitations and obstacles to the success of the national IDD control programs; 3) identify possible solutions to the limitations and obstacles found; and, 4) discuss shared funding among the other agencies and PAHO to support follow-up activities
OBJECTIVE 3: IMPLEMENTATION OF INTERVENTIONS AND EXECUTION OF PLANS OF ACTIVITIES	
3-1 Define detailed plan of activities in each country	In conjunction with PAHO and UNICEF local offices, elaborated a detailed plan of activities (with specified dates and costs) to be implemented in each country according to the needs and recommendations made by the assessment team. Direct interventions in Chile, other than monitoring the exposure to extreme iodine intakes, were deemed unnecessary.
3-2 Support countries with the execution of the activities planned	Allocated funds to be utilized in each country according to the activities specified in each plan
3-3 Implement country-specific plan of activities	Provided specific technical support to countries for the execution of workshops, training sessions, experience exchange visits, and elaboration of quality control and epidemiological monitoring and surveillance systems to be carried out continuously in the countries
3-4 Monitor and supervise country-level activities	Activities monitored and supervised by local PAHO and Ministry of Health counterparts, with direct communication with the Project Manager at PAHO headquarters

The Project Manager with the direct supervision of the Project Director managed all operational and administrative activities related to the project from PAHO HQ. Project materials, such as a health workers' manual, were developed by the Project Manager, reviewed by the team members and disseminated at no-cost to the countries in order to support the local training and educational campaigns. The manual was made available electronically to the countries in order to facilitate the adaptation of it to each country's reality. A copy of the health worker's manual is enclosed with this report and will also be available electronically upon request (in Spanish).

Country-Specific Results

BOLIVIA

Situation Analysis

Although Bolivia was certified as an IDD-free country in 1996, various factors which include: the reduction of international funds, the reduction of budget to maintain the program, the weak private sector infrastructure, and the on-going process of local decentralization in the health sector and its subsequent weakness of the managerial capacity at the National Program Against Goiter (PRONALCOBO), have caused the national program to become inefficient, putting the population of Bolivia, once again, at high risk of suffering from IDD.

Within the last four years, the Bolivian government has reduced the budget destined to the maintenance of the monitoring and surveillance system and the quality assurance system carried out by the Ministry of Health. In addition, once Bolivia was certified as free of IDD, the international support, particularly from UNICEF, was reduced significantly, cutting funds intended to support on-going monitoring activities, technical support to the private sector, and the availability of the potassium iodate.

The process of decentralization that is taking place in the country has led to a lack of adequate control at the central and provincial level. The lack of authority needed to sanction those who do not meet the basic iodization requirements harms the national producers, since the sale of numerous illegal brands of salt (most of which are not iodized) is high and competes with the sale of salt produced nationally. Moreover, since the existing quality control and monitoring and surveillance systems is very weak, the salt industry does not receive feedback from the occasional quality control visits and does not make the corrections necessary to improve its product and ensure the levels of iodization required by law. This is specially the case in the major salt producing states of Oruro, La Paz and Cochabamba.

To further aggravate the situation, the process of iodization is rudimentary. There are 42 small producers that iodize salt by hand failing to meet the minimum requirements for salt iodization (the norm being 40 – 80 ppm). Due to this, the levels of iodine in salt have diminished greatly, showing enormous variability, and although the latest survey (1998) showed that over 90% of the population consumes iodized salt, one third to one half of the population in La Paz and Oruro, respectively, showed population urine levels below the norm.

Activities Performed

Based on this information, a team composed of the members mentioned above executed an initial visit to analyze the situation and perform the following activities:

On June 5th, the team participated in the National Evaluation Workshop for 1998-1999 and Projection to 2000 with the Salt Industry, in Oruro. Sixty salt producers participated in this meeting during which the identification of problems and obstacles faced by the salt producers was discussed with the government and other agencies

present. Recommendations and compromises to resolve the problems mentioned were made by both private and public sectors.

On June 6th, the team met with personnel from the Ministry of Health (Nutrition Department and the General Director of Health) and PAHO and UNICEF representatives to discuss the elaboration of a project to strengthen the activities towards the prevention and control of IDD. During these meetings, obstacles were identified, recommendations were formulated, follow-up activities were presented and the co-financing of the programmed activities was discussed.

Observations/ Recommendations

Based on the findings of the initial visit, and in order to improve the quality control and monitoring system at all levels: production plants, retail stores, and homes; the following recommendations were made by the visiting/evaluating team:

1. The activities of external control, which fall under the responsibility of the Ministry of Health, need to be redefined within the reorganization of the decentralization of the health sector. Health delivery system is now under the responsibility of the municipal level and the budget is also allocated locally. Before this process began, all the activities of quality assurance and monitoring and surveillance were centralized in La Paz; currently, these should be performed at the municipal level. For the purpose of monitoring, the system has to also be designed following the decentralization process.
2. The price of potassium iodate needs to be revised in order to ensure a fair price for the salt producers. After the meeting, the CEASS (Centro de Abastecimiento de Servicios de Salud) committed to maintain the price of the compound at USD \$20 per kilogram and to revise the process of purchasing in order to eliminate intermediaries and reduce the final cost.
3. As requested by the salt producers themselves, training workshops should be conducted with the aim of improving the salt producers' managerial and technical skills and the quality of iodized salt production and sale.

Follow-up Activities Scheduled during the Initial Visit (June 2000)

As a way to contribute to the realization of some of the recommendations made by the evaluating team, HPN allotted USD \$14,800 to provide support with the following activities (UNICEF also committed to provide financial support for some of the listed activities):

1. Training workshops for producers in the area of management. A total of six training workshops, were proposed for Oruro, El Alto (La Paz), Cochabamba and Colchani (to be carried out in the months of August, September and October).
2. Technical support to salt producers. Hire a consultant for three months to provide technical support to all salt producers (to start in August).
3. Experience exchange training. Contact two consultants from countries with similar salt producing conditions (Venezuela and Peru to visit Bolivia and share their experiences with the salt producers (to be carried out starting in August, UNICEF will cover the cost of the Peruvian consultant),
4. Experience exchange visits. Select two national salt producers to travel to countries with similar salt producing conditions (Venezuela and Peru) and visit different plants in order to learn improved technologies, and share the acquired knowledge among other Bolivian producers (to be carried out in September, UNICEF will cover the cost of the visit to Peru).

Results (as of May 2001)

Since the time of the formulation of the recommendations mentioned above, the Project Manager has been in continuous communication with the local PAHO offices obtaining the information presented below.

The on-going socio-political unrest in the country and the lack of priority in the Minister's of Health agenda for the IDD program have hampered the execution of some of the activities planned after the initial visit in June. Regardless of these obstacles, the following activities were accomplished:

1. A training workshop for salt producers was carried out in Oruro, as planned. However, due to local problems, only the theoretical part of this workshop was completed. The follow-up visits to the salt producing plants were not carried out.
2. A training workshop for salt producers was carried out in El Alto. Unlike the Oruro experience, this workshop was carried out to completion and the objectives were accomplished satisfactorily. In addition, the enrolment and registration of the salt producing plants in El Alto was performed according to the criteria established by the government of Bolivia to ensure a minimum of conditions that have to be met for the production of salt. This activity resulted in the closure of the salt producing plants that failed to meet the criteria.
3. A consultant (Mr. Mariscal) was hired for four months (from December to March and from March to April) to provide technical support to the salt producers (terms of reference and copy of the resume are included in Annexes 2 and 3, following this report), with partial funds from PAHO. The consultant provided direct support to the salt producers of La Paz in order to improve the quality of the salt produced and the techniques for adding potassium iodate, such as the implementation of their iodine mixers. In addition, Mr. Mariscal also supported the Ministry of Health with the managing of the salt quality control results and with the organization of meetings for salt producers mentioned above.
4. Regarding the experience exchange activities originally planned, these were cancelled because the national salt producers were only interested in a substitute trip to Spain to observe the machinery utilized there for possible purchasing. Thus, the PAHO local office and HPN decided that the funds destined for these activities would be better employed in supporting activities to strengthen the quality control systems. With that aim, a general meeting with the private and public sectors was carried out in March 2000 in Oruro. In this meeting, it became clear that the two most important factors needed for the improvement of salt production in the country were: 1) to finish the classification of salt producing plants¹ according to the new criteria established by the government to ensure a minimum of conditions that have to be met for the production of salt; and 2) to improve the quality control system. As a result, activities to support the Ministry of Health with both the quality control aspects as well as with the classification of the salt producing plants, were undertaken in Oruro.

Comments

Unfortunately, the impact of the activities pursued in support of the private sector was not obvious within the short life of this project. Some of the factors that influenced this were:

- The critical situation of the salt industry in Bolivia which has been strongly affected by the economic crisis as well as the natural disasters that the country is experiencing

¹ After the present project began, the government of Bolivia established a set of criteria that plants had to meet in order to be allowed to continue producing salt. Failure to meet these requirements resulted in the closure of approximately 20 salt producing plants.

- The floods that have affected the principal source of salt for human consumption in Coipasa. Due to this natural disaster, salt is being obtained from a different source; but this salt is of lower quality and its transportation cost is very high. The increased sales prices reflect these new costs.
- Production of many salt industries in Oruro and Cochabamba has halted due to a lack of raw material, making it very difficult to reclassify them according to the new government criteria.
- The increased lack of human resources at the central level in the Ministry of Health, and the absence of a coordinator responsible for the quality control of salt and for the follow-up of the activities to strengthen the IDD project (including at the local level).

For all the reasons mentioned above, Bolivia considers it critical to continue supporting the private sector to improve the capacity to produce iodized salt of good quality and to maintain the responsibility of the quality control system within the regional health services and mayorships.

CHILE

Situation Analysis

More than 80% of iodized salt consumed in Chile is produced by one highly developed plant, Super Sal Lobos. Until March 2000, the range of iodization required was 60-100 ppm; however, after April 2000 the required iodization range was reduced to 20-60ppm.

The quality control system of iodized salt in Chile is efficient and continuous. This system takes place at two levels: 1) an internal system carried out by qualified personnel in each of the five plants that the enterprise Lobos has throughout the entire country and; 2) an external control system which is carried out by the Institute of Nutrition and Food Technology (INTA). This control is performed on a monthly basis with funds from the industry, analyzing 1,200 samples every month. The resulting reports are sent back to the industry and to the government.

In August 1994, the government of Chile signed a technical cooperation agreement with the iodine producing company Soquimich Iodo S.A., with the dual purpose of improving the quality of water serving more than 20,000 people from the rural sectors of the Metropolitan Region of Santiago de Chile, and evaluating the technology of disinfecting water with iodine. The beneficiaries of this technical cooperation were 10 communities and five rural schools, representing approximately 8,500 people, all of which lived in areas of high risk for iodine deficiency disorders. Seven months later, in March 1995, the Service for Environmental Health of the Metropolitan Region (SESMAS) conducted a study to evaluate the iodine status of a sample of the population receiving the iodine treated water. In addition, in 1997, the Institute for Nutrition and Food Technology (INTA), conducted a similar study in 1000 school children from two communities with history of endemic goiter. (Please refer to Annex 3 for figures).

According to the findings, the SESMAS study found a median urinary iodine excretion level of 158 ug/dl, while the INTA study found a median of 132 ug/dl. Furthermore, more than 96% of the samples taken by the INTA study had iodine levels higher than recommended. However, the authors of the SESMAS study concluded that since the goiter prevalence of the population after two years of receiving iodized water was similar to that before the purification of water with iodine (9.6% and 9.6%, respectively), there was no risk of toxicity. Nonetheless, they recommended continuous monitoring of the population. The INTA study, on the other hand, concluded that the UIE's and the goiter prevalence found in the communities tested were higher, and recommended a more in-depth study to determine the causes of the increased number of goiter cases.

In September 1998, The Thyromobil Project of ICCIDD, examined the urinary iodine excretion levels of school aged children in areas with history of endemic goiter, and obtained mean UIE levels $> 300 \mu\text{g/l}$. Furthermore, the 1998 results also showed decreased goiter prevalence. Based on the report presented to the government of this situation, the government of Chile decided to change the Food Sanitation Regulation and lowered the required iodine levels in salt from 60-100 ppm to 20-60 ppm.

Although the prevalence of goiter has decreased and the country is no longer considered to be at risk of IDD, there still remain over 27 iodine water purifying dosimeters in Chile and the information about the exposure of the people being served with this water needs to be updated in order to avoid putting them at risk of suffering from toxicity and autoimmune hyperthyroidism.

Activities Performed

During the initial visit to Chile in June 2000, the team composed of the members mentioned above performed the following activities:

On June 8th, the team met with representatives of the Ministry of Health, INTA, PAHO and other national organizations in order to discuss the current situation, identify obstacles, formulate recommendations and plan follow-up activities.

On the 9th of June, the team visited the salt producing plant SUPER SAL LOBOS to observe procedures and technology used in the process of producing, iodizing and commercializing iodized salt, and to review the internal quality control system.

Observations/ Recommendations

Based on the information stated above and on the field visits, the team concluded that for the most part, the Chilean population has access to iodized salt of excellent quality. Nevertheless, attention needs to be brought to areas where water is being treated with iodine. The problem was discussed with the authorities of the Ministry of Health and in particular, with the Direction of Environmental Health, under which the water sanitation program exists.

Follow-up Activities Scheduled during Initial Visit (June 2000)

In order to cope with the observed concern, the visiting team recommended the following activities:

1. Identify the geographical areas consuming iodized water.
2. Collect and analyze urine samples from the populations of those areas in order to determine the level of toxicity.
3. Design a plan of substitution of the iodine dosimeters for chlorine dosimeters.
4. Perform a more frequent monitoring of the iodine status of the identified populations in order to ensure that levels of urinary iodine are within the normal ranges.
5. Evaluate the urine iodine levels of the Chilean population in order to measure the impact of the new (lower) iodine requirements.

Although these activities were to be undertaken by the Ministry of Health and Chile did not request financial support from HPN; PAHO committed to maintain close communication and monitor the implementation of the plan of activities in order to eliminate the possible risk of toxicity in some segments of the population. Although these

activities exceed the timeframe of this project, during the life of the project, PAHO was able to reactivate the interest of the government and other agencies involved and to facilitate the communication between the parties in order to advance with the revision of the situation of the populations served with iodized water.

Results (as of December 2000)

Since the time of the formulation of the recommendations mentioned above, the Project Manager has been in continuous communication with the local PAHO offices obtaining the information presented below.

The corresponding authorities in Chile have performed an extensive review of the literature available regarding the existence of the iodine dosimeters and the possible risks of the population receiving iodized water plus iodized salt. In addition, contact was established with Dr. Eduardo Atalah, Nutrition Adviser to the Ministry of Health, in order to ensure the execution of the follow-up activities. According to his last report, the plan of activities is being revised and will be implemented on the year 2001.

PAHO, as part of its mandate, will continue to monitor the execution of activities in Chile beyond the life of this project. A visit, with funds external to this project, took place during the first semester of the year 2001 in order to review the activities that are being implemented. The Chilean government is committed to reviewing the water purifying situation and is open to discuss the possibility of negotiating the substitution of the iodine dosimeters for chloride.

PANAMA

Situation Analysis

The last national survey of the IDD situation in Panama, carried out in 1990, revealed that although the national prevalence of goiter was low (13%), the regions of Azuero and Herrera had prevalences of 23% and 46%, respectively. As a response to this situation, a national plan of action was elaborated, and in 1997, the Project About Iodine Deficiency Disorders was created with financial support from Kiwanis International and UNICEF.

A study carried out in 1999 proved that the efforts made by Panama had a positive impact and significant differences were found in the national and Azuero goiter prevalences, which were reduced to 10.2% and 12.1%, respectively.

Given that the median national urinary iodine excretion levels found in the 1999 study showed values well above the mean (270 µg/l), concern was raised about the risk of exposure to too much iodine. To correct this, Panama began the process of modifying the law (Law #17 of 1955) to lower the iodine levels required from 67 - 100 ppm to 30 - 60 ppm. In addition, Panama initiated the procedure of substituting the law for a decree, in order to facilitate future modifications of the regulations as needed.

All salt available in Panama is either produced nationally, by solar evaporation, or imported from Colombia, and it is stored and processed in eight iodization centers. The three main salt producing companies in Panama are (PANASAL with 50% of the iodized salt produced in the country, Bienes y Raíces Metálicas with 25% of the production, and the Federación Nacional de Cooperativas de Sal de Panamá - FENCOSPA with 15% of the production). All iodized salt is sold in different size containers, with packages labeled with information about the name of the producer and the number and date of production. PANASAL iodizes salt with the spraying method; while, the other producers add the fortificant by mixing it with a dry solution of yodocal.

Panama counts with a well-structured and functioning quality control system. External quality control is under the responsibility of the National Inspection Unit, which performs monthly visits to each of the iodizing centers. The unit analyzes samples collected in the iodizing plants and at the retail level. Currently, only six of the eight iodization centers are functioning; one was closed due to lack of proper hygienic conditions and sanitation and the other is not producing salt for human consumption at the moment. Regarding the internal quality control systems, only three of the six iodizing centers have equipped and functioning laboratories and perform their quality control periodically. Two of the remaining three salt industries do not have a laboratory or an internal quality control system implemented; and, although the other salt industry does have an equipped laboratory, it does not count with trained personnel to perform the internal quality control.

The information obtained from the authorities indicates that the program has an excellent coverage (90% households consume iodized salt of good quality). Educational material was produced with support from UNICEF and KIWANIS, and this material was used in several national information, education and communication campaigns.

Furthermore, the present government's decision to place nutrition, including the national program for the control of IDD, as a number one national priority for the year 2000, facilitated the efforts made during the second part of the year and many of the recommendations made during the first visit have been accomplished. .

Activities Performed during Initial Visit (August 2000)

The following activities were carried out by the team members mentioned above during the first initial visit to Panama (July-August 2000):

On July 31st, the team visited two salt producing plants, PANASAL in the state of Coclé, and FENCOSPA in the state of Los Santos, and the Food Control Laboratory of Los Santos, in order to observe the facilities and methods of production and iodization.

On August 1st, the team met with personnel from the Ministry of Health (Nutrition Department) and PAHO, UNICEF and KIWANIS International representatives in order to identify obstacles, formulate recommendations, and plan follow-up activities.

Observations / Recommendations

During most of the life of the project, Panama was in the process of designing and establishing improved quality control and epidemiological monitoring systems, for which technical cooperation was requested. Members of the team proposed a quality assurance system for the production and iodization of salt and a monitoring and surveillance system. In addition, it was recommended to:

1. Expedite the process of changing the law to reduce the required levels of iodine to 30 – 60ppm of iodine as potassium iodate (KIO₃).
2. Implement the laboratories of the salt producing and iodizing plants to perform their own quality control, with support from the DEPA (Food Protection Department, Ministry of Health).
3. Require a certificate of quality from all salt imported into the country.
4. Determine the level of inspection of each salt producing company. This task was assigned to the Ministry of Health officials in order to evaluate the facilities and techniques used in each plant which will serve as the basis for establishing a monitoring inspection schedule.
5. Continue with IEC efforts to educate health professionals, salt producers, politicians, and the public in general.

Follow-up Activities Scheduled during the Initial Visit (August 2000)

Since Panama counts with enough financial support from KIWANIS International and UNICEF, a financial contribution from HPN was not necessary for the realization of the follow-up activities; however, HPN remains committed to support the country with technical expertise and all the non-financial support necessary to achieve certification as an IDD-free country.

In order to advance towards certification, Panama accomplished to the following activities by the indicated dates:

1. Analyzed the quality of each of the salt producing industries in order to establish the corresponding level of inspection advisable (September 2000)
2. Determined baseline values of iodized salt sold in retail stores, with a sub-sample of the different kinds of retail stores in areas of populations at risk (September – December 2000)
3. Established an annual system of determining iodine content in salt sold in retail stores throughout the country, evaluating between 600 and 1200 samples annually (early 2001)
4. Established an annual monitoring system in homes, in schools or through national surveys (with funds from Kiwanis International)

Results (as of May 2001)

A second visit to Panama was scheduled for the first days of December 2000. During this short visit, the Project Manager met with the National Nutrition team of the Ministry of Health and local PAHO and UNICEF representatives, and the following progress was observed:

1. Regarding legislation, Law 43 of the 25 of October 2000 is ready to be signed by the Minister of Health and the President of Panama. This new law decreases the iodine levels required to 20-60 ppm, allowing the fortificant to be potassium iodate, potassium iodine or iodine and gives 60 days for the salt iodization plants to adopt the new law. In addition, the Executive Decree 306 of the 20 of November 2000 made official the Micronutrient Subcommittee of the National Food and Nutrition Program (PRONAN).
2. With regards to the implementation of laboratories for internal control, the DEPA, with the collaboration of UNICEF, visited the eight salt industries in the country -- obtaining the information stated above -- and equipped laboratories in three of the six existing iodization plants (Bienes Raíces Metálicas, Sal Atencio and FENCOSPA). Furthermore, UNICEF and Kiwanis International contributed with capacity building and the administration of the reagents necessary for the analysis of iodine in salt. In addition, meetings were held with crude salt producers to emphasize the adherence to the law requiring the iodization of this type of salt for animal consumption. The meetings also served to inform the producers of the procedures needed to sell their products in the market (i.e. make a registry of the brands sold by each salt producer, obtain an operation title and receive a certificate of sale) and to identify the three reference laboratories for crude salt and administer reagents and equipment to be distributed to the nine crude salt laboratories.
3. With regards to the establishment of baseline information on the iodine levels of salt sold at the retail level, the national nutrition team followed the recommendations made during the initial visit and completed collecting samples. The information available suggests that almost 10% of the samples contain iodine levels above 100 ppm, and according to the brands of salt sold by districts, it was concluded that these samples belong to two salt producing industries. A revision of the internal quality control system practiced by these plants was envisioned.

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4. Regarding the epidemiological monitoring and surveillance system and the establishment of baseline urinary iodine excretion levels in the population, the national nutrition team followed the recommendations made during the initial country visit and carried out a study by conglomerates at the national level. The results showed that 60% of the samples have iodine values within the norm. However, 12% of the samples were found to be below the recommended 100 µg/l, and close to 30% were found above 300 µg/l. In addition, 6% of the salt samples taken in the schools were non-iodized crude salt; all of these samples came from indigenous areas of extreme poverty. According to the study of salt consumption at the household level, 55% and 44% of the samples had iodine concentrations below and above the 60-100ppm norm, respectively. Thus, the following observations were made: 1) the areas identified as endemic after the 1990 survey are no longer at risk of IDD, since the urinary iodine concentrations are adequate; 2) the results confirm that the iodine urinary levels in the Panamanian population have increased and are above the recommended levels, reinforcing the need to decrease the required levels of iodization to 20-60ppm; and 3) emphasis needs to be placed on indigenous, poor populations in order to decrease their consumption of crude salt and increase their consumption of iodized refined salt. It is thought that the iodization of crude salt will indirectly improve the iodine status of the indigenous population.
 5. In addition to the UIE study, the Ministry of Health also collected information about the knowledge and practices concerning iodine and the disorders produced by its deficiency. The results showed that although 98% of the school teachers in the district conglomerates and 100% of the school teachers in the capital reported having some knowledge about goiter and had some idea of how to avoid IDD, only 23-55% and 5% of the school children in the districts and the capital, respectively, had heard about goiter and IDD. Moreover, in the indigenous districts, only 52-76% of the school children reported using iodized salt at home and 22-33% reported consuming crude uniodized salt.
 6. Regarding the accreditation of the central reference laboratory, it was determined that the first necessary steps were the standardization of the techniques and protocols used for the iodine content analysis among the regional laboratories and central reference laboratory; and the proper training of the personnel in the regional laboratories. In order to accomplish this, workshops were conducted with the regional laboratory and salt industry technicians (done separately) to unify the methodology used for the analyses of iodine in salt. The following step was determined to be the international accreditation of the central reference laboratory.
 7. The national nutrition team met to review the progress of the activities executed in preparation for the external evaluation visit to obtain the certification as an IDD-free country (planned for September 2001). The following activities were confirmed of having been executed:
 - Establishment of a national network of laboratories and obtain national accreditation of regional laboratories
 - Establishment of a system for external quality control in crude salt producing plants
 - Establishment of a biannual sample collection system for epidemiological monitoring and surveillance of the population
 - Execution of a workshop for the standardization of procedures and methodologies used in the analysis of iodine levels in salt
 - Training of field technicians on the procedure to collect crude salt samples from farms for external quality control
 8. The country has requested the visit of an external Committee to evaluate the national IDD control program and the IDD situation with the aim of being declared as an IDD-free country.
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As part of the continued commitment of PAHO to support and monitor the execution of activities for the sustainability of the national IDD control program in Panama, HPN will continue to provide technical support to the country, beyond the lifetime of this project, with the aims of maintaining the achievements obtained and assuring that the efforts made by the national nutrition team are continuous and on-going beyond the certification. Furthermore, the Panamanian government and the international agencies involved are committed to supporting the sustainability of the national IDD control program well into the next millennium.

DOMINICAN REPUBLIC

Analysis of the Situation

The latest national survey, carried out in 1993, demonstrated that IDD was a severe problem in the country. Eighty-six percent of the urine samples contained less than the recommended levels (100 µg/l) and 65% of samples contained < 50µg/l. National goiter prevalence was found to be 5.3%, and up to 12.3% in some regions. Since the national survey was carried out in 1993, it was not possible to have information about the quality of the data; nevertheless, the researchers agreed with the results obtained, because they confirmed that the different prevalence were in accordance with the information they had prior to the study.

There are four salt producing plants and two refineries in the Dominican Republic. One of the salt producing plants (Cooperativa Monte Cristi), is a cooperative composed of 200 small producers (there are a total of 203 producers in the country). Nationally produced salt is iodized with KIO₃ using fumigating backpacks or hoses to spray the diluted solution directly onto the salt, moments before it is mixed and packaged for the refineries. The salt produced in all plants is sold either iodized directly in the market, or not iodized to the refineries where it is processed, packaged and then sold in the market; however, both refineries also repackage the crude uniodized salt and sell it under different names in the market. For this reason, both iodized salt and crude salt are sold under a variety of different brands in the country. One of the refineries, Industrial de Sal Dominicana S.A., only buys imported salt due to its better quality and lower price. The amount of imported salt that comes into the country is unknown.

Because of the high humidity content of nationally produced salt and the poor quality of equipment and technique used for iodization, it is almost impossible to guarantee the iodine content. In addition, more than 60% of the population consumes crude salt (in large crystals), and the local custom of washing the salt in the homes prior to consumption, further reduces the already low iodine content.

The initial visit to the Dominican Republic (August 2000) took effect one week prior to the transition of power to the new government. This presented a unique window of opportunity for the visiting team to advocate for the importance of the national IDD control program and allowed the members of the mission to establish direct contact with the incoming vice-minister of health, continuing the bridge of information with the new functionaries regarding the progress made and the needs for continued efforts to improve the IDD program in the country. However, due to the historically political rivalry among the different parties and since most ministry appointments are linked to the governing party, only one member of the national nutrition team was able to maintain her post in the ministry, while all others were replaced. Unfortunately, this situation contributed to the problem of discontinuity of the personnel and the knowledge about the national situation, making more difficult the continuation of the efforts and tasks pending from the previous government.

Activities Performed during the Initial Visit (August 2000)

On August 7th, the team mentioned above met with old and in-coming representatives of the Ministry of Health (Nutrition Department), as well as representatives of PAHO, UNICEF, and other national institutions to update the incoming government on the current situation, identify obstacles, formulate recommendations, and plan follow-up activities. The team met with the PAHO representative and visited the National Laboratory “Dr. Defilló” to see future location and talk to the personnel.

On the 8th of August, the team visited two salt producing plants, Baní and Monte Cristi (in the states of Peravia and Monte Cristi, respectively).

Observations / Recommendations

After the initial visit in August 2000, the following list of recommendations was presented to the in-coming vice-minister of health in order to sustain the control of IDD:

1. Consolidate and strengthen the National Committee for the Control of IDD
2. Design and carry out a QC system at production and retail level (iodine content of salt)
3. Design and carry out a surveillance and monitoring system (establishing base line levels and a permanent data collection system of iodine levels in the population)
4. Provide technical support to producers in order to guarantee the appropriate levels of iodine in salt (train producers, design QC systems in plants, install mills and mixers)
5. Guarantee availability of KIO₃
6. Design and carry out IEC programs for: consumers, producers, government and health professionals
7. Promote consumption of refined iodized salt in order to reduce consumption of crude crystallized salt
8. Equipe the central laboratory and guarantee the availability of reactivities for the QC of iodized salt
9. Maintain the government's commitment to move forward with the IDD program, achieve sustainable salt iodization and eventually obtain certification as an IDD-free country

As a way of further advocating the importance of the national IDD control program, the new vice-minister of health was invited to participate in a Regional workshop that HPN organized with the participation of 17 countries, to define the mayor nutritional problems and find means of cooperation (this workshop was executed in September 2000 with funds from PAHO and WHO). This interaction with the new vice-minister was successful in obtaining his full compromise to undertake further activities in order to ensure the sustainability of the national IDD control program.

Follow-up Activities Scheduled during the Initial Visit (August 2000)

The visiting/evaluating team and the national nutrition team members at the time, agreed that HPN would contribute with USD \$12,000 to provide support with the following activities (UNICEF also agreed to provide financial support for some of the listed activities):

1. Provide financial and human resources for a training workshop for salt producers in order to improve iodization techniques
2. Train a national food scientist to provide permanent technical support to salt producers in order to guarantee iodization of salt at the appropriate levels
3. Provide technical support for the implementation of a QC system (quantitative) at plant (internal control) and inspection (external control) levels

4. Send a trained professional for one to two weeks, to the Dominican Republic to design and implement a permanent monitoring and surveillance system and carry out data collection in order to establish baseline levels of the iodine situation in the country.
5. Design an information, education and communication (IEC) program to be implemented at the national level, utilizing the data obtained from the survey to be done this year, in order to promote the consumption of refined iodized salt.

In order to receive the funds destined to support the follow-up activities in the Dominican Republic, the national nutrition team members committed to elaborating a detailed and concrete plan of activities and to submit it to HPN by October 2000. However, despite the continuous communications held between the Project Manager and the PAHO local offices and the efforts made by the parties involved, the political instability during the first months of the new government caused an unfortunate delay in the elaboration of such document. For this reason, a second visit was scheduled and a team composed of the Project Manager and a consultant from ICCIDD, traveled to the Dominican Republic in early December in order to elaborate a draft document detailing the plan of activities to be implemented. Although this goal was achieved to its fullness during the second visit in December 2000, the implementation of activities was delayed.

Draft Document and Plan of activities Elaborated during the Second Visit (December 2000)

1. External Quality Control in Salt Iodization Plants

Since none of the salt producing and iodizing plants in the country has an established internal quality control system, the decision was made to implement an external quality control system which would begin performing monthly visits to all the plants. Furthermore, since two of the plants are at a considerable distance from the central reference laboratory located in Santo Domingo, it was decided that two laboratories selected as regional laboratories for the monitoring of iodine levels in salt, needed to be equipped and conditioned. Personnel for both regional laboratories would be identified and trained, and the protocols and methods of analysis used would be standardized with those of the central reference laboratory. Both the Ministry of Health (SESPAS) and the central reference laboratory agreed to be responsible for the realization of these tasks. The Dominican Republic, with the support of PAHO, agreed to monitor the changes in the salt consumption as part of the QA system.

2. Quality Control at the Retail Level

Since the Dominican Republic is divided into 110 districts and 29 provinces plus the capital, the decision was made to collect samples by districts. In order to do this, it was determined that eight to nine districts would be monitored every two months, collecting ten samples from each district. The central reference laboratory would perform the analysis of the 90 bimonthly samples and the collection of the salt samples would be under the responsibility of the Environmental Health Unit of the SESPAS.

3. Epidemiological Monitoring and Surveillance: Urinary Iodine Excretion

Urinary iodine excretion levels would be collected every two years, from school-aged children (6-12 years old), in conglomerates. In order to establish base line information, and based on the population of the Dominican Republic, a data collection sample design was calculated by the visiting team in which 85 conglomerates of 15 children each would be chosen at random (proportionally). Taking advantage of the fact that a height census of school-aged children was planned for the first semester of 2001, the working team agreed to perform the urinary sample collection for the establishment of the baseline levels at the same time. The Epidemiological Monitoring and Surveillance Unit of the SESPAS agreed to be responsible for the execution of this activity. Since the central reference laboratory lacks the equipment necessary to perform the required analysis, the samples would be analyzed either at INCAP or in Peru. Furthermore, the SESPAS would take the

responsibility of adding a urinary iodine monitoring component every two years to the annual school deworming program.

4. Epidemiological Monitoring and Surveillance: Household Salt Consumption

The surveillance of salt consumption at the household level would also be added as a component of the annual school deworming program; however, this was scheduled to be done on a yearly basis. School children would be asked to bring a 10g sample of salt from home and the iodine content of the samples will be tested with iodine kits. This task would be under the responsibility of the Epidemiological Monitoring and Surveillance Unit of SESPAS. The information collected would be used to establish baseline information on the types of salt consumed by the populations and would help in the elaboration of concrete messages for the information, education and communication campaigns.

5. Information, Education and Communication

As mentioned above, the information obtained after the data collection, together with the information from the ENDESA 1996 national survey, would serve to guide the focus and design of the best strategy to increase the consumption of refined iodized salt and decrease the consumption of crude salt and the habit of washing the salt prior to consuming it. The Epidemiological Monitoring and Surveillance Unit of the SESPAS agreed to be responsible for negotiating the elaboration of the messages and the execution of the IEC campaign with the collaboration of UNICEF.

In the pursuit of advancing towards the implementation of the plan of action for the national IDD control program, the following activities were executed during the no-cost extension period of (December 2000 – April 2001):

▪ *Direct support to salt producers*

1. Five fumigating backpacks were purchased and distributed in three of the four iodization plants in the country. Although this action was only an immediate temporary solution to the poor technology used for iodization, it was deemed important since it facilitated the iodization process and served as reinforcement of the government's and the international agencies' commitment to support the salt industry.

▪ *Technical support to improve the iodization process*

1. A national engineer (Mr. Freddy Lara), expert in the field, was identified and hired to visit the four salt producing plants and implement a pilot iodization procedure, based on the individual conditions of each, in order to improve the salt iodization methods used.
2. A meeting with the salt producers of the cooperative plant was held in order to advocate for improved iodization conditions.
3. Educational material was elaborated and distributed to the iodization centers. This material consisted of iodine solution dilution tables, QC charts and procedure guidelines which were elaborated in conjunction with UNICEF.

▪ *Support the baseline study*

1. Identification of the personnel necessary for the two regional laboratories, who will perform the analyses of iodine content in salt.
2. Purchase of reagents necessary for the analysis of iodine content in salt.
3. Shipment of baseline samples for analysis of iodine urinary excretion in a certified international laboratory (INCAP, Peru, Venezuela).

- *Other activities carried out during the no-cost extension period:*

1. Negotiation of the permanent availability of the fortificant (potassium iodate) in the iodization plants.
2. Elaboration of norms and decrees to guarantee the continuity of the iodine epidemiological monitoring and surveillance system established, ensuring its existence regardless of the change of governments that may take place.

HPN is fully committed to support the execution of activities related to the National IDD Control Program of the Dominican Republic and will continue to provide technical support beyond the lifetime of this project, to ensure the national program is well established and its sustainability is guaranteed.

General Conclusion

The effort and time put into the realization of the project by the local salt industries, governments, international agencies and HPN team involved had a positive impact on the national IDD control programs in the countries. The project served to reactivate the interest of the public and private sectors about the need for sustainable national programs and to increase the awareness of the importance of continuous monitoring and surveillance systems. Although all the countries selected were conscious of the importance of the IDD control programs, the project served to increase the priority given to them and to create specific activities aimed at improving their performance.

However, even though the project was able to strengthen the interests about IDD in the selected countries, not all the activities planned could be attained as scheduled. As mentioned before, social, political and structural problems within the health service systems and within the countries delayed the realization of some of the activities programmed and forced other activities to be adjusted to the changing realities of the countries.

Nonetheless, the project served to alert the national governments, the private sector and the International Community of the need for a permanent system to monitor the national programs, in order to detect, in a timely manner, the need for adjustments, changes, or interventions. It is important that all the parties involved in the control of iodine deficiency disorder are aware of the social, political, and economical situations in the countries which may negatively affect the proper functioning of the national IDD programs and that they join efforts and work together for the sustainability of the control of IDD and the maintenance of the goal achieved. With this in mind, PAHO extends its commitment to the countries of providing technical support and guidance beyond the lifetime of this project.

Annexes

Annex 1.

Schedule of Activities in Each Country*

ACTIVITY	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	APR '01
Adjust WHO questionnaire	X								
Send WHO questionnaire to potential countries	X								
Select four countries as beneficiaries	X								
Initiate Phase I (initial assessment visits to identify obstacles and determine follow-up activities)									
Contact selected countries		X							
Program travel agendas in each country		X							
Phase I visit to Bolivia			X						
Phase I visit to Chile			X						
Phase I visit to Panama				X					
Phase I visit to the Dominican Republic					X				
Obtain detailed plan of activities from countries for follow-up					X	X			
Initiate Phase II (implementation of follow-up activities and secondary visits to countries, where necessary)									
Program travel agendas with countries						X			
Phase II visit to the Dominican Republic									X
Phase II visit to Panama									X
Write final report									X

*due to delays in obtaining the funds for the project and obligatory leave of the Project Manager, activities were not begun until April 2000

Annex 4. INTA Study Figures (adapted from original paper)

Goiter Prevalence in School-aged Children by Gender

GENDER	No GOITER		GOITER		TOTAL	
	No.	%	No.	%	No.	%
Males	357	88.6	46	11.4	403	100
Females	327	87.4	47	12.6	374	100
TOTAL	684	88.0	93	12.0	777	100

Goiter Degree in School-aged Children

GOITER DEGREE		No.	%
No Goiter		684	88.0
Goiter	Ia	51	6.6
	Ib	35	4.5
	II	6	0.8
	III	1	0.1
TOTAL		777	100

Average Urinary Iodine Excretion Levels in School-aged Children, by Gender

GENDER	No.	%	$\mu\text{g/dl} \pm \text{S.D.}$
Males	61	61.6	159 ± 88
Females	38	38.4	126 ± 53
TOTAL	99	100	147 ± 78

Percentile Distribution of Urinary Iodine Excretion Levels in School-aged Children, by Gender

PERCENTILE	MALES	FEMALES	TOTAL
10	69.0	54.4	61.2
50	139.0	132.0	137.0
90	251.0	184.9	233.0

Annex 4 (cnt'd)

INTA Study Figures (adapted from original paper)

Iodine Concentration in Salt, by Locale

LOCALE	No.	%	$\mu\text{g l/g salt}$
Household	113	63.5	$95.4 \pm 18.0^*$
Retail Store	58	32.6	78.0 ± 14.4
School	7	3.9	101.4 ± 17.4
TOTAL	178	100	89.9 ± 18.8

* $\bar{x} \pm \text{S.D.}$

Iodine Concentration in Salt, by Name Brand

NAME BRAND	No.	$\mu\text{g l/g salt}$
Lobos	178	$90.0 \pm 18.8^*$
Cerosal	15	92.2 ± 14.8
No Label	7	105.6 ± 17.1
Oceano	4	79.3 ± 38.5
Trinidad	2	9.0 ± 2.8
Pacifico	4	117.3 ± 29.9
TOTAL	210	90.2 ± 21.1

* $\bar{x} \pm \text{S.D.}$

Annex 7.

Iodine Solution Dilution Table (100ppm)

UNIDADES INGLESAS			UNIDADES METRICAS		
Galones Agua	Libras Yodato de Potasio	Quintales Sal Yodada	Litros Agua	Gramos Yodo	Toneladas Sal
0.07	0.017	1	0.25	7.7	0.046
0.13	0.034	2	0.50	15.4	0.092
0.20	0.051	3	0.75	23.1	0.138
0.26	0.068	4	1.00	30.8	0.184
0.33	0.085	5	1.25	38.5	0.230
0.40	0.102	6	1.50	46.2	0.276
0.46	0.119	7	1.75	53.9	0.322
0.53	0.136	8	2.00	61.6	0.368
0.59	0.153	9	2.25	69.3	0.414
0.66	0.170	10	2.50	77.0	0.460
0.73	0.187	11	2.75	84.7	0.506
0.79	0.204	12	3.00	92.4	0.552
0.86	0.221	13	3.25	100.1	0.598
0.92	0.238	14	3.50	107.8	0.644
0.99	0.255	15	3.75	115.5	0.690
1.00	0.257	15.1	3.78	116.3	0.695
1.06	0.272	16	4.00	123.2	0.736
1.12	0.289	17	4.25	130.9	0.782
1.19	0.306	18	4.50	138.6	0.828
1.25	0.323	19	4.75	146.3	0.874
1.32	0.340	20	5.00	154.0	0.920
1.45	0.374	22	5.50	169.4	1.000
1.65	0.425	25	6.25	192.5	1.150
1.98	0.510	30	7.50	231.0	1.380
3.30	0.850	50	12.50	385.0	2.300
3.90	1.000	59	14.75	454.3	2.714
4.95	1.275	75	18.75	577.5	3.450
6.60	1.700	100	25.00	770.0	4.600
8.25	2.125	125	31.25	962.5	5.750
8.58	2.210	130	32.50	1000.0	5.980
9.90	2.550	150	37.50	1155.0	6.900

Iodine Solution Dilution Table (70ppm)

UNIDADES INGLESAS			UNIDADES METRICAS		
Galones Agua	Libras Yodato de Potasio	Quintales Sal Yodada	Litros Agua	Gramos Yodo	Toneladas Sal
0.07	0.012	1	0.25	5.4	0.046
0.13	0.024	2	0.50	10.8	0.092
0.20	0.036	3	0.75	16.2	0.138
0.26	0.048	4	1.00	21.6	0.184
0.33	0.060	5	1.25	27.0	0.230
0.40	0.071	6	1.50	32.3	0.276
0.46	0.083	7	1.75	37.7	0.322
0.53	0.095	8	2.00	43.1	0.368
0.59	0.107	9	2.25	48.5	0.414
0.66	0.119	10	2.50	53.9	0.460
0.73	0.131	11	2.75	59.3	0.506
0.79	0.143	12	3.00	64.7	0.552
0.86	0.155	13	3.25	70.1	0.598
0.92	0.167	14	3.50	75.5	0.644
0.99	0.179	15	3.75	80.9	0.690
1.00	0.180	15.1	3.78	81.4	0.695
1.06	0.190	16	4.00	86.2	0.736
1.12	0.202	17	4.25	91.6	0.782
1.19	0.214	18	4.50	97.0	0.828
1.25	0.226	19	4.75	102.4	0.874
1.32	0.238	20	5.00	107.8	0.920
1.45	0.262	22	5.50	118.6	1.000
1.65	0.298	25	6.25	134.8	1.150
1.98	0.357	30	7.50	161.7	1.380
3.30	0.595	50	12.50	269.5	2.300
3.89	1.000	59	14.75	318.0	2.714
4.95	0.893	75	18.75	404.3	3.450
6.60	1.190	100	25.00	539.0	4.600
8.25	1.488	125	31.25	673.8	5.750
8.58	1.547	130	32.50	1000.0	5.980
9.90	1.785	150	37.50	808.5	6.900

Iodine Solution Dilution Table (50ppm)

UNIDADES INGLESAS			UNIDADES METRICAS		
Galones Agua	Libras Yodato de Potasio	Quintales Sal Yodada	Litros Agua	Gramos Yodo	Toneladas Sal
0.07	0.009	1	0.25	3.9	0.046
0.13	0.017	2	0.50	7.7	0.092
0.20	0.026	3	0.75	11.6	0.138
0.26	0.034	4	1.00	15.4	0.184
0.33	0.043	5	1.25	19.3	0.230
0.40	0.051	6	1.50	23.1	0.276
0.46	0.060	7	1.75	27.0	0.322
0.53	0.068	8	2.00	30.8	0.368
0.59	0.077	9	2.25	34.7	0.414
0.66	0.085	10	2.50	38.5	0.460
0.73	0.094	11	2.75	42.4	0.506
0.79	0.102	12	3.00	46.2	0.552
0.86	0.111	13	3.25	50.1	0.598
0.92	0.119	14	3.50	53.9	0.644
0.99	0.128	15	3.75	57.8	0.690
1.00	0.128	15.1	3.78	58.1	0.695
1.06	0.136	16	4.00	61.6	0.736
1.12	0.145	17	4.25	65.5	0.782
1.19	0.153	18	4.50	69.3	0.828
1.25	0.162	19	4.75	73.2	0.874
1.32	0.170	20	5.00	77.0	0.920
1.45	0.187	22	5.50	84.7	1.000
1.65	0.213	25	6.25	96.3	1.150
1.98	0.255	30	7.50	115.5	1.380
3.30	0.425	50	12.50	192.5	2.300
3.89	1.000	59	14.75	227.2	2.714
4.95	0.638	75	18.75	288.8	3.450
6.60	0.850	100	25.00	385.0	4.600
8.25	1.063	125	31.25	481.3	5.750
8.58	1.105	130	32.50	1000.0	5.980
9.90	1.275	150	37.50	577.5	6.900

Iodine Solution Dilution Table (30ppm)

UNIDADES INGLESAS			UNIDADES METRICAS		
	Libras Yodato de Potasio		Litros Agua		Toneladas Sal
	0.005		0.25		0.046
	0.010		0.50		0.092
	0.015		0.75		0.138
0.26	0.020	4	1.00	9.2	0.184
0.33	0.026	5	1.25	11.6	0.230
0.40	0.031	6	1.50	13.9	0.276
0.46	0.036	7	1.75	16.2	0.322
0.53	0.041	8	2.00	18.5	0.368
0.59	0.046	9	2.25	20.8	0.414
0.66	0.051	10	2.50	23.1	0.460
0.73	0.056	11	2.75	25.4	0.506
0.79	0.061	12	3.00	27.7	0.552
0.86	0.066	13	3.25	30.0	0.598
0.92	0.071	14	3.50	32.3	0.644
0.99	0.077	15	3.75	34.7	0.690
1.00	0.077	15.1	3.78	34.9	0.695
1.06	0.082	16	4.00	37.0	0.736
1.12	0.087	17	4.25	39.3	0.782
1.19	0.092	18	4.50	41.6	0.828
1.25	0.097	19	4.75	43.9	0.874
1.32	0.102	20	5.00	46.2	0.920
1.45	0.112	22	5.50	50.8	1.000
1.65	0.128	25	6.25	57.8	1.150
1.98	0.153	30	7.50	69.3	1.380
3.30	0.255	50	12.50	115.5	2.300
3.89	1.000	59	14.75	136.3	2.714
4.95	0.383	75	18.75	173.3	3.450
6.60	0.510	100	25.00	231.0	4.600
8.25	0.638	125	31.25	288.8	5.750
8.58	0.663	130	32.50	1000.0	5.980
9.90	0.765	150	37.50	346.5	6.900