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Low iodine intakes in weaning infants

In countries where iodized salt programs supply sufficient iodine to older children and pregnant women, weaning infants, particularly those not receiving iodine-containing infant foods, may be at risk of iodine deficiency.



Michael Zimmermann

ICCIDD Deputy Regional Coordinator for
Western and Central Europe

Because iodine deficiency (ID) during infancy may irreversibly impair development and increase mortality, control of ID in populations should emphasize this critical period. Infants are at high risk for ID because their requirements per kg body weight for iodine and thyroid hormone are much higher than at any other time in the life cycle. Infants may be at particularly high risk for ID during the weaning period. Iodization of salt is the recommended strategy to control ID, and lactating mothers consuming iodized salt can transfer the iodine to the infant via breast milk. But experts recommend no extra salt (iodized or not) be given to infants during the first year and mothers are encouraged to feed home-prepared



Figure 1: Collecting a 3 ml spot infant urine sample by noninvasive pad collection

complementary foods without added salt. So as infants wean from breast milk, iodized salt programs contribute little to their iodine intakes, and, in industrialized countries, they depend nearly entirely on iodized commercial complementary formula/foods. However, in most countries, legislation does not stipulate minimum iodine levels for complementary formula/foods.

It is often assumed if school age children and pregnant women are iodine sufficient, infants in the same population will also be iodine sufficient. However, there have been no national studies assessing infant iodine status in countries with established iodized salt programs where the general population has adequate iodine intakes. Previous infant studies were limited by small non-representative sampling and, in many, the iodine intake of the population was too high, or was inadequate. The main indicator of iodine intake in populations is the median (m) urinary iodine concentration (UIC) and WHO states a mUIC ≥ 100 $\mu\text{g}/\text{L}$ in infants indicates iodine sufficiency. A challenge to assessing UIC in this age group is sample collection, but a validated and simple pad collection method has been developed (Figure 1) (1).

Switzerland has a model iodized salt program that was initiated in 1922; in national surveys in 1999 and 2004, $>90\%$ of households were using iodized salt and school children were iodine sufficient. The objective of a recent study (2) was to measure UIC in a national sample of

pregnant women and school children to confirm that the Swiss population remains iodine sufficient in 2009. At the same time, UIC was measured in a national sample of infants. Iodine status of these vulnerable population groups was compared.

Urinary iodine concentrations (UIC) were measured in national samples of: 1) pregnant women ($n=648$); 2) school children ($n=916$); 3) infants at 3 time points: at 3–4 d after birth, and at 6 and 12 mo ($n=875$); and 4) breastfeeding mothers ($n=507$). Breast milk iodine concentrations (BMIC) were measured in the mothers, iodine sources in infant diets were assessed and iodine content of commercial infant formula milks (IFM) and complementary formula/foods (CFs) was analyzed.

Median UICs (Table 1) in pregnant women (162 $\mu\text{g}/\text{L}$) and school children (120 $\mu\text{g}/\text{L}$) were sufficient and only 8% of households were not using iodized salt. Median BMIC was 50 $\mu\text{g}/\text{kg}$. However, mUICs in infants not receiving IFM/CF were not sufficient:

- mUIC in breast-fed infants (82 $\mu\text{g}/\text{L}$) was lower than in non-breast fed infants (105 $\mu\text{g}/\text{L}$) ($p<0.001$);
- mUIC in breast-fed weaning infants not receiving IFM/CF (70 $\mu\text{g}/\text{L}$) was lower than infants receiving IFM (109 $\mu\text{g}/\text{L}$) ($p<0.01$) (Figure 2).

Previous dietary intake studies have highlighted the importance of iodized CF for weaning infants. In the New

Zealand Total Diet study, which simulated typical diets, iodine-containing formula and foods provided 60% of iodine intakes for infants older than 6 mo (3). In the US Total Diet Study, 90% of iodine intake in infants older than 6 mo was provided by infant formula/foods and dairy products (4). In Europe, the required level of iodization for infant formula milks is 10–50 $\mu\text{g}/100$ kcal (2.5 $\mu\text{g}/100$ kJ), but for cereal-based and other CFs there are no requirements for minimum iodization while the allowed upper level is 35 $\mu\text{g}/100$ kcal. In Germany, it is estimated only $\approx 50\%$ of CFs are fortified with iodine; and, using a dietary model, it was estimated that the iodine intake of an 8 mo-old German breast-fed infant who receives home-prepared CF would be only ca. 45 $\mu\text{g}/\text{d}$ compared to ≥ 125 $\mu\text{g}/\text{d}$ in a formula-fed infant who receives commercial CF (5).

In this Swiss study, supplements containing iodine were consumed by only 15% of pregnant and <5% of lactating women. Although iodine supplements (either to lactating mothers or their infants) could supply additional iodine during infancy, most European pediatric societies do not recommend supplements for infants on well-balanced diets or their lactating mothers. Similarly, in countries such as Switzerland with an effective iodized salt program, WHO does not recommend iodine supplementation for infants or lactating women.

Our findings need confirmation in other countries, but suggest these recommendations may need to be reconsidered. In countries where commercial infant foods are available, the fortification of iodine in IFM and CF should be strongly encouraged to ensure adequate iodine intakes in infancy.

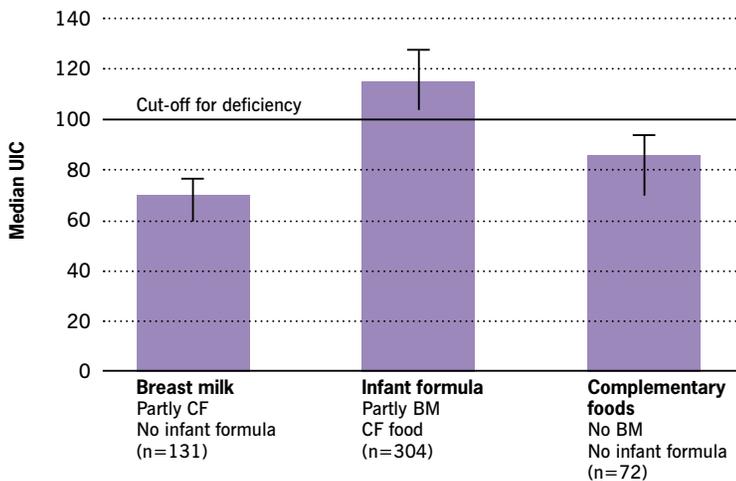
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Table 1: Median UI (µg/L) by age/population group in Switzerland

Age group	Infants 3-4 d	Infants 6 mo	Infants 12 mo	School children	Pregnant women
N	368	279	228	916	648
UIC (95% CI)	91 (82, 99)	91 (79, 103)	103 (92, 116)	120 (120, 128)	162 (144, 177)

Figure 2: Weaning Swiss infants need iodine-fortified formula and complementary foods to avoid deficiency



Satisfying Hidden Hunger: The Asian Development Bank fights IDD in Central Asia

From: *Satisfying hidden hunger: Addressing Micronutrient Deficiencies in Central Asia*. Mandaluyong City, Philippines: Asian Development Bank, 2010.

Background

During the 1990s, the newly emerging countries of Central Asia, as well as neighboring Mongolia, faced a growing and urgent problem of disease caused by micronutrient deficiencies. In response, the Asian Development Bank (ADB) decided to mount a regional food fortification initiative to reverse this spreading public health problem that was particularly affecting poor women and children and was costing the countries about 1% of their gross domestic product.

The major micronutrient deficiencies were IDD and iron deficiency anemia. This article will focus on the fight against IDD. The prevalence of goiter ranged from 23% to 73% in children in Central Asia at the time the initiative began—well above the 5% cutoff used to signal a public health problem. ADB's involvement is rooted in its Policy for the Health Sector. The policy notes that improvements in health support economic growth through (i) increased worker productivity, (ii) increased returns to investments in education, (iii) increased returns to other factors of production, and (iv) freeing up financial resources by preventing disease. Investments in health also help to reduce poverty because the poor suffer from worse health status and face more serious economic and financial consequences when they become ill. These observations apply very well to the problem of IDD.



The ADB program has improved iodine intakes in many Tajikistan children

Satisfying Hidden Hunger

Addressing Micronutrient Deficiencies in Central Asia

Asian Development Bank

Production of iodized salt through the initiative increased significantly and even exceeded regional demand, and the proportion of households using quality iodized salt increased in all countries during the initiative, reaching 90% in Kazakhstan. By the end of the initiative, all countries had enacted legislation making iodization mandatory.

Initiative results indicate that almost 24 million new consumers of iodized salt were added in the region during the first Japan Fund for Poverty Reduction project, and an additional 500,000 newborns were protected against brain damage resulting from iodine deficiency. The annual economic costs avoided by the correction of iodine deficiency across the region through the initiative are estimated at up to \$300 million.

Under the umbrella of the initiative, all the participating countries agreed on a set of fortification standards and made regulations and laws accordingly. Adoption of common standards took place in the remarkably short time of about 2 years.

Much of the credit for the success of the initiative is because of awareness, communication, and marketing activities, through which the participating countries were able to obtain the support of decision makers and other stakeholders down to community members. Coordination of each tier of communication activities from policy level to that of the community was important to ensure that the right messages were available at the right time. In particular, motivating all the key players in fortification was a major task and key factor.

Development Issues

The three development issues that ADB addressed in the initiative were all answered positively.

Public-private partnership in these mainly newly emerging market economies proved successful and vital. Collaboration during the initiative hel-

The Regional Fortification Initiative

ADB's food fortification initiative in Central Asia and Mongolia was conducted through two regionwide projects supported by the Japan Fund for Poverty Reduction. ADB approached the governments of Azerbaijan, Kazakhstan, the Kyrgyz Republic, Mongolia, Tajikistan, and Uzbekistan and obtained their agreement to participate in the initiative, with the United Nations Children's Fund (UNICEF) as the main partner. From the beginning of the initiative, the Kazakh Academy of Nutrition (KAN) provided technical guidance and took part in monitoring and evaluation.

The first project, Improving Nutrition for Poor Mothers and Children in Asian Countries in Transition, aimed to improve the nutritional status and physical and mental capacity of the poor, particularly targeting poor women of reproductive age and children, by establishing an umbrella regional program to deliver micronutrient-fortified salt. The second project, Sustainable Food Fortification in Central Asia and Mongolia, aimed to reinforce and sustain the reduction of IDD among poor women and children in Central Asia.

There were five major components of the initiative:

- Roundtable conferences and regional and national workshops. Three roundtable conferences brought together stakeholders from the countries

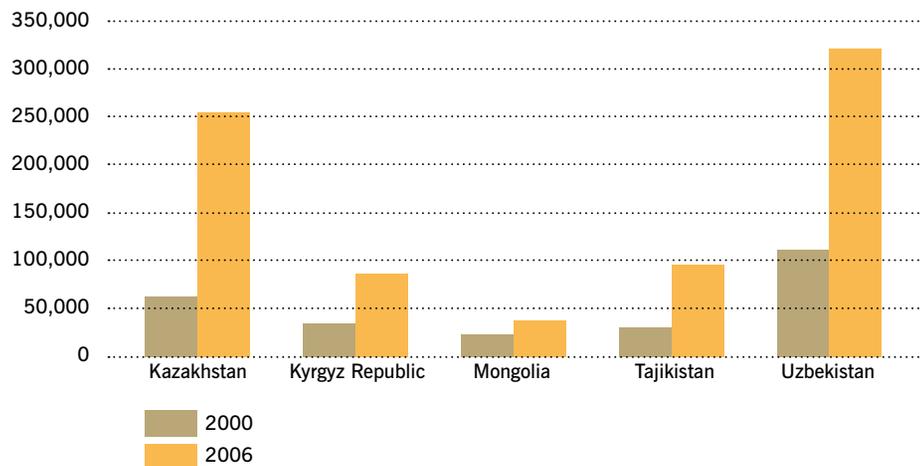
and aid agencies to discuss strategies and targets, resolve major issues, and review progress. Eight regional workshops sought to build capacity among the project countries to deal with pressing issues as they arose. National workshops covered issues that needed agreement and coordination among the various stakeholders.

- Fortification of salt. Iodization of salt was the approach followed. Salt producers were assisted in upgrading processing and marketing technology. A 1-year supply of fortificant was also provided.
- Capacity development. The initiative provided capacity development in appropriate areas to salt industry personnel, government officers, and regulatory authorities.
- Social marketing and mobilization. A communication strategy was developed to strengthen activities in policy and regulatory advocacy, provide organizational motivation and training, create new alliances, and provide community communication to generate demand for fortified salt.
- Monitoring and evaluation. Monitoring included project supervision, technical workshops, midterm review, annual auditing, and a rigorous efficacy study on the impact of fortified salt.

Achievements

By the end of the initiative in 2007, the participating countries were well on the way toward universal salt iodization.

Number of newborns protected each year against the risk of brain damage from iodine deficiency, 2000-2006



ped establish good working relations and strong partnership between the government and the salt industry in all the countries, and the salt industry gradually developed a sense of ownership of the fortification program.

Formation of industry associations and collaboration of government and nongovernment organizations in workshops, etc., further helped sustain the fortification programs.

The question of affordability to the poor was initially a concern. Salt is one of the most basic staples in the region and is very sensitive to price change. When the initiative started, the price of iodized salt was higher than that of noniodized salt. However, by the time the initiative ended, the price differentials were insignificant. This was due in part to increasing ownership and investment by the producers due to the mandatory nature of fortification in the region. Also, growing demand allowed for economies of scale in production.

Finally, the regional approach was vindicated, despite the competitiveness of the Central Asian countries and their many pressing development problems and priorities. The regional approach enabled establishment of common standards for fortified salt, achieved economies of scale, took advantage of cross-learning,

and enriched interregional cooperation. ADB support on a country-by-country basis would not have had these advantages and would have been unable to address regional issues, such as trade and its regulation.

Lessons

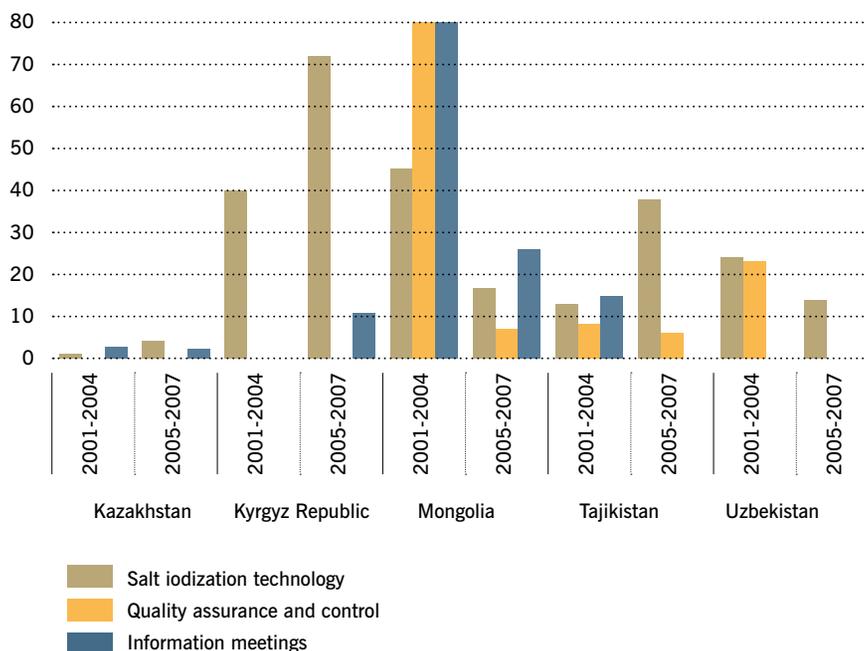
A great many lessons that will prove useful for future work in this field were learned. The following are some major ones:

- Mandatory fortification legislation is

a prerequisite for ensuring universal access to fortified foods.

- Political support at the highest level is needed to ensure sustainability of food fortification programs.
- Public-private partnership was essential in sustaining the momentum of the initiative.
- Quality control in most of the countries was difficult and needs further strengthening at both industrial and retail levels.
- Incentives for food producers were essential during program development to prevent their discouragement because of initial losses during fortification start-up. Cost sharing by industry, however, was an important first step toward sustainability. Donor dependency appeared to be one of the reasons that universal salt iodization had not happened previously.
- Financial capacity of food producers is a key to sustainable food fortification. For small producers, innovative ways to ensure reliable and reasonably priced fortificant supplies are necessary.
- A strong initial information base is necessary on, for example, prevalence of deficiencies and the production and

Numbers of salt engineers and laboratory technicians trained in Central Asia and Mongolia, 2003-2007





The ADB initiative created a “healthy food” logo for packaging, which was adopted by all participating countries.

financial capacity of salt producers; if absent, it should be an early priority of fortification programs.

- A need for awareness building on the advantages of fortified food and its limited availability at local markets was evident in order to increase demand from producers and consumers. Intense awareness campaigns were needed and innovative ways to improve demand are still required.

situation analysis of the particular food industry in addition to studying the feasibility of fortification itself.

- Technology transfer accelerated establishment of food fortification better than using foreign capacity. Domestic capacity development helped the countries to carry out food fortification without external help.

promoting fortification of foods that can improve the micronutrient status of the poor.

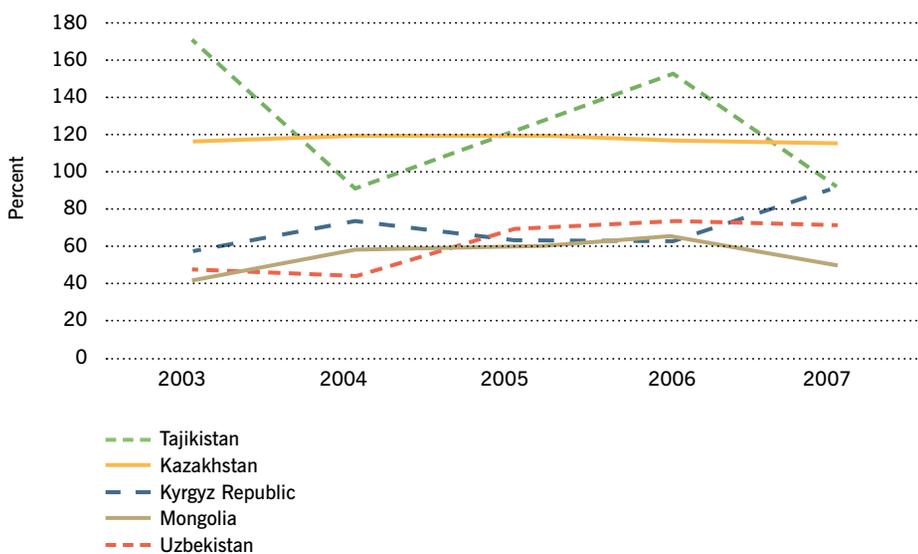
Inclusive growth and regional integration are two of the three strategic agendas of ADB’s long-term strategic framework for 2008–2020, Strategy 2020 which emphasizes the private sector as a driving force for inclusive growth. Through public–private partnership, ADB should reinvigorate its efforts to promote food fortification so as to deliver much-needed micronutrients to populations in need.

A Kazakh success story

As soon as Kazakhstan’s national fortification plan was in place, the Kazakh Academy of Nutrition, along with the Healthy Life–Style Promotion Center and selected public relations firms, produced educational and communications materials about iodine deficiency disorders (IDD) and anemia prevention for pretesting in small focus-group interviews with their specific target groups. After adjustment, the materials were tested during the second half of 2003 in pilot areas of South Kazakhstan oblast. The campaign also included TV features, press conferences, presentations, and training seminars for nongovernment organization (NGO) employees, mass media, and salt and flour product dealers.

The message about the preventive effect of using iodized salt was aimed at large population groups, using the resources of the health care and education sectors, the mass media of the region, and NGOs. The campaign delivered numerous sets of 12 kinds of printed and video products about iodized salt with specific messages to the target audiences: local authorities; salt enterprises and traders; state employees in primary health care and sanitary services; middle schools, colleges, and universities; young school children, teenagers, and pregnant women; mass-media workers; and the general public. Especially in rural areas,

Annual iodized salt production as percentage of annual salt consumption in Central Asia and Mongolia, 2003-2007



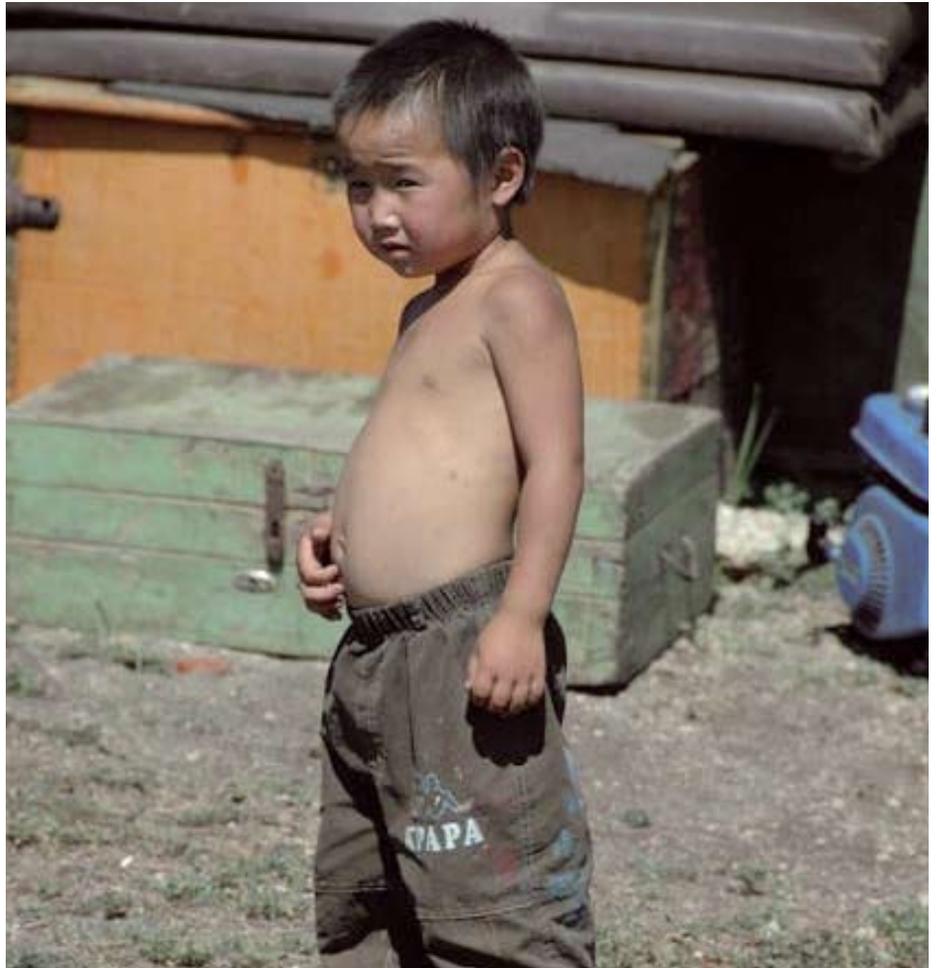
- Limited information hampered the initiative from the outset. The initiative filled critical information gaps in food fortification knowledge in the participating countries that will be vital for future fortification activities in the region. Still, any new attempt to fortify food should be preceded by

Conclusions

In view of the successes of the initiative, the validation of ADB’s regional approach to fortification, and in light of the lessons from the initiative, ADB should continue in its role of catalyst in nutrition development efforts in the region, particularly in advocating and

these groups were enlightened about the dangers of iodine deficiency and the desirability of consuming iodized salt, educated in the principles of iodized salt storage and use during cooking, and informed about the “Healthy Food/ Sapaldy Azdyk” general trademark.

At the end of 2003, assisted by the initiative and the Kyrgyz Red Cross, monitoring surveys and population interviews were conducted on the quality of iodized salt among 91,000 rural and urban households in South Kazakhstan oblast. The results indicated that awareness of IDD and use of iodized salt among the population had improved from 43% to 61%. Virtually all respondents had heard about iodized salt and knew the advantages of using it. Only 3% of households were still using noniodized salt. These results formed the basis of a comprehensive national campaign during 2003–2004, with a follow-up stage that continued into 2006.



Supported by the ADB, correction of iodine deficiency in Mongolia will have health and economic benefits

Combating iodine deficiency in the Philippines through advocacy and partnership with the salt industry

“Iwas Goiter ni Mommy, Lusog-Isip ni Baby”

“Prevent goiter for Mommy, enhance brain development for Baby.”

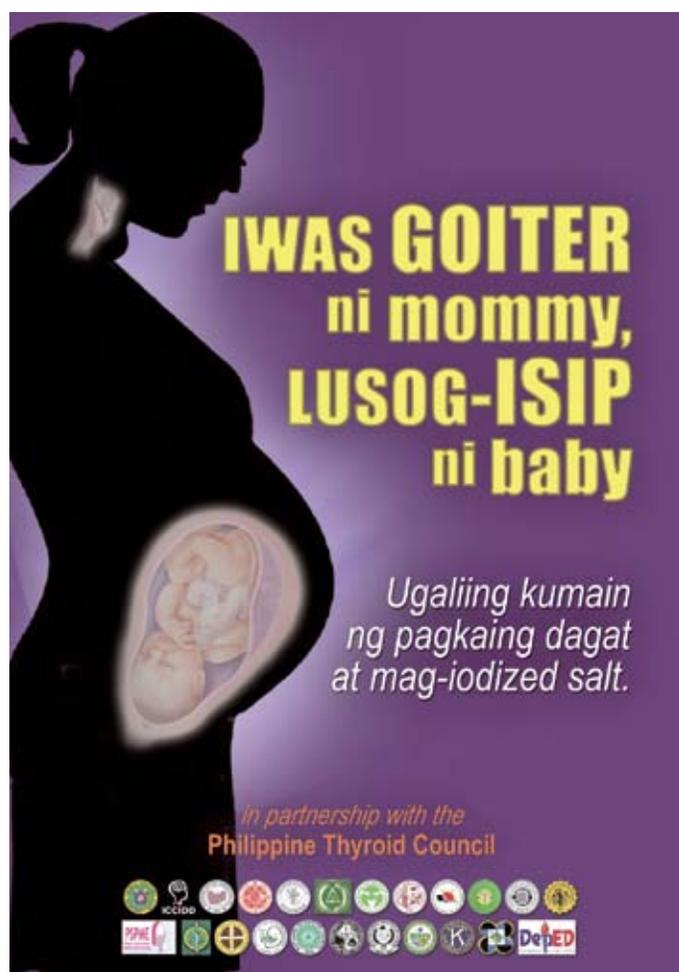


Goiter Awareness Week spreads the message on the benefits of USI for women and children in the Philippines

Advocacy for increasing iodine intakes in the Philippines

The Philippines has regulations calling for 20–40 μg iodine/g of salt (20–40 ppm); thus if an individual eats 5 g of salt iodized at 30 ppm, he or she gets 150 μg iodine from this source alone. Iodine deficiency is best measured through urinary iodine concentrations (UIC) in representative sampling of clusters of population groups. A median UIC between 100 – 200 $\mu\text{g}/\text{L}$ is ideal for school children. However, pregnant women should have higher UIC levels (150 – 249 $\mu\text{g}/\text{L}$). According to the 2008 National Nutrition Survey (NNS) in the Philippines, the iodine status of children 6 – 12 years is optimal as indicated by the median UIC of 132 $\mu\text{g}/\text{L}$. However, the iodine status of pregnant and lactating women is lower than desired. NNS data show that pregnant women have only a median UIC of 105 $\mu\text{g}/\text{L}$ while lactating women have median value of 81 $\mu\text{g}/\text{L}$. Thus, their iodine status is of public health concern, considering that their UICs in the 2003 NNS were higher, at 142 $\mu\text{g}/\text{L}$ and 111 $\mu\text{g}/\text{L}$, respectively. Thus, iodine nutrition may be decreasing among women. They need to be educated more vigorously on the regular use of iodized salt in their cooking and at the table, as well as having iodine-rich food for their diet.

In 2011, the Philippines will celebrate for the 5th year running Goiter Awareness Week (January 23-28, 2011). The poster (below) text in Philipino is translated as „Prevent goiter for Mommy, Enhance brain development for Baby.“ This poster is used to celebrate this week, and the subtext encourages the eating of seafoods and the use of iodized salt. The different logos of the national coalition making up the Philippine Thyroid Council are shown at the bottom.



Philippine poster for Goiter Awareness Week

Philippine salt traders agree to improve salt quality under iodization law

Sarwell Q. Meniano Business World, The Philippines

TACLOBAN CITY November 02, 2010. Salt traders here have agreed to improve product quality in compliance with the salt iodization law. The traders met with the local Bantay Asin Task Force last month to forge a partnership and ensure that the quality of iodized salt marketed in the region meets provisions of Republic Act 8172, or Act for Salt Iodization Nationwide (ASIN). Charles Uykim, Jr., owner of Cocomart with a warehouse in Marasbaras district in this city, has called on the government to start monitoring activities at the source to upgrade the quality of iodine content.

„We just receive salt shipments here. Checking should be done at the production site,“ he added.

producers nationwide. GAIN will send an iodine checker this month to the Tacloban port area.

„The small and portable instrument provides reliable performance,“ Mr. Otico said.

The task force, composed of various government agencies in Region 8, called for a meeting with traders after survey results showed low intake of iodine among target age groups. The latest National Nutrition Survey by the Food and Nutrition Research Institute showed that 97.2% of households in Eastern Visayas have been using iodized salt. However, the same study revealed that median urinary iodine excretion of children in Region 8 is 83 ($\mu\text{g/L}$), in lactating mothers is 58 $\mu\text{g/L}$, and in pregnant women is 83 $\mu\text{g/L}$. These figures are way below the 100-150 $\mu\text{g/L}$ minimum iodine excretion using the same measurement.

„Salt traders must understand that distributing iodized salt is their social responsibility. Only 25% of the households in the country have adequately been using iodized salt. Over 67 million Filipinos and 1.67 million newborns are unprotected,“ Mr. Otico said.

Under the law, salt producers/manufacturers shall register with the Food and Drug Administration, which shall maintain an updated registry of salt producers/manufacturers and shall monitor compliance with the salt iodization program.

Edward P. Otico, an associate of the international organization Global Alliance for Improved Nutrition (GAIN), said his group will assist the Health department in coming up with a quality control system that will be followed by all salt

Breast-milk iodine concentration declines over the first 6 mo postpartum in iodine-deficient women

Mulrine HM, Skeaff SA, Ferguson EL, Gray AR, Valeix P. Am J Clin Nutr. 2010 Oct;92(4):849-56



Many New Zealand women have low breast-milk iodine, putting their babies at risk of deficiency

In infants, iodine deficiency at crucial periods of development may lead to growth retardation, impaired hearing capacity and reduced cognitive function. WHO recommends that infants are exclusively breastfed until 6 mo of age. Consequently, the iodine intake of the breastfed infant relies solely on the iodine concentration of breast milk, which in turn reflects the mother's iodine status. In countries with a good supply of iodine, the breast-milk iodine concentration (BMIC) can be as high as 180 $\mu\text{g/L}$. In iodine-deficient areas, the BMIC often falls to $<50 \mu\text{g/L}$ and is unlikely to supply an infant with enough iodine to meet daily requirements of 110 $\mu\text{g/d}$.

To date, no longitudinal studies have examined the iodine status of lactating mothers concurrently with their breastfed infants during the first 6 mo postpartum. The RDA for iodine of lactating women is 290 $\mu\text{g/d}$, which is based on the assumption that this intake of breast milk will provide

114 $\mu\text{g I/d}$ to exclusively breastfed infants. It is unlikely that breastfeeding women living in areas of iodine deficiency could meet the RDA from dietary sources alone. The use of iodine supplements for lactating women is a simple and cost-effective strategy to increase iodine intakes. In 2006, the American Thyroid Association recommended that breastfeeding women take a supplement containing 150 $\mu\text{g I/d}$. The aims of this study were 2-fold: 1) to determine the iodine status of unsupplemented lactating women and their infants during the first 24 wk postpartum and 2) to compare the effect of 2 levels of iodine supplementation on the BMIC and iodine status in mothers and their infants.

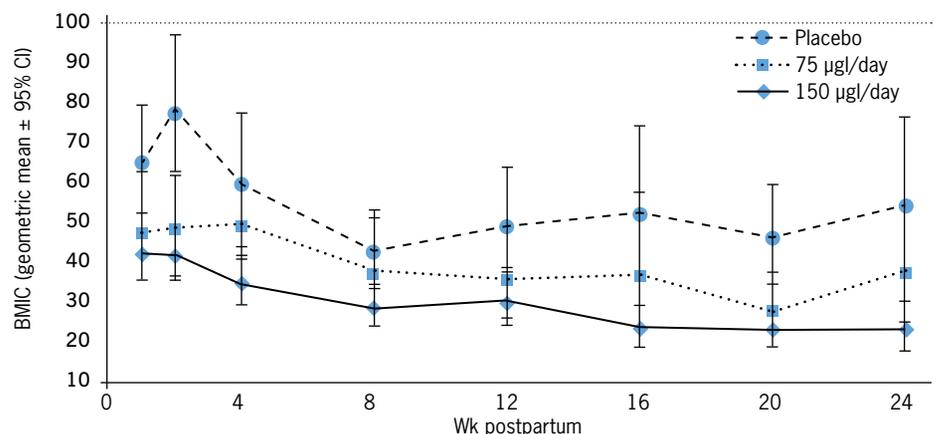
A randomized, double-blind, placebo-controlled supplementation trial was conducted in lactating women who received placebo ($n = 56$), 75 $\mu\text{g I/d}$ ($n = 27$), or 150 $\mu\text{g I/d}$ ($n = 26$) after their infants' birth until 24 wk postpartum. Maternal and infant urine samples and breast-milk samples were collected at 1, 2, 4, 8, 12, 16, 20, and 24 wk. Maternal serum thyrotropin and

free thyroxine concentrations were measured at 24 wk.

Over 24 wk, the median urinary iodine concentration (UIC) of unsupplemented women and their infants ranged from 20 to 41 $\mu\text{g/L}$ and 34 to 49 $\mu\text{g/L}$, respectively, which indicated iodine deficiency (ie, UIC $< 100 \mu\text{g/L}$). Mean maternal UIC was 2.1–2.4 times higher in supplemented than in unsupplemented women ($P < 0.001$) but did not differ significantly between the 2 supplemented groups. BMIC in the placebo group decreased by 40% over 24 wk ($P < 0.001$) (Figure 1) and was 1.3 times and 1.7 times higher in women supplemented with 75 $\mu\text{g I/d}$ ($P = 0.030$) and 150 $\mu\text{g I/d}$ ($P < 0.001$), respectively, than in unsupplemented women. Thyrotropin and free thyroxine did not differ significantly between groups.

The data show that BMIC decreased in the first 6 mo in these iodine-deficient lactating women; supplementation with 75 or 150 $\mu\text{g I/d}$ increased the BMIC but was insufficient to ensure adequate iodine status in women or their infants.

Figure 1 The effect of iodine supplementation on breast-milk iodine concentration (BMIC) presented as geometric means (95% CIs) over 24 wk postpartum (placebo, $n = 51$; 75 $\mu\text{g I/d}$, $n = 24$; 150 $\mu\text{g I/d}$, $n = 24$).



Progress against IDD in the Eastern Mediterranean

Izzeldin Hussein ICCIDD EMRO Regional Coordinator

On October 3 to 6, 2010, the WHO Regional Committee for the Eastern Mediterranean met in the Kuwait Conference Hall of the WHO Office for the Eastern Mediterranean (EMRO) in Cairo, Egypt.

The EMRO regional strategy on nutrition 2010–2019 was developed through a consultative process by the WHO Regional Advisory Committee on Nutrition including representatives from Member States, Food and Agriculture Organization of the United Nations (FAO), UNICEF, World Food Program, International Council for Control of Iodine Deficiency Disorders (ICCIDD), UNRWA, Middle East and North African Nutrition Association and International Union of Nutritional Sciences. The strategy addresses the major health and nutrition problems in the Region and includes control of IDD, targeting undernutrition, and other micronutrient deficiencies. It aims to support countries in establishing and implementing action in nutrition in accordance with their national situation and resources.

Izzeldin Hussein, ICCIDD EMRO Regional Coordinator was invited to discuss and comment on IDD status in the region. He made the following statement:

„I’m pleased to report that ICCIDD participated in the development of the regional strategy on nutrition 2010–2019. Having the honor, I report in



Increasing attention to iodine nutrition in the EMRO region benefits many Arab children

my capacity as Regional Coordinator of ICCIDD that the strategy is very comprehensive, taking into consideration the individual country nutrition situation analysis and the burden of disease associated with inadequate dietary intake in many countries.”

“Micronutrient malnutrition and deficiencies remain a major health problem with severe consequences that can't be ignored or neglected. In particular, the iodine deficiency disorders, among the other micronutrients.

“ICCIDD as an organization with official consultative status with the World Health Assembly of the WHO and with the UNICEF Executive Board is uniquely positioned to provide advocacy and support services to national efforts to eliminate this dreadful scourge. Member states are urged to redouble their efforts to reach those not yet protected from IDD and to sustain the successful programs on continuous basis.”

“I'm pleased to report that the joint assessment by ICCIDD and WHO EMRO on the United Arab Emirates status of IDD carried out last year revealed that UAE have achieved the elimination of the IDD according to the criteria set by WHO UNICEF AND ICCIDD Country Program Assessments 2007. The median urinary iodine is 160 µg/l and more than 94% of the population consumes iodized salt. The total goiter rate decreased from 40% in 1994 to less than 7%. UAE has taken further steps to assure sustainability and a surveillance system will be in place in 2011.



Izzeldin Hussein, ICCIDD EMRO Regional Coordinator (seated) at Cairo Unicef headquarters

To declare the country officially free UAE is urged to submit a request together with assessment reports to WHO EMRO requesting an external USI review through the Iodine Network.”

“Oman has completed the necessary procedures and a committee is now formed to undertake an IDD assessment – planned to take place in Jan 2011. ICCIDD would like to extend its gratitude and thanks to the Sultanate of Oman for initiating the micronutrient deficiencies meeting held by the Executive Board of the Health Minister' Council for GCC States, in Kuwait with focus on IDD. The recommendations of this meeting will form solid ground for elimination of IDD in the Gulf. Qatar will hold its first workshop on IDD on 8-9 December 2010.”

“I conclude that the situation is improving but the major challenges in this region are:

- (a) to achieve USI, a promise made for many years
- (b) sustain progress by more vigorous and more frequent monitoring
- (c) seek ways to use modern technology for monitoring and reporting; like the cellular systems in each country
- (d) activate national committees and assure private sector priorities remain high.”

“ICCIDD appreciates the continued concern and urging of the Regional Director Dr Algezairy to accelerate the process of IDD elimination and would like to confirm ICCIDD commitment to the partnership and alignment with WHO EMRO to achieve the virtual elimination of IDD in the region.”

The WHO EMRO meeting was an opportunity to renew the commitment to the fight against IDD. ICCIDD was able to clearly address the IDD issues in the region, draw attention to and report on the critical situation in some of the countries in the region. The UAE commitment was appreciated by Member States and WHO EMRO, and it was suggested to include UAE within the countries that should be reviewed for possible declaration of being free from IDD. The role of Oman in support of ICCIDD was well appreciated and it was agreed that a workshop will take place in Oman, UAE or Kuwait to review the status and discuss issues pertaining to WHA reporting and sustainability issues. Requests were also received from Kuwait, Libya and Saudi Arabia for visits to discuss ways to implement national IDD programs.

Risk of iodine excess in school children in Guizhou Province, China

Xiao-song LI, De-mei Zhou, Zhong-ying Yao Guizhou Provincial Center for Diseases Control and Prevention, China

Background

Guizhou Province is one of the regions historically affected by iodine deficiency in China. Severe endemic goiter (40%) and cretinism (3%) were reported by many early authors. A law in Guizhou Province stipulating that all salt for human consumption should be iodized at 20ppm was begun in 1985, as the main strategy to correct IDD. Surveillance of urinary iodine values and goiter rate of the Guizhou popula-

tion has been done every 3 years since 1985. The result was that the goiter rate decreased and no more cretins were born. From 1995 to present, China has been implementing universal salt iodization (USI) in the entire country. Iodine deficiency and excess can affect people's health. Thus, achieving the adequate iodine content in salt is important for USI, especially for the large Chinese population. The aim of this research was to determine iodine status in two vulnerable groups (pregnant women and schoolchildren) and offer a proposal to China government for finding the appropriate iodine content in salt for sustainable elimination of IDD in China.



If iodine intakes in older individuals are too high, thyroid diseases can increase

Methods

1. A survey in 2007–2008, across almost the entire Province (three quarters of counties were sampled), evaluated the iodine status of schoolchildren aged 8–10 years ($n=13864$) by measuring urinary iodine concentrations (UIC).
2. Iodine nutrition in pregnant women was evaluated by measuring UIC in ten counties ($n=502$) where IDD historically was mild to severe.

3. According to the sales information in 2008 from the salt company in those counties in the survey ($n=68$ counties), the relationship between average daily salt intake of population and UIC was analyzed.



Guizhou Province in southern China

tion has been done every 3 years since 1985. The result was that the goiter rate decreased and no more cretins were born. From 1995 to present, China has been implementing universal salt iodization (USI) in the entire country.

Iodine is one of the important micronutrients for human health. However, both

Table 1: Distribution of urinary iodine concentrations in schoolchildren in 2008

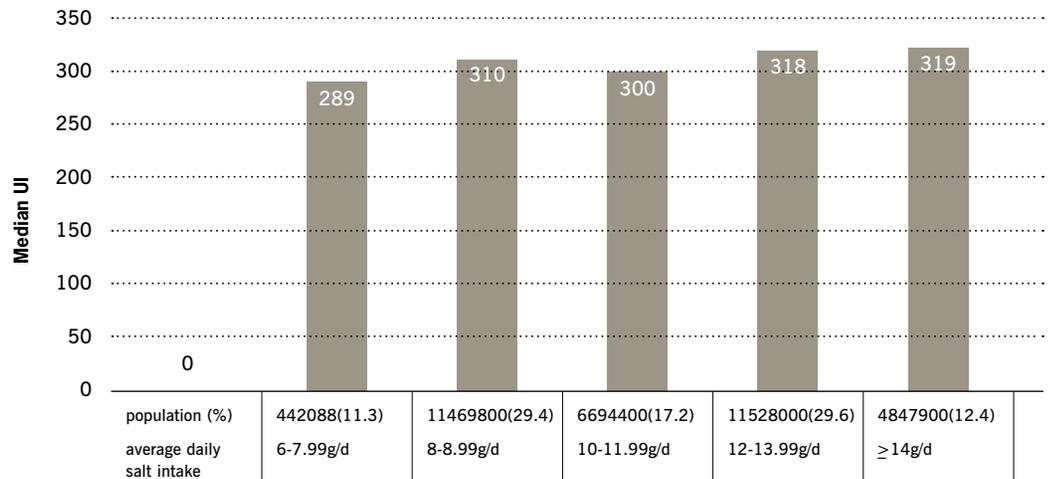
UI/ $\mu\text{g/L}$	Category of iodine intake	Sample (%)
0-19.9	Severe Deficiency	12 (0.1)
20-49.9	Moderate	60 (0.4)
50-99.9	Mild	382 (3)
100-199	Optimal	2727 (20)
200-299	More than adequate	3331 (24)
300 and above	Excess	7352 (53)

Results

This study found that median UIC of schoolchildren was 310 µg/L, range 19 to 1545 µg/L, with 24% more than adequate, and 53% with iodine excess (Table 1). For these individuals, the risk of autoimmune thyroid disorders and iodine-induced hyperthyroidism (IIH) may be increased.

The overall median UIC of pregnant women was adequate at 219 µg/L in 2009, within the range of 150–249 µg/L recommended for pregnant women by WHO. However, in two counties that were historically affected by severe IDD, the percentage of values <100 µg/L was 32% and 41%. Thus, the monitoring of iodine status should focus on pregnant women and infants in the national program in the future.

Figure 1: Average daily salt intake and median UI in 2008



($r=0.006$, $P<0.05$). It is possible that the data were somewhat limited by the use of salt sales data to estimate daily salt intake, rather than direct measurement in households.

Conclusions

The main strategy of control of IDD in China is USI, and it has been effective for 15 years, with salt iodized at 50ppm, and consumed by more than 98 percent of the population. Although most people are tolerant of iodine intakes up to 1000 µg/d, maintaining iodine intake in the appropriate range, as judged by UIC in the range of 100–200 µg/L, can significantly reduce iodine-induced hyperthyroidism (IIH) and risk of other thyroid diseases. This study showed that 53% of schoolchildren had excess iodine intakes and 43% of salt iodine content in household was in the range of 40–50 ppm. This suggests there is room to reduce the amount of iodine in salt. Iodine intake of pregnant women overall was adequate, but some women remain iodine deficient. Thus, in the USI monitoring program, pregnant women should be regularly included.



Growing children in Guizhou need enough iodine, but not too much

Figure 1 shows the average daily salt intake in 68 counties varied from 6 to ≥14 g/d, and shows the relationship between median UIC and average daily salt intake per person in 68 counties. There was a significant but weak positive correlation between these two variables

The "Pescopagano survey" evaluates the impact 15 years after voluntary iodine prophylaxis through iodized salt in Italy

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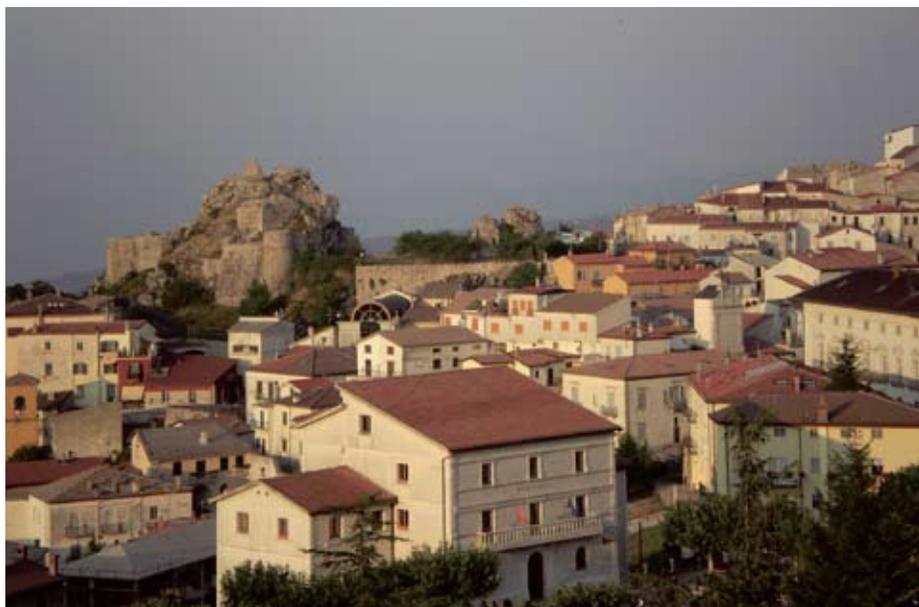
Iodine intakes in Italian children are improving, but some regions remain iodine deficient

Fifteen years ago, in 1995, a landmark cross-sectional survey was done on the prevalence and distribution of thyroid disorders in the whole population of a village in the South of Italy, called Pescopagano, in the Basilicata region (1). At the time of the survey, the village, located in the Lucan Apennines at 954 m above sea level, was characterized by a median urinary iodine (UI) of 55 $\mu\text{g}/\text{L}$, indicating mild to moderate iodine deficiency. At the time of the survey, the registered population of Pescopagano was 2348 people. Daily commuters to neighboring towns accounted for 620 people, and they were excluded from the survey because of their exposure to different dietary

intakes of iodine. A total of 317 people of the 1728 permanently residing in the village failed to respond to 2 consecutive calls to participate in the survey. Thus, 1411 residents were actually examined: 419 (215 males and 204 females) 1- to 14-yr-old children, representing 94.1% of this age group, and 992 (573 females and 419 males) of the 1368 subjects aged 15 yrs or more, representing 72.5% of this age group and referred to as the adult population. General medical practitioners in the village actively took part in each step of the survey. Civil and health authorities strongly supported the project, and informed consent was obtained from parents of the minors and from adult subjects. A questionnaire

sheet was completed for each subject that included personal and family histories of thyroid diseases and dietary habits. Height and weight were measured in the schoolchildren.

The prevalence of goiter was high in the whole population (59%) and progressively increased with age. In schoolchildren aged between 6 and 14, the prevalence was 16%. Thyroid nodularity was exceptional in children, rare in 15-25-yr old subjects, progressively increased with age up to 65 yr and declined in >75 yr. Thyroid functional autonomy progressively increased from 0.7% in children to 15% in >75 yr old subjects, being more frequent in nodular goitrous patients. The overall prevalence of hyperthyroidism was about 3%, and was twice as high as that found in iodine sufficient areas. The large majority of patients with hyperthyroidism was due to toxic nodular goiter and was more frequent in older subjects. The prevalence of overt hypothyroidism was 0.2% while the prevalence of subclinical hypothyroidism was 3.8%. The overall prevalence of both overt and subclinical hypothyroidism was slightly but not significantly lower than documented in iodine sufficient areas. Because the thyroidologists stayed for several days in the village, this contributed to a firm collaboration with the doctors in the village and a relationship based on trust was developed with the population.



The Pescopagano village

This encouraged increased compliance of the people with use of iodized salt, and this became a regular and spontaneous habit.

In order to investigate if the increase of iodized salt consumption had modified iodine intake and the frequency and distribution of thyroid diseases, the investigators carried out a new survey in the community of Pescopagano using the same criteria used in the previous survey. The aim of the second survey was to obtain information on the thyroïdal status of this community 5 years after the introduction of the national iodine prophylaxis program using iodized salt.

At the end of April 2009, the research team from the Department of Endocrinology of the University of Pisa went to Pescopagano to meet the local Authorities to inform them about the study and to ask for the collaboration of local nurses and physicians. The other aim of the meeting was to establish and organize the study logistics. The figures involved were the mayor, the general manager of the local hospital, and authorities of primary and secondary schools. Some days after the meeting with the local authorities, a public assembly was carried out with the purpose of explain-

ing the aim of this new survey to the population. The population largely and actively participated during the assembly, and received answers regarding the effects of iodine deficiency, particularly during pregnancy and in infancy, and about the effectiveness of iodine prophylaxis.

The last week of August 2009 and the first week of May 2010, a team from the Department of Endocrinology of the University of Pisa, including expert thyroidologists, computer operators and nurses, went to Pescopagano. As a whole, 1670 subjects between 3 and 87 years of age were surveyed. Of these, 1186 of the subjects were residents of Pescopagano, the remaining subjects were living in neighboring places, but came back because they were interested in the investigation or because they had relatives residing in the village.

The study included:

- Compilation of a card for each subject containing clinical, anthropometric and dietary habits
- Collection of blood samples for measuring thyroid hormones, thyroglobulin and thyroid antibodies
- Collection of a spot urinary sample for the determination of UI

- Thyroid ultrasound examination
- Fine needle aspiration of suspicious thyroid nodules

Preliminary results suggest:

- 1) Iodized salt was consumed by the majority of interviewed subjects
- 2) There has been an increase in the median UI, from 55 µg/L in 1995, to 87 µg/L in the present survey
- 3) There has been a dramatic reduction of prevalence of goiter in children and in younger adults
- 4) There has been a reduction in thyroid nodularity in younger adults
- 5) Very few cases of clinical overt hyperthyroidism were found in the older adults
- 6) There was no increase in thyroid functional autonomy or hypothyroidism
- 7) There is a likely increase in euthyroid autoimmune thyroiditis

The complete analysis of the data of this second survey is in progress and the conclusive results will be available in the next months.



Members of the Pescopagano research team, with the thyroid ultrasound machine

Reference

1. Aghini-Lombardi F, Antonangeli L, Martino E, Vitti P, Maccherini D, Leoli F, Rago T, Grasso L, Valeriano R, Balestrieri A, Pinchera A. The spectrum of thyroid disorders in an iodine-deficient community: the Pescopagano survey. *Journal of Clinical Endocrinology and Metabolism* 1999 84:561-566.

Announcements

Micronutrient Initiative President receives award for double fortified salt with iron and iodine



Venkatesh Mannar is among 15 innovators from around the world recognized for applying technology to benefit humanity

OTTAWA, Sept. 21, 2010. Venkatesh Mannar, President of the Ottawa-based Micronutrient Initiative, and ICCIDD Board Member, was named as a Laureate of The Tech Awards 2010. Mannar's work in creating Double Fortified Salt, which delivers both iodine and iron, is being recognized as an innovation that could spark global change by reducing intellectual disabilities and anemia. In populations consuming sufficient iodine, IQ levels are shown to be 13 points higher than populations deficient in iodine. Currently, iodine deficiency is the world's leading cause of preventable mental impairment, affecting an estimated 18 million babies each year. Iron-deficiency anemia, the most wide-spread nutritional deficiency, can have life-long effects on a child's cognitive development and learning abilities and puts women at

greater risk of death during childbirth. Mannar was selected as one of 15 global innovators from among hundreds of nominees representing more than 50 countries. The Tech Awards - a signature program of the California-based Tech Museum - is one of the premier annual humanitarian awards programs in the world. The awards recognize technical solutions that benefit humanity and address the most critical issues facing our planet and its people. Mannar's work is being recognized in the health category. Double Fortified Salt delivers small but crucial daily amounts of iodine and iron to human beings at a very low cost. Iodine is critical for brain development and iron is critical for mental and physical ability. Prior to Mannar's work, iron could not be added to iodized salt because the properties in

the two nutrients cancelled each other out when combined.

Mannar worked for more than 15 years with colleagues at the Micronutrient Initiative and University of Toronto Food Engineer Levente Diosady to develop a way the nutrients could be added together and still retain their life-enhancing properties. Already millions of school-children in Tamil Nadu, India are benefiting from Double Fortified Salt through a mid-day meal program, providing them with increased energy for learning.

„It's an honour that The Tech Awards has recognized the potential of Double Fortified Salt to improve the lives of the world's vulnerable,“ said Mannar. „Poor diets lead to devastating micronutrient deficiencies and stop children, families and communities from reaching their full potential. Providing an easy, low-cost way to ensuring consumption of essential iodine and iron can make great strides toward reducing global malnutrition and improving health, educational opportunities and economic productivity. The nutrients in Double Fortified Salt are well distributed within each meal, further promoting absorption.“

One Laureate in each of the five categories of health, education, equality, environment and economic development will receive a \$50,000 cash prize during the annual Awards Gala in Santa Clara, California on November 6. The selected Laureates' projects address multiple humanitarian efforts including innovations in land irrigation and the generation of electricity, the creation of free educational tools, and Mannar's work to alleviate micronutrient deficiencies through Double Fortified Salt.

Abstracts

Projected reduction in healthcare costs in Belgium after optimization of iodine intake: impact on costs related to thyroid nodular disease

Several surveys in the last 50 years have repeatedly indicated that Belgium is affected by mild iodine deficiency. The objective of the present study was to perform a health economic evaluation of the consequences of inadequate iodine intake in Belgium, focusing on undisputed and measurable health outcomes such as thyroid nodular disease and its associated morbidity (hyperthyroidism). For the estimation of direct, indirect, medical, and nonmedical costs related to thyroid nodular diseases in Belgium, data from official registers and expert opinions were used. Only adult and elderly people (≥ 18 years) were taken into account in this study because thyroid nodular diseases predominantly affect this age group. The results showed that the yearly costs due to thyroid nodular diseases caused by mild iodine deficiency in the Belgian adult population are 38 million Euro. It is expected that the iodization program will result in additional costs of 54,000 Euro per year and decrease the prevalence of thyroid nodular diseases by 38% after a 4–5-year period. The net savings after establishment of the program are therefore estimated to be at least 14 million Euro a year, only considering its impact on nodular thyroid disease.

Vandevijvere S, et al. Thyroid 2010 Nov;20(11):1301-6.

Increased iodine deficiency in Victoria, Australia: analysis of neonatal thyroid-stimulating hormone data, 2001 to 2006

The aim of this study was to use neonatal thyroid-stimulating hormone (TSH) concentration data to measure the iodine status of the population of the Australian state of Victoria. The authors did a retrospective analysis of the results of 368 552 neonatal heel-prick blood tests for TSH concentration in Victoria in the years 2001–2006. Iodine deficiency was indicated by a mean percentage of neonatal TSH concentrations > 5 mIU/L of over 3% in accordance with WHO criteria. The results showed the mean percentage of neonatal TSH concentrations > 5 mIU/L ranged from 4.07% in 2001 to 9.65% in 2006, and this increase was statistically significant ($P < 0.001$). The populations of all nine Victorian health regions showed increasing iodine deficiency over the study period. Metropolitan populations had higher iodine deficiency than non-metropolitan populations, and this difference was also statistically significant ($P < 0.05$). These results are consistent with urinary iodine excretion research in Victoria. The authors concluded the high percentage of elevated TSH concentrations among newborns is of concern and requires ongoing monitoring. Neonatal TSH assay is part of routine screening in Australia, and thus offers an effective and economical method of monitoring population iodine status.

Rahman A, et al. Med J Aust. 2010 Nov 1;193(9):503-5.

Iodine status in pregnancy and household salt iodine content in rural Bangladesh

To assess the extent of iodine insufficiency and its association with household iodized salt in rural Bangladesh, urinary iodine and household salt iodine content were measured in pregnant women in early (≤ 16 weeks, $n=1376$) and late (≥ 32 weeks, $n=1114$) pregnancy. Salt and a spot urine sample were collected from women participating in a randomized, placebo-controlled trial of vitamin A or beta-carotene supplementation in rural northwestern Bangladesh during home visits in early and late pregnancy. Salt iodine was analyzed by iodometric titration, and almost all salt samples had some detectable iodine, but over 75% contained < 15 ppm. Median (interquartile range) urinary iodine concentrations were 66 (34–133) and 55 (28–110) $\mu\text{g/L}$ in early and late pregnancy, respectively; urinary iodine < 150 $\mu\text{g/L}$ was found in 80% of women at both times in pregnancy. Although the risk of iodine insufficiency declined with increasing iodine content of household salt (P for trend < 0.05), median urinary iodine did not reach 150 $\mu\text{g/L}$ until iodine in household salt was at least 32 ppm and 51 ppm during early and late pregnancy, respectively. Despite a national policy on universal salt iodization, salt iodine content remains insufficient to maintain adequate maternal iodine status throughout pregnancy in rural northern Bangladesh.

Shamim A, et al. Matern Child Nutr. 2010 Oct 26 [Epub ahead of print]

Seasons but not ethnicity influence urinary iodine concentrations in Belgian adults

The aim of the study was to assess iodine status and its association with ethnicity and seasonality in Belgian adults. A stratified random sample of 401 healthy subjects aged between 40 and 60 years, of Belgian, Moroccan, Turkish and Congolese descent residing in Brussels was obtained. Iodine status and thyroid function were determined. Median UIC was 68 µg/L. The frequency of UIC below 100 µg/L was 73.3%, of which 41.9% fell between 50 and 99 µg/L, and 29.8% between 49 and 20 µg/L. There was no difference in UIC and thyroid function between subjects of different ethnic origins. The frequency of UIC below 50 µg/L was higher in the fall-winter compared to spring-summer periods ($P = 0.004$). Serum FT3 concentrations, but not FT4 and TSH, were significantly greater in winter than in summer. Thus, seasonal fluctuations in UIC suggest that the risk of iodine deficiency among adults living in Brussels is higher in fall-winter than in spring-summer. The prevalence of mild iodine deficiency in Brussels is high among adults but ethnicity does not appear to influence iodine status.

Moreno-Reyes R, et al. Eur J Nutr. 2010 Oct 20. [Epub ahead of print]

Iodine Deficiency Disorders Among Primary School Children in Eastern Nepal

The aim of this study was to assess the iodine status among primary school children of Dhankuta and Dharan in eastern Nepal. A population based cross sectional study was conducted on schools of Dhankuta and Dharan from January-March 2008. 385 samples of both urine and salt were collected from school children aged 6-11 yrs. Salt iodine content was measured by using a semi-quantitative rapid test kit. The median UIEs of school children of Dhankuta and Dharan were 157.1 µg/L and 180.3 µg/L respectively. The percentage of iodine deficient (UIE <100 µg/L) children were 26.6% in Dhankuta and 15.6% in Dharan. The majority of children consumed packet salt. The percentages of salt samples with adequately iodized salt (≥ 15 ppm) were 81.3% in Dhankuta and 89.6% in Dharan. The authors concluded that eastern Nepal is continuously progressing towards the sustainable elimination of iodine deficiency disease as illustrated by a normal median UIE and the majority of households consuming adequately iodized packet salt. It is necessary to maintain the program continuously to ensure adequate iodine nutrition of the population.

Gelal B, et al. Indian J Pediatr. 2010 Oct 2. [Epub ahead of print]

Thyroid function at the third trimester of pregnancy in a Northern French population

The thyroid function of 114 pregnant, healthy Parisian women with mild iodine deficiency was studied at the third trimester of pregnancy, 55 of whom served as their own control three months after delivery, and the thyroid hormone results were compared to North American reference values. All French pregnant women showed an increase in thyroxine binding globulin serum levels. Free thyroxine (FT4) levels decreased by about 30% at the third trimester of pregnancy, as compared to 10-15% in the American population. Moreover, the increase in total thyroxine (TT4) secretion represented only 27%, as compared to 50% in the American population. The authors concluded that the hypothyroxinemia at the third trimester of pregnancy was more prominent in the Parisian population and insufficient iodine intake could be responsible for the deficient increase in TT4. It is therefore concluded that the inability of the thyroid to establish the required equilibrium could be corrected by systematic iodine supplementation before pregnancy.

Bourcigaux N, et al. Ann Endocrinol (Paris). 2010 Sep 29. [Epub ahead of print]

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