



IDD NEWSLETTER

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Correcting iodine deficiency improves growth in children

A recent multicenter study clearly demonstrates that iodine repletion in children improves growth. Because over 285 million school-age children worldwide are iodine deficient, these findings underscore the importance of global efforts to eradicate IDD in this age group.

Michael Zimmermann ICCIDD Western and Central Europe, ETH Zürich, Switzerland

Background

Severe iodine deficiency in utero causes cretinism and dwarfism (1). Iodized oil given during pregnancy in areas of moderate iodine deficiency increases birth weight by 100–200 g. Less clear is the relationship between iodine deficiency and postnatal growth.

Data from cross-sectional studies on iodine intake and child growth are mixed, with most studies finding modest positive correlations. In five Asian countries, household access to iodized salt was correlated with increased weight-for-age and mid-



Children grow better when given adequate iodine

THE INTERNATIONAL COUNCIL FOR CONTROL OF IODINE DEFICIENCY DISORDERS (ICCIDD) is a nonprofit, nongovernmental organization dedicated to sustained optimal iodine nutrition and the elimination of iodine deficiency throughout the world. Its activities have been supported by the international aid programs of Australia, Canada, Netherlands, USA, and also by funds from UNICEF, the World Bank and others.

upper-arm circumference in infancy (2). However, controlled intervention studies of iodized oil alone (3,4) and iodine given with other micronutrients (5-7) have generally not found effects on child growth.

Iodine status may influence growth through its effects on the thyroid axis. Giving thyroxine to hypothyroid children increases their growth. Two important determinants of growth, insulin-like growth factor (IGF)-1 and insulin-like growth factor binding protein (IGFBP)-3 are also dependent on thyroid status. Hypothyroidism decreases circulating IGF-1 and IGFBP-3 levels, and thyroid hormone replacement increases them. In iodine deficient children, impaired thyroid function and goiter are inversely correlated with IGF-1 and IGFBP-3 levels (8).

Study aim

The study aim was to determine if iodine repletion, using iodized salt or iodized oil, improves growth in school age children, and to investigate the potential role of IGF-I and IGFBP-3 in this effect.

Participants

The international study included scientists from the Medical Research Council and the University of Venda in South Africa, the Ministry of Health of Morocco, and, in Albania, the Ministry of Health and Tirana University Hospital, supported by Child Advocacy International, United Kingdom.

Design

Three prospective, double blind intervention studies were done (9):

- in a 10 month study, severely iodine-deficient, 7-10 y-old Moroccan children (n=71) were provided iodized salt and compared to children not using iodized salt
- in a 6 month study, moderately iodine-deficient, 10-12 y-old Albanian children (n=310) were given 400 mg iodine as oral iodized oil or placebo
- in a 6 month study, mildly iodine-deficient 5-14 y-old South African children (n=188) were given two doses of 200 mg iodine as oral iodized oil or placebo

In all three studies, at baseline and follow-up, height, weight, urinary iodine (UI), total thyroxine (TT4), thyroid-stimulating hormone (TSH) and IGF-I were measured; in Albania and South Africa, IGFBP-3 was also measured.

■ In South Africa, iodine repletion modestly increased IGF-1, but did not have a significant effect on IGFBP-3, TT4 or growth.

■ In Albania and Morocco, iodine repletion significantly increased TT4, IGF-1, IGFBP-3, weight-for-age z scores and height-for-age z scores.

Compared to previous studies, strengths of this study were:

- no confounding of the control group by adventitious sources of iodine
- randomized, double blind, placebo controlled designs (in Albania and South Africa)
- large samples of children with poor thyroid function (in Morocco and Albania).

Table 1: Overview of the results of the 3 studies of iodine repletion and growth in school-age children

	Baseline IDD severity (median UI)	Total thyroxine	IGF1	IGFBP3	Weight	Height
Limpopo Province, South Africa	Mild (80 µg/L)	■	■	=	=	=
Pogradeç Region, Albania	Moderate (45 µg/L)	■	■	■	■	■
Brikcha Region, Morocco	Severe (18 µg/L)	■	■	nm	■	■

■ increased = no change nm not measured.

Results (Table 1)

■ In all three studies, iodine treatment increased median UI to >100 µg/L, indicating iodine sufficiency, while median UI in the controls remained unchanged



Growth improved in Moroccan children using iodized salt for one school year



Serena Schoeman, from the South African Medical Research Council, sampling children in Limpopo Province

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Iodized salt offers a glimmer of hope for Darfur refugees

The conflict in Darfur has generated 2.5 million refugees; many have fled to camps in eastern Chad. Getting high-quality iodized salt to these camps is an important part of relief efforts.

Daniel Lantum ICCIDD Regional Coordinator for Francophone West and Central Africa

The UN World Food Program (WFP), based in the Central African Region, has been active in supplying food relief to eastern Chad and to Sudanese refugees living in the massive camps. These camps are now filled to overflowing and calling for more international food aid. In May 2007, a top United Nations official warned that security had deteriorated to a point where delivering humanitarian aid had become “a nightmare”.



Besides hunger and famine among these displaced people, the organization Doctors without Borders has highlighted the importance of micronutrient malnutrition. The supply of iodized salt has been identified as a special need because of the high prevalence of goiter in the children in the camps.

Recent surveys of Sudan have reported household coverage with iodized salt is only 1% and IDD is endemic. Therefore, the supply of iodized salt by the WFP is critical in the refugee camps.



Douala, Senegal to eastern Chad, and then to refugee settlements in the Darfur region. Many international donors offer their food aid through the WFP, and on a site visit in March 2007, ICCIDD representative Daniel

Lantum identified 66 tons of iodized salt identified as Canadian donations and 150 tons identified as French donations. But the WFP is not just supplying any grade of iodized salt, they are providing the very best. Representatives of ICCIDD have been supervising quality assurance of the iodized salt coming from the Doukala Salt Refineries in Senegal. The WFP selects the highest salt quality; the salt conforms to the specifications of the Ministry of Public Health Directive of 1991, which stipulates salt should be iodized at 100 ppm. Thanks to their internal quality control laboratory, the “Societe de la Purification du Sel”, this standard is satisfied. This is verified by a special WFP laboratory, under the direction of Dr. Cebron, that has certified the salt as pure, at 98% NaCl, and with an iodine content of 80 to 100 ppm.

This high quality iodized salt (Daimant Blanc) is packed in 25 kg bags that are specially labeled as from the WFP/PAM, transported from

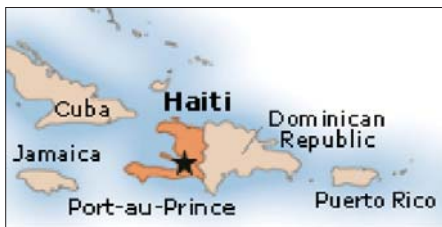
This illustrates that the prolonged food emergency in eastern Chad sparked by the Darfur conflict has led to a regional strategy involving several partners. In this instance, the WFP, ICCIDD, Canadian and French Foreign Aid, and Doctors without Borders are tackling the severe IDD problem among the refugees, along with other micronutrient deficiencies.



An IDD advocacy mission to Haiti

Haiti is among the poorest countries in the Western Hemisphere. Only 2.4% of households have access to adequately iodized salt. Seven million people are at risk of IDD and each year 25,000 newborns are unprotected from brain damage caused by iodine deficiency.

Lucie Bohac Coordinator of the Network for Sustainable Elimination of Iodine Deficiency



Background: the urgent need for action

Haiti is recognized by the Iodine Network as a priority country for IDD control. To stimulate action toward the elimination of IDD, a team of international experts recently visited Haiti. Mission participants included representatives of World Food Program (WFP), EU Salt, the U.S. Centers for Disease Control and Prevention, ICCIDD and UNICEF.

The mission to Haiti had three primary goals:

- To obtain a commitment from the government of Haiti to take immediate steps to protect the mental and productive capacity of its people by eliminating IDD.
- To stimulate political interest, commitment and action for the production of higher quality salt; in the recognition that only a higher quality of salt could eventually be iodized.
- To understand and address the economics of domestic salt production, fortification, and sale, in order to arrive at a viable plan to produce, fortify and market high quality fortified salt.

The program of the mission included advocacy meetings with representatives of the Ministries of Agriculture, Commerce and Health as well as meetings with staff from international development agencies including CIDA, the French Cooperation, The Pan American Health Organization (PAHO), The Food and Agriculture Organization of the United Nations (FAO) and the World Bank.

The Mission team also visited salt ponds, a salt production operation, and the only operational iodization facility in Haiti.

Findings: a call for a national IDD coalition

A cross-cutting theme for Mission members was the need for strong national leadership on the issue of USI. The Haitian Ministry of Health and Population has been working to develop a program to introduce iodized salt since 1998. However, the Mission observed that this leadership has not yet translated into concrete advocacy, political commitment, intersectoral coordination and recognition of control of IDD and USI as a national priority.

Challenges to overcome in Haiti include:

- Unclear roles and responsibilities for IDD/USI programs at the governmental level

- Limited awareness of IDD and the importance of iodized salt among partners and donors
- Lack of a champion for IDD/USI
- Lack of legislation for salt iodization
- Lack of support and involvement of medical professionals and civic society
- Scarcity of current data on IDD (lack of data makes policy decisions much more difficult)
- Limited interagency coordination

Recommendations to achieve immediate and long-term goals

To eliminate IDD, the Mission recommends that the Haitian government and its partners take steps to improve the quality and quantity of locally-produced iodized salt. They also recommend that iodized salt be made available at a price that the population can afford. But this will take time as well as financial and human resources.

In the immediate interim, measures must be considered to protect the vulnerable population from IDD. Appropriate measures would be:

- complementary importation of iodized salt
- protection of the population at higher risk by iodine supplementation.



The IDD team, with an armed Pakistani escort, visits a salt production site in Haiti

To make progress towards salt iodization and improving iodine nutrition in Haiti, improved coordination of government, private sector (salt producers) and international agencies is critical.

An inter-ministerial and inter-sectoral committee (national IDD coalition) should be developed to:

- establish elimination of IDD as a government priority
- outline roles of the various partners
- guarantee that at-risk populations are adequately protected from IDD
- develop timelines to improve local salt production
- monitor progress in eliminating IDD.

In parallel, health education efforts should be undertaken to inform consumers about the nutritional requirements for iodine and the health benefits of the consumption of iodized salt. Further specific recommendations were made in relation to rehabilitating salt production facilities, improving access to iodized salt, and introducing an information, education and communication campaign.

Current action and challenges on the path forward

Both the WFP and UNICEF are distributing iodized oil capsules in certain regions of Haiti to immediately protect the most at-risk population.

In a joint project, the Micronutrient Initiative (MI) and the WFP are attempting to improve salt production using serial operations instead of

restoring single pond operations, as well as mapping for locations suitable for series operations. In addition, the MI - WFP project is conducting an education campaign aimed at the Health and Agriculture staff with an aim to stimulate the formation of an IDD National Coalition and IDD legislation.

The critical piece of the strategy, the building of a national coalition to eliminate IDD, is not yet established. Ultimately, national ownership is an essential requirement of the effort to eliminate IDD and to sustain optimal iodine nutrition.

To see the full report of the Iodine Network's Advocacy Mission (available in June 2007) see: www.iodine-network.net.

The 2007 World Health Assembly strengthens call for mandatory reporting of iodine nutrition by Member States

The 60th World Health Assembly unanimously passed a resolution reinforcing the call for mandatory reporting on achievement of USI and elimination of IDD.

David Haxton Executive Director, ICCIDD

The ICCIDD delegation to the 2007 WHA consisted of the Chair, Gerard Burrow, the Executive Director, David Haxton, Jack Ling and the Regional Coordinator for Latin America, Eduardo Pretell, supported by UNICEF. They were able to convince the WHA to repeat its call, first made in 2005 at the 58th WHA, for Member States to accelerate efforts to achieve IDD elimination and to report at 3 year intervals on their progress.

The resolution was adopted by acclamation (see next page). It was proposed by the Government of Peru. Co-sponsors were the Governments of Argentina, Bhutan, Bolivia, Brazil, Chile, China, Cuba, Ecuador, El Salvador, Guatemala, Honduras, Indonesia, Islamic Republic of Iran, Panama, Paraguay, Uruguay, Venezuela and Zimbabwe.

It was the first item to be discussed under the broad heading of technical and health issues. Eduardo Pretell, representing Peru, gave an excellent introduction that was well received. China and Canada then made short supporting statements. Iran spoke in the names of all Member States in its region, and Guinea spoke in the name of all 47 African countries. The discussion on iodine lasted 22 minutes, and although there was likely additional country support among other Member States, they did not make additional statements in order to keep the session from becoming too long.

However, despite the call of the 2005 WHA, it is clear a large number of

Member States did not fully report or did not report at all on the issue. Or, if they did, the information was included in a larger document. To improve this, it is hoped that in the Regional Meetings of WHO in 2007, ICCIDD delegates will approach Member States on the issue of national reporting and seek ways for ICCIDD to assist in this process. The report to the WHA contained in "WHO Sixtieth World Health Assembly, Item 12.21, A60/28 dated 5 April, 'Progress reports on technical and health matters'" is based on information available and was prepared by the Secretariat. This document can be obtained on the WHO website (www.who.org) in the area relating to the WHA (see p.11-12).

The official statement of Gerard Burrow, ICCIDD Chair, speaking in the name of the Global Network on Sustained Iodine Nutrition, was as follows:

"At its 58th session in 2005, the World Health Assembly approved WHA Resolution 58.24, which called for Member States to undertake a series of actions to assure that the goal of universal salt iodization and sustainable elimination of iodine deficiency disorders is achieved. The Director General was requested to foster cooperation with Member States and international organizations in providing technical assistance and facilitating a network of iodine nutrition. A report on the implementation of the resolution was to be made during this sixtieth World Health Assembly.

While progress in the sustained elimination of iodine deficiency disorders has been made by a number of Member States over the past three years, as many as one third of the world population remains severely iodine deficient. As a result, twenty-two million children may fail to reach their full intellectual potential with significant social and economic consequences. The introduction of universal salt iodization (USI) in a deficient population can increase the average I.Q. of the population by as much as 13.5 points. As a consequence, cognitive development and school performance are enhanced, leading to greater economic productivity for the population as a whole. Iodine deficiency can be eliminated for pennies per day. The cost benefit is enormous.

Achieving iodine sufficiency, as defined by 90% or better household access to iodized salt, is commendable but not enough. Unless iodine nutrition is maintained, the symptoms and signs of iodine deficiency will recur in a short period of time. The sustainable elimination of iodine deficiency requires active commitment and advocacy on the part of the Member States, based on national investments by salt producers, the public and the body politic. However, the rewards are great. Sustainable elimination of iodine deficiency will contribute to many of the United Nations Millennium Goals, including elimination of poverty, decreased infant mortality, improved maternal health and Higher Education."

Draft Resolution for consideration by 60th World Health Assembly

The Sixtieth World Health Assembly, Having noted with appreciation the Director General's report on the status of iodine nutrition in response to WHA Resolution WHA 58.24,

Noting that while some progress has been made by a number of member states in the sustained elimination of iodine deficiency disorders in the past two years, between one fourth and one third of the world's population still suffer from this micronutrient deficiency, most of them in impoverished areas of the world,

Concerned that iodine deficiency can prevent children from attaining

optimal brain development, which can lead to learning impairment with subsequent social and economic consequences.

Recognizing that the fight against this deficiency contributes directly to many of the UN Millennium Goals, including anti-poverty, infant mortality, maternal health, education for all, gender equity and private-public partnership,

Applauding the support of international and bilateral development agencies, especially WHO, UNICEF, WFP, non-governmental and private partners, like KIWANIS International and the International Council for the Control of Iodine Deficiency Disorders and the Global Network for Sustained Iodine Nutrition,

Urges member states

To redouble their efforts to reach those not yet protected from IDD and to sustain the successful programs on a continuous basis,

To follow the recommendation of WHA Resolution WHA58.24, adopted by WHA in 2005 on monitoring iodine nutrition status every three years

Requests the Director General

To continue to strengthen WHO's cooperation with other agencies in supporting member states in fighting this micronutrient deficiency and report on iodine status every three years as stated in WHA Resolution WHA 58.24.

Elimination of iodine deficiency in the Republic of Georgia

Zurab Sehnishvili, Parmi Sudchev, Gregory Gerasimov National Nutritional Center, Republic of Georgia; Centers for Disease Control and Prevention, USA; and ICCIDD Eastern Europe/Central Asia Office

Background

Georgia, a country of 4 million inhabitants, is situated in the south Caucasus bordering Russia, Azerbaijan, Armenia and Turkey. Iodine deficiency disorders (IDD) were endemic in the Republic of Georgia secondary to low iodine levels in the water and soil. Cases of giant goiter and cretinism were described in the book "Goiter in Svanetia" (the historical region of Georgia) published in the beginning of the last century. An endemic goiter control program was implemented in Georgia, then a republic of the former USSR, in 1955-1986, including salt iodization and distribution of iodine tablets to vulnerable groups.



Since 1996, efforts have been made by the government of Georgia and international partners, such as UNICEF, to implement universal salt iodization (USI). These have included a 1996 Presidential decree requiring salt iodization, establishing the National IDD Council, a 1997 tax exempt policy for iodized salt

imports, and elaboration of national standards for iodized salt in 1998. A breakthrough was the law on the "Prevention of iodine, other microelement and vitamin deficiencies" that was passed in February 2005, banning the import and sale of non-iodized salt.

Salt importation

All iodized salt in Georgia is imported, primarily from Ukraine, but with small amounts from Greece, Azerbaijan, Russia, and Turkey. Current regulations mandate iodization at 40 +/-15 ppm. Over 40,000 tons of salt were imported in 2005, of which 90% was classified as iodized.

2005 national survey

A national school-based cluster survey of 970 children aged 6–12 years was conducted in November 2005 to measure the impact of the recent law on salt iodization. Urinary iodine (UI) excretion was measured in 900 selected children by an accredited Belgium laboratory. Goiter prevalence was assessed by palpation of 200 children per school by endocrinologists. The 970 selected children were asked to bring a salt sample from their homes to school the following day. They were also asked to note the manufacturer and expiration date of the salt. Compliance was 98.7%. Household salt iodine content was measured in the field using MBI rapid testing kits (for both KI and KIO₃). Approximately 20% of samples were randomly selected for WYD (portable spectrophotometry) testing, as well as for iodometric titration (for only KIO₃). Results of the survey (1) showed that median (range) UI was 321 (29-9034) µg/L. Only 4% of samples were less than 100 µg/L, while 41% were in the range of 100 to 299 µg/L and 55% were above 300 µg/L.

The goiter rate by palpation is presented in Table 1. The frequency of goiter decreased with increasing household salt iodization. Female gender and increasing age were associated with a higher prevalence of goiter. The high frequency of goiter in Georgia likely reflects longstanding iodine deficiency, rather than current iodine status. Thyroid size decreases in response to increases in iodine intake, but goiter rate may not return to normal for months or years after correction of iodine deficiency primarily due to persisting goiter in older children [2].

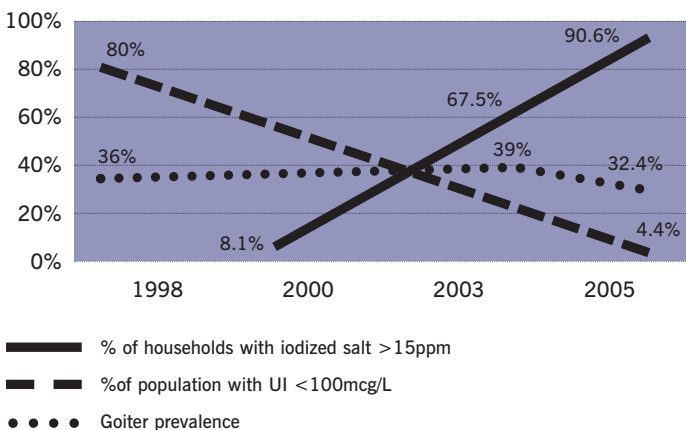
Field testing of salt samples for iodine (n=957) showed that 81.5% of samples were fortified with KIO₃, 14.4% with KI, and 4.1% were not iodized. Five samples of iodized salt (only KIO₃ tested, n=136) were randomly selected from each cluster and tested by iodometric titration. Median iodine concentration was 40.2 ppm (range 9.5 – 74.1), and 94.1% of samples were adequately iodized (>15ppm).

Figure 1 summarizes the success of Georgia's efforts to eliminate IDD.

Table 1: Goiter rate in schoolchildren in Georgia in 2005 (n=4420)

Goiter Grade	Number (%)	95% CI
0	3092 (67.6%)	62.5-72.8
1	1284 (31.0%)	26.3-35.6
2	44 (1.4%)	0.5-2.3
Total goiter rate (Grade 1 + 2)	1328 (32.4%)	27.2-37.5

Figure 1: IDD Elimination in Georgia, 1999 to 2005
Trends of salt iodization, urinary iodine, and goiter prevalence



While only 8% of salt was adequately iodized in 1999 and only 67% was iodized in 2003, over 90% of salt samples were adequately iodized in 2005. Similarly, there has been improvement in iodine nutrition. In 1998, 80% of urine samples had an iodine concentration less than 100 µg/L; in 2005, only 4% of samples were under 100 µg/L. Goiter rates are also decreasing. In 2003, goiter prevalence was 39%, whereas in 2005, goiter prevalence was 32%.



Georgian children learn better because the successful national salt iodization program



Newborns in Georgia are protected against damage from iodine deficiency by USI

Conclusions

With the passage of the 2005 law banning the import and sale of non-iodized salt, Georgia now meets the primary WHO/UNICEF/ICCIDD criteria for elimination of iodine deficiency: more than 90% of households are using adequately iodized salt, median UI is above 100 µg/L and only 4% of population has UI levels <100 µg/L. Although goiter rates are still high, they should continue to decrease with sustained consumption of iodized salt. Continued enforcement of legislation on salt iodization will be essential for sustaining IDD elimination in the Republic of Georgia.

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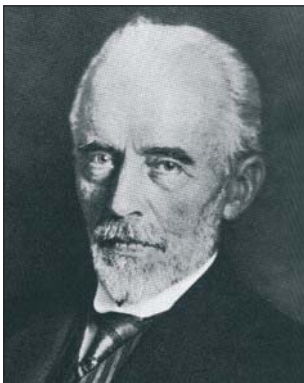
In Retrospect Historical chapters in the global effort to eliminate goiter and cretinism

The 1932 International Conference on Endemic Goiter and Cretinism

At this groundbreaking meeting, leading scientists vigorously debated the cause of goiter and cretinism. Goiter is ascribed to a variety of causes, including parasites, drinking water and toxins. However, many participants correctly identified the cause as iodine deficiency and advocate iodine prophylaxis on a national scale.

A REVIEW OF THE INTERNATIONAL CONFERENCE ON ENDEMIC GOITRE HELD AT BERNE, SWITZERLAND*

BY R. R. FITZGERALD,
Montreal



F. de Quervain



D. Marine



Th. Kocher

In opening the meeting, Dr. Carriere, the Chairman of the Swiss Goiter Commission, stated to Switzerland belongs the rather dubious honor of leading the list of the countries in which goiter is endemic. "In this small country, goiter, cretinism, deaf-mutism and idiocy not only blight the lives of a high percentage of the people but also leave the remaining apparently heal-

thy population under the stigma of borderline physical and mental deficiency."

He said: "The Swiss Goiter Commission...is now in the midst of a great experiment in prophylaxis with iodized salt. The results of this experiment are eagerly awaited." He said endemic goiter and the intensity of the disease was gradually falling,

based on examination of school children and military recruits. He justified this national experiment in iodine prophylaxis, in place before the cause of goiter is clearly understood, by referring to the treatment of smallpox and of syphilis, where remedies were used with success long before the causative agents had been identified.

He emphasized: “in spite of gratifying progress in many phases of the goiter problem, the original questions – what is endemic goiter? – how does it originate? – what are the means of its prevention? have yet to be answered.” The Commission thus put these three questions to the medical world, and invited answers from all countries. An attempt was made to have both sides of controversial material presented. Invitations were issued and 188 scientists gathered from 18 countries.

The debate

David Marine (see photo), of New York, began with the surprising assertion that, in endemic areas, there is little regional variation in goiter. He believed a fall in iodine intake leads to goiter, and there is no clear distinction between diffuse and nodular goiter. He stated they can both produce thyroxine, and they are not neoplasms. This statement was strongly challenged.

Holst, of Oslo, reported that although Norway was a maritime country, and all of the inhabitants ate large quantities of fish, goiter was endemic, but there were no cretins.

Roussy, of Paris, quoted the experiments of Repin in which goiters were produced in rats fed with water from goitrous areas. The goitrogenic factor was believed to be either an unidentified gas or a ‘colloid’ substance. But boiled water failed to produce goiter in a large number of rats.

On the second day of the Conference, de Quervain (see photo), of Berne, opened the discussion on iodine metabolism. He believed the daily requirement is 50 µg, and 500 µg/day or more may lead to hyperthyroidism. Iodine taken by mouth acts upon an abnormal gland by changing its activities in the directi-

on of the normal: “...it slows down hypersecretion and stimulates a gland in hypoactivity”.

Kocher (see photo), of Berne, gave the results of the examination of goiters before and after iodine treatment. He found that nodular goiter before treatment showed a diminution in the total iodine, as compared with normal glands, and stated: “Treatment with iodine may lead to a reduction in the size of the goiter”.

Blum, of Frankfurt, struck a strong note of disagreement when he made the apparently heretical assertion that the thyroid is not a gland of secretion. He believed no iodine-containing hormone had yet been demonstrated in the circulating blood. He also said: “No district in the world is so low in iodine that the meager requirements of the body, 50 µg/daily, cannot be supplied”.

Veil stated “the danger of giving excess iodine to a goitrous person is that the person possessed a large workshop which was delicately adjusted to a low supply, and sudden flooding would easily lead to the production of extra thyroxine”.

Sturm, an associate of Veil, mentioned that the iodine content of the blood varied with the seasons of the year, and that excessive amounts administered to people with normal glands were eliminated within three days in the urine.

McGarrison, of the Pasteur Institute, Coonor, India recognized the part that iodine may play in goiter prevention, but stated the essential cause was, in his opinion, an infection or toxic agent derived from the gastrointestinal tract.

Berard and Dunet emphasized the fact that drinking water plays the most important part in the cause of endemic goiter, and stated that, bey-

ond doubt, certain kinds of water produce goiter. In support, Galli-Valerio suggested: “iodine is only an antidote, and lack of iodine cannot be looked upon as the cause of goiter, just as quinine is the antidote for malaria, but the cause of malaria is not a lack of quinine”.

Crotti believed the cause of goiter was an infectious parasite. In freshly removed goiters he found a variety of microorganisms, including a spirillum, a flagellated infusorian and a fungus. He produced goiter in dogs by giving these microorganisms. He stated: “Iodine treatment of water diminishes or destroys this flora and thereby accounts for its efficacy”.

A recommendation for iodized salt

At the final session on prophylaxis, Jaensch held that it was wrong to dispense iodine to the general populace, and favored personal and social hygiene as the great prophylactic measures, with individual, not general, iodine therapy by physicians.

In contrast, Wagner-Jauregg, in a prescient argument for USI, said iodine prophylaxis:

- needs to act before the disease is manifest (must be given prenatally)
 - must reach every one endangered
 - its initiative and responsibility should not be left to the individual.
- He therefore recommended: “iodized table salt (5 mg potassium iodide per kg) should be compulsory for the population, and that iodine tablets be given to children at regular intervals”.

Volunteering in Ghana: a new ICCIDD Member's perspective



Palpating for goiter in children as part of the sentinel iodine survey in Jirapa district, Ghana

Personal stories **Marla Barkoff, M.D.** Division of Endocrinology (in July 2007), The University of Chicago, IL, USA

“...when I watched my team members travel into the village equipped with questionnaires I had helped compile, urine vials I had cleaned, and knowledge of the importance of iodine I had taught – for me it was a proud moment.”



“How can I help?” I asked Jack Ling on a February morning in 2006. With a background of medical research in Africa and a future in endocrinology, I had become increasingly fascinated but also disturbed by the current state of IDD control.

ICCIDD had never before sent a volunteer into the field. More importantly, what could I offer? A medical degree and enthusiasm were my assets, but clearly I was not an expert in iodine deficiency. Fortunately, Professor Ling spread the message on my behalf. David

Haxton, Executive Director, raised the issue with the UNICEF Representative in Ghana, and I was invited to join an upcoming sentinel zone survey of iodine deficiency in northern Ghana in January and February 2007.

A baseline iodine deficiency survey of Ghana conducted between 1991 and 1994 revealed that iodine deficiency was serious in all 27 regions of the country and most severely affected the northern regions. Once the government mandated consumption of iodized salt in 1996, annual

household surveys conducted by Ghana Health Service have served as process indicators. However, over the past decade, no biological impact assessment has been performed to evaluate the current state of IDD.



Rebecca Ahun of UNICEF (left) and Marla Barkoff at Songor Lagoon, Ghana

A collaborative effort to conduct a sentinel zone impact assessment was being planned between UNICEF Ghana, the Department of Nutrition and Food Science at the University of Ghana, and the Nutrition Unit of Ghana Health Service, incorporating the recommendations of ICCIDD through the Regional Coordinator's reports. So on January 1, 2007, I boarded a plane to Accra. I was, I hoped, on my way to help.

Upon arrival in Accra, I was warmly greeted by the UNICEF Ghana team, including Dorothy Rozga, Mark Young, and Rebecca Ahun, the USI project officer. Meetings were arranged with J. Armah of Ghana Health Service and E. Asibey-Berko at the University of Ghana, the Focal Point for ICCIDD in Ghana. We all sat down to discuss the sentinel zone survey, and I quickly learned that my experience was to be richer than expected. At that first meeting, I realized that I was sitting in on the very early stages of the survey planning.

My first four weeks were spent preparing for data collection, designing population sampling strategies, reading WHO manuals on IDD surveys, and absorbing the literature. The

greatest learning for me, however, took place in the Dr. Asibey-Berko's iodine laboratory. As a physician in the United States, when I want a UI level, I check off a box on a piece of paper. Five days later, another piece of paper with a value arrives in my folder. This is all I previously knew about UI testing. Under the guidance of the senior lab technician Joyce, I spent one week learning to measure iodine content in salt and urine.

I journeyed with Ms. Ahun to Songor Salt Project, one of the largest salt producers and iodizing centers in Ghana, which markets its product as Diamond Salt. We spent hours watching and speaking with many of the lagoon's salt collectors, processors, and packagers. I saw two iodizing sprayers at work and used the pocket-sized spot testing kit for qualitative measure, in lieu of quantitative data.



Small scale producer of Ghanaian salt

Within a mile of the large-scale salt production, we visited a family washing and drying locally collected salt. Their portable iodizing sprayer had malfunctioned six months prior to our visit, so they were loading their non-iodized salt into polyethylene bags indistinguishable from those used at Songor. Upon passing the first police check point on the road back to Accra, Ms. Ahun questioned the stationed officers about their use of test kits to ensure passage of only iodized salt to market. The three police officers were unaware of the importance of the kits, despite the fact Ms. Ahun had delivered them to

the check point during a previous visit. A law against the production of non-iodized salt means little if a government cannot enforce it.

Once preparations were finalized, we embarked on a two-day road journey to the northern district of Jirapa, one of the most severely iodine deficient districts in the baseline survey. Ms. Ahun and I visited the main Jirapa market and spent time with the women selling salt. These women shared their knowledge about iodized salt, some stating that "it's good for the neck" and "it keeps the neck small."



Demonstrating salt iodine test kits to a salt seller in the Jirapa market, Ghana

The next step involved training staff in executing the school and household questionnaires, goiter palpation, and urine collection. The teams were comprised of educators, nutrition officers, and statisticians with an impressive mix of gender, age, and language skills. I was thrilled to see our efforts come into action by spending time with school children, discussing iodated salt in the villages, palpating necks, and sampling household salt. For many physicians, these activities may not have seemed glamorous or exciting, but when I watched my team members travel into the village, equipped with questionnaires I helped compile, urine vials I had cleaned, and knowledge of the importance of iodine I had taught, for me it was a proud moment.

Supporting small scale salt producers is essential for achieving USI

David Haxton and Venkatesh Mannar ICCIDD Executive Director; President, The Micronutrient Initiative, Ottawa, Canada

Background

The strategies of the 1990s have brought us to an unprecedented level of salt iodization, availability and household access in many countries. Although significant success has been achieved, more effort is required to reach the goal of universal salt iodization (USI). This is especially important since the population with little (or no) market access to iodized salt may be in greatest need for protection against IDD. In many countries, the ability to produce and market iodized salt profitably by small and some medium-scale salt producers continues to pose the main challenge to achieving USI. Thus, the strategies used to achieve the current near 70% level of household access to iodized salt worldwide may not necessarily reach the remaining 30% of the population.

We would like to stimulate discussion on this issue and to offer ideas on how development assistance might ensure improved and sustainable procurement services for the small producer, and alleviate the producer's barriers to entering into a wider market. It is necessary to identify the obstacles and define initiatives to address them. These can be done with an entrepreneurial stance and take national issues into full account. Addressing this issue is complementary to current plans to increase iodized salt production and sale by large

and medium producers, since all are required to achieve the USI goal and to sustain it.

The Challenge

Key difficulties identified in the 'sector' of small producers are:

- They are not (usually) part of large producer associations with the benefits that implies. They have limited markets for their product. Their physical assets are limited to the most rudimentary tools and processes. They usually have primitive packaging arrangements. Even when combined with neighbors, their influence on the market and the access to better equipment, adequate packaging materials and other raw materials is limited.

- Combined with these physical and economic constraints, they are subject to external influences of the weather and the need for regular harvests, facilities for cleaning and grinding to make a better, clean product, and transport and quality assurance needs.

- The vicious circle of poverty combined with the primitive methods of the livelihood combine to prevent them from expanding and growing and to have fair and competitive access to a wider market.

- In many countries, iodized salt for domestic animals has not markedly expanded. Even where adequate

legislation is in place, it often does not extend to iodization of salt for processing food. In many regions, it is not uncommon for a household to have two types of salt (iodized and not; and there is no separation of salt for human and animal use). Emphasis on salt for animals is not only important to the animal and the farmer, but to the producer since it opens a larger market and more opportunities.

- Even where the small producer attempts to improve the product, the limitations on advertising and promotion, on access to low cost freight systems, and improved packaging and procurement of needs at fair prices, remains a major obstacle.

Lessons learned over 20 years... and applying them to work with small producers

Supply of iodized salt is vital, of course, but it must be matched with a demand pull; thus investment in education and information is vital. The small producer needs help, and sometimes even protection, to compete with the larger entities and stay viable in the economy. Associations of small producers are often able to improve market access and sustain sales of the product. They may even be able to assist in combining processes of cleaning and packing.

Sustained and secure markets are needed. Equally important is a sustainable and secure procurement chain for raw materials and expendables, including potassium iodate in convenient sized packages and prices, plastic bags and storage facilities, equipment and supplies, preventive maintenance efforts, training and orientation and management assistance. Combinations and/or cooperatives of small holders can reduce some costs, but, most importantly, they can offer the product to a wider audience and compete with the larger producers' penetration of the market place.

Provision of supplies, equipment, capital goods and expendables from development sources has a key role to play, but they must be time bound and have firm plans for self sustaining momentum. A major lesson learned is the need for stable, secure and fair procurement procedures, with particular emphasis on those for the small and smallest of producers. The larger producers have access to markets for their raw materials and resources to sell their products over distance. A procurement and support system for the poor and small holder would assist in 'leveling the playing field'.

All interventions through foreign collaboration need to have assurance of national ownership and national ability to sustain the effort over time. There is no accurate way to judge the time period that might be involved and each situation needs to be analyzed on its own merits and demands. Interventions by assistance from foreign agencies need to consider customs, culture and practice. Small producers have different interests: they want to stay in business, feed a family, improve their lives and

their time is equivalent to money. We need to take those factors into account when discussing development plans. The urge to assist everything should be resisted, but the thought of doing nothing is not honorable.

A focus on assuring a procurement and supply system for small producers

In most countries of concern, the small producer needs help to stay in business, stay productive, make a profit and have access to good tools and supplies.

Over time, some small producers will be amalgamated into larger production units, and some will merge into cooperatives or organizations of mutual interest. Many will remain independent. Their major requirement is access to a secure procurement and supply system within their financial capacity that can be sustained over time by a blend of sources of support.

A procurement system for this group of producers should consider the need for:

- access to expanded markets
- equipment and maintenance support
- expendable supplies like bags and potassium iodate
- quality assurance improvements
- protection from unfair trade practices
- access to the existing procurement process nationally.

In each situation, it is necessary to plan for maintenance and replacement, secure channels at fair prices for expendables and ensure collaboration from authorities, both public

and private. For instance, in some countries where procurement of potassium iodate is handled centrally and repackaging is a factor, the size of the package might be looked at to accommodate the small holder. The same comment would apply to sources of plastic and burlap bags.

Some development agencies respond to this obvious need by arranging for procurement and gift of the potassium iodate in an effort to quickly accelerate iodized salt production. Some have provided operating equipment without charge. While these gestures may enable a quick increase in production, the introduction of the product free of charge or with subsidized budgets may not take the market into account, and may distort the market or upset current collaborative efforts of other producers. Also, this approach needs to be complemented with a longer term strategy, as well as a package of support to institutionalize and sustain procurement for USI within countries.

How can we direct assistance to and support small producers without disrupting market processes, while at the same time attempting to increase production of iodized salt and access to it, and, most importantly, to build self reliance and national commitment? What can be done to increase profit in order to sustain production at this level? To focus alone on 'increasing production' will bring only short term benefits with the potential of longer term disillusionment.

Recommendations

- 1.** The issues looked at in this paper arise in all countries, regardless of level of achievement, but we ought to focus on the countries with the most severe problems in achieving USI.
- 2.** A major first step is to recognize the problems and the challenges and to include in the process from the beginning the salt producers, processors and government officials. No national discussion can be successful unless it includes all of these key players. Importers and suppliers of iodization equipment and potassium iodate should also be part of the process.
- 3.** There is need to create or reinforce a national procurement process that includes purchase of equipment, as well as supplies and quality assurance support. Development agencies can assist in management, design and some start-up costs. This requires an economic analysis and an entrepreneurial approach.
- 4.** Many governments, and a large number of those on the list of priority countries, have subsidy payment schemes designed to assist low income groups. Working with the government to provide a subsidy for the smallest producers/processors that ensures fair competition, but gives economic breathing room to the poorest groups, should be explored. Government purchases for schools, health services, and other local basic services should support the lowest income groups. Micro-credit organizations could be encouraged to enter this field of development.
- 5.** Reach agreement with major producers to combine their separate procurement processes into a national pool which would: (a) negotiate attractive prices; (b) assist the middle and small producer to obtain smaller quantities in a pattern matching his economic capacity; and (c) assure fair prices to all. This could include equipment and bulk supplies, as well as sources of technical assistance and potassium iodate. Development agencies could assist in assuring equity and good management and offer support in communications and education. Again, this requires an entrepreneurial approach and a sound business plan based on good practices.
- 6.** Create a revolving fund in which all have a stake and which would allow for one of the UN Agencies to arrange international procurement at reduced rates, with the domestic purchases of iodized salt constantly replenishing the fund. The fund could negotiate with producers of potassium iodate for a good price, and could also help with equipment. There are examples of this approach in Myanmar, Nicaragua, Bolivia, and Egypt, among others.
- 7.** Form cooperatives to assist the small producers but also to allow for other services beneficial to the families and communities. In Senegal, for example, it might be a way to sustain interest of the small producer to iodize salt, if the resulting income not only paid for the cost of production, but also schools and social services.
- 8.** In some exceptional cases it might even be considered worthwhile to buy all the bad raw material (salt) and with an aggressive market strategy, create a demand for iodized clean salt at similar prices, while solutions to disposition of the costly bad raw material are sought.
- 9.** Seek to develop alternate sources of employment of small producers, to allow for either their absorption into larger companies or to accommodate them, if put out of business, by the expansion plans of other traders.
- 10.** Seek ways to have salt from small scale producers enter the market for food processing, especially local market products.
- 11.** Help the small pan holders and small scale producers with education and promotional marketing tools for village use and local market creation. This includes involvement with local services providers in health, education, welfare, women's literacy efforts, fish processing, etc.

Meetings and Announcements

FENS-IUNS Congress

The 10th European Nutrition Conference will be held in Paris, France, 10-13 July 2007, at the Palais des Congrès. For more information, please visit the website: www.fens2007.org

FANS-IUNS Congress

The 10th Asian Congress of Nutrition will be held in Taipei, Taiwan, September 9-13, 2007, at the International Convention Center. The theme of the conference is "Diet, Nutrition and Optimal Health: From Food Supply to Nutrigenomics." For more information, please see the website: <http://www.2007ACN.org.tw/>

The 78th Annual Meeting of the American Thyroid Association

The 78th Annual Meeting of the American Thyroid Association will take place in New York City at the New York Sheraton Hotel & Towers from October 3 - 7, 2007. There will be a "*Translational Symposium on Iodine*" on Sunday, October 7, 2007, chaired by Dr. Gerard Burrow, ICCIDD. Meeting details can be found online at www.thyroid.org.

The 32nd Annual European Thyroid Association Meeting

The 32nd Annual European Thyroid Association meeting will take place in Leipzig, Germany, on Sept 2-7. There will be a "*Satellite Meeting of the ICCIDD West Central Europe Region*", chaired by Aldo Pinchera and Gerard Burrow, on Saturday, September 1. For further information on the congress, see: www.eta2007.de.

First Micronutrient Forum convenes in Istanbul, Turkey

Washington, DC - The first Micronutrient Forum was held in Istanbul, Turkey on 16-18 April 2007. The Micronutrient Forum was established in 2006, merging the

International Vitamin A Consultative Group (IVACG) and the International Nutritional Anemia Consultative Group (INACG), with an expanded mandate to address all micronutrient deficiencies of public health significance. For the first time a single meeting addressed several micronutrients - vitamin A, iron, zinc, folate and iodine.

The theme of the meeting was "Consequences and Control of Micronutrient Deficiencies: Science, Policy, and Programs - Defining the Issues." Dr. Alfred Sommer, Chair of the Micronutrient Forum Steering Committee, said that the meeting was designed to allow scientists and policy makers to take stock of the current scientific evidence and determine if "tipping points" had been reached for various questions.

Dr. Michael Zimmermann, ICCIDD, in his presentation on "Key Barriers to Global Iodine Deficiency Control: A Summary" emphasized several key points including the role of iodine supplementation of pregnant women in areas of iodine deficiency, the potential dangers of high iodine intakes and the importance of iodine repletion in normal child growth.

Nigeria's successful iodized salt program recognized

The meeting also highlighted successful national level micronutrient programs that are achieving impact, such as the presentation by Dr. Dora Akunyili on Nigeria's successful salt iodization program (see Box next page).

Dr. Necdet Unuvar, Undersecretary for Health in Turkey, opened the meeting on behalf of the Minister of Health of Turkey. Turkey has been very successful in reducing iron, zinc and iodine deficiencies using fortification and supplementation strategies.

Dr. Meera Shekar, World Bank, urges redoubling of efforts to attain universal salt iodization

In her closing address, Dr. Meera Shekar, World Bank, congratulated the Forum participants for bringing all the micronutrients under one roof, making it more feasible to develop well-coordinated and effective programs. Dr. Shekar focused attention on micronutrient interventions for which evidence of impact is strong enough to warrant investment of limited resources. She urged a redoubling of efforts to attain universal salt iodization and vitamin A supplementation to children under 5 years of age.

Food fortification is making good progress in developing countries and the recently released World Health Organization guidelines for fortification will serve national policymakers well. Dr. Shekar urged the development of program platforms that would combine the most effective approaches for maternal and child health.

The Micronutrient Forum was co-hosted by the Micronutrient Forum Program Committee and the Local Organizing Committee of the Ministry of Health of Turkey. The Micronutrient Forum Program Committee and the Micronutrient Forum Secretariat planned and organized the meeting with support from A2Z, the U.S. Agency for International Development (USAID) Micronutrient and Child Blindness Project, with funds from USAID. The proceedings of the first Micronutrient Forum will be published in the SIGHT AND LIFE Magazine. Additional information about the meeting is available on the Micronutrient Forum website: <http://www.micronutrientforum.org>

Nigeria given award for its USI program at the Micronutrient Forum Meeting in Istanbul

Sola Ogundipe Vanguard Media Ltd., Nigeria

Nigeria has been honored with the universal salt iodization (USI) certification award, in recognition of the nation's pragmatic approach towards combating endemic IDD through an aggressive salt iodization.



Dr. Dora Akunyili

By virtue of recording an unprecedented feat of 100 per cent salt iodization at factory level, and 98 per cent at both household and retail levels, Nigeria was awarded the USI Certification award as the first African nation to achieve this enviable target. With this development, Nigeria joins a select group of countries that have achieved this landmark through dint of dedication and commitment. But the achievement did not happen easily. It was obtained through the concerted regulatory and enforcement action of the

National Agency for Food and Drug Administration & Control (NAFDAC), backed by much-needed UNICEF counterpart funding.

Director-General of NAFDAC, Prof. Dora Akunyili, was given the award by a high powered delegation including representatives of UNICEF, The Micronutrient Initiative, CDC and ICCIDD officials. She received the USI compliant certification award on behalf of the Federal Government of Nigeria. In her presentation entitled: "Nigeria's Universal Salt Iodization Program Success Story; the Process and Lessons Learned", she attributed the country's remarkable success to strong political commitment of the government, strict enforcement of salt iodization law by NAFDAC, compliance by industry and an effective partnership with other stakeholders. She recalled that, following the World Summit for Children in 1990, Nigeria adopted the USI program. This reduced dramatically the number of Nigerians afflicted with goiter, from 40 million in 1990, to 25 million in 1993, to 11 million in 1998 and to about 6 million in 2004. Dr. Akunyili observed that Nigeria is Africa's success story on IDD elimina-

tion, a scourge that had bedeviled the country for three decades.

Salt iodization has become an integral component of NAFDAC's comprehensive high profile campaign to assure Nigerian consumers receive quality food and drug products. Dr. Akunyili said from inception of the program: "iodized salt is communicated not only as a health issue but as an essential consumer right, and salt companies saw the importation of iodized salt as patriotic responsibility towards the reduction of a rising trend in infant mental and physical deficiency in the country. NAFDAC conducts generic multi-channel consumer education campaigns focusing on the threats of IDD, the health benefits of iodized salt and generic promotion via the Nigerian USI logo targeting manufacturers, government policy makers, religious/community leaders and consumers."

Nigerians resident in Turkey who attended the ceremony described the USI certification award for Nigeria as a source of pride and morale booster to Nigerians at home and in the diaspora.

Abstracts

Short-term changes in maternal and neonatal urinary iodine excretion.

Smyth PP et al. *Thyroid*. 2007;17(3):219-22

In this Irish study, investigation of maternal urinary iodine (UI) excretion in the immediate antenatal and early postpartum periods showed a fall in median values from 93 µg/L antenatally to 36 µg/L at delivery subsequently rising to 49 µg/L and 63 µg/L at days 3 and 10 postpartum respectively. Measurement of UI in babies born to nursing mothers suggested transfer from the mother with median neonatal values of 117 and 159 µg/L being recorded

at days 3 and 10. While maternal UI seemed to relatively unaffected by breast feeding, median UI from breast feeding babies (148 µg/L) was significantly greater than in those bottle feeding (50 µg/L). This was also reflected by the finding that no breast feeding baby had a UI values < 50 µg/L in comparison to 50% of bottle feeders.

Sustainable universal salt iodization in low-income countries - time to re-think strategies? Assey VD et al. *Eur J Clin Nutr*. 2007 Mar 21; [Epub]

The authors describe the status of salt iodination machines, salt producers' experi-

ences and quality of salt produced in Tanzania. Qualitative and quantitative data was collected from the factory sites, observations were made on the status of UNICEF-supplied assisted-iodation machines and convenience samples of salt from 85 salt production facilities were analyzed for iodine content. A total of 140 salt works visited had received 72 salt iodation machines in 1990s, but had largely abandoned them due to high running and maintenance costs. Locally devised simple technology was instead being used to iodate

salt. High variability of salt iodine content was found and only 7% of samples fell within the required iodation range. Although iodine content at factory level is highly variable, overall iodine supply to the population has been deemed largely sufficient. The need for perpetual iodine fortification requires reassessment of salt iodation techniques and production-monitoring systems to ensure sustainability. The emerging local technologies need evaluation as alternative approaches for sustaining universal salt iodation in low-income countries with many small-scale salt producers.

Iodine intake in Germany. Results of iodine monitoring in the German Health Interview and Examination Survey for Children and Adolescents (KiGGS). Thamm M et al. *Bundesgesundheitsblatt Gesundheitsforschung Gesundheitschutz*. 2007;50(5-6):744-9

In iodine monitoring during KiGGS, the thyroid volumes of all children and adolescents from six years of age were determined using sonography. To assess iodine intake among the population, iodine excretion in the urine was also measured. The median ioduria value was 117 µg/L, putting it at the lower end of the scale of 100–200 µg/L recommended by the World Health Organisation. It can be concluded from these results that the iodine prophylaxis has been successful and that iodine intake has improved compared with the past. In accordance with the WHO recommendations there is no iodine deficiency in Germany any more; however, at the same time the population's iodine intake is at a relatively low level. The aim is at least to keep up what has been achieved, meaning that measures to improve iodine intake must not be allowed to slacken.

Iodine prophylaxis: the protective factor against stomach cancer in iodine deficient areas. Golkowski F et al. *Eur J Nutr*. 2007 May 11; [Epub]

The aim of the study was evaluation of incidence rate of stomach cancer in Poland and its possible relation to increased iodine consumption in the years 1992–2004. The increase in iodine consumption in this period of time was proved by rise in percentage of schoolchildren (6–8 years old) with ioduria above 100 µg/L from 11.4% in 1992–1993 to 52.9.1% in 2003. It was correlated with the decrease in goiter prevalence from 18.8% to 3.2% respectively.

In Krakow the standardized incidence ratio of stomach cancer for men decreased from 19.1 per 100,000 to 15.7 per 100,000, and for women from 8.3 per 100,000 to 5.9 per 100,000 in the years 1992–2004. A significant decline of average rate of decrease was observed in men and women (2.3% and 4.0% per year respectively). The observed association between improved iodine supply and decrease of incidence of stomach cancer could indicate the protective role against stomach cancer of iodine prophylaxis in iodine deficient areas.

Seaweed and soy: companion foods in Asian cuisine and their effects on thyroid function in American women. Teas J et al. *J Med Food*. 2007;10:90–100.

Seaweeds and soy are two commonly eaten foods in Asia. Both have been reported to affect thyroid function, seaweed because of its iodine content and soy because of its goitrogenic effect. Twenty-five healthy postmenopausal women (mean age 58 years) completed a double-blinded randomized crossover study. Ten capsules (5 g/day) of placebo or seaweed (*Alaria esculenta*), providing 475 µg of iodine/day, were consumed daily for 7 weeks. A powdered soy protein isolate, providing 2 mg of isoflavones/kg of body weight, was given daily during the last week of each treatment arm. On average, this provided 141.3 mg of isoflavones/day and 67.5 g of protein/day. Blood samples and 48-hour urine samples were collected before and after each intervention period. Seaweed ingestion significantly increased I/C (µg of iodine/g of creatinine) concentrations and serum TSH. Soy supplementation did not affect thyroid end points. Seven weeks of 5 g/day seaweed supplementation was associated with a small but statistically significant increase in TSH. Soy protein isolate supplementation was not associated with changes in serum thyroid hormone concentrations.

Iodine deficiency activates antioxidant genes and causes DNA damage in the thyroid gland of rats and mice. Maier J et al. *Biochim Biophys Acta*. 2007 Mar 24; [Epub]

Because thyroid nodules are frequent in areas with iodine deficiency, the aim of this study was to characterise molecular events during iodine deficiency, that could explain mutagenesis and nodule formation.

The authors studied gene expression of catalytic enzymes for detoxification and antioxidative defence, quantified DNA oxidation and damage as well as spontaneous mutation rates (SMR) in mice and rats fed an iodine controlled diet. Antioxidative enzymes such as superoxide dismutase 3, glutathione peroxidase 4 and the peroxidases 3 and 5 showed increased mRNA expression, which indicates increased radical burden that could be the cause of additional oxidized base adducts found in thyroidal genomic DNA in the experiments of iodine deficiency. Furthermore, the uracil content of thyroid DNA was significantly higher in the iodine-deficient compared to the control group. While SMR is very high in the normal thyroid gland it is not changed in experimental iodine deficiency. Our data suggest that iodine restriction causes oxidative stress and DNA modifications.

Assessment of thyroid function and urinary and breast milk iodine concentrations in healthy newborns and their mothers in Tehran. Ordoorkhani A et al. *Clin Endocrinol (Oxf)*. 2007 Apr 27; [Epub]

The study objective was to measure breast milk iodine (MI) and urinary iodine (UI) concentrations in healthy newborns and their nursing mothers from an iodine-sufficient region, to determine adequacy and to relate these parameters to thyroid function tests in mothers and infants. Forty-eight healthy neonates of 37 to 42 weeks' gestation with normal cord blood TSH values and their mothers were recruited in Tehran, Iran. Thyroid function tests were performed, and maternal and infant urinary iodine excretion, and maternal milk iodine (MI) concentration were measured. Neonatal age was 25.9 ± 3.9 days and maternal age was 25.8 ± 5 years. Median (range) UI in neonates was 271 µg/l (57–800) and in mothers was 107 µg/l (20–710). Median (range) MI was 148 µg/l (45–750). Among euthyroid neonates, UI was adequate despite low median maternal UI and MI concentrations. There were no significant correlations between UI or MI and thyroid function tests in the mothers and infants.

Povidone iodine-induced overt hypothyroidism in a patient with prolonged habitual gargling: urinary excretion of iodine after gargling in normal subjects. Sato K et al. *Intern Med.* 2007;46:391-5.

Iodine-induced hypothyroidism that develops in patients who gargle routinely with povidone iodine is well known. Usually the hypothyroidism is mild and resolves spontaneously upon cessation of gargling. Here, the authors report a 63-year-old patient with overt hypothyroidism that developed due to habitual gargling with povidone iodine for more than 10 years. The urinary excretion of iodine was estimated to be greater than 5 mg/day, based on values obtained from 18 normal subjects who gargled three times a day (mean 4.6 mg). After discontinuation of the gargling, the patient was euthyroid for more than 10 months.

Chronic iodine excess does not increase the incidence of hyperthyroidism: a prospective community-based epidemiological survey in China. Yang F et al. *Eur J Endocrinol.* 2007;156(4):403-8.

The study investigated the influence of different iodine intake levels on the incidence of hyperthyroidism in a prospective, 5 year, community-based survey in three communities with mild-deficient, more than adequate (previously mild deficient iodine intake), and excessive iodine intake. In the three communities, median urinary iodine excretion was 88, 214, and 634 µg/L ($P < 0.05$) respectively. The cumulative incidence of hyperthyroidism was 1.4, 0.9, and 0.8% ($P > 0.05$) respectively. Autoimmune hyperthyroidism was predominant in thyroid hyperfunction in all the three cohorts. Either positive TPOAb (> 50 U/ml) or goiter in original healthy participants was associated with the occurrence of unsuspected hyperthyroidism in 5 years. Iodine supplementation may not induce an increase in hyperthyroidism in a previously mildly iodine-deficient population. Chronic

iodine excess does not apparently increase the risk of autoimmune hyperthyroidism.

Iodine nutritional status in the school-aged population in Alicante (Spain). Zubiaur Cantalapiedra A et al. *An Pediatr (Barc).* 2007;66(3):260-6.

The authors conducted an observational study to determine the prevalence of endemic goiter and nutritional iodine status in the province of Alicante. Urinary iodine excretion was measured in a morning urine sample, and thyroid volume was measured by means of a thyroid ultrasound scan. A case of goiter was diagnosed if thyroid volume was above the 97th percentile adjusted by age, as published by the WHO. No cases of goiter were found. In addition, the median urinary iodine excretion levels adjusted by age were within the normal range, as defined by the WHO's criteria. Endemic goiter was not found in the province of Alicante and urinary iodine excretion values demonstrated adequate iodine intake.

Induction of goitrous hypothyroidism by dietary iodide in SJL mice. Li HS et al. *Endocrinology.* 2007;148(6):2747-2752.

The authors investigated the role of dietary iodide on the development of hypothyroidism, as well as thyroiditis, in strains of mice that do not develop spontaneous autoimmune thyroiditis. Intake of 0.05% NaI via drinking water for 10 wk induced hypothyroidism in SJL/J mice as indicated by elevated TSH and depressed total T(4) values in serum. Hypothyroidism did not appear to have an autoimmune basis because only focal mononuclear cell infiltrates were found intrathyroidally, and anti-thyroglobulin antibodies or increased organification of iodide were not detected. These phenomena were not observed in similarly treated CBA/J mice, suggesting polymorphisms in genes controlling events downstream of iodide uptake by thyrocytes. Interestingly, RT-PCR analysis indicated that unlike CBA/J, SJL/J mice could

not down-regulate Na/I symporter gene expression during the NaI treatment. No significant temporal or strain differences were observed regarding the expression of thyroglobulin, pendrin, thyroid peroxidase, and DUOX1 and DUOX2 genes after NaI intake. The results point to the generation of a mouse model for the study of iodine-induced hypothyroidism, which does not seem to have an autoimmune basis.

Vitamin A repletion in rats with concurrent vitamin A and iodine deficiency affects pituitary TSHbeta gene expression and reduces thyroid hyperstimulation and thyroid size. Biebinger R et al. *J Nutr.* 2007;137(3):573-7

The aim of this study was to investigate the effect of VA supplementation (VAS) and/or dietary iodine repletion, alone and in combination, on the thyroid-pituitary axis in rats with concurrent VAD and ID. Weanling rats ($n = 96$) were fed diets deficient in VA and iodine or sufficient in both (control), for 30 d. Subsequently, deficient rats were repleted with iodine and/or single VAS or remained deficient for 10 d. High-dose VAS restored SR concentrations to normal in both iodine-deficient and iodine-sufficient rats. Despite continuing VAD, provision of the iodine-sufficient diet entirely reversed the abnormalities of the pituitary-thyroid axis produced by VAD and ID. In iodine-sufficient rats, VAS had no discernible effects on the pituitary-thyroid axis; in iodine-deficient rats, VAS reduced pituitary production of TSH and thyroid stimulation but had no discernible effects on circulating thyroid hormone concentrations. Primary hypothyroidism in rats with concurrent VAD and ID does not reduce the efficacy of VAS, nor does VAD reduce the efficacy of dietary iodine to correct pituitary-thyroid axis dysfunction due to ID. In concurrent VAD and ID, VAS, independent of iodine repletion, reduces thyroid hyperstimulation and size, an effect likely mediated through the effects of VA on pituitary TSHbeta gene expression.

THE IDD NEWSLETTER is published quarterly by ICCIDD and distributed free of charge in bulk by international agencies and by individual mailing. The Newsletter also appears on ICCIDD's website (www.iccidd.org). The Newsletter welcomes comments, new information, and relevant manuscripts on all aspects of iodine nutrition, as well as human interest stories on IDD elimination in countries.

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