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In this Issue:

Iodine supplementation improves cognition in mildly iodine-deficient children

From the publication in: Am J Clin Nutr. 2009;90(5):1264-71. **Rosie Gordon, Meredith Rose, Sheila Skeaff, Andrew Gray, Kirstie Morgan** and **Ted Ruffman.** The Departments of Human Nutrition, Preventive and Social Medicine, and Psychology, University of Otago, Dunedin, New Zealand

This groundbreaking study demonstrates for the first time that correction of even mild iodine deficiency in children can improve their ability to learn.

The consequences of severe iodine deficiency during critical periods of brain development are well-known, but less is understood about the effects of milder forms of iodine deficiency. Although two meta-analyses have reported differences of 10-13.5 IQ points between moderate to severely iodine-deficient and iodine-sufficient populations (1,2), differences in

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.

other factors that may affect cognitive ability, such as socioeconomic status, could not be eliminated and may have biased the results.

In 2006, a randomized controlled trial (3) in moderately iodine-deficient Albanian children reported that children in the iodine group performed significantly better on tests of cognitive function than did children in the placebo group. Until now, there has not been a similar study in a mildly iodine-deficient population. The reemergence of iodine deficiency in New Zealand is believed due to: lower concentrations of iodine in milk because of the discontinuation of iodine-containing sanitizers in the dairy industry, declining use of iodized salt, and an increased consumption of processed foods not made with iodized salt. Studies in New Zealand schoolchildren have reported a median UI of 66 μg/L and goiter prevalence of ca.10%, indicating mild iodine deficiency (3,4). Thus, the aim of this study was to investigate the effect of iodine supplementation on cognition in mildly iodine-deficient children.

The study was a randomized, placebo-controlled, double-blind trial in 184 children aged 10–13 y in Dunedin, New Zealand. Children were randomly assigned to receive a daily tablet containing either 150 μg iodine or placebo for 28 wk. Biochemical, anthropometric, and dietary data were collected from each child at baseline and after 28 wk. Cognitive performance was assessed through 4 subtests from the Wechsler Intelligence Scale for Children.

Dunedin, New Zealand

The results showed that at baseline, children were mildly iodine deficient (median UI: 63 μg/L; thyroglobulin concentration: 16.4 μg/L). After 28 wk, iodine status improved in the supplemented group (UI: 145 μg/L; thyroglobulin: 8.5 μg/L), whereas the placebo group remained iodine deficient (UIC: 81 μg/L; thyroglobulin: 11.6 μg/L). Iodine supplementation significantly improved scores for 2 of the 4 cognitive subtests (Figure 1): picture concepts and matrix reasoning but not for letter-number sequencing or symbol search. The overall cognitive score of the iodine-supplemented group was 0.19 SDs higher than that of the placebo group ($p<0.02$).

This study had many strengths: its randomized, placebo controlled, double-blind design; its use of a daily supplement mimicking the effect of iodine fortification; good compliance over the study period; a dietary measure of iodine intake; and the inclusion of new cognitive subtests designed to reflect current clinical knowledge and practice. A limitation of the study was its relatively short duration of 28 wk and the small sample size, so that it may have been somewhat underpowered to detect a difference between groups.

The elimination of iodine deficiency by the year 2005 was a World Fit for Children target (6), yet a large proportion of children worldwide still have inadequate iodine intakes. Although the percentage of households consuming adequately iodized salt has increased in the past 2 decades, particularly in developing countries where moderate to severe iodine deficiency was prevalent, countries such as the United States, Australia, and New Zealand have reported declining iodine intakes over this same period. The lack of data on the adverse effects of mild iodine deficiency might explain why some governments have been slow to implement strategies to improve iodine intakes in these countries.

This is a groundbreaking study in that it demonstrates convincingly for the first time that mildly-iodine deficient children have impairments in perceptual reasoning and suggests that mild iodine deficiency could prevent children from attaining their full intellectual potential. For complete details on this study, please see: Am J Clin Nutr 2009;90:1264–71.

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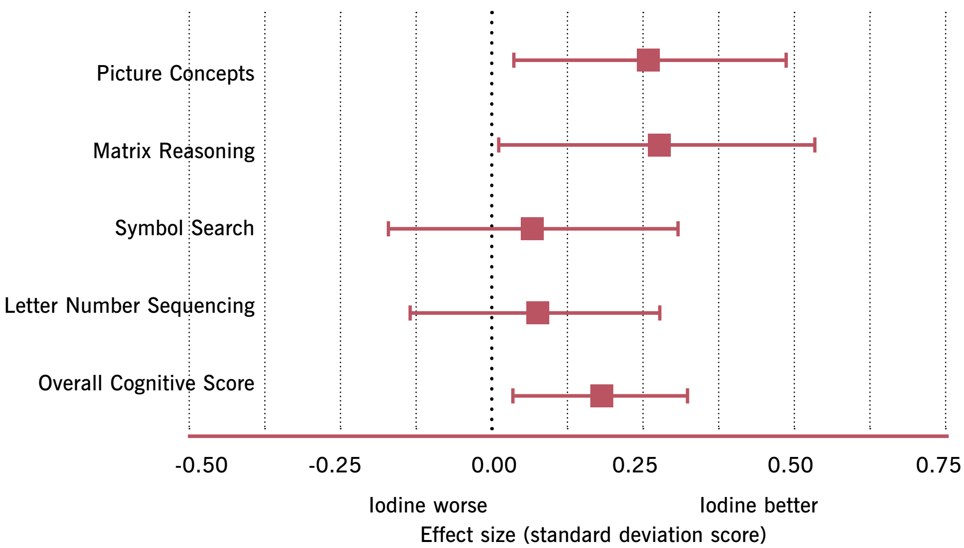
Figure 1. **The mean (95% CI) effect of iodine supplementation on final scores for each individual Wechsler Intelligence Scale for Children cognitive subtest and overall cognitive score (n = 166). Children who were supplemented with iodine had better scores for picture concepts, matrix reasoning, and overall cognitive score (p <0.02) than did children who received the placebo.**



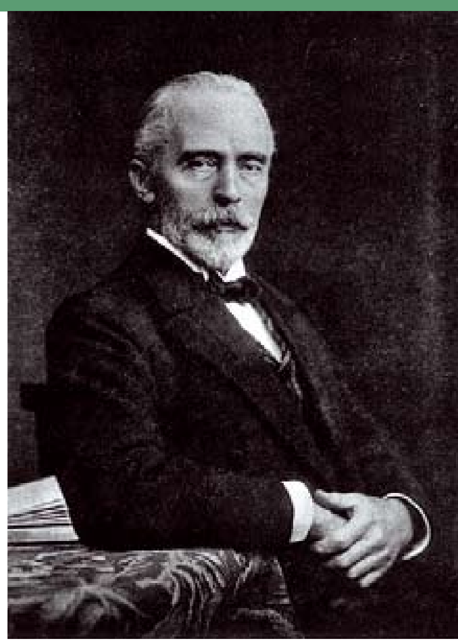
100 years ago: The Nobel Prize goes to Swiss surgeon Theodor Kocher for research on goiter and the thyroid

Hans Bürgi Board Member of ICCIDD, Solothurn, Switzerland

"Eliminating goiter and cretinism worldwide would amount to more than building the Egyptian pyramids" Theodor Kocher

In 1909, the Swiss surgeon Theodor Kocher was awarded the Nobel Prize in Physiology and Medicine "for his work on the physiology, pathology and surgery of the thyroid gland" [1]. Kocher had no choice but to get involved in the thyroid field: he was born, raised, trained, and appointed professor of surgery at the University of Berne, Switzerland and at that time the region was still ravaged by an incredibly high prevalence of goiter and cretinism. In 1883, in the city of Berne, 55% of schoolchildren had a goiter, often even a large nodular one. In 1923 the Canton of Berne (at that time with a population of about 600,000) housed 700 cretins in special institutions, in addition to those cared for by their family at home [2]. So it is no wonder that of the 143 papers in Kocher's publication list, 23 papers (16%) deal with the thyroid gland [3].

Kocher was a surgeon, and he assumed his main task was to develop safe methods for removing large goiters causing pressure symptoms. Indeed, he refined the operative technique in a way that let goiter surgery become routine, with a mortality of less then 1%. Kocher used his surgical activity to unravel the function of the thyroid gland which in 1872, the year of Kocher's appointment to the Chair of Surgery, was still totally unknown. His experience as a surgeon allowed him to define new clinical pictures and pathophysiology, as well and novel surgical and pharmacological treatments for goiter.



Theodor Kocher (1841- 1917). Professor of Surgery at the University of Berne, Switzerland.

In 1883, Kocher reported to a meeting of the German Society of Surgeons on the follow-up of 18 patients after total thyroidectomy [4]. Only two were in good general health. The remaining 16 had developed the following clinical picture: fatigue, weakness and pain in the extremities, cold intolerance, slowing of mental function, movements and speech, swelling of extremities and eyelids, low blood pressure, anemia, growth arrest (if in the growth phase). He coined the term 'cachexia strumipriva' for this condition and correctly considered it the same as myxedema, a disorder first described by two English physicians, Ord and Gull. In the following years Kocher elaborated on cachexia strumipriva / myxedema [5], which were improved by oral thyroid extracts or, temporarily, by thyroid tissue transplants.

On December 11, 1909, Kocher gave his Nobel lecture, entitled "Concerning Pathological Manifestations in Low Grade Thyroid Diseases" [6]. By that time, Kocher had further elaborated on the features of cachexia strumipriva; he had correctly concluded that the clinical picture of cachexia strumipriva was the opposite of Graves'-Basedow's disease. The terms "hypothyroidism" and "internal secretion" appear for the first time in this lecture, which shows that Kocher had advanced in his understanding of thyroid physiology and become familiar with the concept of hormones, though the term had not yet been coined. He had set up a research laboratory where he and his coworkers studied the lymphocyte count and blood coagulation in Graves' disease and on the iodine content of euthyroid and hyperthyroid goiters.

By 1910, Kocher's group had operated on 469 hyperthyroid goitres [7], an undertaking that before Kocher's improvements of the operative technique was considered particularly risky. Kocher had meanwhile accepted Möbius' view that Graves'- Basedow's disease was due to a hyperactivity of the thyroid gland. He had noticed that there were two forms of hyperthyroidism: Graves'- Basedow's disease, characterized by exophthalmus and diffuse goitre, and Jod-Basedow (today called iodine-induced hyperthyroidism). The latter occurs in preexisting nodular goiters, is triggered by iodine intake and lacks exophthalmus [8]. The distinction is clinically relevant, since persons with large nodular goitres should stay away from all forms of iodine.

Thus, over the years, despite his enormous workload as a surgeon, Kocher had made a remarkable number of "non-surgical" discoveries: he had shown that the thyroid gland avidly accumulated iodine, described the clinical picture of hypothyroidism, observed a high lymphocyte count in Graves'-Basedow's disease, and described a second form of hyperthyroidism: Jod-Basedow.

Kocher's advances in thyroidology were important, but the most pressing problem in the thyroid field, that is, endemic goitre and cretinism, remained a puzzle. Most researchers thought that factors in food and water were the cause of endemic cretinism and goiter, and there were only few advocates of the iodine deficiency theory.

In 1883/84, Kocher and his team surveyed all 76,000 schoolchildren of the canton of Berne [9]. He plotted the findings on a detailed map, with the intention to correlate goiter with certain geologic formations. The survey showed a highly variable prevalence of goiter, depending on location. The variability of goiter prevalence did not, as claimed by others, correlate with specific geological formations or bacterial contamination of water. All places where cretinism occurred also had endemic goiter, but the reverse did not apply. Some drinking waters appeared to be "goitrogenic", neighbouring springs not.

In the following years, Kocher focussed his interest on the pathogenesis of cretinism. The intriguing question was: which common aetiology could explain goitre and cretinism, two radically different disorders affecting the thyroid and the brain? In his review of the available literature, Kocher concluded that all theories were conjectural and unsatisfactory. Frustrated, he agreed with another author that "eliminating goiter and cretinism worldwide would amount to more than building the Egyptian pyramids" [6].

In 1907 a Swiss Goitre Committee was founded. With the help of Kocher, the Committee established a research plan that sounds reasonable and logical to this day. Rats were kept over one year in eight different villages and fed with local food and water. Two pathologists, Langhans and Wegelin, published the results in a monograph in 1919 [10]. In goitrous villages, the rats developed goiters with numerous mitoses. Potassium iodide added to the drinking water prevented these rat goiters. But obsessed by the theory of a goitrogenic agent in water, the researchers failed to consider the obvious explanation for endemic goiter: iodine deficiency!

In 1917, the year of his death, Kocher still favored goitrogenic agents in water as the cause of endemic goitre. David Marine's finding of goiters in fish hatched in certain waters supported the water theory, in Kocher's mind. Nonetheless, he agreed that time was ripe to stop discussions, and that one should cautiously embark on trials of prevention, e.g. by adding small amounts of iodine to water supply systems [11]. Interestingly, the final solution of the problem of goiter and cretinism did not come from the heights of Swiss academic medicine. Rather, the merit goes to two physicians practicing in rural Alpine areas. Bayard, general practitioner in the Valley of Zermatt and Eggenberger, surgeon in the small canton of Appenzell, proved the feasibility of using salt as a carrier for iodine on a large scale.

Kocher did not live to witness the triumph of prophylaxis with iodized salt; he died in 1917, six years before introduction of iodized salt in Appenzell. But his research on goiter and cretinism played a major role in the success of the Swiss iodized salt program, and laid the foundation for future global efforts to control IDD.

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Tracking progress towards sustainable elimination of IDD in Thailand

2009 External Review of the IDD Elimination Program in Thailand

"Thai children who lack adequate amounts of iodine in their diets will not be able to fully contribute to the development of their country. This would be a serious waste of Thailand's most valuable resource – the human potential of its children."

Professor Cres Eastman ICCIDD Vice Chairman and Regional Coordinator for Asia Pacific

IDD have been recognized as a serious public health problem in Thailand for over 50 years. In 2004, an experienced team of experts reviewed the progress made in the Thai IDD Elimination Program. This mission found that, with respect to the indicator of adequate iodization of household salt, Thailand scored poorly with 47.2 per cent against the goal of > 90 per cent; the indicator of urinary iodine excretion in Thai children achieved a satisfactory figure. Overall, the result was disappointing as only 5 of 10 indicators were partially attained against the standard required of 8 out of 10 indicators being fully attained. The report provided a series of recommendations, relating to each of these indicators, which were intended to be constructive suggestions for improving the program and ultimately achieving sustainable IDD elimination. Many of these recommendations have been successfully implemented, but there is little evidence of significant improvement in iodine nutrition in the Thai population.

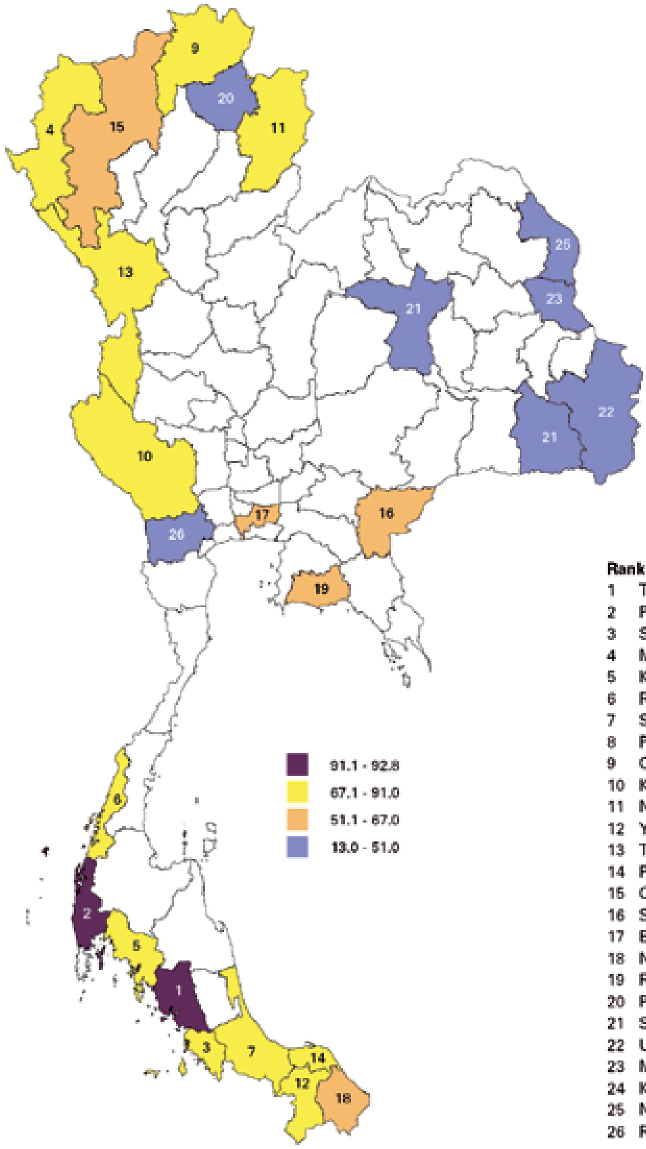
In early 2006, the National IDD Control Board (NIDDCB) met for the second time since 1994, presided over by HRH Princess Maha Chakri Sirindhorn. The NIDDCB confirmed the importance of IDD control for IQ development of the Thai population (in contrast with the long-held focus on endemic goiter control) and approved a five-year Master Plan for IDD Control (2006-2011).

In 2007-2008, those responsible for implementing the Master Plan became concerned about slow progress. UNICEF expressed concern that there had been little progress towards Universal Salt Iodization (USI) in Thailand in recent years, as exemplified by inadequate coverage of household iodized salt and an apparent decline in urinary iodine concentrations in pregnant women. In late 2008, a decision was made to conduct a review of progress of the IDD plan. The review took place in March-April 2009. For each of the findings and recommendations below, details are provided in the body of the report.

The most important findings of the review were:

- Overall there has been little progress in eliminating IDD in Thailand over the past five years, despite a high level of commitment and hard work by many people and organizations dedicated to IDD elimination.
- Endemic goiter in children has been controlled, but iodine nutrition is sub-optimal in a high proportion of pregnant women (60-70 per cent of pregnant women based on urinary iodine excretion), leading to potential fetal and neo-

Coverage of iodized salt at household level by province



Rank		
1	Trang	92.8
2	Phangnga	91.5
3	Satun	90.9
4	Mae Hong Son	90.1
5	Krabi	86.1
6	Ranong	84.9
7	Songkhla	84.8
8	Phuket	81.1
9	Chiang Rai	77.7
10	Kanchanaburi	74.6
11	Nan	73.1
12	Yala	69.8
13	Tak	69.1
14	Pattani	68.6
15	Chiang Mai	66.5
16	Sa Kaeo	66.2
17	Bangkok	59.7
18	Narathiwat	57.4
19	Rayong	52.0
20	Phayao	44.0
21	Sri Saket	42.2
22	Ubon	38.6
23	Mukdahan	32.1
24	Khon Kaen	19.4
25	Nakorn Phanom	18.0
26	Ratchaburi	12.7

natal brain damage and loss of IQ in approximately 100,000 babies born annually in Thailand.

- There was no evidence that the required increased resources had been put into the IDD elimination efforts over the past five years, and an important recommendation from the 2004 review was that the NIDDCB needs to meet more regularly than it has in the past.
- A significant disappointment has been the lack of inter-ministerial (Health, Education, Industry, Food and Drug Administration (FDA) collaboration and the failure to form an "Intersectoral Technical Working Group", as strongly recommended in the 2004 review, to advise and report to the NIDDCB and to take responsibility for implementation of the national strategy.

Production and quality control of iodized salt

- The major impediment to progress and therefore lack of implementation of Universal Salt Iodization (USI) is the current regulations on iodization of edible salt. The weakness is that these regulations – under Public Health Ministerial Notification no. 153 – apply only to salt used in direct flavoring of food for cooking or at the table. Unless this notification is amended to include iodization of all salt for human and animal consumption, it is unlikely that IDD will ever be eliminated in Thailand.

- The lack of implementation of USI has led to the development of many other initiatives to increase iodine intake by food fortification using either iodized salt or iodine directly added to certain food products such as snack foods, noodles and fish sauce. While these initiatives are commendable, it is unlikely that they will make a significant contribution to eliminating IDD in Thailand.
- The formation of three regional Salt Producers Societies is a very positive and commendable initiative. They are working together to improve the quality of iodized salt and seem motivated to improve the health of the Thai people.
- However, there remains large numbers of small-to-medium-sized salt producers, many engaged only in packaging and repackaging salt for the retail market, who either do not iodize the salt or iodize it inadequately. Most of these producers are not registered (and are not required to be registered by the FDA) and are not members of Salt Producers Societies. It is therefore not possible to know the exact number of salt producers in Thailand, especially the smaller ones.
- Quality assurance procedures for iodized salt at the manufacturing and wholesale level are deficient and have not shown any improvement from the 2004 review.

Monitoring and surveillance

- A very positive change in direction in the program in Thailand has occurred with transfer of the focus from monitoring goiter rates by palpation of the neck in children to measuring urinary iodine excretion (UIE) in pregnant women and emphasizing the importance of iodine for the developing brains of the fetus and infant.
- The involvement of schoolchildren in testing household salt samples is a commendable initiative, but probably produces a significant bias in monitoring data.
- Data on UIE are collected annually from a sample of pregnant women. This data is analyzed and provides regional and national estimates of iodine status. However, there has been limited use of data for program improvement and this can be improved. The program should be expanded to include all women of reproductive age, not just pregnant women.
- The neo-natal Thyroid-Stimulating Hormone (TSH) screening program for congenital hypothyroidism in Thailand covers 94 per cent of live births and is built upon modern laboratory technological methods and an excellent data storage and analysis system. More use needs to be made of the data coming from the screening program.

Advocacy, information, education and communication

- Many commendable initiatives for information, education and communication (IEC) activities have occurred in this area over the past five years and have raised the household coverage of iodized salt in some areas of the country.
- The major problem is to scale-up these initiatives through an evidence-based advocacy and communication strategy.

Assessment against programmatic indicators

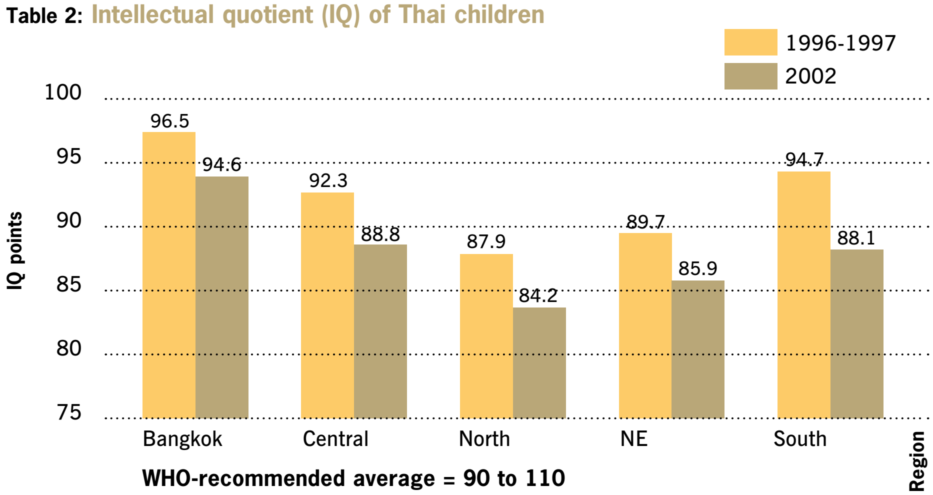
Of the 10 programmatic indicators, only 1 indicator has been fully attained, 5 partially attained and 4 indicators not attained. It should be emphasized that assessment of attainment of a number of these indicators is based upon examination and analysis of the best evidence available during the review and therefore should acknowledge that the Thai program has gone a long way towards achieving success. Nonetheless, major deficiencies in the program remain. While progress has been achieved in certain areas since 2004, other areas have slipped back.

Table 1: Median Urine Iodine Concentrations (MUIC) in pregnant women (300 pregnant women/province; 15 provinces/year as part of the cyclical monitoring system)

Year	Median UIC (μg/l)	MUIC (n,%)	
		<100 μg/l	<150 μg/l
2000	153	2,131 (49.3)	
2001	112	2,626 (64.9)	
2002	107	3,201 (71.4)	
2003	114.5	2,784 (65.4)	
2004	101.6	3,189 (74.9)	
2006	82.5	2,399 (57.4)	2,999 (71.8)*
2007	108.2	2,032 (46.9)	2,649 (61.2)*

*According to WHO guidelines the proportion of pregnant women who have urine iodine concentrations of <150 μg/L should be not more than 50%

Table 2: Intellectual quotient (IQ) of Thai children



WHO-recommended average = 90 to 110
Average of developed countries = 104
Ramathibodi Hospital Study 2004

Recommendations

- Universal salt iodization will not succeed until it is underpinned by strong and enforceable legislation.
- As with the 2004 report, once again it is recommended that an Intersectoral IDD Coordinating Committee be established that represents all the relevant stakeholders and is given sufficient authority and resources to implement the National Plan.
- Until USI can be achieved, it is critical to improve iodine nutrition in pregnant and breast feeding women through the implementation of a nationwide supplementary iodine program delivered through antenatal care clinics.
- Major changes to monitoring and surveillance and quality assurance are needed.
- With respect to advocacy, health information and communication, the engagement of professional communication and social mobilization experts is needed to develop and execute an evidence-based national advocacy strategy, to recruit commitment and support from leaders at all levels and to scale up good initiatives for IEC activities found in some localities.

Focus on IDD at the 9th World Salt Symposium in China includes an IDD Prevention and Control Workshop organized by the Ministry of Health

Lucie Bohac Coordinator, Network for Sustained Elimination of Iodine Deficiency

The 9th World Salt Symposium took place in Beijing, China on Sept. 4-6, 2009. Organized by China National Salt Industry Corporation (a member of the Network for Sustained Elimination of Iodine Deficiency), the Symposium hosted approximately 1200 participants from over 50 countries.

As this event marked a decade of the salt industry's collaboration in the effort to eliminate IDD through universal salt iodization (USI), it was an opportunity to celebrate one of the biggest public health success stories of the last decades. It also provided an outstanding occasion to deepen the commitment of the world salt industry to the objectives of eliminating IDD. Thus, the Network for Sustained Elimination of Iodine Deficiency was involved in the preparation of the Salt Symposium.

The Salt Symposium began with a colorful Opening Ceremony during which virtually every single speaker spoke about IDD and emphasized their commitment to continue USI to eliminate IDD. Special guest speakers included Saad Houry, Deputy Executive Director of UNICEF, Zhou Tienong the Vice-Chair of the National People's Congress; Chen Hong, Deputy-Mayor of Beijing; as well as Network Members Mao Qingguo, General Manager of China National Salt Industry Corporation; Wouter Lox, Managing Director, EU Salt; Walter Becky, Past Chair of the Salt Institute; and Dick Hanneman, President of Salt Institute. In the Plenary Session speakers included S. Sundaresan, India Salt Commissioner and Chen Zupei, ICCIDD Regional Director.

Key points made by the speakers were:

- Significant progress has been made in eliminating iodine deficiency in China since 1993 when the State Council agreed to make it a priority to provide optimal iodine to the population with salt as the principle vehicle for delivery and to form a National Coalition to assure national political commitment. This commitment accompanied by efficient law enforcement, professional and nationwide monitoring and evaluation, a national communications plan and effective oversight have made China an example of success.
- At about 5 to10 cents per year per person, salt iodization has proven to be cost effective and a wise investment in human capital. This investment needs to reach the 38 million children born each year still unprotected from IDD.
- From both salt industry and public health perspectives challenges remain. For example: access to affordable potassium iodate poses an issue for many producers; changes in consumption patterns towards prepared rather than home-made meals requires that food processors also use iodized salt; and misconceptions and misinformation need to be addressed as both science and the experience of other countries confirm that the benefits of salt iodization are huge while the risks are small and transient, and can be controlled.
- The challenges of newly established USI programs are different from those that are maturing. It is important to stick to the goal; if the elimination of iodine deficiency is to be assured, then salt iodization needs to remain the standard.
- The private public partnership of the salt industry and public and civic sectors and collaboration towards IDD elimination has been very successful and inspired innovation.
- Although salt iodization on a national scale was originally started in Europe, universal salt iodization is not a standard in Europe; trade barriers and EU regulations present the salt industry with big challenges.
- The global salt industry leaders present all reaffirmed their commitment to continuing to work towards the elimination of IDD through USI.

The Technical Program ran over the course of the Symposium. Three of the nine breakout sessions were dedicated to IDD, for a total of 16 papers. ICCIDD provided the coordination and chaired the IDD track in the technical session. The selected papers were published in the Symposium proceedings. Among the topics of papers presented were: focus on monitoring in China, case study of the private public partnership in salt iodization in India, the policy environment and national health program for iodine deficiency control in India, the use of iodized salt in processed foods, case study of South African experience in adjusting iodine levels in salt to respond to UIE monitoring, a profile of a demonstration project to include small salt producers in a national USI program and an overview of global progress, lessons learned and emerging issues from IDD/USI programs. Together, the plenary and technical sessions drew attention to and strengthened the importance of USI in the global goal of eliminating and sustaining the elimination of iodine deficiency.

Excerpts from the speech at the Symposium of Saad Houry, Deputy Executive Director of UNICEF:

1) "Thanks to the efforts of a vibrant partnership between private and public sectors - who came together with the aim of eliminating iodine deficiency through the iodization of salt, the majority of children born every year - 84 million or 70% of all newborns – DO receive the protection they need against the scourge of iodine deficiency."

2) "Let us remember that while most people already use iodized salt, in too many cases, the poorest and most vulnerable populations are not able to. It is up to us to find innovative ways to reach these unreached children and communities."

3) "Some ninety years after it was first tried, salt iodization remains the single most effective and affordable means of ensuring that children – wherever they might be found – receive the iodine that is crucial for their mental development, and indeed for the future of their societies."

Because international experts in IDD and USI were gathered in Beijing, the Ministry of Health of China, with the support of China CDC, UNICEF, ICCIDD, GAIN and the Network for Sustained Elimination of Iodine Deficiency, took the occasion to organize a special meeting.

The objective of the meeting was to summarize and discuss experience and achievements in IDD elimination efforts in China, to analyze existing challenges and explore effective remedies, to review international experiences with respect to similar challenges faced by China and to inform media representatives with clear evidence based facts on iodine nutrition and IDD elimination both globally and in China.

The meeting "Strategies for IDD Prevention and Control" took place on Sunday, September 6th. Present at the meeting were 35 senior Chinese participants from the Ministry of Health, China CDC, National IDD Advisory Committee (NIDDAC), National Training AND Technical Support Team (NTTST), National Reference Laboratory (NRL) as well as Chinese endocrinologists and nutritionists from national and provincial institutions. Nineteen international participants from UNICEF, WHO, ICCIDD, MI, GAIN, the IDD Network Secretariat and SIDA participated.

Opening the day-long meeting Mr. Bai Huqun, Deputy Director General, Bureau of Disease Prevention and Control, described the background, China's achievements and challenges over the years, and China's commitment to IDD elimination goals. Other presentations from Chinese participants included the following provincially oriented topics: the subsidy policy in Xinjiang Autonomous Region; the supply non-iodized salt in the areas where there is naturally occurring high level of iodine in the water; the conversion of small salt plants to stop non-iodized salt coming into the market and model village of expansion of iodized salt in Gansu province. In addition, the following five presentations concentrated on a national level perspective including: progress in IDD elimination in China; the iodized oil program in high risk regions; the results of National Salt Monitoring; IQ test in mild IDD areas of Hainan Province; and thyroid function and iodine nutritional status in pregnant women.

Presentations from the invited international participants included: Importance of iodine deficiency and global progress with USI (Dr. Nicholas Alipui of UNICEF and Chair of the Network for Sustained Elimination of Iodine Deficiency); China's leadership in USI programming (Dr. Jonathan Gorstein, Coordinator of the GAIN-UNICEF USI Partnership Project); Understanding the relationship between iodine and thyroid function (Dr. Rajan Sankar of GAIN) and Policy implications and the way forward for mature USI programs (Dr. Pieter Jooste, ICCIDD).

Along with the information shared, there was active discussion on the issues raised by the public media in China regarding the need to continue universal salt iodization, recent iodine nutritional status in China, issues relating to iodine deficiency and excess, as well as the claimed links (in the media) between iodine and thyroid disease. In addition, other monitoring issues were discussed, such as how to manage the USI program adjustments with respect to differing UIE levels between school aged children and pregnant/lactating women.

Z. P. Chen made the following statements in his summary of the meeting conclusions:

1) China went from being a country of severe iodine deficiency to one which has virtually eliminated IDD.

The lessons learned from this success include:

- Strong political will and commitment both from top leaders at national and provincial levels is critical;
- Universal salt iodization is accepted as major intervention for the correction of iodine deficiency and is confirmed by legislation (a monopoly policy of only iodized salt for human consumption and strict ban on non-iodized salt into the market);
- Effective monitoring system and feedback mechanism for readjustment of iodine concentration in salt must be in place;
- A sustained communication and social mobilization campaign (ie. National IDD Day) is needed;
- International cooperation on the National IDD Control Program and intensive technical supports from other agencies has made the difference;
- The establishment of a central leading and coordination group for oversight of the national program is essential.

2) China is a good example of a national IDD elimination program for the world

For fifteen years USI has been working well in China, a large and complex country with a huge and diverse population. Other countries can benefit from China's experiences and this would help eliminate iodine deficiency around the world.

3) USI plays a positive role in children's brain development

The impact of iodine on brain development in China has been established. Children born after salt iodization began in China showed an increase of 12% of IQ points, a reflection of this intervention upon the improvement of human potential and quality of life for further generations. It also confirms the important role that USI plays.

4) Optimizing iodine intake levels required to eliminate iodine deficiency yet minimizing the risks of excess

Iodine nutrition status in populations should be intensively and periodically monitored to identify iodine deficiency and iodine excess. Evidence shows that the impacts of iodine deficiency on the human brain and physical development far outweigh any danger from iodine excess, the effects of which are usually transient. More research can be done to explore the issues that monitoring of IDD/UIE reveals but there is no reason to question the national USI program in China.

5) Monitoring is a key tool to inform program modification

The recent monitoring data in China demonstrated that the iodine intake at a population level is sufficient, although there are still areas of iodine deficiency and there are areas of excess, but these do not affect the national picture. The value of making readjustments of the iodine concentration in edible salt in response to urinary excretion findings by the established monitoring system has been well established. It is important that intensive monitoring follows up after any readjustment of iodine concentration in salt has been made.

6) Communication

Communication and advocacy strategies should emphasize the need to protect the population against the preventable brain damage resulting from iodine deficiency. More attention should be given to iodine deficiency rather than iodine deficiency diseases or disorders because:

- In China there is no word for disorders and the association of IDD with disease gives the wrong impression;
- There is an on-going need to inform the public that iodine deficiency can be prevented and eliminated if iodine is supplied in the daily diet, such as through iodized salt.

Dr. Chen concluded by saying that it should be emphasized that environmental iodine deficiency of the earth is forever a reality, and iodine deficiency in the population is forever a risk. Therefore, a USI Program should be in place forever.

The meeting closed with a general agreement that there is a need to establish more comprehensive multi-country surveillance of iodine nutrition, rather than focusing on salt and urinary iodine only. China's success and leadership could help to drive this effort with support of the international community.

Elimination of iodine deficiency in Fiji

Iodine deficiency was recognized as a public health problem in Fiji in 1996 and universal salt iodization was introduced. A new national study shows the remarkable success of Fiji's IDD elimination program.

From the Ministry of Health of Fiji's Iodine Report. Compiled by: **A. Nisha Khan** National Advisor-Dietetics & Nutrition, Ministry of Health, Fiji

Background

In 1994, UNICEF worked with the Ministry of Health, the Ministry of Education and WHO to survey iodine status in Fiji. The survey was done in three areas on the island of Viti Levu (Ba, Sigatoka and Suva). It found that the prevalence of goiter as determined by ultrasound and palpation in school children and pregnant women in Viti Levu was ca. 45%. The mean urinary iodine (UI) concentration in 15 schools in the Ba, Sigatoka, and Suva areas ranged from 2-94 μg/L, with an average value of 26 μg/L, indicating moderate-to-severe IDD. It also reported that salt iodine levels were insufficient and ranged from <0.01 to 3.21 mg/100g salt.

As a result a Cabinet Paper was produced that recommended that non-iodized salt be included in the list of prohibited imports for Fiji. The paper was approved and recommendations gazetted in February 1996. The report also recommended regular monitoring of iodine in salt imports and the prevalence of IDD. The 1996 Gazette notice gave to the Central Board of Health (CBH) under the MOH the responsibility for the certification of iodized salt imports, and Pure Food Inspectors monitor the imports and the standards.

Study design

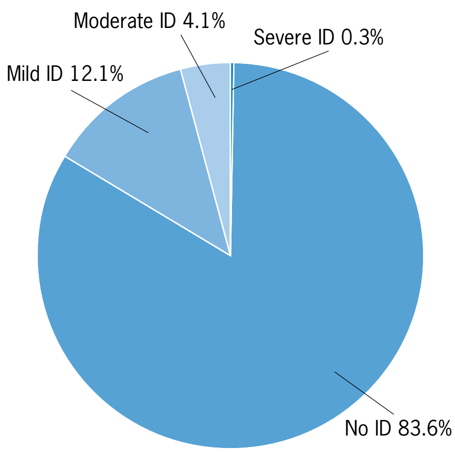
Due to the high costs required for a large scale cross-sectional survey, a smaller sentinel survey was done. Sentinel districts were chosen because they had moderate or severe ID in the 1994 study before implementation of salt iodization. The study included the following:

- collection of spot urine samples from school children (8-12 years) and pregnant women
- structured interview of pregnant women regarding diets and knowledge
- structured interview of school children regarding demographics and knowledge
- semi-quantitative assessment of iodine level of salt samples brought by the school children from their homes

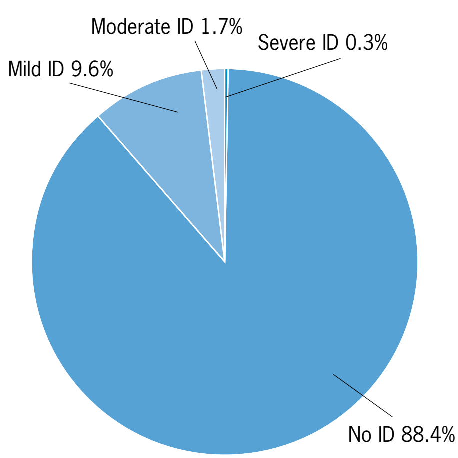
In addition to the original schools in the 1994 study, the study also included schools and the antenatal clinics from Labasa to assess IDD in north Fiji. The survey included 18 schools and 4 antenatal units from Ba, Sigatoka, Suva and Labasa. The urinary iodine levels were measured at the Endocrinology Laboratory at Westmead Hospital, in Sydney, Australia. A total of 979 urine samples from school children and 292 urine samples from pregnant women were analyzed, while 883 samples of salt were tested for iodine.

As shown in the figure on this page, school children in Fiji are clearly iodine sufficient with a median UI of 237 µg/L. Also, only ca. 4% of the population had a UI less then 50 µg/L. However, knowledge about the importance of iodine was low: the majority (78.6%) of the children didn't know if iodine was important while 12.7% said iodine wasn't important and 8.7% said iodine was important for health. Similar results were obtained from the questionnaire for pregnant mothers. Of the 883 salt samples tested, 98.4% (868) met the current Fiji mandated standards (minimum 15 ppm), when tested using rapid test kits.

The UI results from the pregnant women are shown in the figure on this page. They were clearly iodine sufficient with a median UI of 227 µg/L. There was an association between consumption of maize flour and soy milk and a low spot UI value in the pregnant women.



Iodine deficiency in school children based on UI results



Iodine deficiency during pregnancy based on UI results

Women with a low UI value were 6.15 times more likely to have been consuming soy milk compared to those without iodine deficiency. The majority of the population were regularly using salt in cooking, indicating that the use of salt as a carrier for iodine remains a good choice.

Conclusions

This was the first follow up study to evaluate the effect of the USI program in Fiji since its implementation in 1996. The implementation of USI has been highly effective. Another recent study by health inspectors and dieticians using MBI test kits for determining salt iodine levels in various areas of Fiji and found that 99.6% of the 3890 samples randomly selected at household levels had adequate iodine content of above 15ppm. These results are similar to results of this study where 98.4% of salt was adequately iodized.

Moreover, of the 10 programmatic indicators that ICCIDD recommends as being essential for sustained IDD elimination, Fiji has 9 in place. But some of the programmatic indicators have been achieved very recently. Hence, it remains important that the National Micronuntrient Fortification Committee continues to assess and monitor the iodine status of Fiji to ensure sustainable elimination of IDD. Although there is room for improvement, and reinforcement of the iodine program will need to continue, this study shows that progress achieved in the control of IDD in Fiji over the past decade is remarkable.

The importance of iodine in enteral and parenteral nutrition

An expert panel of the American Society for Parenteral and Enteral Nutrition has recommended the addition of iodine to parenteral nutrition. As chlorhexidine replaces iodine-containing disinfectants for intravenous catheter care, iodine deficiency may occur during long-term parenteral nutrition. Infants may be particularly vulnerable because of their small thyroidal iodine store.

Michael B. Zimmermann
Human Nutrition Laboratory, ETH Zürich, Switzerland. From the publication in: Gastroenterology 2009;137(5 Suppl):S36-46.

Infants and children

Experts generally recommend iodine intakes of 30 to 60 µg/kg/day for preterm infants (1). Formula milks for preterm infants contain 20 to 170 µg iodine/L, and, depending on the dietary iodine intake of the mother, breast milk generally contains 50 to 150 µg/L. Because oral absorption of iodine is efficient and oral iodine bioavailability is typically 90-95%, iodine dosages via the enteral (oral) or parenteral (intravenous) route should be nearly equivalent. However, commercially available parenteral nutrition solutions contain much less iodine than breast milk or preterm formula milks. U.S. and European clinical nutrition societies recommend parenteral iodine intakes of 1 µg/kg body weight/day (2,3).

This conservative recommendation assumes parenterally-fed infants will absorb iodine through the skin from topical iodinated disinfectants, and also receive small amounts of adventitious iodine in other infusions. Frequent use iodinated antiseptics in infants can result in high rates of transcutaneous absorption of iodine, iodine excess and neonatal hypothyroidism (4).

But because of concerns over possible iodine excess, and the potential advantages of chlorhexidine-based antiseptics

(5), use of iodinated antiseptics in infants may be decreasing, putting infants at risk of iodine deficiency. If parentally-fed preterm infants are not exposed to adventitious sources of iodine, they may receive only 1-3 µg iodine/kg body weight/day, and become iodine deficient. Iodine deficiency should be avoided during this period because it may transiently lower thyroid hormone levels in the first weeks of life, and transient hypothyroxinemia in preterm infants has been linked to impaired neurodevelopment (6). A daily dose of 1 µg iodine/kg body weight is also recommended for older children receiving PN, but this is likely to be too low for many; a recent study in 15 children on long-term PN found most were iodine deficient (7). If needed, parenteral trace element additives containing iodine are available for pediatric use [e.g. Peditrace® solution (Fresenius Kabi, Bad Homburg, Germany)] which contain potassium iodide.

Adults

Commercially-available products for enteral nutrition generally supply 75-110 µg iodine/serving. Daily iodine requirements in adult patients receiving total enteral nutrition or total PN are estimated to be 70-150 µg (8). However, most PN formulations do not contain iodine. Iodine deficiency is not likely to occur because of cutaneous absorption from iodine containing disinfectants and other adventitious sources of iodine. It has been suggested that thyroidal iodine stores are often adequate to meet the needs of patients requiring total PN for less than 3 months; in iodine-sufficient adults, thyroidal iodine content is 15-20 mg. Also, many individuals on long-term PN are able to eat and drink limited amounts and have a functioning duodenum and thus may absorb dietary iodine. Table 1 summarizes recommendations for iodine intake by age group for patients during parenteral nutrition.

If needed, intravenous sodium iodide solutions are available. For example, Iodopen® (APP Pharmaceuticals, Schaumberg, IL,USA) contains 100 µg iodine/mL. According to the manufacturer's specifications, the usual adult dosage for prophylaxis or treatment of iodine deficiency is 1 to 2 µg iodine/kg of body weight/day. For children and pregnant/lactating women, the recommended dosage is 2 to 3 µg iodine/ kg of body weight/day.

In conclusion, iodine requirements for individuals on long-term PN should be better defined, particularly when chlorhexidine-based antiseptics are used in place of iodinated antiseptics. If it is demonstrated that there is increased risk of iodine deficiency in such patients, the possible need for revision of current PN iodine guidelines should be considered.

Table 1: **Recommendations for daily iodine intake during parenteral nutrition**

Age group	ASCN (ref.2) [a,c]	ESPGHAN/ESPEN (ref.3) [b,c]	AGA (ref. 8) [d]
Infants and children	1 µg/kg body weight	1 µg/kg body weight	
Adults	–	–	70–140 µg

[a] Subcommittee on Pediatric Parenteral Nutrient Requirements from the Committee on Clinical Practice Issues of the American Society for Clinical Nutrition (ASCN).
[b] European Society of Paediatric Gastroenterology, Hepatology and Nutrition (ESPGHAN) and the European Society for Clinical Nutrition and Metabolism (ESPEN).
[c] Assumes parenterally-fed infants and children will absorb iodine through the skin from topical iodinated disinfectants and also receive small amounts of adventitious iodine in other infusions.
[d] American Gastroenterological Association (AGA).

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Thyroglobulin is a useful indicator of even mild iodine deficiency in adults

WHO/ICCICC/UNICEF currently recommend using thyroglobulin as a indicator of iodine status in children. A new Danish study suggests it is also useful in adults.

Michael Zimmermann ICCIDD Office for Western and Central Europe

In measuring the iodine status of a population, the recommended measures are primarily urinary iodine (UI) concentration and thyroid size. UI concentration reflects the recent (days) iodine intake but does not give any information about thyroid dysfunction. Thyroid volume, on the other hand, reflects not only current iodine status, but also iodine status in the preceding years, perhaps even lifetime iodine exposure. Thyroglobulin (Tg), a thyroid-specific protein and precursor in the synthesis of thyroid hormones, has been suggested as a marker of iodine deficiency that would be intermediate between these two (1). Serum Tg increases with increasing thyroid mass (goiter) and/or increased TSH stimulation, and appears to respond to changes in iodine intake within weeks. With the development of a stable dried whole-blood spot Tg assay, the measurement of Tg has become possible even in remote areas, and a normal reference range for school-age children has been established (2).

In a previous Danish study, Tg was found to be a sensitive marker of iodine deficiency with higher Tg values in an area with moderate iodine deficiency compared with an area with mild iodine deficiency (3). In a recent study by Pernille Vejbjerg and co-workers (4) from Bispebjerg University Hospital, Copenhagen, Denmark, the aim was to further describe Tg as a marker of iodine status on a population level with comparison to thyroid volume, and to evaluate the effect on Tg of the Danish salt iodization program.

Two cross-sectional studies were performed before (1997–1998, n=4649) and after (2004–2005, n=3570) the start of the Danish iodization program in two areas with mild and moderate iodine deficiency. Serum Tg was measured and thyroid volume was measured by ultrasonography. The median UI increased by 40–45 μg/l after iodization in both areas and were 108 μg/l in Copenhagen and 93 μg/l in Aalborg, suggesting the areas were iodine sufficient and mildly iodine deficient, respectively, according to WHO.

Before iodization, the median serum Tg was significantly higher in moderate than in mild iodine deficiency. Iodization led to a lower serum Tg in all examined age groups. The overall median serum Tg decreased from 10.9 to 8.7 μg/l ($P<0.001$) in the area with previous

Figure 1. Median serum thyroglobulin (μg/l) and inter-quartile range (whiskers) before (n=4649) and 4 years after (n=3570) iodization of salt in two regions of Denmark with mild and moderate iodine deficiency.

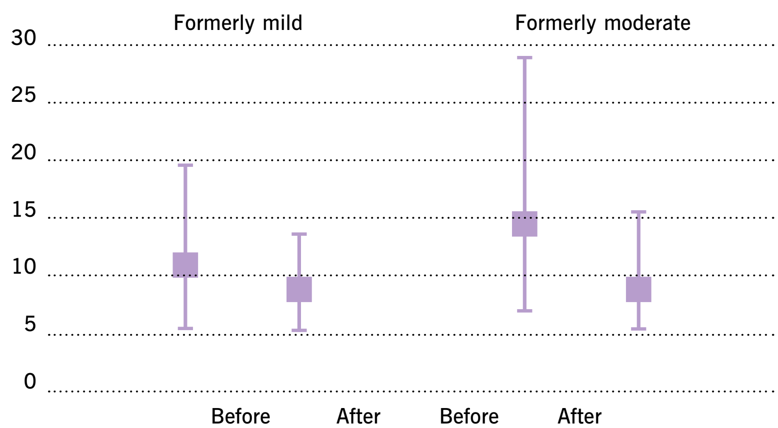
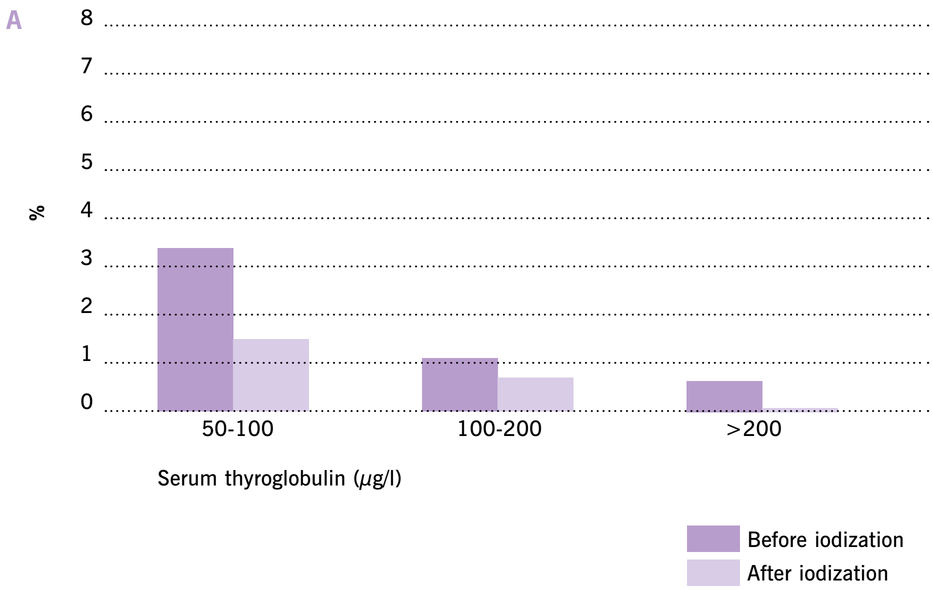
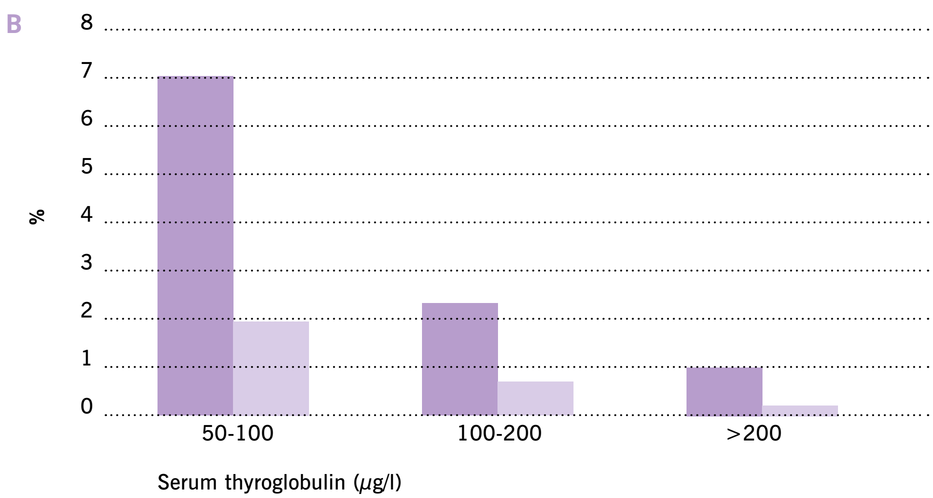


Figure 2: **The prevelance of elevated serum thyroglobulin in three classes before (n=4649) and 4 years after (n=3570) iodization of salt in two regions of Denmark with mild (A) and moderate (B) iodine deficiency.**





mild iodine deficiency and from 14.6 to 8.9 μg/l (P<0.001) in the area with formerly moderate iodine deficiency (Figure 1). The preiodization difference in Tg level between the regions was eliminated. The prevalence of Tg above the suggested reference limit (40 μg/l) decreased from 11.3 to 3.7% (P<0.0001) (Figure). Tg demonstrated a higher efficacy than thyroid volume to show a difference between pre- and post-iodization values.

It is uncertain if it is necessary to perform a concurrent anti-Tg antibody (TgAb) measurement to control potential assay interference caused by TgAb. Although potential interference may depend on the Tg assay used, this Danish study in adults and previous studies in children (5) suggest that measurement of TgAb is unnecessary when Tg is used in a population context. Thus, this new study indicates serum Tg is a suitable marker of iodine nutrition status in adult populations.

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PERSONAL STORIES

An Indonesian policeman joins the fight against IDD

REMBANG, Indonesia, 13 November 2009 – Police officer Pak Sunandar has become expert in a skill not commonly practiced amongst law enforcement officers: iodine titration.

"I'm already used to doing this," he says, swirling a beaker filled with pur ple fluid. Since 2006, Mr. Sunandar and his colleagues on the local law enforcement team have tested the level of iodine in salt samples from markets and salt producers in Indonesia's Rembang District.

Mr. Sunandar was one of the founding members of Rembang's Iodine Deficiency Disorders Task Force, a team that promotes universal salt iodization. He knows iodine deficiency is the primary cause of preventable mental retardation and brain damage, having the most devastating impact on the brain of the developing fetus and young children in the first few years of life.

UNICEF and a diverse group of public- and private-sector organizations worldwide are working to eliminate iodine deficiency in Indonesia through universal salt iodization, an effective, low-cost intervention. In Rembang District, UNICEF has been supporting a major salt iodization drive since 2003 with the help of local authorities, who have managed the various initiatives to increase consumption and ensure compliance with iodization regulations.

One of the drive's key goals is to raise community awareness through mass media channels, interpersonal communication and routine testing of salt in households, schools and small shops. Teams of local health volunteers have been invaluable to this effort. The volunteers go house to house to test salt supplies and hold monthly meetings at health clinics to teach mothers of young children about the benefits of iodized salt.

Under the guidance of the task force, Mr. Sunandar's team tackles the supply side of the equation, enforcing the local law on mandatory salt iodization. At the beginning of its operation, in 2006, the team confiscated non-iodized salt from vendors in the market and replaced it with iodized salt. Vendors were also warned that the penalty for selling non-iodized salt can amount to $5,000 in fines or up to three years in detention.

This approach led the district's vendors to procure and sell only iodized salt in Rembang's markets.The task force also provided technical assistance to Rembang's salt producers and conducted regular testing of iodized salt at the points of production – thus ensuring that producers were following local laws.

Mr. Sunandar says he enjoys his job because he knows that iodized salt is necessary for the health and development of Rembang's future generations. He has even traveled to other provinces to advise local authorities on salt iodization law enforcement.

Meetings and Announcements

Asia-Oceania Thyroid Association Confers 2009 Prize Lecture to Fereidoun Azizi

ICCIDD Regional Coordinator for the Middle East & North Africa Fereidoun Azizi of Tehran, Iran, received the Nagataki Prize given by the Asia-Oceania Thyroid Association during its 9th Congress held in Nagoya, Japan November 1-4, 2009. The Nagataki Prize is one of the two AOTA prize lectures conferred on a non-Japanese physician or scientist delivered during its congresses held every 2 years. The topic of Dr Azizi's prize-winning lecture is "Thyroid Disease in Pregnancy & Lactation."

Prof Fereidoun Azizi is the Head of the Endocrine Research Center of the Shahid Behesti University of Medical Sciences in Tehran. He has written numerous articles on iodine deficiency disorders. There were 7 abstracts from his group that were accepted for the AOTA Congress.

Mandatory fortification of bread with iodized salt begins in Australia

Mandatory fortification of bread with iodized salt came into force in New Zealand on 27 September 2009.

The essential nutrient iodine will also be added to bread, through the addition of iodized salt, in Australia from 9 October 2009 to help address the re-emergence of iodine deficiency across most of the population. Dr Paul Brent, Chief Scientist for Food Standards Australia New Zealand (FSANZ), said this initiative will address this important public health issue. 'Iodine is essential for the healthy function of the thyroid gland to help it produce hormones that regulate metabolism, including the regulation of body temperature. Most people need only a small amount a day but we need iodine regularly because we cannot store large amounts in the body,' Dr Brent said. 'Iodine can be found in many foods, but much of the Australian and New Zealand food supply is low in iodine as our ancient soils lack this important nutrient. In the past some of our iodine came from iodized table salt but now many of us are correctly following healthy eating recommendations not to add salt at the table or when cooking. This has contributed to widespread iodine deficiency throughout the population. The mandatory iodine fortification regulation requires the replacement of the existing salt in bread with iodized salt. This is preferable to people adding extra iodized salt to their food. The only exception is organic bread which is not required to contain iodine because of the rules about organic food.

'We chose to add iodised salt to bread as it is a commonly eaten food. However, we recognize that some people may not eat bread. Other sources of iodine in the diet, in addition to the fortified bread, include seafood, fish, dairy products, and eggs. If you are concerned about getting enough iodine in your diet, or if you are planning a pregnancy or breastfeeding, we suggest you consult your doctor or health professional for advice as you may need iodine supplements. In developing mandatory iodine fortification, FSANZ set up an Iodine Scientific Advisory Group which included experts in a variety of fields. Mandatory iodine fortification is expected to reduce inadequate iodine intakes from 43% to less than 5% in the Australian population. The increase in iodine intake is about the same as the iodine content of a large glass of milk and safe even for iodine sensitive individuals,' Dr Brent concluded.

PAHO panel declares no conflict between salt iodization and salt reduction efforts

In Washington, D.C. on November 3, 2009, a panel hosted by the Pan American Health Organization (PAHO) representing the ICCIDD, US AID, Health Canada, PAHO, US FDA and the International Life Sciences Institute (ILSI) affirmed unanimously that there is no conflict between the global campaign to iodize salt and efforts in many countries to moderate salt intake levels.

Representing ICCIDD was Americas Regional Coordinator Eduardo Pretell, former Minister of Health of Peru. Pretell explained that as salt intake levels may vary, or as the iodine contribution of iodized salt changes within the overall diet, salt iodization programs have proved they can simply and easily adjust the level of iodine fortification. He emphasized the necessity of systematic monitoring of iodine sufficiency either through measuring the household use of iodized salt or, better, through regular population surveys of urinary iodine excretion.

Pretell's comments were amplified by Dr. Omar Dary from US AID who spoke generally on micronutrient fortification, but chose virtually all his examples from salt iodization initiatives. Dary explained that salt is the ideal carrier for iodine and other vital nutrients because its intake is consistent and predictable. He warned that the U.S. is at risk of iodine deficiency, urged American food processors to use iodized salt and reiterated Dr. Pretell's insistence that monitoring is the key to success in salt iodization. The importance of Dr. Dary's advocacy for food processors to use iodized salt was brought home by Dr. Eric Hentges, president of ILSI, who presented new data confirming that, in the U.S., about three-fourths of salt is consumed as part of processed foods (none of which is iodized).

Kenya lowers iodine level in iodized salt

Responding to data showing excess iodine levels in Kenya, the country has enacted new regulations which reduce the level of iodine from 168.5 mg/kg to between 50 and 84 ppm. As quoted in Business Daily on November 5 2009 in Nairobi, local salt producers say adjusting to the lower level will be simple and they are pleased the lower levels will save them the cost of this „expensive but extremely essential ingredient."

Abstracts

Estimation of iodine intake from various urinary iodine measurements in population studies.
Iodine intake is often measured by a surrogate measure, namely urine iodine excretion as almost all ingested iodine is excreted in the urine. However, the methods for urine collection and the reporting of the results vary. These methods, and their advantages and disadvantages, are considered in this article. There are two main ways in which urine can be collected for iodine measurement. The first is the collection of urine over a period, usually 24 hours. The second is the collection of a spot urinary sample. As 24-hour collections are difficult to perform for large number of persons, single spot urinary samples are preferable to the 24-hour urinary collections in population studies. The iodine concentration in urine depends on the intake of both iodine and fluid. This, and the fact that there is a considerable variability in the daily iodine intake, makes the iodine measurement in spot urine samples unreliable for evaluating individuals for iodine deficiency. In populations of at least 500 subjects, the median value of spot urinary iodine concentration is a reliable measure of the iodine intake in the population as there is a leveling out of the day-to-day variation in iodine intake and urinary volume.
Vejbjerg P et al. Thyroid. 2009;19(11):1281-6.

Urine Iodine Levels in Preeclamptic and Normal Pregnant Women.
The aim of this study was to investigate the urine iodine (UI) concentration in women with severe preeclampsia (n=40) and in healthy women (n=18) in Erzurum, Turkey. The median UI women with severe preeclampsia was 43 µg/L, lower than 209 µg/L in healthy pregnant women. Blood magnesium concentration was found to be 1.63 +/- 0.05 mg/dL for women with severe preeclampsia, lower than that of healthy pregnant women (1.87 +/- 0.05 mg/dL). There was a positive correlation between urinary iodine level and blood magnesium level in pregnant women with preeclampsia. However, there was no correlation between urinary iodine level and blood magnesium level in healthy pregnant women. T3 and free T3 levels were significantly higher in women with severe preeclampsia than in healthy pregnant women.
Gulaboglu M, et al. Biol Trace Elem Res. 2009 Oct 29. [Epub ahead of print]

Subclinical hypothyroidism in Korean preterm infants associated with high levels of iodine in breast milk.
The dietary iodine intake of lactating women has been reported to be high in Korea. The aim of this study was to assess iodine balance and to determine its relationship with thyroid function in preterm infants. Thyroid functions of preterm infants born at 34 wk gestation or less were evaluated in the first (n = 31) and third (n = 19) weeks. Mothers' breast milk (BM) and random urine samples of infants were taken on the same days for thyroid function tests. Iodine concentrations in BM were very high (198-8484 µg/liter), and one third of the infants had an iodine intake of more than 100 µg/kg per day at the third week after birth (excessive iodine intake group). At that time, the levels of TSH were positively correlated with urinary iodine. The frequencies of subclinical hypothyroidism were high in the excessive iodine intake group at the third and sixth weeks. Excessive iodine intake from BM contributed to subclinical hypothyroidism in these preterm Korean infants.
Chung HR et al. J Clin Endocrinol Metab. 2009;94(11):4444-7

Lower prevalence of mild hyperthyroidism related to a higher iodine intake in the population: prospective study of a mandatory iodization programme.
The authors evaluated the influence of a higher iodine intake on thyroid hormone levels and the prevalence of thyroid dysfunction in the Danish population. Two cross-sectional studies were analyzed. In all, 8219 individuals were examined before (n = 4649) or after (n = 3570) the introduction of a mandatory iodization program in 2000 in two regions with established mild and moderate iodine deficiency. The authors found a higher median serum TSH after the introduction of mandatory iodization of salt: 1.51 mU/l vs. 1.30 mU/l before iodization. There was a lower prevalence of mild hyperthyroidism and a tendency towards a lower prevalence of overt hyperthyroidism. The prevalence of mild hypothyroidism increased, most pronounced among young women after iodization. Conversely, there was a lower prevalence of undiagnosed overt hypothyroidism. However, when currently treated participants were included, the prevalence of hypothyroidism increased after iodization in the area with formerly mild iodine deficiency. In conclusion, a change in pattern of thyroid dysfunction was seen in relation to mandatory iodization of salt. There was no rise in the prevalence of hyperthyroidism and the prevalence of mild hyperthyroidism was halved. Conversely, prevalence of hypothyroidism increased.
Vejbjerg P, et al. Clin Endocrinol (Oxf). 2009;71(3):440-5.

Maternal iodine status and neonatal thyroid-stimulating hormone concentration: a community survey in Songkhla, southern Thailand.
To study aim was to determine iodine intake and urinary iodine excretion (UIE) in a group of pregnant Thai women (n=236) and the concentration of thyroid-stimulating hormone (TSH) in their neonates in southern Thailand. A quarter of the participants lacked knowledge of iodine and the prevention of iodine deficiency, although 70 % used iodized salt. The median iodine intake in the three districts was 205-240 µg/d, with 53-74 % of pregnant women having iodine intake <250 µg/d. The median UIE in the three districts was 51-106 µg/l, with 24-35 % having UIE < 50 µg/l. The mean neonatal TSH was 2.40 mU/l, with 8.9 % of neonates having TSH > 5 mU/l. The authors concluded that the women and their newborns are at risk of mild iodine deficiency. Education regarding the importance of iodine supplements and the promotion of iodized salt should be added to Thai national health-care policies. *Jaruratanasirikul S et al. Public Health Nutr. 2009;12(12):2279-84.*

Iodine status and thyroid function of 330 pregnant women from Nice area assessed during the second part of pregnancy
The authors studied 330 pregnant women in the third trimester of pregnancy. Median UIE was 64 µg/l, reflecting inadequate iodine intake in our population. According to the UIE threshold used for diagnosis (100 to 150 µg/l), ID was present in 74.3% to 85.8% of women; 5.4% had excessive iodine intake, including one taking iodine fortified tablets. Only 8.8% had adequate intake, suggesting that current strategies to eradicate ID are inefficient in our country. Median fT4 was 12.3 pmol/l (8-20.1) and TSH 1.93 mUI/l (0.24-6.57). We used different thresholds proposed in the literature to diagnose: hypothyroxinemia: 41.2% were less than 12pmol/l, 10% less than 10.3 pmol/l and 1.8% less than 9 pmol/l (lower limit of our reference range); subclinical hypothyroidism: 26.3% had TSH greater than 2.5 or 3.9% greater than 4 mUI/L, 1.2 to 13% had combined low fT4 (<9 pmol/l or <12 pmol/) and higher TSH (>2.5 mUI/l). There was no correlation between UIE and thyroid tests. In conclusion, ID is common in this population and there is a wide range of hypothyroxinemia and subclinical hypothyroidism prevalence.
Hiéronimus S et al. Ann Endocrinol (Paris). 2009;70(4):218-24.

Lifestyle factors related to iodine intakes in French adults.
Among French adults, regression analyses were used to determine correlates of iodine intakes. Usual iodine mean intake was calculated by averaging six 24 h dietary records completed over a 2-year period in females aged 35-60 years (n 2962) and males aged 45-60 years (n 2117). Iodine intakes ranged from 30 to 446 µg/d. The median iodine intake was 150.7 µg/d for males and 131.4 µg/d for females. Overall, 8.5 % of males and 20.3 % of females had intakes <100 µg/d. Alcohol drinkers and smokers tended to have lower iodine intakes than abstainers or non-smokers. Regular physical activity and both intermediate and high education levels were associated with a lower risk of iodine intake of <150 µg/d. These data show a borderline low iodine intake in this middle-aged French population.
Valeix P et al. Public Health Nutr. 2009;12(12):2428-37.

Role of pendrin in iodide balance: going with the flow.
Pendrin is expressed in the apical regions of type B and non-A, non-B kidney intercalated cells, where it mediates Cl(-) absorption and HCO3(-) secretion through apical Cl(-)/HCO3(-) exchange. Since pendrin is a robust I(-) transporter, we asked whether pendrin is upregulated with dietary I(-) restriction and whether it modulates I(-) balance. Thus I(-) balance was determined in pendrin null and in wild-type mice. While pendrin abundance was unchanged when dietary I(-) intake was varied over the physiological range, I(-) balance differed in pendrin null and in wild-type mice. Serum I(-) was lower, while I(-) excretion was higher in pendrin null relative to wild-type mice, consistent with a role of pendrin in renal I(-) absorption. Increased H2O intake enhanced differences between wild-type and pendrin null mice in I(-) balance, suggesting that H2O intake modulates pendrin abundance. As water intake rises, pendrin becomes increasingly critical in the maintenance of Cl(-) and I(-) balance.
Kim YH, et al. Am J Physiol Renal Physiol. 2009;297(4):F1069-79.

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