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Progress against IDD in Afghanistan

Two in three Afghan children are iodine deficient. Iodine deficiency is believed to result in 500,000 babies being born each year in Afghanistan with intellectual impairment, seriously undercutting the intellectual capacity of the entire country.

Afghanistan is emerging from more than two decades of conflict that have ravaged the country and left the public health system in ruins. Although the war that toppled the Taliban government in late 2001 has subsided, the humanitarian crisis in Afghanistan is far from over. Ongoing violence and insecurity continue to put millions of Afghans, many of them children and young women, at high risk for inadequate nutrition and poor health. In the more remote regions of the country, particularly in the southern provinces, delivery of food, medicine, and iodized salt remain unreliable. Afghanistan has the fourth highest level of malnutrition in the world. One in 10 Afghan children is severely malnourished and more than half suffer from stunted growth. Protecting women and children from IDD is vital to the country’s future.
Iodine nutrition in Afghanistan

Iodine deficiency has historically been common in Afghanistan, with early surveys in mountainous districts reporting goiter in 20-63% in children and women. The valleys of the Oxus River in Amu Darya along the country's northern border were particularly endemic, with sporadic cretinism and impaired hearing. Surveys reported goiter rates of 30% in females in Bamyan and Kapissa in 1989, 31% in females and 16% in children in Nangarhar in 1990, and 16% in pregnant women and 19% in schoolchildren in 12 regions of Kabul in 1991-1992.

More recent surveys indicate access to iodized salt remains low, with disparate coverage by region. For example, a 1999 survey in Nangarhar Province found 13% of preschool children and more than 50% of 10-14 y-olds were goitrous. A 2002 survey by the NGO Action Contre la Faim in school age children and adult women in the Panjshir Valley area reported a 50% goiter prevalence. In a Nutrition and Health Survey in Badghis Province in early 2002, there was a high prevalence of goiter. Iodization of salt in this region is difficult as most household salt is in rock salt form and obtained from deposits in western Afghanistan by small harvesters and vendors. Thus, the study concluded iodine intake of women of reproductive age was inadequate, and other methods for increasing dietary iodine be explored, including provision of iodized oil. In mid-2003, it was estimated that only 11% of households had access to iodized salt.

The first national survey was done in 2004. The National Vitamin and Mineral Deficiency Survey measured urinary iodine (UI) concentration in nearly 800 children aged 7-11 years, and over 1000 non-pregnant 15-49 year-old women. Household salt samples were tested for iodine. The median UI level among 7-11 year old children was 49 µg/L. The prevalence of UI <100 µg/L was 72%, and the prevalence of UI <50 µg/L was 51%. The iodine status of women was even less adequate, with a median UI of 42 µg/L. Three quarters of women had a UI <100 µg/L and 58% had a level <50 µg/L. There was a significantly lower proportion of 7-11 year old children in Kabul with UI <100 µg/L compared to the other clusters (55% vs. 75%). Similarly, the proportion of women with UI <100 µg/L in Kabul was significantly lower than the other clusters (57% vs. 78%).

Individuals displaced from their homes by the Afghan conflict are also vulnerable to IDD. A Nutrition and Health Survey in the Maslakh Refugee Camp in Herat in April 2002 found IDD was a serious health problem among women as indicated by the high prevalence of goiter. Less than 50% of households were being given iodized salt in their food rations.

In the 2004 national survey, 28% of Afghan households had detectable iodine in their salt using rapid test kits. Households in rural clusters were much less likely than those in urban clusters to have iodine in their salt (18% vs. 58%). Iodized salt coverage in Kabul was significantly higher than other clusters (75% vs. 25%).

Labeled packages of salt were found in only 32% of households, and of those 286 salt packages, 62% were labeled as “iodized”. Based on rapid tests, 88% of salt samples labeled as “iodized” tested positive for iodine. Of the labeled samples, 67% were produced in Afghanistan, 16% in Iran, and 15% in Pakistan.

Current IDD control efforts

Despite the continuing violence and insecurity, UNICEF, the World Food Program (WFP) and other NGOs are working intensively to reduce malnutrition through supplementary feeding centers, including provision of iodized salt, in local villages and towns. UNICEF, WHO, WFP and non-governmental organizations (e.g. CARE) in Afghanistan are working with public and private organizations in the country (e.g., relevant government ministries and salt producers and importers) to implement programs to fortify salt with iodine. Partners include Afghanistan Ministries of Public Health, Mines and Industries, Food Stuffs and Light Industries, Agriculture and Commerce. UNICEF is also providing technical support on salt iodization to the ministries of Public Health, Industry and Trade.

In May 2006, the Afghan Government launched a new National Strategy for Children at Risk. The strategy, designed by the Ministry of Martyrs, Disabled and Social Affairs, with support from UNICEF and other partners, aims to improve provision of care for the country's most vulnerable and neglected children, who suffer disproportionately from malnutrition and IDD.
A recent multi-media campaign encourages Afghan households to increase their consumption of iodized salt. The campaign, led by the Ministry of Public Health with the support of UNICEF, builds upon a successful increase in the production of iodized salt following the establishment of ten iodized salt plants in Afghanistan since 2003. These plants now have the capacity to meet the population’s requirement of iodized salt for the country is about 88,000 MT/yr. This new information campaign aims to increase demand from households.

With the core message “for a healthy happy nation, use iodized salt every day”, the campaign uses radio and television spots, posters and banners, and point-of-sale information leaflets to show consumers the benefits of iodized salt. It helps consumers recognize genuine iodized salt in the marketplace through the introduction of an official seal that identifies government-approved iodized salt. The ultimate goal is to increase the availability of iodized salt to >85% of the population.

In summary, despite steady progress in the face of continuing violence, Afghanistan remains moderately-to-severely iodine deficient in many regions. If the conflict undercuts the speed of implementing USI in all parts of the country, consideration could be given to supplementation to women and children in high-risk areas. Access to iodine labs also needs to be strengthened.

Although iodized salt production and distribution is increasing, a monitoring program does not yet exist.

“Geographically, Afghanistan belongs in the iodine deficient regions of South and Central Asia,” said United Nations Children’s Fund (UNICEF) Representative in Afghanistan, Dr. Sharad Sapra. “The consequences of IDD can be considered as an emergency that requires immediate action to reduce the suffering of millions of women and children, making the widespread provision of iodized salt all the more critical.”

References

http://www.unicef.org/infobycountry/afghanistan


The women and children of Iraq are caught up in war for the third time in 20 years. The deteriorating conditions brought on by the war and its subsequent civil unrest has had a major health impact. Even before the most recent conflict, many children were highly vulnerable to disease and malnutrition. The latest reports show that acute malnutrition among children under five has nearly doubled in the last two years, and nearly 1 million children under the age of five suffer from chronic malnutrition. Less than half of Iraqi household have access to adequately iodized salt.

Reaching vulnerable women and children continues to be a challenge. Humanitarian work has been crippled by the fact that international aid agencies have been directly targeted and forced to operate from outside the country. “The biggest concern for the children of Iraq today is that we have very little access to them,” says UNICEF’s Director of Emergencies Dan Toole. “Particularly in places of extreme conflict we cannot get to the children to provide them with assistance. There is active warfare going on, areas are cordoned off for military operations and we have no access to those children so that’s the biggest issue.”

Historically, Iraq was an area of severe endemic goiter, with goiter prevalence as high as 95% in some areas. However, a Joint Government of Iraq-UNICEF Overview of the years 1990-2000 reported that iodization of salt began in 1990 and from 1990-1998 only iodized salt was distributed in food rations. Legislation was adopted in 1996 and the action plan reviewed in 1998. The Ministry of Health estimated household consumption of iodized salt increased from 51% in 1997 to nearly 90% in 1999, due to advocacy by UNICEF for the iodization of salt.

Currently, there is no monitoring program, and no recent data on urinary iodine levels or goiter. Iodized salt consumption ranges from 10-90% in various locations, and although it is difficult to accurately estimate, it is thought that currently about 40% of households have access to adequately iodized salt.

To combat iodine and other micro-nutrient deficiencies in Iraq, UNICEF, other UN agencies and NGOs are working to: 1) provide potassium iodate, iodine/salt-mixing machines and salt testing kits to sustain salt iodization, 2) equipment and capacity building for the national flour fortification project, and 3) vitamin A and iron/folic acid supplementation, in an effort to reach nearly 500,000 infants and 700,000 pregnant and lactating women.
In May 2006, supported by the United Nations World Food Programme (WFP) and UNICEF, a comprehensive nutrition survey covering 98 districts and 22,050 rural and urban households was reported. Although the study did not directly assess iodine nutrition, it is likely that its results also reflect current iodine status and access to iodized salt.

Commenting on the study, Roger Wright, UNICEF’s Special Representative for Iraq, lamented that children were confirmed as the major victims of food insecurity. “The chronic malnutrition rate of children in food insecure households was as high as 33%, or one out of every three children malnourished,” he stated. Chronic malnutrition affects the youngest and most vulnerable children, aged 12 months to 23 months, most severely. “This can irreversibly hamper the young child’s optimal mental and cognitive development, not just their physical development,” he said. Acute malnutrition was also of concern, with 9% of Iraqi children being acutely malnourished. The highest rates (12-13%) were again found in children <2 years.

Continuing food insecurity and lack of iodized salt in Iraq cannot be attributed to any one factor, but stems from several causes, including the lingering effects of war and sanctions, plus the ongoing conflict and insecurity.

Severe iodine deficiency in Sudan

Aggravated by armed conflict, IDD remains a major public health problem in Sudan. More than 20% of school-age children are goitrous, and the prevalence reaches 40% in the Darfur region of western Sudan. Only 1% of the population has access to adequately iodized salt.

Izzeldin Hussein ICCIDD Subregional Coordinator, Middle East and North Africa Region

Sudan has a population of 32 million, with six million living in the capital, Khartoum. Over 5 million are infants and children less than 5 years old. Endemic goiter in Sudan was first reported in 1952 in south and southwest Sudan near the Zaire border, as well as in the Northern Province and in Darfur in western Sudan. The southern and western regions of Sudan are currently facing a severe humanitarian crisis, with greater than a million people displaced from their homes and numbers rising daily. Despite a ceasefire signed in early 2005, the armed conflict has continued, and half the displaced population remains inaccessible for humanitarian relief. Many of Sudan’s 15 million children are malnourished and iodine deficient, and the situation of many children and women in the Darfur region is critical.
Sudan. An extensive survey in Darfur province in 1967 of over 17,000 individuals reported a total goiter rate of 57.5%, with 18.5% having large, visible goiters. An investigation into the cause of endemic goitre in Sudan was done in 1971, and plasma iodine concentration was measured in Khartoum and Darfour provinces. The study concluded that the major cause of endemic goiter in Sudan was iodine deficiency.

Several interventions were subsequently introduced in the 1970s in an effort to control IDD, including distribution of potassium iodide tablets to school children in the Darfur area. Also, in selected regions, iodine was added to well water, sugar was fortified with iodine, and supplements of iodized oil were given. In 1989, the Government of Sudan initiated the IDD Control Program using Lipiodol capsules and administration of iodized oil injections for a target population of 1.5 million in the Darfur region.

The National Nutrition Directorate under the Federal Ministry of Health is the focal point and responsible for the IDD control program in Sudan. A comprehensive national survey in 1997 of nearly 41,000 primary school children reported a total goiter rate of 22% (see Table).

### The special needs of the Darfur Region

Up to June 2006, 3.6 million people have been affected by the ongoing crisis in Darfur, with 1.8 million of them children, many of whom have been displaced multiple times through repeated violence. Most communities lack basic medical and nutrition services, and iodine deficiency is endemic. The impact of severe iodine deficiency, together with violence, disease, and malnutrition is debilitating a generation of Sudanese children in this region.

Because of political instability and armed conflict, the production and supply of iodized salt has been deteriorating. The World Food Program (WFP), in association with US Centers for Disease Control and Prevention, the FAO, UNICEF, Save the Children, and the Government of Sudan, conducted an Emergency Food Security and Nutrition Assessment Survey in September 2004 in the Darfur region. The prevalence of visible goiter among women was as high as 25.5%. Iodized salt is currently supplied to the Darfur area and Southern Sudan under the WFP. In southern Sudan, with population of about 5 million, salt requirements are ca. 10,000 tons per year, and the WFP has been supplying iodized salt to about 2.7 million people in Darfur region.

### Salt production in Sudan

A federal government decree in 1994 required all edible salt to be iodized at a level of 50 ppm using potassium iodate. The salt fortification level was later reduced to 25–35 ppm. However, despite this important legislation, there has been little progress in salt iodization. Sudan produces ca. 140,000 metric tons of salt annually. However, only about 3000 tons are iodized. UNICEF estimates that currently only 1% of households have access to adequately iodized salt.

In Sudan, the main source of salt is a 56 km long coastal region of the Red Sea. Smaller amounts are produced in the northern coastal regions, but these are not considered major production sites. The Sudanese requirement for iodized salt is in the range of 100,000 to 112,000 tons yearly, based on an estimated per capita intake of 4 g/day. Salt sold in the informal markets is commonly packed by shopkeepers in bags of 200 and 500 g. The price in Khartoum

### Prevalence of goiter among school children in Sudan

<table>
<thead>
<tr>
<th>Region</th>
<th>n</th>
<th>Goiter rate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Northern</td>
<td>5773</td>
<td>38</td>
</tr>
<tr>
<td>Eastern</td>
<td>7937</td>
<td>8</td>
</tr>
<tr>
<td>Khartoum</td>
<td>8165</td>
<td>5</td>
</tr>
<tr>
<td>Central</td>
<td>7865</td>
<td>23</td>
</tr>
<tr>
<td>Darfur</td>
<td>4835</td>
<td>28</td>
</tr>
<tr>
<td>Kordofan</td>
<td>4503</td>
<td>39</td>
</tr>
<tr>
<td>Upper Nile</td>
<td>1874</td>
<td>42</td>
</tr>
<tr>
<td>Total</td>
<td>40,922</td>
<td>22</td>
</tr>
</tbody>
</table>
for a 500 g portion is $0.25. From the production sites, 70-85 kg bags are distributed mainly by road to Khartoum and other regional centers. Distribution to rural areas, and particularly to mountainous regions, is limited, in part by the high costs of transport. In 1993, UNICEF supplied the two major producers with iodization equipment, generators and laboratory equipment.

In a 2005 status report, it was estimated that Sudan’s annual salt needs are about 140,000 tons for edible use, including livestock requirements, a further 20,000 tons for caustic lye production and 5,000 tons for canning. The total domestic demand of 165,000 tons/year is currently met by indigenous salt sources. No salt is imported and small amounts are exported to Ethiopia, Chad, and Central Africa. Raw salt in Sudan is produced by solar evaporation, and most of the production units are owned by the private sector. However, salt quality is generally low, due to the lack of proper techniques of salt manufacturing and trained personnel. Although not operational in all cases, iodization plants exist with equipment in Obeit city in the Red Sea region, and Nyala in the Darfur region. All the salt works along the Red Sea coast use sea brine taken directly from the sea or creeks. The quality of salt suffers due to charging of crystallizers with low-density brine and non-elimination of bitterns and recharging the bittern into the sea.

Salt produced in Port Sudan is transported by road, and the additional transportation cost increases the price of salt in Khartoum by approximately 10-fold. The raw salt is distributed in crystal form, packed in jute bags, and supplied by the traders. It is crushed by millers in several towns. The crushed salt is then packed in second-hand high-density polyethylene bags, and sold to retailers. The retailers sell the crushed salt at prices varying from 50 SD to 100 SD per kilo, either loose or packed in unmarked plastic pouches. Refined salt is also retailed at 77 SD/kg. A number of Government levies on salt seem to be one of the reasons responsible for the high cost of salt to the consumer in Sudan: the levies and taxes amount to 100% to 137% of the cost of salt.

**Challenges to IDD control**

Major challenges stand in the way of universal salt iodization in Sudan. More than a decade after adopting USI as the strategy for combating IDD, Sudan has not been able to produce sufficient quantities of iodized salt. There are many potential reasons for this lack of progress. A major one is that the salt producers are not trained and not aware of proper salt producing and processing techniques, and they are profit-oriented rather than quality-oriented. There is no legislation that compels them to produce and sell iodized salt. Secondly, there is no system in place to monitor production and distribution, and no authority delegated to a Ministry or Department for oversight. As a result, the unrefined crystal salt usually sold by salt producers ends up with millers, where the crystals are crushed and sold un-iodized to retailers.
Major success stories in the global fight against IDD: Iran and China

With an estimated population of 71.4 million, Iran is the most populous country in the Middle East and North African Region, and the 16th most populous in the world. With an estimated population of 1.3 billion, including 86 million children under 5 years of age, China is the most populous country in the world, and China’s current process of "modernization" is of a speed, scale and scope probably unprecedented in human history. The following reports, prepared by Chen Zupei, ICCIDD Regional Coordinator, China and Eastern Asia region, and Fereidoun Azizi, ICCIDD Regional Coordinator, Middle Eastern Region, highlight how sustained elimination of IDD was achieved in these countries.

Sustained elimination of iodine deficiency in the Islamic Republic of Iran: an update

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Historically, IDD was endemic in many areas of Iran. The first epidemiological assessment of goiter, conducted in 1969, found iodine deficiency was common in most cities and in the rural regions at the foot of the Alborz and Zagross mountains, with the prevalence of goiter ranging from 10 to 60% in the provinces (1). However, no long-term preventive measures were taken. In 1983-84, after a gap of 15 years, Azizi et al. reported that populations of Shahriar (2), Tehran (3) and the south-central province of Kohkyloyeh-BoyerAhmad (4) had low median urinary iodine (UI) excretion and hyperendemic goiter. Subsequently, severe IDD was found in many villages located in the north of Tehran city (5,6).

In 1995, thyroid status and neurologic, psychometric and auditory functions were reported by Azizi et al (5) in presumably normal schoolchildren, aged 6 to 16 years from three iodine deficient areas in Iran. This study demonstrated that mild to moderate growth retardation and neurological, auditory and psychomotor impairments were present in apparently normal subjects residing in areas of iodine deficiency (5). In a subsequent study of schoolchildren from three areas with different degrees of iodine deficiency, the results indicated alteration in psychomotor development may occur in children with moderate iodine deficiency despite normal physical growth (6).
Before iodine supplementation, median UI in all provinces was <100 µg/L, and was even 20 µg/L in many regions (Table 1).

Table 1: Median urinary iodine concentration in selected endemic and hyperendemic regions in Iran before iodized salt distribution.

<table>
<thead>
<tr>
<th>Location</th>
<th>Province</th>
<th>Urinary iodine (µg/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kiga</td>
<td>Tehran (rural)</td>
<td>20±11</td>
</tr>
<tr>
<td>Randan</td>
<td>Tehran (rural)</td>
<td>12±5</td>
</tr>
<tr>
<td>Zagoon</td>
<td>Tehran (rural)</td>
<td>18±10</td>
</tr>
<tr>
<td>Keshar</td>
<td>Tehran (rural)</td>
<td>19±10</td>
</tr>
<tr>
<td>Tehran City</td>
<td>Tehran (urban)</td>
<td>39±19</td>
</tr>
<tr>
<td>Shahriar</td>
<td>Tehran (rural &amp; urban)</td>
<td>71±39</td>
</tr>
<tr>
<td>Hanna</td>
<td>Esfahan (rural)</td>
<td>40±21</td>
</tr>
<tr>
<td>Yasuj</td>
<td>Boyer-Ahmand (rural)</td>
<td>34±39</td>
</tr>
<tr>
<td>Doruhani</td>
<td>Boyer-Ahmand (rural)</td>
<td>24±17</td>
</tr>
</tbody>
</table>

These findings prompted the Ministry of Health and Medical Education to form the Iranian National Committee for Control of IDD (INCCIDD) in 1988, including government, media, industry and academic partners. Since 1989, IDD has been a health priority in the country. The INCCIDD prepared a national plan with detailed objectives and strategies for IDD control. Salt iodization began in 1990. The production, distribution and consumption of iodized salt increased gradually, with a national survey in 1993 showing <50% of households were consuming iodized salt. INCCIDD then announced universal salt iodization (USI) and all salt factories were obliged by law to produce only iodized salt for household use. Also, and enhanced and vigorous system of evaluation and monitoring was applied.

The IDD prevention program in Iran (7,8)

Under the National IDD Elimination Committee, a subcommittee for production and distribution related to USI activities:

- Identified related bodies and their functions;
- Defined guidelines and activities for each section and the tasks required at different levels;
- Developed training material and conducted the required training for salt producers, laboratory and health care workers.

Measures taken for USI monitoring include:

At production level:

- Factories
  - Daily sampling of iodized salt from 8-10 lines, to assess the level of iodine with titration and registration in the logbook.

Food Safety Department

- Inspection of iodized salt factories including:
  - Appropriate manufacturing
  - Labeling
  - Potassium iodate packages
  - Storage of iodized salt
  - Laboratory log books
- Random sampling of iodized salt from factories and dispatch to the provincial food laboratory

Food and Drug Laboratory

- Recording the results on special iodized salt assessment forms (ISAF) and sending these to national level officials through the provincial IDD committee
- Assuring capability of the salt factory technician to perform titration and their retraining if necessary

At distribution level (urban areas)

By the environmental health specialists:

- Sampling of existing salt in the market every three months by environmental health workers and analysis at the Food Laboratory;
- Recording the results on the ISAF by the provincial food laboratories and its relaying to national level officials through the provincial IDD committee
- Inspection of iodized salt at all sites where food is provided (restaurants, hospitals, day care centers, and canteens) with rapid test kits
- If tests show lack of iodine in the salt, importance of iodized salt is stressed and source of the defective salt is traced
- Results of this testing is relayed to the national level

Nutrition Department

- Computer data entry of all ISAFs from the provinces
- Half-yearly reports generated and feedback provided (IDD committees, salt producers, Food Inspection Department, National Food Laboratory, Environmental Health Dept)
- Same procedures followed as with the market salt and feedback sent to related bodies

Integrated activities in rural areas

- Testing of salt with rapid test kits and education about importance of iodized salt provided by the Behvarz at the Health House. Testing is done in:
  - Local shops
  - All households (once a year)
  - Schools (every 6 months)
- Results of statistics of iodized salt utilization in households registered on special stickers on the Vital Horoscope
Health technicians supervise Behvarz activities using a checklist.

**Rural checklists include:**
- Is iodized salt available in the rural market?
- Has the Behvarz put the sticker of the iodized salt on the Vital Horoscope of the village?
- Have the schoolchildren been taught about the benefits of iodized salt?
- Are village shopkeepers aware of the reason why they should sell exclusively iodized salt?

**National labs, quality assurance**
- Bi-annually, the National Food Laboratory sends blind samples of iodized salt to provincial food labs to ensure precision of their tests.
- Necessary training provided to laboratories with low performance ratings.
- Surveys are done to monitor USI.
- Questions on IDD are integrated into other public health surveys.
- Iodized salt utilization among households in rural and urban areas is surveyed.
- Each year, UI is measured in 240 schoolchildren (8-10 yrs) in each province.

The 2nd National Survey in 1996

In 1996, the second national survey was conducted 7 years after the initiation of iodized salt production, and 2 years after the implementation of the new law for mandatory consumption of iodized salt in households (9). The total number of 8-10 y-old children surveyed was 36178 of which 2917 had urinary iodine assessments. Approximately half of the schoolchildren in each province were from rural regions. In 16 of 26 provinces, the total goiter rate was more than 40% in boys and over 50% in girls. However, the majority of schoolchildren had small, grade 1 goiters. There was no significant difference in goiter prevalence between boys and girls or schoolchildren of rural and urban regions. In all 2917 schoolchildren, median urinary iodine excretion was 205 µg/L. Over 85% of children had UI >100 µg/L.

The 3rd National Survey in 2001

The third national survey was conducted in 2001. More than 33000 schoolchildren were examined from all 28 provinces by inspection and palpation methods for goiter, and more than 3300 urine samples were collected. Ultrasound was used to measure thyroid size of 7-10 yr Tehranian children.

The total goiter rate was 9.8%. The total goiter rate in Ilam, Chahar Mahal Bakhtiari, Hamadan, Khoozestan, Zanjan, Semnan, Sistan Baloochestan, Fars, Qom, Kordestan, Kerman, Kermanshah, Golestan and Gilan was >10%. The prevalence of goiter grade 2 in 22 provinces was <5% and in 6 other provinces (Booshehr, Chahar Mahal Bakhtiari, Sistan Baloochestan, Qom, Kordestan, Kermanshah) the goiter rate was <10%. These rates were significantly lower than the corre-
sponding rates in the 1996 study. Figure 2 depicts the prevalence of goiter in different provinces in 1996 and 2001 and indicates significant reduction in total goiter rate in all provinces during a 5-year period. The reduction was greatest in formerly hyperendemic regions including Ilam, Hamedan, Kohkiloyeh Boyerahmed and Kermanshah.

Median UI (range) and 95% CI were 165 (18-410) and 183-190 µg/L, respectively. UI values <100, 100-199, and >200 µg/L were present in 19.7%, 45.7%, and 34.7% of children, respectively. Frequency distribution of low (mild, moderate, and severe) and adequate iodine intakes in various provinces according to their median UI levels are shown in Table 2. Median UI concentrations increased significantly in most provinces, compared to 1996.

Use of iodized salt (1994 to 2004)

National surveys in 1996, 1998, 2000 and 2004 have shown that more than 95% of the households were consuming iodized salt (9) (Fig 3). The results of the survey done in the year 2000 showed that 94.5% in urban and 91.8% in rural areas were consuming iodized salt.

The impact of iodine prophylaxis in severely iodine deficient Iranian schoolchildren

In villages in Northwest Tehran in 1989, before iodized salt was introduced, iodine deficiency was severe. Ten years afterwards, there were significant decreases in the goiter rate, and urinary iodine increased (Table 3). In 1989, many of schoolchildren were hypothyroid. For example, the prevalence of serum TSH between 5 and 10 µU/ml was 30% in Kiga and 22% in Randan, and the prevalence >10 µU/ml was 40% in Kiga and 24% in Keshar, respectively. In sharp contrast, in 1999, no child had a TSH ≥5.0 µU/ml (12).
Impact on child intelligence

Comparison of the intelligence quotient (IQ) in 1989 and 1999 in four villages is shown in Table 4. An increase in IQ was found in 3 of 4 villages; the greatest increase was 10 points in Randan.

Based on results of the national monitoring programs in 1996 and 2001, it was concluded that Iran has an optimal and sustainable program for control of IDD, including meeting the following programmatic indicators:

- An effective and functional national body (IDD Nation Committee), responsible to the government for the elimination of IDD, has been active since 1989. This multidisciplinary council includes the relevant fields of nutrition, medicine, industry and education etc.
- Political commitment to universal salt iodization and the elimination of IDD was made in 1989 and is sustainable.
- A responsible executive officer has been appointed for the IDD control programme, since 1990.
- Universal salt iodization has been legalized since 1992. The Ministry of Industry has announced that salt factories should produce only iodized salt for household use.
- I.R. Iran has been committed to assessment and reassessment of progress made in the elimination of IDD, with access to laboratories able to provide data on salt and urinary iodine.
- Public education programs and social mobilization on the importance of IDD and the consumption of iodized salt have been vigorously followed in the last 11 years. These programs have been integrated into the health network, with full participation of Behvarz (rural health workers) in education and monitoring.

### Table 2: Comparison of mean and the frequency of IQ in schoolchildren of villages before (1989) and 10 years after iodine supplementation (1999)

<table>
<thead>
<tr>
<th>Location</th>
<th>Year</th>
<th>mean±SD</th>
<th>Q &gt;100</th>
<th>90-100</th>
<th>70-90</th>
<th>&gt;70</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kiga</td>
<td>1989</td>
<td>95±11</td>
<td>36</td>
<td>29</td>
<td>35</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>1999</td>
<td>95±11</td>
<td>36</td>
<td>29</td>
<td>35</td>
<td>0</td>
</tr>
<tr>
<td>Keshar</td>
<td>1989</td>
<td>96±9</td>
<td>24</td>
<td>53</td>
<td>20</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>1999</td>
<td>96±9</td>
<td>24</td>
<td>53</td>
<td>20</td>
<td>3</td>
</tr>
<tr>
<td>Sangan</td>
<td>1989</td>
<td>96±9</td>
<td>24</td>
<td>53</td>
<td>20</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>1999</td>
<td>96±9</td>
<td>24</td>
<td>53</td>
<td>20</td>
<td>3</td>
</tr>
<tr>
<td>Randan</td>
<td>1989</td>
<td>96±9</td>
<td>24</td>
<td>53</td>
<td>20</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>1999</td>
<td>96±9</td>
<td>24</td>
<td>53</td>
<td>20</td>
<td>3</td>
</tr>
<tr>
<td>Zagoon</td>
<td>1989</td>
<td>96±9</td>
<td>24</td>
<td>53</td>
<td>20</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>1999</td>
<td>96±9</td>
<td>24</td>
<td>53</td>
<td>20</td>
<td>3</td>
</tr>
</tbody>
</table>

### Table 3: Total goiter rate and median urinary iodine in schoolchildren of villages before (1989) and 10 years after iodine supplementation (1999)

<table>
<thead>
<tr>
<th>Village</th>
<th>Goiter rate (%)</th>
<th>1989 Median urinary iodine (µg/L)</th>
<th>1999 Median urinary iodine (µg/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>All children 11-16 years old 6-10 years old</td>
<td>1989</td>
</tr>
<tr>
<td>Kiga</td>
<td>100</td>
<td>64 71 58</td>
<td>19</td>
</tr>
<tr>
<td>Keshar</td>
<td>99</td>
<td>52 53 51</td>
<td>18</td>
</tr>
<tr>
<td>Sangan</td>
<td>99</td>
<td>52 56 50</td>
<td>23</td>
</tr>
<tr>
<td>Randan</td>
<td>100</td>
<td>61 79 42</td>
<td>12</td>
</tr>
<tr>
<td>Zagoon</td>
<td>100</td>
<td>54 67 41</td>
<td>18</td>
</tr>
</tbody>
</table>

### Table 2: Classification of twenty-eight provinces of Iran according to median UIC values, Iran, 2001

<table>
<thead>
<tr>
<th>Classification by Median UIC (µg/L)</th>
<th>Provinces (No. of urine samples)</th>
<th>UIC values (µg/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>100-149</td>
<td>West Azarbaijan, Isfahan, Boushehr, Khorasan, Semnan, Golestan (n = 719)</td>
<td>&lt;20 20-49 50-99 &lt;100</td>
</tr>
<tr>
<td>150-199</td>
<td>East Azarbaijan, Ardebil, Ilam, Tehran, Charmahal, Khouestan, Zanjan, Sistan, Ghom, Kordestan, Kerman, Kermanshah, Kohkiloeyeh, Guilan, Lorestan, Mazandaran, Markazi, Hormozgan, Hamedan, Yazd (n= 2370)</td>
<td>4.8 12.8 82.4</td>
</tr>
<tr>
<td>&lt;200</td>
<td>Fars, Ghazvin (n = 240)</td>
<td>0 3.8 7.9 88.3</td>
</tr>
</tbody>
</table>

* Numbers indicate percentages.
Regular data on salt iodine at fac-
tory (daily), retail (monthly) and 
household levels (yearly) are collec-
ted in each province and analyzed by 
the National Committee.

Regular laboratory data on urina-
ry iodine in school-aged children 
with appropriate sampling for higher 
risk areas in each province on a yearly basis and nationally once every 5 years.

Cooperation from the salt industry in maintenance of quality control is excellent, supervised by the IDD executive officer.

Database with recording of results 
and regular monitoring procedures, 
particularly for salt iodine and urina-
ry iodine is available in the Ministry 
of Health (MOH). Neonatal TSH 
has been measured in Tehran in 1989 and 1997-1999, and indicates a signi-
ficant decrease in transient hyperthy-
rotropinemia and recall rate.

According to these criteria, I.R. Iran 
has achieved sustainable IDD control since 1996, as recognized by WHO-
EMRO in the year 2000 (13). Monitoring of the IDD control pro-
gramme is planned every 5 years. Commenting on Iran’s accomplis-
ments in the control of IDD, Dr. 
Azizi stated (14), “they should 
remind us that USI, although achieved in the majority of countries where iodine deficiency is a major public health problem, is not suffi-
cient by itself to eliminate IDD. The 
main objective should focus on suit-
able effective and sustainable iodine nutrition rather than on IDD con-
trol. Greater attention needs to be 
paid to the development of an effi-
cient, sustainable and operating monitoring system in each country.”

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Endocrinol Metab 2003; 2: 46–47.
Sustained Elimination of IDD in China: an update

Chen Zupei ICCIDD Regional Coordinator, China and Eastern Asia region

Background
Goiter was recorded in ancient Chinese medical writing as early as 3,000BC. In the modern age, the landmark study on IDD in China was done in Hebei Province in 1960, by the endocrine research group from Tianjin Medical College. The study demonstrated that iodine deficiency was responsible for endemic goiter and endemic cretinism, and suggested that mild mental retardation was the major adverse effect on the population. These findings catalyzed the central government to organize a national survey in 1970, which estimated 35 million patients had visible goiter, there were ~250,000 cretins, and 700 million people were at risk for iodine deficiency (1). The central government supported a National Iodized Salt Program (iodized with KI at 10-30 ppm at production level) as the main strategy for control of IDD. Although the goiter rate fell, and nearly no new cretins were born, IDD was not completely controlled due to a lack of strong political will, poorly iodized salt and no effective monitoring system.

The “National Advocacy Meeting to Eliminate of IDD by the Year 2000 “ was held by the State Council in Beijing in 1993, which was a follow-up to the UN Summit for Children in 1990. This meeting, attended by many government representatives, as well as WHO, UNICEF, UNDP, ICCIDD, and the World Bank, was a milestone for the elimination of IDD in China. The Chinese government made the political commitment to eliminate IDD by the year 2000. The State Council approved a new National IDD Control Program, with USI as the major intervention against IDD, and, by 1995, this covered all of China.

Virtual elimination of IDD
Chinese capacity for iodized salt production in 1993 could only meet 40% of the total need for USI. Remarkable efforts to increase the production of iodized salt were made by the Central Government with the World Bank support, and 115 salt plants were renovated to improve production capacity, iodization and packaging. Table 1 shows the rapid progress in increasing the iodized salt supply for human consumption, which, since 1999, is adequate to reach the goal of USI (1,5).

Table 1: The production of iodized salt in China (in 10,000 Tons)

<table>
<thead>
<tr>
<th>Year</th>
<th>Production</th>
</tr>
</thead>
<tbody>
<tr>
<td>1993</td>
<td>330</td>
</tr>
<tr>
<td>1994</td>
<td>363</td>
</tr>
<tr>
<td>1995</td>
<td>539</td>
</tr>
<tr>
<td>1996</td>
<td>605</td>
</tr>
<tr>
<td>1997</td>
<td>620</td>
</tr>
<tr>
<td>1998</td>
<td>650</td>
</tr>
<tr>
<td>1999</td>
<td>753</td>
</tr>
<tr>
<td>2002</td>
<td>720</td>
</tr>
<tr>
<td>2005</td>
<td>730</td>
</tr>
</tbody>
</table>

National monitoring is done using WHO/UNICEF/ICCIDD criteria, with each province considered as basic unit, and a PPS cluster method used to sample schoolchildren aged 8-10 years old (6). The results led to a National Evaluation Program, worked out by 5 ministries, that was first conducted in 1999 at county, prefecture and province levels. A national evaluation mission was organized by the Ministry of Health and the Salt Industry Bureau in 2000. Eleven national teams were sent to each province to evaluate the following items:

- The provincial IDD control program
- The management of iodized salt
- Health education
- Technical indicators including urinary iodine, total goiter rate and proportion of household consuming effectively iodized salt.

During the mission, the teams determine for each province the degree of IDD elimination according to the following criteria:

- **Category I:** Complete IDD elimination: urinary iodine >100 ug/L; the proportion of households consuming iodized salt >90%; TGR <10%;
- **Category II:** Basic IDD elimination: urinary iodine >100 ug/L; the proportion of household consuming iodized salt >90%; TGR <20%;
- **Category III:** IDD is not eliminated: either urinary iodine or coverage of iodized salt is not meeting the criteria.

In 2000, the findings indicated 17 provinces were Category I, 7 provinces were Category II, and 6 provinces were Category III.
In 2002 and 2005. The following results have been achieved:

- **Proportion of households consuming adequately iodized salt** is >90%.
- The goiter rate is <5% and the median UI is ~240 µg/L.
- The median UI is ~3.3±5.8 ppm (CV 17%).
- The coverage rate of non-iodized salt (<5 ppm) is 1.9%.
- Lot quality assurance: 97.9%.
- Iodine concentration in salt: 33.5±5.8 ppm (CV 17%).

An important recent survey focused on the iodine status of the major target populations (women of childbearing age, pregnant and lactating women and their babies) after USI, and was jointly supported by the Ministry of Health, the Salt Industry and ICCIDD. Yan Yuqin, ICCIDD China Focal Point, organised 12 teams to complete the study. Sampling was done in urban and rural areas from 12 provinces, and schoolchildren (8-10 y), women of child-bearing age (20-40 y), pregnant women and their infants (0-2 y) were studied. The coverage rate of USI was ~97%. Table 3 shows the urinary iodine concentration in target groups with data on milk iodine (4). In pregnant and lactating women in some of rural and urban areas UI was <100-150 µg/L, suggesting mild iodine deficiency in these groups although household salt is adequately iodized. The results of the study emphasize that iodine nutrition in pregnant and lactating women should be given more attention to ensure sufficient iodine supply to their newborns.

A preliminary study suggests iodine deficiency can reduce IQ by 10 points, and the correction of iodine deficiency can increase IQ by 11 points in a population at risk for iodine deficiency (3). In 2005, IQ of 8-10 y-old children born after 1995 (after achievement of USI) was measured, and their IQ had reached a normal level of 103.5 by China Ravens’ Test (5). This suggests the disappearance of mental impairment caused by iodine deficiency, which has plagued regions of China for thousands of years.
Quality control in iodine determination

Two iodine laboratories in China, the National IDD Reference Laboratory (NRL) and the Iodine Laboratory of the Institute of Endocrinology, Tianjin Medical University, participate in the EQUIP international iodine laboratory quality control program. Yan Yuqin, ICCIDD China Focal Point, organized a group to investigate a new method for urinary iodine determination, a modified Sandel-Koltoff reaction using the ammonium persulfate digestion. This was approved by National Standard Committee for urinary iodine determination, and published by the Ministry of Health in 2005.

The NRL is responsible for external quality control for all iodine laboratories at the province, prefecture and county levels. NRL sent urine and salt standards to regional laboratories as an external quality control for UI and salt iodine measurements, in cooperation with UNICEF and NIDDAC. The results showed 32 iodine laboratories at the province level are qualified both for urinary and salt iodine determinations, and that 96.4% (320/323) at the prefecture level and 92.7% (851/900) at the county level are qualified for salt iodine determinations (titration method). The Annual Meeting on National Salt Monitoring and Laboratory Quality Control is held every year to review current progress and analyze problems. Selected labs and professionals receive rewards for excellent quality assurance from NRL and UNICEF.

Table 3: Median urinary iodine concentration (UI) in target groups in China

<table>
<thead>
<tr>
<th>Target groups</th>
<th>UI (µg/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>School Children</td>
<td>229</td>
</tr>
<tr>
<td>Women at child bearing age</td>
<td>220</td>
</tr>
<tr>
<td>Pregnant women</td>
<td>179</td>
</tr>
<tr>
<td>Lactating women</td>
<td>191</td>
</tr>
<tr>
<td>Babies</td>
<td>240</td>
</tr>
<tr>
<td>Milk</td>
<td>145</td>
</tr>
</tbody>
</table>

Lessons learned

- There is strong political will and commitment to the virtual and sustained elimination of IDD by top leaders in central and provincial governments.
- Multisectoral coordination with executive body authority is working at both central and provincial levels.
- There is legislation on USI and monopoly of the salt trade nationwide.
- There is an effective monitoring system with reliable quality control and data communication.
- There is strong technical support both from NIDDAC (National IDD Advisory Committee to MOH) and ICCIDD.
- There is strong international support for the China National IDD Control Program.
- The education, communication and social mobilization program plays an important role in the implementation of USI.

Future goals

Considering the current situation, that is, basic elimination of IDD at the national level in 2000, the Chinese Government and the Central Committee of China Communist Party has made the decision to aim for the goal of 95% of counties achieving virtual elimination of IDD by 2010.

Regrets

Prof. Tizhang Lu died on July 30, 2006 at age 84. Prof. Lu had worked for more than 10 years with the Chinese ICCIDD office as Council Member, and as a Senior Advisor since the establishment of ICCIDD. Prof. Lu was an expert endocrinologist and international expert on IDD. He contributed greatly to efforts to eliminate IDD in China, and will be greatly missed.

References

Effects of excess iodine intake on thyroid diseases in China

Iodine is an essential component of thyroid hormones, and either low or high intake may lead to thyroid disease. In a prospective study, a research team from China Medical University in Shenyang examined the effects of high iodine intakes on populations in three regions of China (1). The three regions were: 1) Panshan; mildly deficient (median urinary iodine (UI) excretion, 84 µg/L); 2) Zhangwu; more than adequate (median, 243 µg/L); and 3) Huanghua; excessive (median, 351 µg/L). Participants enrolled in a baseline study in 1999, and during the five-year follow-up through 2004, the researchers examined the effect of regional differences in iodine intake on the incidence of thyroid disease. Of the 3761 unselected subjects who were enrolled at baseline, 3018 (80.2 percent) participated in the follow-up study. Levels of thyroid hormones and thyroid autoantibodies in serum, and iodine in urine, were measured and B-mode ultrasonography of the thyroid was performed at baseline and follow-up.

The researchers reported that more than adequate or excessive iodine intake was associated with an increased cumulative five-year incidence of subclinical hypothyroidism and autoimmune thyroiditis, but not of overt hypothyroidism or hyperthyroidism. In many people, the first two disorders were not sustained. Among subjects with mildly deficient iodine intake, those with more than adequate intake, and those with excessive intake, the cumulative incidence of overt hypothyroidism was 0.2 percent, 0.5 percent, and 0.3 percent, respectively; that of subclinical hypothyroidism, 0.2 percent, 2.6 percent, and 2.9 percent, respectively; and that of autoimmune thyroiditis, 0.2 percent, 1.0 percent, and 1.3 percent, respectively (see Table 1).

Among subjects with euthyroidism and antithyroid antibodies at baseline, the five-year incidence of elevated serum thyrotropin levels was greater among those with more than adequate or excessive iodine intake than among those with mildly deficient iodine intake. A baseline serum thyrotropin level of 1.0 to 1.9 mIU per liter was associated with the lowest subsequent incidence of abnormal thyroid function. This important study indicates that more than adequate or excessive iodine intake may lead to modest increases in subclinical hypothyroidism and autoimmune thyroiditis. The findings highlight the need to carefully monitor iodized salt programs to maintain sufficient, but not excess, iodine intakes in populations.

Table 1: The cumulative incidence of thyroid disease in 3 regions of China: Zhangwu (with iodine intake that was more than adequate); Huanghua (with excessive intake), and Panshan (with mildly deficient intake). The numbers in the table are numbers of cases (per cent). The prevalence was calculated at baseline (1999); incidence is the cumulative incidence between 1999 and 2004. There were significant increases in incidence of subclinical hypothyroidism and autoimmune thyroiditis when iodine intake was more than adequate or excessive.

<table>
<thead>
<tr>
<th>Thyroid Disease</th>
<th>Panshan (Mildly Deficient I Intake)</th>
<th>Zhangwu (More Than Adequate I Intake)</th>
<th>Huanghua (Excessive I Intake)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overt hypothyroidism</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prevalence</td>
<td>3 (0.3)</td>
<td>15 (0.9)</td>
<td>21 (2.0)</td>
</tr>
<tr>
<td>Incidence</td>
<td>2 (0.2)</td>
<td>6 (0.5)</td>
<td>3 (0.3)</td>
</tr>
<tr>
<td>Subclinical hypothyroidism</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prevalence</td>
<td>10 (0.9)</td>
<td>46 (2.9)</td>
<td>65 (6.1)</td>
</tr>
<tr>
<td>Incidence</td>
<td>2 (0.2)</td>
<td>33 (2.6)</td>
<td>25 (2.9)</td>
</tr>
<tr>
<td>Autoimmune thyroiditis</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prevalence</td>
<td>5 (0.5)</td>
<td>27 (1.7)</td>
<td>30 (2.8)</td>
</tr>
<tr>
<td>Incidence</td>
<td>2 (0.2)</td>
<td>13 (1.0)</td>
<td>11 (1.3)</td>
</tr>
<tr>
<td>Overt hyperthyroidism</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prevalence</td>
<td>18 (1.6)</td>
<td>32 (2.0)</td>
<td>13 (1.2)</td>
</tr>
<tr>
<td>Incidence</td>
<td>12 (1.4)</td>
<td>12 (0.9)</td>
<td>7 (0.8)</td>
</tr>
<tr>
<td>Subclinical hyperthyroidism</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prevalence</td>
<td>41 (3.7)</td>
<td>62 (3.9)</td>
<td>12 (1.1)</td>
</tr>
<tr>
<td>Incidence</td>
<td>12 (1.4)</td>
<td>25 (2.0)</td>
<td>9 (1.0)</td>
</tr>
</tbody>
</table>

Reference
Meetings and Announcements


The Micronutrient Forum will hold its first international meeting in Istanbul, Turkey on 16–18 April 2007. The theme of the meeting is “Consequences and Control of Micronutrient Deficiencies: Science, Policy, and Programs – Defining the Issues”. The Micronutrient Forum will serve as a stimulus for policy-relevant science and as the internationally recognized catalyst for moving the global community towards consensus around evidence based policies and programs that reduce micronutrient deficiencies around the globe. The micronutrient deficiencies of primary interest to the Micronutrient Forum are vitamin A, iron, folate, zinc, and iodine. Meeting participants are welcome from a wide diversity of relevant disciplines such as maternal and child health, nutrition, biochemistry, agriculture, horticulture, education, communications, and development. Participants are expected to include representatives from international agencies, national ministries, educational and research institutions, food and chemical industries, and non-governmental organizations.

The 77th Annual Meeting of the American Thyroid Association will take place on October 11 – October 15, 2006, at the Sheraton Wild Horse Pass Resort & Spa, in Phoenix, Arizona, USA. For more information, go to: [http://www.thyroid.org](http://www.thyroid.org)

**1st World Congress of Public Health Nutrition, Barcelona, September 28–30, 2006**

Under the theme ‘Advancing Science and Global Partnerships’, the 1st World Congress of Public Health Nutrition aims to facilitate and enhance such endeavours, fostering a base of sound scientific evidence as well as providing a forum for networking and alliance building. For more information, go to: [http://www.nutrition2006.com](http://www.nutrition2006.com)

**Progress for Children: A Report Card on Nutrition**

A UNICEF report published on May 2, 2006 (Progress for Children: A Report Card on Nutrition) found that poor nutrition remains a global epidemic contributing to more than half of all child deaths, about 5.6 million every year. “The lack of progress to combat undernutrition is damaging children and nations,” said UNICEF Executive Director Ann M. Veneman. “For every visibly undernourished child, there are several more battling a hidden nutritional crisis,” Veneman said. “Many are seriously deficient in essential vitamins and minerals such as iodine, vitamin A and iron.” Specifically for iodine, the Report Card states that, in 1990, few developing countries had large-scale salt-iodization programs, and fewer than one in five households were estimated to consume adequately iodized salt. As a result, about 1.7 billion people, or 32 per cent of the developing world population, lived at risk of iodine deficiency disorders (IDD). The campaign to eliminate iodine deficiency through universal salt iodization has succeeded in boosting the proportion of developing-world households that consume iodized salt to 69 per cent — and 82 million newborns are now being protected every year from IDD-caused learning disabilities. Yet large differences in levels of iodized salt consumption exist among regions. The highest levels are recorded in Latin America/Caribbean (86 per cent) and East Asia/Pacific (85 per cent); in sub-Saharan Africa 64 per cent of households consume iodized salt. The lowest level (47 per cent) is recorded in CEE/CIS. The current round of Multiple Indicator Cluster Surveys (MICS) will update information on iodized salt consumption and is expected to document significant improvements, particularly in CEE/CIS. In 33 countries, less than half of households consume iodized salt, and each year 37 million newborns in the developing world are unprotected from the lifelong consequences of brain damage associated with IDD. For more information, go to: [http://www.unicef.org/progressforchildren/2006n4/index_introduction.html](http://www.unicef.org/progressforchildren/2006n4/index_introduction.html)

**Abstracts**


To prevent goiter and nodular hyperthyroidism, iodine fortification (IF) of salt was introduced in Denmark in 1998. All new cases of overt hyperthyroidism in two areas of Denmark before and for the first 6 yr after iodine fortification were registered. From a computer based register of all new cases of hyperthyroidism in two population subcohorts with moderate iodine deficiency (ID) (Aalborg) and mild ID (Copenhagen), data were obtained: 1. before IF (1997–1998); 2. during voluntary IF (1999–2000); 3. during early (2001–2002); and 4. late (2003–2004) period with mandatory IF. The overall incidence rate of hyperthyroidism increased (baseline: 102.8/100,000/year; voluntary IF: 122.8; early mandatory IF: 140.7; late mandatory IF: 138.7 (p for trend < 0.001)). Hyperthyroidism increased in both sexes (P < 0.001) and in all age groups: 0–19 yr: 20–39: 40–59 and 60+ (p for trend < 0.001). The increase was relatively highest in young adults aged 20–39 yr; late mandatory IF (per cent increase from baseline): age 20–39: 160%, P < 0.001; age 40–59: 29%, P < 0.01; age 60+ years: 13%, P = ns. The authors concluded that even a cautious iodization of salt results in an increase in the incidence rate of hyperthyroidism. Contrary to current concepts many of the new cases were observed in young subjects, and are presumably of auto-immune origin.

In Denmark, mandatory iodine fortification of table salt and salt in bread (13 p.p.m. iodine) was initiated in 2000/2001. The Danish investigation on iodine intake and thyroid disease (DanThyr) is the monitoring of the iodine fortification program. DanThyr consists of three main parts: a study of population cohorts initialized before and after iodization of salt, a prospective identification of incident cases of overt hyper- and hypothyroidism in the population since 1997, and compilation of data from the national registers on the use of thyroid medication, thyroid surgery, and radioiodine therapy. The study showed profound effects of even small differences in iodine intake level on the prevalence of goiter, nodules, and thyroid dysfunction. Other environmental factors were also important for goiter development (increase in risk, smoking and pregnancy; decrease in risk, oral contraception and alcohol consumption), and the individual risk depended on the genetic background. There were more cases of overt hypothyroidism in mild than in moderate iodine deficiency caused by a 53% higher incidence of spontaneous (presumably autoimmune) hypothyroidism. On the other hand, there were 49% more cases of overt hyperthyroidism in the area with moderate iodine deficiency. The cautious iodine fortification program, aiming at an average increase in iodine intake of 50 mg/day has been associated with a 50% increase in incidence of hyperthyroidism in the area with the most severe iodine deficiency. Monitoring and adjustment of iodine intake in the population is an important part of preventive medicine.


In this short review, the author provides an update on thyroid hormones in the development of different tissues, in particular the brain. The peripheral metabolism of thyroid hormone involves three deiodinases. Normal brain development requires the coordinated expression of two of them (D2 and D3) to secure intracellular T3 levels that are optimal for the particular brain region and stage of development. The role of newly-discovered thyroid hormone transporters in the nervous system is also discussed, as well as the molecular mechanisms that underlie why sufficient iodine intake is required for optimal neurological development of the fetus and neonate.


The objective of this study was to assess the levels of 39 toxic metals and essential minerals in hair samples of children with autism spectrum disorders and their mothers compared to controls. The sample included children with autism spectrum disorders (n=51), a subset of their mothers (n=29), neurotypical children (n=40), and a subset of their mothers (n=25). Iodine levels were 45% lower in the children with autism (p=0.005). Autistic children with pica had a 38% lower level of chromium (p=0.002). Autistic children with low muscle tone had very low levels of potassium (~66%, p=0.01) and high levels of zinc (31%, p=0.01). Low iodine levels are consistent with previous reports of abnormal thyroid function, which likely affected development of speech and cognitive skills. Further investigations of iodine and other elements are warranted.


This article is a brief review of the estimated incremental risks (increases in hazard quotient or decreases in thyroid uptake of iodine) to pregnant women (and hence their fetuses) associated with perchlorate exposure in community water supplies. The analysis draws on the recent health effects review published in 2005 by the U.S. National Research Council. Other members of the population should be at a level of risk below that calculated here, and so protection of the sensitive subpopulation would protect the general public health. The analysis examines the intersubject distribution of risks to this sensitive subpopulation at various potential drinking water concentrations of perchlorate. Results suggest that maximum contaminant levels of up to 24.5 µg/L should pose little or no incremental risk to the large majority of individuals in the most sensitive subpopulations exposed in the United States at current levels of perchlorate in water.


The median urinary iodine concentration (UIC) for Italian schoolchildren was 90 µg/L in Biella and 136 µg/L in Novara in a survey carried out in 1995–1996. The aim of this study was to assess goiter prevalence by ultrasonography in Biella and Novara schoolchildren and to evaluate the median UIC in Biella schoolchildren. The ultrasound goiter prevalence as function of age was 15.7% in Biella and 14.8% in Novara. The ultrasound goiter prevalence as function of body surface area was 17.1% in Biella and 7.1% in Novara. UIC for Biella children in primary school was 150–159 µg/L. Based on the results of UIC, Biella is considered as iodine sufficient area. However, based on the results of goiter prevalence by ultrasonography, both Biella and Novara would be classified as iodine deficient areas. UIC and goiter prevalence, however, provide different information about iodine status: UIC supplies information about present iodine status while goiter prevalence assesses past iodine status.


A case of iodine-induced hyperthyroidism due to the ingestion of a kelp-containing tea was reported. A 39-year-old woman with multinodular goiter presented with typical signs of hyperthyroidism, which was confirmed by endocrine tests. A detailed medical history revealed that she had been treated for a period of 4 weeks by a Chinese alternative practitioner with a herbal tea containing kelp because of her enlarged thyroid. The consumption of the tea was discontinued and an antithyroid drug therapy was initiated. Physicians should advise patients with underlying thyroid disease to avoid complementary or alternative medications containing iodine.

The study was done to determine whether pregnant women and their newborns show evidence of iodine deficiency, and to examine the correlation between maternal urine iodine concentration (UIC) and newborn thyroid-stimulating hormone (TSH) level. A study included a cross-sectional sample of 815 pregnant women (> or = 28 weeks gestation) and 824 newborns. The median UIC for pregnant women was 85 µg/L, indicating mild iodine deficiency. Almost 17% of pregnant women had a UIC < 50 µg/L, and 18 newborns (2.2%) had TSH values > 5 mIU/L. There was no statistically significant linear correlation between neonatal whole-blood TSH level and maternal UIC. Mothers with a UIC < 50 µg/L were 2.6 times more likely to have a baby with a TSH level > 5 mIU/L.

Gestational hypothyroxinemia and cognitive function in offspring.

The effects of gestational hypothyroxinemia on the neurointellectual prognosis of children in the first year of life living in an industrial city with mild iodine deficiency was studied. The sample included 13 children of mothers with thyroid hormone-corrected gestational hypothyroxinemia in the first trimester and 10 children of mothers with normal levels of free thyroxine. Cognitive functions were assessed at ages six, nine, and 12 months using the Gnome mental development scale. The results showed that maternal free thyroxine levels at the early stages (5-9 weeks) of pregnancy correlated significantly with the coefficients of mental development among the children at ages 6, 9, and 12 months. Early (not later than nine weeks) correction of gestational hypothyroxinemia with levothyroxine improved the neurointellectual prognosis of the offspring to the level of development of children born to mothers with normal thyroxine levels.


Anemia and co-existing deficiencies of zinc, iron, and vitamin A occur among children in many developing countries. The authors assessed the efficacy of a micronutrient-fortified seasoning powder served with a school lunch on improving the micronutrient status of rural Thai children. Children (n = 569) aged from 10 schools were randomly assigned to receive a seasoning powder either unfortified or fortified with zinc (5 mg), iron (5 mg), vitamin A (270 µg), and iodine (50 µg) (per serving) and incorporated into a school lunch prepared centrally and delivered 5 d/wk for 31 wk. For anemia and vitamin A, no intervention effect was apparent. However, the odds of zinc and iodine deficiency in the fortified group were 0.63 (0.42, 0.94) and 0.52 (0.38, 0.71) times those in the unfortified group, respectively. Therefore, a micronutrient-fortified seasoning powder incorporated into lunch programs in day care centers and schools may be a promising vehicle for improving iodine status.

Effects of six months of daily low-dose perchlorate exposure on thyroid function in healthy volunteers.

Perchlorate has been detected in U.S. drinking water supplies at levels ranging from 4 to 200 µg/liter as well as in agricultural products. Perchlorate is known to be a competitive inhibitor of iodine uptake by the thyroid through the sodium-iodide symporter. The objective of the study was to determine whether prolonged exposure (6 months) to low levels of perchlorate would perturb thyroid function. In a prospective, double-blinded, randomized trial, 13 healthy volunteers were given either placebo or 0.5 mg or 3.0 mg potassium perchlorate daily. There was no significant change in the thyroid (123I) uptakes during perchlorate administration. There were no significant changes in serum T(3), free T(4) index, TSH, or Tg concentrations during the exposure period, compared to baseline or postexposure values. Urine iodine values for the 3-mg perchlorate group were higher, but not significantly so, at baseline than during perchlorate exposure. The authors concluded that a 6-month exposure to perchlorate at doses up to 3 mg/d has no effect on thyroid function.