China: Improving USI to ensure optimal iodine nutrition for all

Historically, many regions of China were iodine deficient and affected by endemic goiter and cretinism. This blocked economic development, because it limited intellectual capacity and learning potential, lowering IQ in children in affected areas by more than 10 points. The Chinese government’s introduction of mandatory Universal Salt Iodization (USI) in 1994 has led to enormous progress, and the program is now a model for many countries. The government to maintain iodine sufficiency in the country through support to the salt industry, which has operated as a monopoly, as well as rigorous monitoring of the program to assure effective coverage and penetration throughout the country.

But as the program enters its next phase, new questions have emerged. To discuss them and develop future plans, the Bureau of Diseases Prevention and Control of the National Health and Family Planning Commission (NHFPC) held a national Workshop on IDD Prevention and Control Strategies in China on November 5–6, 2014. It was organized on behalf of the NHFPC by the Institute of Nutrition and Health and the Center of Endemic Disease Control of China, with support from UNICEF, GAIN and the Iodine Global Network (IGN). It brought together 160 participants, from central and provincial CDC offices, universities, public health institutions, and China Salt. Global experts on iodine nutrition and universal salt iodization were invited to share experiences from other countries. The following four questions were addressed:

1. Apparent lack of correspondence between iodine nutrition of SAC and pregnant women

The Chinese IDD Elimination Program is supported by a complex and detailed monitoring system that over the years has generated extensive data on the MUIC of school-age children, and recently also of pregnant women. By WHO definition based on MUIC in SAC, population iodine status is adequate or more than adequate in almost all provinces. In four provinces iodine intakes are excessive in children because of unusually high salt intakes in mountainous regions (Guizhou and Jiangxi provinces) or high iodine content of the ground water (Jiangsu and Anhui). Thus, excessive iodine intakes are not attributable to the salt iodization program. At the same time, pregnant women in six of China’s 31 provinces are classified as borderline iodine deficient. This has raised questions whether the iodine intake in SAC may be slightly high in some provinces and how to achieve optimal iodine intake during pregnancy without exceeding optimal intake in SAC.
A multi-center study in 2013 (1), including children from China, suggested that the criteria for adequate iodine nutrition in SAC could be extended from 100–199 μg/L to 100–299 μg/L, based on the finding that there was no increase in the prevalence of elevated thyroglobulin (Tg) or anti-thyroid antibodies (i.e., indicators of thyroid dysfunction) in children across these ranges.

The WHO range for adequate iodine in pregnancy is a MUIC of 150–249 μg/L. But WHO also suggested that, where high coverage of adequately iodized salt (HHIS) has been sustained for at least two years, women probably enter pregnancy with adequate stores and so do not need to achieve this level of intake through pregnancy and lactation (2). Since this scenario is true in most provinces in China, a MUIC of 100–150 μg/L may not be a cause for concern. Sufficient iodine stores in the thyroid, combined with dietary iodine, should be enough to maintain thyroid health in the mother and baby. Mothers and babies in such situations should be monitored and followed up to verify this assumption.

It follows that iodine status in SAC may only be in excess of requirements in four provinces due to high iodine in drinking water, while pregnant women may only have inadequate iodine nutrition in three provinces where sustained HHIS coverage >90% for the last two years has not been achieved (Shanghai, Tianjin and Tibet).

2. Impact of increased iodine intake on thyroid disorders

Speakers in this session included Prof. Michael Zimmerman, Executive Director of the IGN, Dr. Peter Laurberg from Aalborg University Hospital in Denmark, Dr. Teng Weiping, Chairman of the China Endocrinology Association, and Prof. Yan Yuqin of the Institute of Endocrinology, Tianjin Medical University. In their presentations, they addressed the question whether increased population iodine intake from salt has caused an increase in thyroid disorders, reported by some doctors and academics in China.

• Prof. Teng Weiping from China and Prof. Peter Laurberg from Denmark reviewed the links between iodine intake and thyroid disorders. When salt iodization is introduced in iodine deficient countries, some individuals may experience a small, transient increase in mild subclinical hyperthyroidism. But after 5–7 years, the prevalence of hyperthyroidism decreases again, to levels even lower than before iodization. In parallel, there is a marked decrease in goiter and thyroid nodules and, in severely deficient areas, a reduction in risk for hypothyroidism. Overall, the benefits of iodized salt on thyroid disorders outweigh the small risks.

• Increasing incidence of papillary thyroid cancer has been reported in many countries, including China. However, this is occurring in countries with rising, stable, and declining iodine intakes (e.g., in the U.S., where intakes have fallen sharply). Most experts put it down mainly to improved diagnostic techniques, able to detect smaller cancers. There is no association between the overall incidence of thyroid cancer and dietary iodine intake (3), and the risk for the more aggressive forms of thyroid cancer is reduced by iodized salt. Overall, there is strong evidence that iodine deficiency, rather than excess, increases thyroid disorders in populations, and USI has been proven to effectively and sustainably reduce iodine deficiency and improve IQ (4).

• Ongoing monitoring of population iodine status is essential to ensure that the salt iodine levels are adjusted to protect against deficiency but not risk excessive intake and possible adverse effects. Countries like Denmark and Switzerland have used monitoring to modify salt iodine content and track changes in iodine nutrition.

China, too, has demonstrated that population iodine status can be adjusted by changing iodine levels in salt, and the next national IDD survey is expected to reflect these recent changes.

3. Is >90% HHIS coverage necessary for adequate iodine nutrition?

In a small number of provinces in China, iodine nutrition of SAC and sometimes pregnant women is adequate even though HHIS coverage is below 90%. This has led to assertions that such populations may be receiving iodine through natural foods, supplements, or other sources and do not need to achieve >90% HHIS coverage. Hence, some individuals have suggested that people should have the choice whether to consume iodized salt or not, particularly in urban areas with high levels of awareness.

Xiaoguang Yang of the National Institute of Nutrition and Health, Karen Codling, IGN Regional Coordinator for Southeast Asia and the Pacific, Jonathan Gorstein, Global Project Coordinator for the BMGF USI Partnership Project and IGN Senior Advisor, and the Shanghai Municipal Centre for Disease Control presented data to inform this discussion.
Many studies and analyses confirm that iodized salt provides the majority of iodine intake in China, including in coastal areas with suspected high seafood intake. Modeling has demonstrated that, reducing iodine intake from iodized salt (due to less iodine in salt or lower coverage) would lead to a significant proportion of the population falling below the recommended nutrient intake (RNI) level.

High coverage with adequately iodized salt is also necessary to ensure equitable intake of adequate iodine at sub-national level. Thus, while MUIC may reflect adequacy at the national or provincial level, analysis of the MUIC of district or county populations or sub-populations has demonstrated that pockets of iodine deficiency may still persist if universally high coverage of adequately iodized salt is not achieved.

The intake of table salt is decreasing due to rising salt intake through processed foods and parallel efforts to reduce total salt intake to prevent non-communicable diseases. Decreased salt consumption has been measured in national and small-scale studies across China. A decline in HHIS coverage will reduce iodine intake through table salt, potentially to levels that cause a re-emergence of iodine deficiency. Use of non-iodized salt in processed food may also lead to inadequate iodine levels, as the intake of processed food is increasing. Monitoring the relative contributions of HHIS and other sources of iodine and salt in the diet is imperative to make appropriate program adjustments.

4. Changes in the salt industry

The success of the Chinese salt iodization program over the past 25 years can be attributed to the partnership and commitment of the national salt industry to ensure universal coverage of adequately iodized salt. In China, the industry is uniquely organized as a monopoly, with strong, centralized control by the government. It is possible that the structure of the Chinese salt industry will change in the future: the monopoly may be removed and privatized, which may affect the USI program. Worldwide, voluntary salt iodization models have generally not achieved universal HHIS coverage except in unique situations, e.g., when there is only a small number of salt producers who all choose to iodize salt despite a lack of legislation, or when the majority of iodine intake is through processed foods that utilize iodized salt.

References

1. Zimmerman MB et al. Thyroglobulin is a sensitive measure of both deficient and excess iodine intakes in children and indicates no adverse effects on thyroid function in the UIC range of 100-299 μg/L: a UNICEF/ICCIDD Study Group report. J Clin Endocrinology and Metabolism. 2013; 98(3)
2. WHO Secretariat on behalf of the participants to the Consultation. Prevention and control of iodine deficiency in pregnant and lactation women and in children less than 2 years: conclusions and recommendations of the Technical Consultation. Public Health Nutrition. 2007; 10(12A): 1606-1611

Based on the wealth of data, global experiences, and expert guidance, the NHFPC were provided points for consideration in policy making. These included:

- the importance of maintaining or achieving household coverage with adequately iodized salt at >90%;
- the importance of regular systematic monitoring of the iodized salt program to avoid both iodine deficiency and excess;
- consideration of including regular monitoring the iodine status of women of reproductive age, in addition to pregnant women and children;
- as more data become available, consideration of the modification of the reference values for the median UIC in children and pregnant women to assist programs in covering all vulnerable groups.