

Lessons Learned from China In sustained elimination of Iodine deficiency

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Abstract

IDD were recorded in ancient Chinese medical literatures for thousands of years which now is also one of very significant public health problem and continue to threaten the quality of life, human potential and social economic development in China. It was estimated that 700 million people are at risk for iodine deficiency prior to prophylaxis. The epidemiological surveys revealed there were 35 million patients with endemic goiter (visible), 250,000 typical cretinism and proportion of mild mental retardation (IQ 50-69) covered 5-15% of the children in many IDD endemias, IQ distribution curves of children have a generalized tendency to shift to the left and IQ deficit of 10 points in the population living in IDD areas. Strong political commitment on elimination of IDD has been made by Chinese Government and USI has been accepted as the major intervention for correction of iodine deficiency nationwide since 1995. China has set up monitoring system on IDD and iodized salt, which includes : (1) Regular salt monitoring activity at county level (household) each year ; (2) Quality control at production level ; (3) irregular check at retail level and ; (4) National Monitoring activity: China has already implemented National Monitoring Activities every two or three years in 1995,1997,1999,2002 and 2005 respectively since 1995 after USI. All the activities are based on WHO/UNICEF/ICCIDD criteria. The monitoring results in 2005 indicated that China has maintained the sustained elimination of IDD : Coverage rate of qualified iodized salt (20-50 PPM) at household level): 90.2%; Iodine concentration in iodized salt at consumer level : 30.8 PPM; Urinary iodine in children : 246.3 µg/L; Total goiter rate in 5% by palpation and 4% by ultrasound respectively. The success of National IDD Control Program provided the following experience: strong political will and commitment to virtual elimination of IDD by top leaders; multisectoral coordination at both central and provincial levels; legislation on Universal Salt Iodization and monopoly of the salt trade; effective monitoring system and international cooperation.

History

Iodine Deficiency Disorders(IDD) were recorded, as goiter, in ancient Chinese medical literatures as early as 3,000BC which now is also one of very significant public health problem and continue to threaten the quality of life, human potential and social economic development in China. The most important epidemiological survey and intervention study in Chengde, Hebei Province in 1960, was led by Prof Xianyi Zhu (H.I.Chu),and Dr. T Ma from Tianjin Medical College. The intensive study demonstrated that the environmental

iodine deficiency is the main etiology for endemic goiter and endemic cretinism. Iodized salt is the most effective intervention for correction of iodine deficiency. This public health problem urged central government to organize a national epidemiological survey in 1970', which revealed there were 35 million patients with visible goiter and 250,000 typical cretins prior to prophylaxis. In addition, it was estimated that 700 million people are at risk for severe and moderate iodine deficiency^[1]. Another important finding indicated that the risk for high proportion of mild mental retardation rather than cretins was major insults for the population, which demonstrated the proportion of mild mental retardation (IQ 50-69) covered 5-15% of the children who grown up in IDD areas, in contrast to children living in non-IDD areas. IQ distribution curves have a generalized tendency to shift to the left with IQ deficit of 10 –12 points by a Meta-analysis^[2]. These individuals have been called "subcretins" in China and recognized as the main type of brain damage^[3].

The central government adopted National Iodized Salt Program as the main strategy for control of IDD Since 1970', but only in moderate and severe IDD endemias. Magnificent progress was achieved in the control of IDD and goiter rate was decreased, however, IDD was not completely under the control since lack of strong political will, unqualified iodized salt and no regular and effective monitoring system.

1993 National Advocacy Meeting – Milestone for virtually elimination of IDD in China

"National Advocacy Meeting to Eliminate of IDD by the Year 2000 " was held by State Council in Beijing in 1993 and State Councilor, Madam Peng Peiyun hosted the high level meeting, which was the historic follow-up activity of UN Summit for Children in 1990. Premier Li Peng signed the Summit declaration before this Meeting. Chinese Government has made the political commitment for the elimination of IDD by the year 2000. The State Council approved a new National IDD Control Program and a Regulation on Iodized Salt. Universal Salt Iodization (USI) was accepted as major intervention and then gradually covered all of China since 1995. Health Education and IDD Day are playing an important role in social mobilization. Another important event was to have established a Multi-sectoral Leading Group for the coordination at State Council level headed by Madam Peng. The National Monitoring activity on IDD and National and Provincial Monitoring System on iodized salt were setting up at production and household levels since 1993 Advocacy Meeting, and data communication was simultaneously established through national computer system.

USI Program: Legislation and monopoly

The State Council made an important historical decision to assure that all edible salt both for human and animal consumptions should be iodized. In support of this decision, Chinese Government promulgated "Iodized Salt Management Regulation for Control of IDD in China" and "Edible Salt Monopoly Regulation". 34 local laws or regulations were formulated and enforced in each province in order to supply acceptable iodized salt and not to allow the illegal salt to enter the market. This policy facilitated centralization of the salt industry and continuation of a centrally planned system, instead of free market mechanism, for the management of salt production and distribution. These legal

strategies strongly support the implementation of USI program in all of China.

A nationwide sales framework with a regulated salt market for wholesaling and retailing iodized salt was set up and continuously strengthened to assure edible salt iodization and distribution. In addition, There is strong ban on the production, transportation and sale by any salt producers and salt wholesalers without legal licenses. The centralization of iodized salt production and distribution demonstrated very high coverage of iodized salt (see table 1) to most areas (but not most of remote areas) and the centrally planned mechanism is able to effectively prevent the non-iodized salt from entering the market.

Monitoring and quality control

There are 5 components for monitoring and quality control system setting up in China.

1. Iodized salt quality assurance at production level: all the licensed salt plants have set up their own laboratories to monitoring iodine concentration in salt during production process, before packaging and before transportation.

2. Iodized salt monitoring at county level: The National Reference Laboratory (NRL) carries out National Monitoring on Iodized Salt at household level in each county once or twice a year. Monitoring indicators including iodine concentration in salt, coverage of iodized salt and coverage of non-iodized salt are tracked. NRL also plays a role of external quality assurance on each county laboratory.

3. Impact evaluation is implemented every two or three years, by using WHO/UNICEF/ICCIDD criteria. Each province is considered as a basic unit for the epidemiological survey. The Probability Proportional to size (PPS) cluster method was accepted for assessing IDD prevalence. Monitoring indicators include iodine concentration and coverage of iodized salt at household level, total goiter rate and urinary iodine concentration in schoolchildren. NRL is responsible for external quality control on salt or urinary iodine determinations. These activities were carried out by China CDC in 1995,1997,1999, 2002 and 2005 separately⁽⁴⁾ (Table 1).

4. Feedback mechanism: The Ministry of Health (MOH) regularly organizes a consultation meeting when these activities are finished. The National IDD Advisory Committee (NIDDAC) to MOH and other experts or partners express their final suggestions, recommendations or consultations for government consideration. It is also an opportunity to share the data, experiences, and further the cooperation among partners. The meeting also gives the solution or further intervention to solve the problem discovered by National Monitoring Activity.

TABLE 1. National Monitoring Results between 1995 to 2005

Indicators	1995	1997	1999	2002	2005
The proportion of household consuming iodized salt					
≥5 mg/kg (%)	39.9	81.1	88.9	95.2	94.9
20-50 mg/kg (%)	29.7	69.0	80.6	88.9	90.2
median iodine level	16.2	37.0	42.3	31.4	30.8

Urinary iodine level in children						
	medium(μ g/L)	164.8	330.2	306.0	241.2	246.3
TGR (%)	Palpation	20.4	10.9	8.8	5.8	5
	ultrasonography	-	9.6	8.0	5.6	4

Achievement

Up to now, the national monitoring data (Table 1) showed that China had already reached the goal of virtual elimination of IDD by the year 2000 and has maintained the sustainability of IDD elimination after 2000 ⁽¹⁾⁽⁴⁾. Another important survey concentrated on the iodine nutritional status of major target population (women of childbearing age, pregnant and lactating women and their babies) was conducted in provinces where the coverage rate of USI was around 97%. The table 2 shows the urinary iodine concentration in target groups with data on milk iodine⁽⁵⁾

Table 2 Urinary iodine in target groups (μ g/L)

Target groups	Urinary iodine
School children	229.1
Women at child-bearing age	220.2
Pregnant women	178.8
Lactating women	191.3
Babies	240.4
Milk	145

The results reveal the following facts: (1)Adequate iodine nutrition in all the special target groups and there is no iodine excess. (2)The newborn are completely protected by sufficient iodine intake. (3)Urinary iodine between 150-250ug/l indicates adequate iodine nutrition for women, including pregnant and lactating women. (4)Urinary iodine in schoolchildren after USI should not be below 150ug/l, so as to meet the requirements of pregnant and lactating women. (5)The iodine nutrition in pregnant and lactating women should be given more attention to ensure the sufficient iodine supply to their infants or babies even after USI.

Lessons learnt

- 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 authority body is persistently working at both central and provincial levels;
- Legislation on Universal Salt Iodization and monopoly of the salt trade nationwide;
- Effective monitoring system with reliable quality control and data communication;
- Strong technical support both from NIDDAC (National IDD Advisory Committee to MOH) and ICCIDD;

- Strong international support for the National IDD Control Program (WHO, UNICEF, UNDP, UNIDO, AusAID, CIDA, ICCIDD, World Bank ,SIDA and Kiwanis).
- Education, communication and social mobilization program plays an important role in the implementation of USI.

Current challenge

1. Four provinces without meeting to the goal of virtual elimination of IDD

The National Evaluation revealed there were 7 provinces without meeting the virtual elimination goal in 2000 and they are Tibet, Xinjiang, Qinghai, Gansu, Sichuan, Chongqing and Hainan provinces. Recent evaluation activity on these provinces is conducted in 2008 and the results indicated that Sichuan, Chongqing and Gansu have met the goal of virtual elimination with over 90% of coverage of qualified iodized salt. Therefore only 4 provinces (Tibet, Xinjiang, Qinghai and Hainan) left behind. Tibet and Xinjiang have set up subsidy policy of iodized salt program. The coverage of iodized salt in these provinces are obviously increased (table 3), such as Xinjiang has reached to 91%.

Table 3 Coverage of iodized salt in 4 provinces during 2007- 2008

Province	coverage in 2007(%)	coverage in 2008(%)
Xinjiang	83.91	91.56
Tibet	29.59	53.08
Hainan	78.13	80.41
Qinghai	85.59	91.33

2. About 200 counties without meeting to the national goal

The Regular National Iodized Salt Monitoring is performing at country level every year. There are 87.85% of counties nationwide has already reached the goal of the coverage rate of qualified iodized salt at level of more than 90%. The National Goal by the year 2010 is that 95% of the counties should be covered by 90% iodized salt at household level. Therefore 7.15 per cent left to meet the National Goal, i.e., about 200 counties without meeting to the national goal.

3. possible hiding iodine deficiency in pregnant or lactating women

Iodine deficiency also existed in pregnant women if they don't have enough consumption of qualified iodized salt. We want to find out the urinary iodine concentration in relationship between children and women or the relationship between coverage of iodized salt and urinary iodine in target population (pregnant, lactating women and women at child bearing age) The results demonstrated (table 4) that the urinary iodine in target population could be over 150ug/L if the urinary iodine in children is between 150-250ug/L^[5]. I

Table 4. the relationship in urinary iodine between school children and women

Median urinary iodine of school children ($\mu\text{g/L}$)	Forecasted values of median urine iodine ($\mu\text{g/L}$)		
	Women of childbearing age	Pregnant and lactating women	Infants
100	112.1	106.4	124.7
150	154.7	134.0	176.8
200	197.2	161.7	228.9
250	239.8	189.4	281.0
300	282.4	217.1	333.2

The National Iodized Salt Monitoring in 2007 also revealed that the urinary iodine in target population (pregnant, lactating women and women at child bearing age) is below 150 $\mu\text{g/L}$ if the coverage of qualified iodized salt is below 80%(see table 6). According to the new recommendation by WHO, the adequate level of urinary iodine in pregnant women should be in 150-249 $\mu\text{g/L}$. Therefore, 80% of coverage of qualified iodized salt is possibly the cut-point as the indication of iodine deficiency for target population.

4. Iodine excess

The iodine excess areas in 11 provinces (mainly in 6 provinces) are now confirmed by the high concentration of iodine in drinking water (well water) and water iodine is over 150 $\mu\text{g/L}$, usually over 300 $\mu\text{g/L}$, the highest 1000 $\mu\text{g/L}$. The urinary iodine in Children is between 500 to over 1000 $\mu\text{g/L}$ and iodine excess goiter patients are found in the children with urinary iodine over 800 $\mu\text{g/L}$. TGR is between 10-20%, mainly Grade I, but nodular goiter patients are rarely found. Up to now we did not find any cretins or obvious mental retardation measured by using IQ test for school children. Appendix 3 is the list of iodine excess areas nationwide. The government already called on stopping supply of iodized salt in stead of non-iodized salt and worked out a special monitoring plan for iodine excess areas.

5. Readjustment of iodine concentration in edible salt

The National monitoring results in 2005 demonstrated the possibility and feasibility of adjustment of iodine concentration in salt since there are five provinces with iodine excess (UI is over 300 $\mu\text{g/L}$), 16 provinces with more than adequate iodine nutritional status (UI is between 200-300 $\mu\text{g/L}$) as well as UI at national level is 241 $\mu\text{g/L}$ in 2002 and 246 $\mu\text{g/L}$ in 2005.

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