

中国预防碘缺乏病

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甲状腺肿大是碘缺乏病（IDD）的主要表现之一，早在公元前 3,000 年就被中国古代医学文献记载。IDD 严重破坏居住于碘缺乏地区居民的生活质量，抑制人类潜能发展，影响当地的社会和经济发展，它是我国重大公共卫生问题。1960 年，由天津医科大学朱宪彝、马泰主持完成的河北省承德地区流行病学调查和防治项目，提出环境中碘缺乏是造成地方病甲状腺肿和地方性克汀病的主要病因。

基于碘缺乏病业已成为公共卫生问题的关注，中央政府在 20 世纪 70 年代组织了全国性流行病调查工作，结果发现 350,000 例可见甲肿病人，以及 250,000 例症状明显的地方性克汀病病人。另外，根据调查结果，推测我国约有 7 亿人口生活在中度或重度碘缺乏地区^[1]。专家估计，在碘缺乏地区智商结果在 50 到 60 之间的儿童占到全体儿童的 5% 到 15%^[2]。根据我国文献报道所完成的系统回顾研究表明，生活在碘缺乏病区儿童的智商比碘充足儿童平均落后 12.5 点。病区儿童智商左移的结果表明我国碘缺乏地区存在相当一部分亚临床克汀病人，在碘缺乏所致脑损伤病人中占据多数^[3]。

碘盐是预防碘缺乏及其损伤的最有效方法。早在 20 世纪 70 年代，中央政府就开始采用碘盐预防 IDD，主要是在中重度 IDD 地区实施了国家碘盐项目，用于防治 IDD。在此之后，直至 20 世纪 90 年代中期之前，我国通过碘盐干预，甲状腺肿大率迅速下降，然而病区 IDD 问题尚没有得到完全有效控制，原因显而易见，诸如政治意愿和承诺不到位、市场上仍然在销售非碘盐，另外，在技术层面上，国家缺乏对于干预效果的及时和有效的监测体系。

1993 年召开的国家动员大会是中国消除碘缺乏病的里程碑事件

1993年由国务委员彭佩云女士领导，国务院组织召开的“中国2000年实现消除碘缺乏病目标动员会”（the National Advocacy Meeting for the Elimination of IDD by the Year 2000）在北京举行。此历史事件是中国落实1990年联合国世界儿童问题峰会决议的具体步骤。当时任中国总理的李鹏先生出席会议，并代表中国政府在决议文本上签字，从而向世界庄严承诺到2000年时，在中国消除碘缺乏病。随即国务院同意启动新的国家消除碘缺乏病规划，并颁布《食盐加碘条例》。全民食盐加碘（Universal Salt Iodization，USI）成为预防碘缺乏病的基本干预措施，于1995年底在全国实施。

中国消除碘缺乏病的成功，依赖于三个方面。首先，国家消除碘缺乏病规划中将健康教育和碘缺乏病宣传日列为干预措施，并在全国开展活动。通过长期不断努力，健康教育和IDD宣传日不断地向人民大众普及科学的防治知识，促进了社会动员，从而为消除IDD奠定了社会基石。此外，在中央政府一级设立了跨部门领导小组，委派彭佩云女士担任领导小组组长，承担协调国务院各有关部门及相关组织的责任，政治保障成为中国USI成功另一基石。最后，中国成立在中央和省级建立了碘盐监测体系，并借助计算机网络技术构成信息传递系统，在生产和用户水平上持续不断地监测盐碘水平，并及时将数据提供给有关部门，从而在技术层面上保障了消除IDD。

全民食盐加碘项目实施的保障：法规和专营

国务院制订了一项重要和历史性的决策，要求用于人类和动物的所有食用盐都必须添加充足的碘。为此，中国政府颁布了中国控制碘缺乏病食盐加碘管理条例。随后，34个省、自治区或直辖市制订了相应法律或法规，要求市场只能出售碘盐，并防止非碘盐流入。上述措施促进了盐业重新调整，生产更加集中化，出现了配送中心，同时，也宣布了不易监督的生产、经销、零售和质量监督的自由市场机制退出。中央和各省颁布的法律和法规保证了食盐加碘在全国的实施。

全国范围内的盐批发和零售专营机制业已建立，并不断得到加强，确保了食用碘盐的销售。严格的禁令让盐生产商和零售业主不敢违法，否则将会受到吊销营业执照的处罚。除了交通不便的遥远地区，碘盐生产的集中化和配送中心的出

现使碘盐在全国大多数地区保持了高覆盖率，见表 1，从而有效地防止了非碘盐的国内市场的流入。

碘盐的监测和质量控制

中国碘盐的监测和质量控制包括如下五个环节：

1. 生产水平上的碘盐质量保证。所有获得生产许可的盐厂都必须建立自己的实验室，在产品包装和运输前，实验室要监测生产过程中盐碘浓度。

2. 县级水平上的碘盐监测。由国家参照实验室实施的各县家庭食用盐碘含量监测每年执行 1 至 2 次。监测指标包括盐碘浓度、碘盐覆盖率和可能存在的非碘盐。该实验室对各县实验室执行质量控制。

3. 国家水平上的碘盐效果评估每 2 至 3 年实施一次，采用 WHO/UNICEF/ICCIDD 标准。流行病学调查采用容量比例概率抽样法（Probability Proportional to Size, PPS），以省、自治区或直辖市为基本单位评估 IDD 状况。监测指标包括盐碘浓度、家庭水平的盐碘覆盖率、学校儿童的总甲状腺肿大率和尿碘浓度。全国 IDD 监测由中国疾病预防控制中心负责，已经实施多年，结果见表 1。

4. 咨询机制。国家卫生部定期组织专家咨询会议，商讨国家监测工作。卫生部的国家碘缺乏病咨询专家组（NIDDAC）和其它专家或合作伙伴出席会议，陈述各自的观点、讨论呈递给政府的最终建议。咨询会议还为防治 IDD 各方提供了分享信息、结果和经验的机会，也使各方了解到防治进程，以及发现的新问题，共同探讨未来合作的内容。特别需要指出的是，对国家监测实施结果的反馈是非常重要的，它将防治 IDD 工作不断地推向前进。

表 1. 1995 年至 2005 年间国家监测结果

指标	1995	1997	1999	2002	2005
家庭食用碘盐率					
有碘率 $\geq 5\text{mg/kg}(\%)$	39.9	81.1	88.9	95.2	94.9
合格碘盐率 $20\text{-}50\text{mg/kg}(\%)$	29.7	69.0	80.6	88.9	90.2

	盐碘中位数 (µg/L)	16.2	37.0	42.3	31.4	30.8
学校儿童						
	尿碘中位数(µg/L)	164.8	330.2	306.0	241.2	246.3
	触诊总甲肿率 (%)	20.4	10.9	8.8	5.8	5.0
	B 超总甲肿率 (%)	-	9.6	8.0	5.6	4.0

中国消除碘缺乏病的成就

按中国所取得的成果，已经实现了到 2000 年实际消除碘缺乏病的目标，并在以后的若干年间连续取得成功，到现在为止，成功实现可持续消除^[1, 4]，详见表 1。当一个地区碘盐覆盖率达到 90%以上时，就能保证居住于当地的育龄妇女、妊娠妇女、哺乳期妇女、以及她们的孩子碘营养需要，防止婴幼儿发生碘致性脑发育损伤^[5]。

表 2. 易感人群尿碘浓度和哺乳期妇女的乳碘浓度 (µg/L)

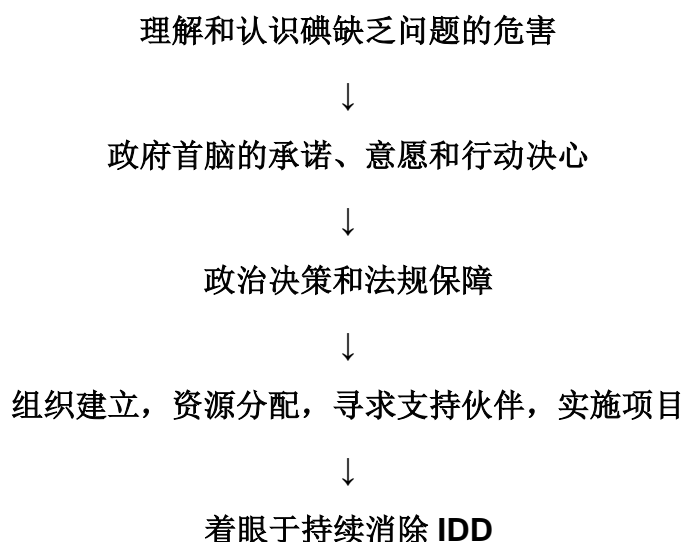
研究人群	碘浓度(µg/L)
学龄儿童尿	229.1
育龄妇女尿	220.2
妊娠妇女尿	178.8
哺乳期妇女尿	191.3
婴幼儿尿	240.4
母乳	145.0

该项研究发现：包括妊娠和哺乳期在内的妇女尿碘水平在 150 和 250µg/L 之间；被调查的不同人群碘营养充足，不存在碘过量摄入；在脑发育关键期，和婴幼儿避免了碘缺乏的威胁；学校儿童的尿碘水平不能低于 150 µg/L，否则，当地的妊娠期和哺乳期妇女将面临碘缺乏的危险；为确保新生儿和幼儿有充足的碘营养，应该对实施碘盐供应地区的妊娠期和哺乳期妇女进行碘营养监测。

中国经验：成功要素

- 中央和省政府的高层政治领袖具有消除碘缺乏病的坚定和持久的政治意愿和承诺。
- 中央和省的跨部门协调机制保证了消除 IDD 意愿的执行。
- 法律和法规保障了全民食盐加碘的实施，食盐专营制度将法律法规落实到盐的销售市场。
- 高效的监测机制保证了可靠的质量控制和数据交流。
- 国家专业机构和专家咨询组提供技术保障和防治知识。得到国外政府、国际组织和其它各方的技术和资源的坚强支持，包括世界卫生组织、联合国儿童基金会、联合国开发计划署、联合国工业发展组织、澳大利亚对外援助局、加拿大对外援助局、世界银行、瑞典对外援助局、Kiwaniis 国际和盖茨基金会。
- 持续不断的健康教育、宣传和社会动员。

中国-瑞典碘致性智力残疾的预防和康复项目历时 12 年，积累了珍贵的经验，形成了县级水平上消除碘缺乏病的结构框架。



Preventing iodine deficiency disorders in China

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The occurrence of iodine deficiency disorders (IDD), manifested as goiter, was recorded in ancient Chinese medical literature as early as 3,000 BC. This condition has continued to be a significant public health problem, threatening the quality of life, human potential and socioeconomic development in China. An important epidemiological survey and intervention program was carried out in Chengde, Hebei Province in 1960, under the leadership of Xianyi Zhu and T Ma of Tianjin Medical College. This intensive study demonstrated that lack of iodine in the environment was the main etiological cause of endemic goiter and cretinism.

Recognition of this public health problem urged the central government to organize a national epidemiological survey in the 1970s, which revealed the existence of about 35 million individuals with visible goiter and 250,000 with clear signs of cretinism. In addition, it was estimated that about 700 million people were at risk of developing severe or moderate iodine deficiency ^[1]. Equally important was the observation, following meta-analysis, that between 5 and 15% of children residing in areas with iodine deficiency could have IQ levels ranging between 50 and 60 ^[2]. There was thus a shift in the distribution of IQ levels in these communities amounting to a reduction with 10 to 12 points, as compared to children with adequate iodine intake. These individuals are referred to as sub-cretins, a condition that is recognized as the main type of iodine deficiency-induced brain damage in China ^[3].

Provision of iodized salt is the most efficient intervention for the prevention of iodine deficiency and its consequences. As a result of this, the central government adopted, commencing in the 1970s, the National Iodized Salt Program as the main strategy for the control of IDD, albeit only in areas with moderate and severe IDD. This resulted in a dramatic reduction of goiter rates

in the intervention areas, although the IDD situation was still not under satisfactory control, due in part to insufficient political will and commitment, continued marketing of non-iodized salt and inadequate and inefficient monitoring of the intervention.

The 1993 National Advocacy Meeting – Milestone in the elimination of IDD in China

In 1993 the National Advocacy Meeting for the Elimination of IDD by the Year 2000 was organized by the State Council in Beijing, with State Councilor Madam Peng Peiyun as host. This historic event constituted follow up of activities spearheaded by the UN Summit for Children in 1990 in which Premier Li Peng took part and also signed the Summit Declaration. In this manner, the Chinese Government made clear its political commitment to the elimination of IDD by the year 2000. The State Council subsequently approved a new National IDD Control Program and the Regulation on Iodized Salt. Universal Salt Iodization (USI) was accepted as the primary intervention for the prevention of IDD and was firmly on track in virtually all of China by 1995.

Important components of this intervention included the Health Education and IDD Day that was observed throughout China. This recurrent event played a crucial role in providing knowledge and in social mobilization. Another event that greatly contributed to the success of the program was the creation of the Multi-Sectoral Leading Group that was charged with the responsibility of coordinating all related activities at State Council level under the able leadership of Madam Peng Peiyun. A National and Provincial Iodized Salt Monitoring System were established with activities to be carried out at production and household levels. This comprehensive system that produced substantial amounts of data was coordinated by a national computer system.

Launching the universal salt iodization program: the power of legislation and monopoly in the delivery of health care

The State Council made an important and historical decision to ensure that all edible salt, both for human and animal consumption, should be adequately iodized. In support of this decision, the Chinese Government promulgated the Iodized Salt Management Regulation for Control of IDD in China and the Edible Salt Monopoly Regulation. 34 local laws or regulations were formulated and enforced in each province in order to supply acceptable iodized salt and to prevent illegal non-iodized salt from entering the market. This policy facilitated centralization of the salt industry and continuation of a centrally planned system, instead of free a market mechanism that would be difficult to monitor, for the management of salt production, marketing and distribution and quality control. These legal strategies strongly supported the implementation of the universal salt iodization 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. A strong ban was imposed on producers and wholesalers who were not in possession of legal licenses. The centralization of iodized salt production and distribution led to high coverage of iodized salt (see table 1) in most areas, with the exception of remote ones, and effectively prevented non-iodized salt from entering the Chinese market.

Monitoring and quality control

The monitoring and quality control system in China has five components:

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

2. Iodized salt monitoring at county level. The National Reference Laboratory carries out quality control at household level in each county once or twice a year. Monitoring indicators include iodine concentration in salt, coverage of iodized salt, and possible existence of non-iodized salt. The

National Laboratory also plays an important role in quality assurance at the level of 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 the assessment of IDD prevalence. Monitoring indicators include iodine concentration and coverage of iodized salt at household level, total goiter rate and urinary iodine concentration in school children. The National Laboratory is responsible for external quality control regarding determination of iodine in salt or urine. These activities have been carried out by China Center for Disease Control over a number of years. ⁽⁴⁾ (Table 1).

4. Feedback mechanisms. The Ministry of Health (MOH) regularly organizes consultation meetings whenever activities are completed. The National IDD Advisory Committee (NIDDAC) of the Ministry and various other experts or partners presents their views as well as final suggestions and recommendations for consideration by the government. These consultations also provide an opportunity for the partners to share the data that have been produced and processed, experiences gained and problems encountered in order to jointly find solutions or explore areas for future cooperation. Of particular importance is providing feedback to the National Monitoring Activity as it moves ahead into new areas of implementation.

TABLE 1. National Monitoring Results 1995 to 2005

Indicators	1995	1997	1999	2002	2005
Percentage households consuming iodized salt					
≥5mg/kg(%)	39.9	81.1	88.9	95.2	94.9
20-50mg/kg(%)	29.7	69.0	80.6	88.9	90.2
Median iodine levels (µg/L)	16.2	37.0	42.3	31.4	30.8

Schoolchildren					
Median urinary iodine levels (µg/L)	164.8	330.2	306.0	241.2	246.3
TGR* By palpation (%)	20.4	10.9	8.8	5.8	5.0
TGR* By ultrasonography (%)	-	9.6	8.0	5.6	4.0

Note: TRG – Total goiter rate

Some indicators of achievements

The national data presented in Table 1 clearly show that China had already achieved the goal of virtual elimination of IDD by the year 2000 and has succeeded in sustaining these results even after this year ^[1, 4]. This fact is further validated by the results of surveys focusing on the iodine nutritional status of populations groups at risk of IDD, namely women of childbearing age, pregnant and lactating women and their babies. ^[5] Table 2. These groups nowadays live in areas where the coverage rate of iodized salt is about 90%.

Table 2. Urinary iodine concentrations in vulnerable groups and in milk(µg/L)

研究组 Study groups	尿碘 Urinary iodine (µg/L)
学龄儿童 School children	229.1
育龄妇女 Women of child bearing age	220.2
妊娠妇女 Pregnant women	178.8
哺乳期妇女 Lactating women	191.3
婴幼儿 Babies	240.4
母乳 Milk	145.0

The results of China's interventions reveal the following facts:

1. Samples from at risk groups clearly display adequate iodine nutrition with no suggestion of excess intake of iodine.
2. The most sensitive groups, newborns and young children, seem to be

adequately protected from the risks of iodine deficiency during a sensitive period of brain growth.

3. Urinary iodine levels between 150 and 250µg/L indicate adequacy of iodine nutrition for all women, including pregnant and lactating women.

4. Urinary iodine in school children with adequate iodine intake should not be below 150 µg/L. Concentration below this level suggest that their mothers are not receiving adequate iodine both during pregnancy and lactation.

5. The iodine nutrition of pregnant and lactating women should be carefully monitored in order to ensure adequate supply to newborn and young children even in areas where iodized salt has been implemented.

Lessons learnt from the Chinese experiences: Some determinants of success

- Strong and sustained political will and commitment to the elimination of IDD at the highest levels of leadership in central and provincial governments
- Multi-sectoral coordination with executive authority at both central and provincial levels
- Legislation on universal salt iodization and monopoly or strict control of the salt market nationwide
- Effective monitoring system with reliable quality control and data communication
- Strong technical support both from specialized national agencies and advisory groups with specific skills and know how
- Strong international support from technical and aid agencies (WHO, UNICEF, UNDP, UNIDO, AusAID, CIDA, ICCIDD, World Bank, SIDA and Kiwanis).
- Education, communication and social mobilization programs at all stages of implementation

A decade of Sino-Swedish Co-operation (1995-2008) on Prevention and

Rehabilitation of Iodine Deficiency-Related Mental Retardation provided valuable experiences and a hierarchy of factors that work towards the implementation and maintenance of programs at national and county levels.

Understanding and recognition the problem



Commitment, willingness, determination to act



Policy decisions, legislation



Setting up a structure, providing resources, seeking support and implementing



IDDFocus on sustainability

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