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# RECOMMENDED IODINE LEVELS IN SALT AND GUIDELINES FOR MONITORING THEIR ADEQUACY AND EFFECTIVENESS



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United Nations Children's Fund

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International Council for the Control of Iodine Deficiency Disorders

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Geneva

# Recommended iodine levels in salt and guidelines for monitoring their adequacy and effectiveness

Based on a joint WHO/UNICEF/ICCIDD consultation
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## Background

### 1 Introduction

1.1 Universal salt iodization is the recommended intervention for preventing and correcting iodine deficiency.

1.2 In the past, recommendations for iodine levels in salt were made on the assumption that, from producer to consumer, iodine losses from iodized salt were commonly between 25% and 50%, and that average salt intakes were commonly between 5 and 10 g/person/day.

1.3 Substantial experience has been gained in the last decade in implementing universal salt iodization and assessing its impact on iodine deficiency disorders (IDD) (1).

1.4 A major achievement is the spectacular reduction of IDD in countries that have implemented universal salt iodization.

1.5 However, it appears that some people in some countries now have iodine intakes that are unnecessarily high and that may occasionally be associated with iodine-induced hyperthyroidism (2).

1.6 For this reason, WHO, UNICEF and the International Council for Control of Iodine Deficiency Disorders carried out a study in seven African countries to examine the relationship between salt iodization and population iodine status.

1.7 Previous recommendations for iodine levels in salt have been reconsidered as a result of this study, and in the light of other technical and scientific developments.

## 2 Iodine requirements

2.1 To meet iodine requirements, the current recommended daily iodine intakes are:

- 50 $\mu$g for infants (first 12 months of age).
- 90 $\mu$g for children (2–6 years of age).
- 120 $\mu$g for school children (7–12 years of age).
- 150 $\mu$g for adults (beyond 12 years of age).
- 200 $\mu$g for pregnant and lactating women.

## 3 Risk of iodine-induced hyperthyroidism

3.1 Iodine-induced hyperthyroidism is an iodine deficiency disorder which may occur—primarily in older people—when severely iodine-deficient populations increase their iodine intake, even when the total amount is within the usually accepted range of 100–200 $\mu$g/day.

3.2 On a population basis, iodine-induced hyperthyroidism represents a transient increase in the incidence of hyperthyroidism, which will disappear in due course with the correction of iodine deficiency.

3.3 Iodine-induced hyperthyroidism occurs in some subjects who have pre-existing autonomous nodular goitre. It appears likely that some patients with latent Graves' disease are also at risk.

3.4 The number of people at risk of iodine-induced hyperthyroidism is directly proportional to the number of subjects with nodular goitre.

3.5 The occurrence of iodine-induced hyperthyroidism is probably related to the relative increase, and rapidity of increase, of iodine intake, which occurs when iodized salt is introduced in populations that are severely iodine deficient.

3.6 An increase in the incidence of hyperthyroidism may follow relatively small increments in iodine intake, but the risk is most likely to be greatest following ingestion of larger increments.

3.7 There is no level of iodine in salt that offers complete protection against some increase in the incidence of hyperthyroidism in a previously iodine-deficient population.

3.8 On a population basis, the benefits of correcting iodine deficiency through universal salt iodization vastly outweigh the risks of iodine-induced hyperthyroidism.

# Recommendations

## 4 Required iodine levels in salt

**4.1** Taking into account the following revised assumptions, which are based on new information:

- iodine lost from salt is 20% from production site to household,
- another 20% is lost during cooking before consumption,
- average salt intake per capita is 10 g/day,

in order to provide 150 $\mu$g/day of iodine via iodized salt, iodine concentration in salt at the point of production should be within the range of 20–40 mg of iodine (or 34–66 mg potassium iodate) per kg of salt. When all salt used in processed food is iodized, the lower limit (20 mg) is recommended. Under these circumstances, median urinary iodine levels will vary from 100–200 µg/l.

**4.2** In many situations in developing countries, however, despite improvements in salt production and marketing technology, the quality of available salt is poor, or salt is incorrectly iodized, or salt that has been correctly iodized deteriorates due to excessive or long-term exposure to moisture, light, heat and contaminants. Under these circumstances, iodine losses can be 50% or more from the moment salt is produced until it is actually consumed, and median urinary iodine levels could thus fall below the recommended range (100–200 µg/l). In addition, salt consumption is sometimes considerably less than 10 g/person/day. All these factors should be taken carefully into account, particularly when establishing the initial level of iodine in salt.

4.3 If median urinary iodine levels from a representative sample of the population at risk are not within the recommended range, salt iodization levels and factors affecting its utilization should be reassessed focusing on:

- Salt quality and iodization procedures.
- Factors affecting iodine losses in salt, e.g. packaging, transport. storage, cooking.
- Food habits in relation to salt intake and cooking practices.

## 5 Risk of iodine-induced hyperthyroidism associated with iodine levels in salt

5.1 Where severe iodine deficiency has been a long-term problem, in the light of the risk factors for iodine-induced hyperthyroidism noted in part 3, especially points 3.5 to 3.7, iodine levels in salt should be set at the lowest level that will prevent all manifestation of iodine deficiency disorders while minimizing the risks of iodine-induced hyperthyroidism.

5.2 Periodic surveys of urinary iodine are necessary to monitor actual iodine intake. Iodine levels in salt should be adjusted accordingly to progressively ensure a median of 100–200 $\mu$g/l.

## 6 Requirements for monitoring iodine status and adequacy of iodine levels in salt

**6.1** A national monitoring programme should include:

**6.1.1** Establishing an IDD committee of qualified individuals who are responsible for programme monitoring and evaluation.

**6.1.2** Ensuring regular quality control of iodine concentration in salt at the point of production by using titration methods or, in the case of imported salt, at the point of entry by using reliable test kits. Consignments with suspect iodine levels should be re-checked by titration.

**6.1.3** Setting up independent laboratories capable of carrying out salt iodine titration and urine iodine analysis to ensure external quality control.

**6.1.4** Designating sentinel sites to carry out the following activities:

- Monitoring periodically salt iodine levels in retail shops and households using reliable test kits.
- Conducting occasional goitre prevalence surveys.
- Measuring regularly urinary iodine.

**6.1.5** Adjusting salt iodine levels based on monitoring results, especially of iodine in urine.

6.1.6 Alerting health workers to possible occurrence of hyperthyroidism, and ensuring access to appropriate treatment when necessary.

6.1.7 Establishing a health notification system for cases of hyperthyroidism at selected hospitals in areas of former severe/moderate iodine deficiency.

6.2 The following equipment and procedures may also be required:

6.2.1 A laboratory capable of investigating thyroid function, particularly TSH and thyroid hormones.

6.2.2 Ultrasound equipment to complement palpation.

6.2.3 Semi-quantitative test kits for measuring urinary iodine, as soon as such kits are available.

## Related reading

WHO/FAO/IAEA. *Trace elements in human nutrition and health*, World Health Organization, Geneva, 1996.

Hetzel BS, Pandav CS. *SOS for a billion. The conquest of iodine deficiency disorders*. 2nd ed., Oxford University Press, Delhi, 1996.

WHO/UNICEF/ICCIDD. *Indicators for assessing iodine deficiency disorders and their control through salt iodization*. Document WHO/NUT/94.6, available in English, French and Spanish from the Nutrition Unit, World Health Organization, Geneva, ICCIDD, Avenue de la Fauconnerie 153, B-1170 Brussels, Belgium and UNICEF, 633 Third Avenue (24th floor), NY 10017.

## References

1. Iodine deficiency disorders cover a spectrum of pathological conditions resulting from a deficiency of iodine, and include goitre, hypothyroidism, cretinism, deaf-mutism, squint, spastic diplegia, mental retardation, dwarfism, stillbirth, congenital anomalies, and increased perinatal mortality.

2. Hyperthyroidism is a condition marked by increased functional activity of the thyroid gland with excessive biosynthesis and secretion of thyroid hormones triiodothyronine (T3) and thyroxine (T4), leading to thyrotoxicosis, whose characteristic manifestations include profuse sweating, weight loss, increased appetite, ocular changes (especially upper eyelid retraction), cardiovascular effects (especially tachycardia and arrhythmias), dyspnoea, nervousness, weakness, and fatigability.

## *Related WHO documents available on request*

### Iodine and Health
Eliminating Iodine Deficiency Disorders Safely through Salt Iodization: A WHO Statement

1994, 7 pages [E, F, S]
WHO/NUT/94.4

A WHO statement summarizing the cumulative scientific evidence concerning the safety of providing iodized salt to non-deficient populations.

### Global Prevalence of Iodine Deficiency Disorders

*Micronutrient Deficiency Information System Working Paper*, No. 1
1993, 80 pages

A detailed summary of the most recent information on the magnitude and distribution of goitre and other iodine deficiency disorders throughout the world. Estimates, which are country-specific, represent the first exact quantification of at-risk populations. The document includes maps and summary tables of national goitre prevalence rates for virtually every country in the world.

### Iodized Oil During Pregnancy
Safe Use of Iodized Oil to Prevent Iodine Deficiency in Pregnant Women A Statement by the World Health Organization

1996, 11 pages
Reprinted from the *Bulletin of the World Health Organization*, Vol. 74, No. 1, 1996

Evaluates the risks and expected benefits from iodized oil, given orally or by injection, to pregnant women in areas of severe iodine deficiency where iodized salt is not available. The conclusions, which were approved by the International Council for Control of Iodine Deficiency Disorders, showed that for preventing and controlling moderate and severe iodine deficiency, the giving of iodized oil is safe at any time during pregnancy.

### Indicators for Assessing Iodine Deficiency Disorders and their Control Through Salt Iodization

1994, vi + 55 pages
WHO/NUT/94.6

Sets out fundamental principles governing the use of indicators to monitor the epidemiology of iodine deficiency disorders and the progress of salt iodization as the recommended preventive intervention. Information includes advice on the selection of clinical and biochemical indicators, indicators specific to age and physiological groups, survey sample size, and a simplified goitre grading system.

Guidance is also provided on the ultrasound measurement of thyroid size, the determination of urinary iodine levels and interpretation of thyroid-related hormone estimates, recommended levels of salt iodization appropriate for different climates, salt-consumption patterns in different parts of the world, and available packaging for iodized salt. Numerous examples of practical problems – and their solutions – are also included.

### Recommended Normative Values for Thyroid Volume In Children Aged 6–15 Years

*World Health Organization* and *International Council for Control of Iodine Deficiency Disorders*
*Bulletin of the World Health Organization*, Vol. 75, No. 2, 1997
In press

Sets out recommended upper normal limits for thyroid volume, assessed using ultrasonography, for iodine-replete boys and girls aged 6–15 years. These cut-off values are recommended for interpreting survey and surveillance ultrasonography data among school-age children. In countries with a high prevalence of child growth retardation, thyroid volume is provisionally considered to be more directly a function of total body surface area. Therefore, recommended upper normal limits of thyroid volume, calculated according to body surface, are also reported.

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