Original Article

Assessment of iodine deficiency disorders in Meerut district, Uttar Pradesh

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Iodine deficiency disorders (IDD) are an important public health problem in India. Meerut district, Uttar Pradesh, is a known IDD endemic area. A study conducted in 1986 reported a total goitre rate of 24.9% in the entire population of Meerut district. During 1990–97 intensive efforts were taken by the Uttar Pradesh Government to ensure universal availability of iodized salt to the population. No survey has been conducted since 1997 on the status of iodine deficiency in the Meerut district. Hence, the present study was conducted in order to assess the prevalence of IDD and to estimate the iodine content of salt consumed in the households of Meerut district, Uttar Pradesh. The 30 cluster sampling methodology and indicators for assessment of IDD as recommended by the joint WHO/UNICEF/ICCIDD (World Health Organization/United Nations Children's Fund/International Council for the Control of Iodine Deficiency Disorders) Consultation in full was utilized for the survey. A confidence level of 95%, relative precision of 10% and design effect of three were considered in the calculation of the sample size. The prevalence of goitre at the time of survey was estimated to be 15%. A total of 6485 school children in the 6–10 years age group were selected using probability proportionate to size cluster sampling methodology. A total goitre prevalence rate of 11.6% was found in the district. It was observed that 5.4, 2.9 and 19.9% of the children had urinary excretion levels of < 2.0, 2.0–4.9, and 5.0–9.9 µg/dL, respectively. The median urinary iodine excretion of the children studied was found to be 15.0 µg/dL. Fifty-three percent of the children studied consumed salt with an iodine content of less than 15 p.p.m., which was below the stipulated level (15 p.p.m.). The study showed that the population is in a transition phase from iodine deficient (as revealed by total goitre rate) to iodine sufficient (as revealed by median urinary iodine excretion of 15.0 µg/dL). There is a need to further strengthen the existing monitoring system for the quality of iodized salt in the district in order to achieve the elimination of IDD.

Key words: excretion levels, goitre, iodine deficiency disorders, iodized salt, urinary iodine.

Introduction

Iodine is an essential element required for normal human growth and development. The daily requirement of iodine is 150 µg. Until recently, iodine deficiency was recognized only by the presence of goitre, which is caused by hyperplasia of the thyroid gland due to non-availability of iodine for synthesis of the gland's hormones, tri-iodo thyronine and thyroxine. Now, it is known that iodine deficiency not only causes endemic goitre and cretinism but also a wide spectrum of disabilities which includes deaf mutism, mental and physical retardation and various degrees of neuromotor dysfunction.[1–5]

Meerut district is a known iodine deficiency disorders (IDD) endemic area. A study conducted in 1986 reported a goitre prevalence of 24.9% in the district.[6] In order to ensure adequate availability and use of iodized salt, the government of Uttar Pradesh (UP) issued a ban on the sale of non-iodized salt for human consumption in 1987. Under this ban order, sale of iodized salt with a minimum of 30 p.p.m. iodine at the manufacturer's level and 15 p.p.m. iodine at the consumer level is ensured in the state.[7,8] During 1990–97, the State Government of Uttar Pradesh implemented intensive efforts to ensure universal availability of iodized salt to the entire population.

No survey has been conducted since 1997 on the status of iodine deficiency in Meerut district. Hence, the present study was conducted in order to assess the prevalence of IDD and to estimate the iodine content of salt consumed in the households in Meerut district, Uttar Pradesh.

Methods

The study was conducted in Meerut district, Uttar Pradesh. The 'EPI-30 cluster' sampling method, as recommended by the joint WHO/UNICEF/ICCIDD Consultation on indicators for assessing IDD and their control programmes, was followed for selecting the survey sites.[9] Children in the 6–10 years age group were considered for the present study. School children in this age group were recommended for the

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assessment of IDD because of their combined high vulnerability to disease, the number of representatives of their age group in the community and easy accessibility.[9] In Meerut district, more than 80% of school-going children were enrolled in primary classes and hence the school approaches was adopted.

The district has a total population of 3 404 000. For population proportionate to size cluster-sampling methodology all of the schools in the village and urban area in the district, with their respective populations, were enlisted. From these, a total of 30 clusters were selected.[9]

Calculation of sample size

The sample size was calculated based on an estimated presumption of goitre prevalence as 15%. A confidence level of 95%, relative precision of 10% and design effect of three were used for calculating sample size. Based on these parameters, a sample size of 6410 was obtained.

In each identified population unit (cluster), all the primary schools were enlisted and one school was randomly selected for the detailed survey. In each cluster, approximately 215 children were surveyed. If the sample size could not be obtained from one school, an adjoining school was included to complete the sample of a cluster. In each class, the children were briefed about the study objectives. Subsequently, children aged between 6 and 10 years were identified with the help of school records for inclusion in the study.

The clinical examination for goitre was undertaken by medical doctors specially recruited and trained for the survey. Grading of goitre was performed according to the criteria recommended by the joint WHO/UNICEF/ICCIDD (grade 0 = no goitre; grade 1 = thyroid palpable but not visible; and grade 2 = thyroid visible with neck in normal position). When in doubt, the immediate lower grade was recorded. The results were recorded in a predesigned questionnaire. The sum of grades II and I provided the total goitre rate in the study population.

On-the-spot urine samples were collected from every 8th child included in the study. In each cluster, approximately 25 urine samples were collected in wide-mouthed screw capped plastic bottles. One drop of toluene was added to each sample to inhibit bacterial growth and to minimize bad odour. Iodine was determined by the wet digestion method.[10] The results were expressed as µg iodine/dL urine. The data were entered into the predesigned questionnaire.

In each cluster, 25 children were randomly selected to bring 20 g of salt that was routinely consumed in their respective homes in autoseal polythene pouches. The iodine content of the salt was estimated by the standard idometric titration method.[11]

Results

A total of 6485 school children in the age group of 6–10 years were included in the study. Table 1 gives the distribution of children according to sex and age. The male : female ratio was nearly 1 : 1. A total goitre prevalence rate of 11.6% was observed among the subjects studied. Table 2 shows the urinary iodine excretion level in the children studied. It was found that 5.4, 2.9 and 20% of the children had urinary excretion levels of < 2.0, 2.0–4.9, and 5.0–9.9 µg/dL, respectively. The median urinary iodine excretion of the children studied was found to be 15.0 µg/dL.

The iodine content of salt samples collected and analysed is depicted in Table 3. Salt with a nil iodine content was consumed by only 4.0% of the subjects. Approximately 53.4% of families consumed salt with an iodine content of less than 15 p.p.m.

Discussion

It has been recommended that if more than 5% of school age children (6–10 years) are suffering from goitre, the area should be classified as endemic for iodine deficiency.[9] In the present study, a total goitre prevalence rate of 11.6% was found, signifying that in Meerut district, iodine deficiency existed. In an earlier study in 1986, a goitre prevalence of 24.6% was reported.[6] The decrease in the prevalence of goitre could be possibly attributed to the implementation of the salt iodination programme in the district.

The median urinary iodine excretion level of the children studied was found to be 15.0 µg/dL, indicating that there was no biochemical deficiency of iodine in the subjects studied (i.e. when the cut-off of median urinary iodine excretion of 10 µg/dL or more was used as a criteria for predicting status of iodine nutriture).

In the present study, 53.4% of the beneficiaries consumed salt with an iodine content of less than 15 p.p.m., which was below the stipulated level (of 15 p.p.m.). This finding revealed that although the salt was being iodized, either an inadequate quantity of iodine was added to it at the produc-

Table 1. Distribution of subjects according to age and sex, Meerut district, Uttar Pradesh, 1998 (n = 6485)

Age (years)	Male	Female	Total
6	989	859	1848
7	750	655	1405
8	594	578	1172
9	478	493	971
10	599	490	1089
Total	3410	3075	6485

Table 2. Urinary iodine excretion (UIE) levels in the study subjects, Meerut district, Uttar Pradesh, 1998 (n = 710)

UIE level (µg/dL)	*n*	%
< 2.0	38	5.4
2.0–4.9	21	2.9
5.0–9.9	142	20.0
10.0 +	509	71.7

Median UIE Level = 15.0 µg/dL.

Table 3. Iodine content of salt samples, Meerut district, Uttar Pradesh (1998) (n = 716)

Iodine content	*n*	%
Nil	28	4.0
< 15 p.p.m.	354	49.4
15 p.p.m. +	334	46.6
Total	716	100.0

Mean iodine concentration 20.5

tion level or there were losses of iodine at the different points of distribution. The present study indicates that the population of Meerut district is in a transition phase from iodine deficient to iodine sufficient nutriture as revealed by the median urinary iodine excretion level of 15 µg/dL. The possible reason for this transition might be the increased consumption of salt by the population. The iodine is available from the food eaten by the population. The additional iodine was supplemented by iodized salt, which possibly led to adequate iodine nutriture in the population. There is a need for the State Government to strengthen the Monitoring Information System used for assessing the quality of salt available to beneficiaries.

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