Biochemical Iodine Deficiency in Selected Schools of Aligarh

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Summary

The goiter prevalence reflects the iodine deficiency in past while urinary iodine excretion levels (UIEL) gives the current status of iodine nutrition. The study was conducted to assess the status of biochemical iodine deficiency in school children of 1st–5th standard (6–12 years). A total of 907 students of seven schools were included using probability proportional to size method. About 10% of urine samples from total children were tested for UIEL. Statistical analysis was done using SPSS version 20 (IBM SPSS Statistics for Windows, Version 20.0. Armonk, NY: IBM Corp). UIEL values lower than 100 μg/L were observed in 23.3% of samples. The proportion of children with UIEL of <20 μg/L was nil in 6 years. Out of 13 students who were consuming salt with nil iodine content, 46.2% had <20 μg/L UIEL. The prevalence of iodine deficiency, calculated by the proportion of children having UIEL of <100 μg/L, was 23.3%. Based on UIEL values, the area would be categorized as having "no biochemical iodine deficiency."

Key words: Biochemical iodine deficiency, iodine deficiency disorders, urinary iodine excretion level

Iodine deficiency is one of the most neglected and widespread of all nutritional deficiencies, constituting a brake on human development.

Iodine is required for the synthesis of thyroxine (T_4) and triiodothyronine (T_3). These hormones are very important in the regulation of the metabolism of proteins, carbohydrates and fats and almost all the activities of the body.

According to the World Health Organization (WHO), iodine deficiency occurs in 130 countries in the world, and 2.2 billion people live in iodine-deficient areas.[1]

Surveys conducted in India have revealed that out of the 325 districts surveyed in India, 263 districts are IDD-endemic, i.e., the prevalence of iodine deficiency disorder (IDD) is above 10% in the population.[2]

A number of survey and research activities have been carried out in various parts of the world and in our country aimed at assessing the magnitude of the problem and status of the National Iodine Deficiency Disorders Control Programme. However, data are deficient on various aspects of the problem. Because of deficient data, there is a need for further research in a number of fields related to IDD so that these data can be made available to planners and policymakers. Paucity of clinical, laboratory, and epidemiological data in Aligarh makes it difficult to understand the magnitude of problem. The present study is an attempt to carry out an in depth assessment biochemical iodine deficiency in school children.

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The study was conducted among school children (6–12 years). Three government and four private schools in Aligarh were selected.

From 1st to 5th standard children (age group 6–12 years) were the "sampling units."

The data were collected from January 1, 2013, to December 31, 2013.

Directorate General of Health Services found a goiter prevalence rate of 12% in Aligarh District.[3]

Taking "p" as 12% and relative error (l) 20% of "p," the sample size (N) was calculated as:[4]

$N = 4 \times P \times q/l^2$

q (%) $=100 - p$,

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$N = 4 \times 12 \times 88/(0.2 \times 12)^2$

$N = 733$

Taking into consideration 20% nonresponse/non-cooperation rate, total sample size was:

$N = 733 + (0.2 \times 733)$

$N = 879$

However, a total of 950 participants were included in the study.

Schools were contacted several days before the study began to inform the principals of the schools, the study purpose and to get consent from them as well as parents/guardians of children.

Schools were contacted several days before the study began to inform the principals of the schools, the study purpose and to get consent from them as well as parents/guardians of children. In consultation with principal, a suitable date (a day on which the attendance in the school was maximum, preferably early in the week, avoiding national and state holidays), time and place for interviewing and examining the children were chosen. As a part of ethical considerations, they were briefed about the presentation of IDD, and its consequences and methods available for its prevention especially health benefits of taking iodized salt in diet, food items which prevent the utilization of iodine in the body. This helped us having their maximum participation for conducting the study in school children, and it also ensured good attendance of students.

The school authorities were asked to provide us the list of students who were enrolled in classes from 1st to 5th standards and were in the age group 6–12 years. We requested for school records showing their dates of births. The age was classified according to their dates of births.

The required sample was selected by "Multistage sampling" by doing a subsampling. In the first stage, schools were selected over a period of time, and permission was obtained from school authorities. In the second stage, a list of students in class 1st–5th standard in the age of 6–12 years was obtained. Our "sampling frame" consisted of number of students selected from one school. As per probability proportional to size method, number of students in a school was proportional to the strength of a total number of students (6–12 years) from all schools. The next stage was to select students in a school. With the help of random number table, a random sampling method was applied to select the final numbers of students from a school to be included in the study. We assigned each student a serial number in that school.

Keeping in view the recommendation,[5] we took 10% of urine samples from total children interviewed, i.e., 90 from 907.

Urine collection from the study subjects was performed only after getting permission from principals and their guardians. Sterile plastic urine containers were labeled and distributed to the students. Instructions to the students were given regarding the collection of urine samples. Five milliliters of fresh "on the spot" urine sample was collected from each selected subject in sterile plastic containers and labeled with unique identification number corresponding to the student's name. Few drops of toluene were added to each urine sample to inhibit bacterial growth and to minimize bad odor.

Urine samples were analyzed in the laboratory of the Department for Estimation of Urinary Iodine Excretion Levels (UIEL) using the Wet Digestion Method of the Sandell-Kolthoff reaction.[6] A pooled urine sample was prepared for internal quality control (IQC) assessment. The IQC sample was analyzed 25 times with standards and blank with duplicate. This IQC sample having a known concentration range of iodine content was run with every batch of test samples. If the result of IQC sample was within range (i.e., mean ±2 standard deviation), the test was deemed in control, and if the results were outside the range, the whole batch was repeated.

Every child was asked to bring approximately two teaspoons (10 g) of salt in labeled auto sealed polythene pouches. The study was approved by Institutional Ethics Committee.

Inclusion criteria for study population were students of schools whose principals gave consent to our study, students of classes from 1st to 5th standard who were the age group of 6–12 years and students whose parents/guardians gave consent to our study.

Exclusion criteria was students not attending the school on the day of the study

The analysis of distribution of UIEL revealed values lower than 100 μg/L in 23.3% of samples [Table 1]. Iodine deficiency is defined by the WHO as median urinary iodine concentration (MUIC) that falls below 100 μg/L, while a MUIC of 50–99 μg/L, 20–49 μg/L, and <20 μg/L indicates mild, moderate, and severe iodine deficiency, respectively.[6]

Based on these values the area would be categorized as having "No iodine deficiency." Our results are similar to study done in Meerut District, Uttar Pradesh.[7]

The proportion of children with urinary iodine excretion level of <20 μg/L was nil in 6-year age group while it was 18.2% in 9–10-year age group. A study conducted in Gujarat showed that the proportion of children with urinary iodine excretion of <100 μg/L was lowest in the 6-year age group, whereas the highest proportion was found in the 10-year age groups.[8] These results were in conforming to our findings. Similar results were also found in Gujarat.[9]

As shown in Table 2, out of 13 students who were consuming salt with nil iodine content, 46.2% had <20 μg/l UIEL. A statistically significant inverse association between the variable salt iodine content and urinary iodine excretion level was also found in a study conducted in Brazil. Iodine levels in salt for consumption were below the regulated by the Brazilian Health Ministry and there was also detected a significant iodine deficiency in the children's urine.[10]

Based on Median Urinary Iodine Concentration (MUIC) values for all children, the area would be categorized as having "No iodine deficiency."

Table 1: Distribution of Urinary Iodine Excretion Levels in different age groups

Serial number	Age (years)	UIEL (μg/L)				Total (%)
		<20 (%)	20-49.9 (%)	50-99.9 (%)	≥100 (%)	
1	6	0	0	1 (14.3)	6 (85.7)	7 (7.8)
2	7-8	3 (10.3)	1 (3.4)	2 (6.9)	23 (79.3)	29 (32.2)
3	9-10	2 (18.2)	3 (27.3)	1 (9.1)	5 (45.5)	11 (12.2)
4	11-12	4 (9.3)	1 (2.3)	3 (7.0)	35 (81.4)	43 (47.8)
Total		9 (10.0)	5 (5.5)	7 (7.8)	69 (76.7)	90 (100.0)

UIEL: Urinary Iodine Excretion Levels

Table 2: Distribution of Urinary Iodine Excretion levels and iodine content of salt

Serial number	Iodine content (ppm)	UIEL (μg/L)				Total (%)
		<20 (%)	20-49.9 (%)	50-99.9 (%)	≥100 (%)	
1	0	6 (46.2)	2 (15.4)	1 (7.7)	4 (30.8)	13 (14.4)
2	1-7	2 (10.5)	1 (5.3)	3 (15.8)	13 (68.4)	19 (21.1)
3	8-15	1 (2.4)	0 (0.0)	1 (2.4)	39 (95.1)	41 (45.6)
4	>15	0 (0.0)	2 (11.8)	2 (11.8)	13 (76.5)	17 (18.9)
Total		9 (10.0)	5 (5.5)	7 (7.8)	69 (76.7)	90 (100.0)

UIEL: Urinary Iodine Excretion Levels

As the iodine content of salt increased, UIEL also increased in most of the study population. This indicates that through intake of adequately iodized salt consumption, iodine nutrition can be improved.

A mission approach is required with effective and efficient coordination among all stakeholders of IDD control efforts in India, especially in socioeconomically backward areas to achieve and sustain the IDD control campaign.

At last, it is concluded that if all salt is iodized adequately and all families use only iodized salt, then iodine deficiency will no longer threaten the health and development of children. This will help building a healthy society and nation.

Integrated package of communication activities aimed at wholesalers, retailers, and consumer with intensive social mobilization activities for at least 3 years.

Proper laboratory facilities for UIEL estimation as well as for checking the iodine content of salt through iodometric titration need to be set up in Aligarh District.

Better monitoring of iodine content in salt at various levels by the concerned agencies like, Food Safety Standard Authority of India should be done.

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Conflicts of interest

There are no conflicts of interest.

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