Prevalence of Iodine Deficiency Disorders - A School Based study in Aligarh

Mohammad Athar Ansari*, Zulfia Khan
1Department of Community Medicine, JN Medical College, AMU, Aligarh-202002

ABSTRACT
Introduction: Iodine deficiency is one of the most neglected and wide spread of all nutritional deficiencies, constituting a real brake on human development. Deficiency of iodine may result in development of goitre and other Iodine Deficiency Disorders (IDD). Objective: To assess the status of iodine deficiency disorders (IDD) in school children.

Methods: This study was conducted among school children of 1st to 5th standard (6–12 yrs.) from 1st January 2009 to 31st December 2013. A total of 950 students of seven schools were included in the study using proportionate to population size (PPS) method. Each child was examined clinically. Statistical analysis was done using SPSS version 20.

Result: Age distribution of the study population shows that majority of the students (30.5%) belonged to 11-12 years, and most of the students (56.2%) were males. Only 17 (1.8%) students had goitre. Goitre prevalence was slightly higher (1.9%) in the 6-8 years age group and in females (1.9%). Manifestations of iodine deficiency other than goitre, were retarded growth (0.6%), squint (0.3%), deafness (0.2%), lethargy (0.5%), and mental retardation (0.1%).

Conclusion: In the present study, Aligarh may be classified as non-endemic for iodine deficiency as the goitre prevalence in school children was only 1.8%, below the 5.0%, required for endemicity. Sustained IEC (Information, Education and Communication) activities should be carried out to sensitize the people regarding IDD.

Keywords: Iodine deficiency, Iodised salt, Awareness

INTRODUCTION
"Iodine deficiency is so easy to prevent that it is a crime to let a single child be born mentally handicapped for the reason."

H. Labouisse
Executive Director, UNICEF (1978)

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

Iodine is required for the synthesis of thyroxine (T4) and triiodothyronine (T3). These hormones are very important in the regulation of the metabolism of proteins, carbohydrates and fats and in almost all the activities of the body.

As far as the magnitude of the problem is concerned, the countries of South East Asia present a particularly urgent challenge for the control of iodine deficiency disorders (IDD). Many countries in South East Asia have IDD as a significant health problem. According to World Health Organization (WHO), iodine deficiency occurs in 130 countries around the world, and 2.2 billion people (38% of the world’s population) live in iodine deficient areas.[1]

In India, IDD has been identified as a public health problem. It has been observed that the world’s most intense goitre belt is in India stretching 2400 Kms from Kashmir in the North West to the Naga Hills in the East. In addition to the known Himalayan endemic belt, iodine deficiency and endemic goitre has been reported from many other states in the country as well. New pockets of iodine deficiency are being identified continuously. 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 IDD is above 10 per cent in the population.[2] Out of total population of India (approx 1200 million) more than 200 million are at risk of IDD.[3] WHO has recommended that for assessment of Iodine deficiency in an area, children in the age group 6-
12 years should be surveyed.\[^4\]

At present best source for iodine supplementation is iodinated salt in the form of "Iodised Salt" containing potassium iodide (KI) and "lodated Salt" containing potassium iodate (KIO3). KIO3 has an advantage over KI in that it is more stable and has a longer shelf life. The other methods of iodine supplementation are injection of iodised oil, addition of iodine to bread and iodination of irrigation water but these methods are not applicable to all the people.\[^5\]

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 NIDDCP. 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 this data can be made available to planners and policy makers. 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 of clinical features of IDD in school children.

Objective: To assess the status of iodine deficiency disorders in school children.

**MATERIALS AND METHODS**

The present study was conducted among school children (6–12 yrs.). School children were chosen for the study because they are highly vulnerable to IDD, representative of the community and easily accessible. Three government and four private schools in Aligarh were selected.

**Sampling Unit**

1\(^{st}\) to 5\(^{th}\) standard children of the schools (age group 6-12 years) were the “sampling units” for study conducted in schools. This is the preferred group as it is usually accessible. There is a practical reason for not measuring very young age groups. The smaller the child, the smaller the thyroid, and more difficult it is to perform palpation.\[^4\]

In the selected schools, almost every child of 1\(^{st}\) standard had completed six years of age and most of the children of 5\(^{th}\) standard were completing twelve years of age.

**Study Duration**

The data for the first part of the study was collected over a period of four years from 1\(^{st}\) January 2009 to 31\(^{st}\) December 2013. Different schools were approached over this period as per convenience of the investigator and school authorities. Taking into account the limited resources, this method was adopted.

**Sample Size**

Sample Size: Directorate General of Health Services found a goitre prevalence rate of 12% in Aligarh District.\[^6\]

This prevalence of goitre was used for calculating the minimum sample size in our study. Taking the value of prevalence ‘p’ as 12% and relative error (l) 20 % of ‘p’, the sample size (N) was calculated as:\[^7\]

\[
N = 4 \times p \times q / l^2
\]

Where p (%) = prevalence,  q (%) = 100-p, 1 = relative error

\[
N = 4 \times 12 \times 88/ (0.2 \times 12)2
\]

Taking into consideration 20% non-response / non-cooperation rate, the above sample size was increased by 20% then the total sample size was:

\[
N = 733 + (0.2 \times 733)
\]

N = 879

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

**Plan of 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. 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 presentation of IDD, and its consequences and methods available for its prevention especially health benefits of taking iodised 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 1\(^{st}\) to 5\(^{th}\) 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.

**Sampling Procedure**

The required sample was selected by “Multistage sampling” by doing a sub sampling. In the first stage, schools were selected over a period, and permission was obtained from school authorities. In the second stage, a list of students in class 1\(^{st}\) to 5\(^{th}\) standard in 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 (PPS) method, number of students in a school was proportional to the strength of 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. The school authorities were given a consent form in Hindi and English to distribute among these students and get it signed by their parents/guardians. On the day of interview, if a child was found to be absent, the child sitting next to him/her was taken into account after taking consent. We then moved on to next child as required. Henceforth similar strategy was applied in all schools of Aligarh.

**Inclusion Criteria**

1. Students of schools whose principals gave consent to our study.
2. Students of classes from 1\(^{st}\) to 5\(^{th}\) standard who were of age group 6-12 years.
3. Students whose parents/guardians gave consent to our study.

**Exclusion Criteria**
1. Students not attending the school on the day of study.
2. Students whose parents/guardians did not give consent to our study.
3. Students aged less than 6 years and more than 12 years.

Each child was examined clinically for the presence of goitre and other features of IDD as per the standard WHO guidelines. The most important local examination done was thyroid examination. If no visible swelling was seen in front of the neck, then the neck of the student was examined from back to feel the thyroid gland. If the thyroid gland was palpable, then the student was asked to swallow. If the swelling moved up, then it was Grade 1 goitre. If no thyroid gland was palpable, then it was designated as Grade 0 goitre. The sum of Grades 1 and 2 gave the Total Goitre Rate (TGR).

**RESULTS**

Age distribution of the study population shows that majority of the students (30.5%) belonged to 11-12 years, followed by 7-8 years (27.7%) and 9-10 years (26.8%) age groups (Fig. 1).

The sex distribution of the study population reveals that most of the students (56.2%) were males. Female students comprised (43.8%) of the study population (Fig. 2).

Maximum number of students, selected in the study was Muslims (66.8%) and Hindu students comprised 33.2% of the study population (Fig. 3).

Fig. 4 shows that out of 950 students, only 17 (1.8%) had goitre and 933 (98.2%) students did not have goitre. Out of 17 students having goitre, 16 (1.8%) had Grade 1 goitre and only 01 (0.1%) student was suffering from Grade 2 goitre. It has been seen in the Table-1, that in the 6-8 years age group, goitre prevalence was slightly higher (1.9%) than 9-12 years aged children (1.7%). Table-2 depicts that goitre prevalence was more in females (1.9%) than males (1.7%). Female/male ratio was found to be 1.1. In females due to physiological high demand especially in early adolescence, goitre may appear. Similar results were found by other researchers where more females were having goitre.

As it is seen in Table-3, manifestations of iodine deficiency other than goitre, observed in the study were retarded growth (0.6%), squint (0.3%), deafness (0.2%), lethargy (0.5%), and mental retardation (0.1%). There might be other associated factors playing a role in these conditions besides iodine deficiency that need to be studied.

**DISCUSSION**

The total goitre rate (TGR) or prevalence was 1.8%. Similarly, in the state of Jharkhand, very low prevalence of
goitre (0.9%) was noticed.\[^8\] Very low prevalence of 0.02% was recorded in Bishnupur, Badaun districts in a study conducted by Indian Council of Medical Research during 1997-2000.\[^9\] The goitre prevalence in a study population was found to be 0.125% in Bellur, Hobli in the southern part of India\[^{10}\] and 0.17% in Raipur.\[^{11}\] The total goitre rate was 4.83% among primary school children aged 6-12 years in Jamnagar.\[^{12}\]

In a study done in Budgam district, total goitre rate (TGR) was 5.57% and Grade 2 goitre was noticed only in 0.17% of surveyed children (0.96% in Girls & 0.48% in Boys) which is comparable to our study.\[^{13}\]

However, high prevalence of endemic goitre was found among school children of Churachangpur district in Manipur with a total goitre rate of 28.39% and most of the goitre were of grade 1 (26.48%) in spite of adequate iodine intake.\[^{14}\]

This could be because people of the region regularly consume bamboo shoot items which are rich in cyanogenic glycosides, glucosinolates and thiocyanate. Thiocyanate inhibits the iodide uptake by the thyroid and blocks the organic binding of iodine by competing with iodide. It also increases iodine efflux.\[^{15}\]

High prevalence could be also be attributed to the withdrawal of the ban notification on sale of non-iodized salt during the study period.

Generally, iodine requirement increases with age. Older children had prolonged exposure to iodine sufficient environment because ban on sale of non-iodized salt was lifted in January 2001 and, Government of India imposed ban on sale of non-iodised salt for human consumption again in 2006. Older children might be benefitted from the ban while younger students, born between the year 2001 and 2006 might have consumed non-iodised salt because their age corresponded to the period when no ban was there.

Similar results were observed in Istanbul, Turkey where prevalence of iodine deficiency was significantly higher in younger (≤ 10 years) children.\[^{16}\]

However, In a study, it was found that goitre rate increased with age.\[^{17}\] Age-specific prevalence rate (ASPR) was higher in 9 to 12 yr age group as compared to 6 to 8 yr age group.\[^{18}\]

In pre pubertal age (11-14 years) maximum cases of goitre were seen in a study conducted in Dehradun.\[^{19}\]

In a study carried out in Jamnagar among primary school children aged 6-12 years, no significant difference between age and sex was observed.\[^{12}\]

In a study in Tanzania, overall regional TGP in 6 - 12 years of age was 5.5%.\[^{20}\] It should be remembered that Tanzania has iodization of salt since last 17 years, a period comparable with India.

A similar female preponderance of goitre had been reported by several other authors in India as well as abroad. It was also observed that goitre prevalence among girls was significantly higher than boys.\[^{21-23}\] Prevalence of goitre among females was 6.4% compare to males (4.1%) in a study conducted in Dehradun.\[^{19}\]

The overall prevalence of cretinism among children examined from 07 districts was 0.072% whereas that of deaf-mutism was 0.27% among children examined from 08 districts.\[^{9}\] In a study conducted long back in the year 1982, prevalence of other findings was very low because in areas where goitre prevalence was high (more than 50%) major attendant disabilities of endemic goitre such as endemic cretinism, deaf-mutism and feeble mindedness were present in about 4% of the population.\[^{24}\] Since in the present study, goitre prevalence was very low, major attendant disabilities of endemic goitre were present only in a very small study population.

In a study conducted in Sikkim, overall prevalence of endemic cretinism (3.5%) was observed in general population and not in children.\[^{25}\] In Tarai region of Uttar Pradesh, prevalence of endemic cretinism was reported to be 1.2%.\[^{26}\]

**CONCLUSION**

If more than 5% of school age children have goitre, the area should be classified as “Endemic” for iodine deficiency.\[^{27}\]

In the present study, the goitre prevalence in school children was 1.8%. Thus, Aligarh may be classified as non-endemic for iodine deficiency. In the present study, the TGP of 1.8% was possibly due to continued consumption of salt with inadequate quantity of iodine. There are other determinants of IDD like environmental, socio-economic, cultural and dietary factors, which are to be studied further to get the comprehensive picture of IDD. Certain recommendations can be made from the present study.

These are as follows-

- **Integrated package of communication activities aimed at wholesalers, retailers and consumer with intensive social mobilization activities for a period of at least three years.**

- **Sustained IEC (Information, Education and Communication) activities should be carried out more vigorously in schools and general population so that people are made aware about the benefits of consumption of iodated salt.**

- **The simplest method to prevent the broad spectrum of IDD is to consume adequately iodated salt daily.**

- **There is a need to enforce strictly the decree of universal iodization of salt in the country so that the population can have access only to iodated salt.**

**What this study adds:**

1. **What is known about this subject?**

Various studies have been carried out by the researchers in India and abroad but no such study has been conducted in Aligarh and adjoining areas to find out the prevalence of iodine deficiency after universal salt iodisation (USI) programme implementation.

2. **What new information is offered in this study?**

Findings of this study can be utilised in schools for monitoring the impact of consumption of iodised salt and to improve its consumption in the community.
Table-1 Distribution of study population according to age and goitre

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Age (Years)</th>
<th>Present</th>
<th>Goitre</th>
<th>Absent</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>No.</td>
<td>%</td>
<td>No.</td>
<td>%</td>
</tr>
<tr>
<td>1.</td>
<td>6-8</td>
<td>8</td>
<td>1.9</td>
<td>397</td>
<td>95.8</td>
</tr>
<tr>
<td>2.</td>
<td>9-12</td>
<td>9</td>
<td>1.7</td>
<td>536</td>
<td>99.2</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>17</td>
<td>1.8</td>
<td>933</td>
<td>98.2</td>
</tr>
</tbody>
</table>

Table-2 Distribution of study population according to sex and goitre

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Sex</th>
<th>Present</th>
<th>Goitre</th>
<th>Absent</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>No.</td>
<td>%</td>
<td>No.</td>
<td>%</td>
</tr>
<tr>
<td>1.</td>
<td>Male</td>
<td>9</td>
<td>1.7</td>
<td>525</td>
<td>98.3</td>
</tr>
<tr>
<td>2.</td>
<td>Female</td>
<td>8</td>
<td>1.9</td>
<td>408</td>
<td>98.1</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>17</td>
<td>1.8</td>
<td>933</td>
<td>98.2</td>
</tr>
</tbody>
</table>

Table-3 Distribution of study population according to other manifestations of iodine deficiency other than goitre (n=950)

| S. No. | Other manifestations of iodine deficiency | Present |  | Absent |  |
|--------|------------------------------------------|---------|  |--------|  |
| 1.     | Retarded Growth                          |     06   | 0.6  |     944 | 99.4    |
| 2.     | Squint                                   |     03   | 0.3  |     947 | 99.3    |
| 3.     | Deafness                                 |     02   | 0.2  |     948 | 99.8    |
| 4.     | Lethargy                                 |     05   | 0.5  |     945 | 99.5    |
| 5.     | Mental Retardation                       |     01   | 0.1  |     949 | 99.9    |

REFERENCES


How to cite this article: Ansari MA, Khan Z. Prevalence of Iodine Deficiency Disorders - A School Based study in Aligarh. Int Arch BioMed Clin Res. 2016 April;2(2):12-17
Source of Support: Nil, Conflict of Interest: None