Short Communication

Assessment of iodine deficiency in school age children in Nainital District, Uttarakhand State

Umesh Kapil MD[1], Ravindra Mohan Pandey PhD[2], Shyam Prakash PhD[3], Madhulika Kabra MD[4], Neha Sareen MSc[1], Ajeet Singh Bhadoria MD[1]

[1] *Department of Human Nutrition, All India Institute of Medical Sciences, New Delhi, India*
[2] *Department of Biostatistics, All India Institute of Medical Sciences, New Delhi, India*
[3] *Department of Gastroenterology and Human Nutrition, All India Institute of Medical Sciences, New Delhi, India*
[4] *Department of Pediatrics, All India Institute of Medical Sciences, New Delhi, India*

Iodine deficiency disorder (IDD) is a major public health problem in Uttarakhand. The present study was conducted in district Nainital, Uttarakhand state with an objective to assess the prevalence of IDD in school age children. A total of 2269 children in the age group of 6-12 years were included. Clinical examination of thyroid of all children was undertaken. "On the spot" urine samples were collected from 611 children. Salt samples were collected from the family kitchen for 642 children. The Total Goitre Rate (TGR) was 15.9%. The proportion of children with urinary iodine excretion levels <20, 20-49, 50-99, 100-199 and 200 µg/L and above, was nil, 11.8, 24.9, 38.3 and 25.0 percent, respectively. The median Urinary Iodine Excretion level was 125µg/L. About 57.7% of the children were consuming salt with iodine content of 15 ppm and more. Findings of the present study indicates that the population is possibly in transition phase from iodine deficient as revealed by Total Goitre Rate of 15.9% to iodine sufficient as revealed by median urinary iodine excretion level of 125 µg/L. 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: goitre, iodine, iodised salt, thyroid, urinary iodine excretion

INTRODUCTION

Iodine deficiency disorders (IDD) are a public health problem in India. Out of 587 districts in the country, 282 have been surveyed for IDD and 241 have been found to be endemic to iodine deficiency.[1] The deficiency of iodine not only leads to goitre but also to a spectrum of health consequences.[2] Iodine deficiency is a major public health problem in Uttarakhand state, India. In district Nainital, the prevalence rate of goitre according to a survey conducted in 2003 was found to be 6.9%.[3] The present study was conducted in November, 2012 with the objective to assess the prevalence of iodine deficiency in school age children (6-12 years) in district Nainital, Uttarakhand as there is a lack of data in this field.

MATERIAL AND METHODS

A cross sectional survey was conducted in November, 2012. Children in the age group of 6-12 years were included. In district Nainital, the school enrollment of primary classes was more than 90 percent and hence a school-based approach was adopted. All the primary schools in rural and urban area in the district with their respective child enrollment were enlisted. Thirty schools (clusters) were selected according to the population proportionate to size (PPS) cluster sampling methodology.[4] In each school, the children were briefed about the objectives of the study and the informed consent was undertaken. The date and time for the survey was decided as per the convenience of the school. In each identified school (cluster), 76 children were included using a Random Number Table (RNT). In each school, children were serially arranged according to their age groups 6-<8, 8-<10 and 10-12 years. With the help of the RNT, a total of 26 children were selected from each of the age group. If the desired sample of children could not be covered from the selected school, the nearest adjoining school was included to complete the sample size. The clinical examination of the thyroid of each child was conducted. The grading of goitre was done according to the criteria recommended jointly by WHO/UNICEF/ICCIDD (a) Grade 0- not palpable and not visible; b) Grade I- palpable but not visible; and c) Grade II- palpable and visible).[4] When in doubt, all the investigators recorded the immediate lower grade. The intra- and inter-observer variation was controlled

Corresponding Author: Dr Umesh Kapil, Department of Human Nutrition, All India Institute of Medical Sciences Ansari Nagar, New Delhi-110029, India.
Tel: +91-9810609340; Fax: +61 26588663, 26588641
Email: umeshkapil@gmail.com
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by repeated training and random examinations of goitre grades by the experts. The sum of Grade I and II provided the Total Goitre rate (TGR) in the study population.[4] From each cluster, "on the spot" urine samples were collected from 20 children selected randomly, with the help of RNT from the list of children enrolled for clinical thyroid examination. Plastic bottles with screw caps were provided to each child for the urine samples. The samples were stored in the refrigerator until analysis. The analysis was done within 2 months. The UIE levels were analyzed using the wet digestion method.[5] Twenty one children were selected randomly from each cluster and were provided with auto-seal polythene pouches with an identification slip. Children were requested to bring four tea spoons of salt (about 20 g) from their family kitchen. The iodine content of the salt was analyzed by using standard iodometric titration (IT) method.[6]

Quality control measures

The Internal Quality Control (IQC) methodology was adopted during UIE analysis. A pooled urine sample was prepared. It was analyzed 25 times with standards and blank in duplicate. The mean (X) UIE and standard deviation (SD) of this pooled sample was calculated. This was considered as Internal Quality Control (IQC) sample. The IQC sample was stored in refrigerator in various aliquots. The 95% confidence interval for mean of UIE of IQC sample was then calculated. This was used as the operating control range. The methodology adopted was as follows:

Sample Mean (X) ± 2 (SD)

The X–2(SD) = the lower confidence limit or Lower Concentration Value (LCV)

X + 2(SD) = the upper confidence limit or Upper Concentration Value (UCV)

The operating control range for IQC sample was between LCV and UCV. A regular linear graph paper was utilized to prepare Levey Jennings plots. The mean Urinary Iodine Excretion of the IQC sample was plotted as a continuous horizontal line on the Y-axis. The lower concentration value (LCV) was plotted below the mean line on the Y-axis scale and the upper concentration value (UCV) was plotted above the mean line on the Y-axis scale. The X-axis was used to plot the date on which the IQC sample was analyzed. This chart was used to plot the date specific analysis. The pooled urine sample was analyzed with every batch of UIE estimation. The Urinary Iodine Excretion was obtained for the IQC sample for each batch. If the value of the IQC sample was between the two limit lines of LCV and UCV, then the UIE test was deemed valid, and all results were accepted. If any value of the IQC sample was plotted outside the two limit lines of LCV and UCV then, the test was considered as invalid, and the entire batch was repeated.[7]

The project was approved by the ethical committee of All India Institute of Medical Sciences, New Delhi.

Sample size

Keeping in view the anticipated prevalence of 15%, a confidence level of 95%, and absolute precision of 2.0 and a design effect of 1.5, a total sample size of 1837 was calculated. In each cluster, 61 children were to be studied. However, we studied a total of 2269 children.

RESULTS

i) Prevalence of goitre

A total of 2269 children (1020 boys and 1249 girls) were included. The TGR was 15.9%.

ii) Urinary iodine excretion

A total of 611 random samples of urine were collected. The median UIE level was 125 µg/L. The percentage of children who had UIE levels <20, 20-49, 50-99, 100-199 and 200 µg/L and above, was nil, 11.8, 24.9, 38.3 and 25.0 percent, respectively.

iii) Iodine content of salt consumed in the families of children surveyed

A total of 642 salt samples were collected. It was found that 4.4, 37.9 and 57.7 percent of the salt samples had iodine content of <5 ppm, 5-<15 ppm and 15 ppm and more, respectively.

There was a positive correlation between UIE level and iodine content of salt (r=0.23, p<0.001). No significant correlation was found between iodine content of salt and prevalence of goitre amongst children.

DISCUSSION

According to WHO/UNICEF/ICCIDD, if more than 5% school age children (6-12 years) are suffering from goitre, the area should be classified as endemic to iodine deficiency.[4] In the present study, a TGR of 15.9% was found, indicating that the subjects had mild iodine deficiency. The grading of goitre was done according to the criteria recommended jointly by WHO/UNICEF/ICCIDD. When in doubt, all the investigators recorded the immediate lower grade. The intra- and inter-observer variation was controlled by repeated training and random examinations of goitre grades by the experts. An earlier survey conducted in 2003 found a prevalence rate of TGR as 6.9%.[3] A survey conducted amongst school age children documented the prevalence of IDD as 3.7% in district Nainital.[8]

The median UIE level amongst the children studied was found to be 125 µg/L, indicating that there was no biochemical deficiency of iodine. Positive correlation was found between UIE level and iodine content of salt (r=0.23, p<0.001). According to WHO, global database on iodine deficiency amongst school age children in Nainital, the median UIE level was found to be 110 µg/L.[9] In the present study, 42.3% of families were consuming salt with iodine content of less than 15 ppm, which is below the stipulated level of iodine. An earlier study reported that 55.2% of the children were consuming salt with iodine content of less than 15 ppm.[10] In Uttarakhand the use of adequately iodized salt by the population has decreased from 60% in NFHS-2 (1989-99) to 46% in NFHS-3 (2005-06).[11] The increase in TGR could be due to consumption of salt with low iodine content by a higher percentage of population.

Results of the present study indicated that the population in district Nainital is possibly in transition phase from iodine deficient (as revealed by TGR) to iodine sufficient (as revealed by median UIE) nutrition. To elimi-

nate iodine deficiency disorders, there is a need to monitor iodine content of salt regularly so that the entire population of the district receives adequately iodized salt.

Limitations of the study

The intra- and inter-observer variation in goitre examination was controlled by repeated training and random examination of goitre grade by experts. However, despite of all the precautions for the quality control, a possibility existed for misclassification of goitre grade I. The non-response rate was less than 1% as the study was conducted as a part of school annual health examination.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

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[4] *Department of Pediatrics, All India Institute of Medical Sciences, New Delhi, India*

Uttarakhand 州，Nainital 地区学龄儿童的碘缺乏评估

碘缺乏病(IDD)是 Uttarakhand 州一个重大的公共健康问题。本研究是在 Uttarakhand 州 Nainital 地区进行，目的是评估碘缺乏病在学龄儿童中的流行。共有 2269 名年龄在 6-12 岁的儿童被纳入本研究。对所有儿童的甲状腺进行临床检查，收集了 611 名儿童的现场尿样，从 642 名儿童的家庭厨房中收集食盐样本。总甲状腺肿大比例为 15.9%。不同尿碘排泄水平<20, 20-49, 50-99, 100-199 和 200 μg/L，儿童所占比例分别为 11.8, 24.9, 38.3 和 25.0%。平均尿碘排泄水平为 125 μg/L。约 57.7%的儿童摄入的食盐含碘量不低于 15 ppm。本研究结果表明：人口从 15.9%碘缺乏所致甲状腺肿率过渡到尿碘排泄作为足够量中位数 125 微克/升水平是可能的。为了实现在本地区消除碘缺乏病，进一步加强现有的碘盐质量的监测系统是必要的。

关键词：甲状腺肿、碘、碘强化食盐、甲状腺、尿碘排泄