Goiter Prevalence and Thyroid Autoimmunity in School Children of Delhi

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Abstract

Introduction: Several studies from India, performed prior to 2010, have reported a goiter prevalence of greater than five per cent in school going children. There has been considerable success in universal salt iodization efforts in the past decade. We studied the prevalence of goiter and thyroid autoimmunity in school going children in Delhi between 2010 and 2014 to assess the impact of salt iodization. **Materials and Methods:** The study employed the population proportionate to size (PPS) cluster sampling methodology to select subjects between the age of six and 14 years, from all 34 wards of 9 districts of Delhi. Cluster randomization sampling design was followed and in this way we identified 30 wards, from each of which 90 children were recruited for the study. The total sample size was 2700 children. Estimation of fT3, fT4, TSH, anti-TPO antibodies and urine iodine concentration (UIC) was done for 10% of the study population. **Results:** The prevalence of goiter in this study in the 6–14 years age group was 6.4%. The prevalence of goiter was higher in females (7.7% compared to 5.3% in males, $P = 0.01$). In the 270 subjects who were selected for biochemical evaluation, subclinical hypothyroidism was seen in 18.4% and positive anti-TPO antibodies were seen in 14.8%. The median UIC was 150 μg/L. **Conclusions:** There is improvement in goiter prevalence in the post-iodization period in Delhi. But still, residual goiter rates are above five per cent suggesting presence of other causes of goiter in this area. There is a high prevalence of thyroid autoimmunity in this population.

Keywords: Goiter, iodine deficiency, UIC

Introduction

Iodine deficiency disorders were recognized as a major health problem in India since 1962 and the iodization of common salt is being used as a method of iodine supplementation.[1] The household coverage of iodized salt in the country has been improving under the National Iodine Deficiency Disorders Control Program (NIDDCP) and a household coverage of iodized salt of 92% was reported in 2014-2015.[2] Several studies conducted in the period prior to 2010 have reported a high prevalence of goiter in school children. In 2003, a nationwide study of 14762 school children had reported a goiter prevalence of 23% while later in 2012, another study of 38961 school children reported 15.5% goiter prevalence[3,4] We studied the goiter prevalence in school going children of the national capital territory (NCT) of Delhi between 2010 and 2014 to assess whether the prevalence has reduced below the cut off of 5% which would indirectly reflect iodine sufficiency.[5]

Access this article online

Quick Response Code:

Website: www.ijem.in

DOI: 10.4103/ijem.IJEM_645_19

Materials and Methods

This study was conducted from the year 2010 to 2014. The eligible study population was school going children of both sexes who were recruited from Delhi Government, private and Municipal Council of Delhi schools. The state of Delhi comprised of nine districts which was further divided into 34 wards. We used the population proportionate to size (PPS) cluster sampling methodology to select subjects from all 34 wards of 9 districts of Delhi. Cluster randomization sampling design was followed and in this way, we identified 30 wards, from each of

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Submitted: 21-Dec-2019 **Revised:** 30-Dec-2019
Accepted: 26-Jan-2020 **Published:** 30-Apr-2020

How to cite this article: Gupta P, Raizada N, Giri S, Sharma AK, Goyal S, Jain N, *et al*. Goiter prevalence and thyroid autoimmunity in school children of Delhi. Indian J Endocr Metab 2020;24:202-5.

which 90 children (45 boys and 45 girls) were recruited for the study. The exclusion criteria included clinically obvious thyrotoxicosis, history of autoimmune disorder, signs or symptoms of hypothyroidism as well as features of any systemic illness. Written informed consent was taken from the parents or guardians of selected children. Examination and grading of goiter were done as per WHO guidelines.[5] A predesigned questionnaire was administered, which included information about socio-demography, anthropometry, family history of goiter, drug history, present and past history of any acute or chronic illness, previous surgery or hospital admissions.

Out of the study population, 10% were selected and blood samples were collected from these children for estimation of free T3(fT3), freeT4 (fT4) and TSH as well as anti-thyroid peroxidase (TPO) antibodies. Urine samples were taken from these students for estimation of urine iodine concentration and salt samples were collected from their households for estimating salt iodine concentration. Free T4 and TSH were measured by radioimmunoassay method using commercially available kits (Beckman Coulter Inc., Czech Republic). Anti-TPO antibodies were measured using an enzyme linked immunoassay using commercially available kits (Beckman Coulter Inc., Czech Republic). Urine iodine was measured using ammonium persulfate oxidation followed by colorimetric estimation.[6] Urine iodine concentration was defined as the concentration iodine in a spot urine sample and the results were expressed as µg/L. Salt iodine was measured using titration method using sodium thiosulfate.[5] The normal range for TSH was 0.4-5.0 mIU/L. The normal range for fT 4 was 0.85-1.77 ng/dl. Subclinical hypothyroidism was defined as TSH above 5.0 mIU/ml with fT4 in the normal range, while overt hypothyroidism was defined as TSH above 5.0 mIU/ml with fT4 below the normal range. The normal range for anti-TPO antibodies provided by the manufacturer was less than 12 IU/ml. Anti-TPO antibodies above 12.0 IU/ml were considered as positive for this study. For the purpose of analysis the subjects were divided into three age groups: 6–8 years, 9–11 years, and 12–14 years. The prevalence of goiter was expressed as a percentage of the study population. The prevalence between sexes and between age groups was compared using Chi square test. UIC was expressed as median and range for the population.

Results

The study population included 2700 children with a mean age of 9.9 years with a standard deviation (SD) of 2.1 years. There were equal number of male and female subjects. The prevalence of goiter in this study in the 6–14 years age group was 6.4% and the goiter prevalence in 6–12 years age group was 6.1%. The prevalence was highest in the 12–14 year age group (7.6%) followed by 9–11 year age group (7.2%). The 6–8 year age group had a prevalence of 4.4% which was significantly lower than the other two age groups ($P = 0.01$ for 9–11 years and $P = 0.009$ for 12–14 year age group). The prevalence of goiter was higher in females (7.7% compared to 5.3% in males, $P = 0.01$). The prevalence of goiter in males and females among various age groups is shown in Figure 1. Grade 2 goiter was seen in 2.2% while grade 1 goiter was present in 4.2% of the subjects. Females had significantly higher proportion of grade 2 goiter as compared to males.

The prevalence of goiter in 6–12 year age group was lowest in Central district (1.2%) and highest in district North West district (10.9%). The mean monthly income was lowest in Southwest district (goiter prevalence 9.03%) followed by Central district (goiter prevalence 1.2%), while the highest mean monthly income was seen in East district (goiter prevalence 5.64%). However, the income for Central district was not significantly lower as compared to other districts. The prevalence of goiter in Delhi government schools, MCD schools, and private schools was 7.8%, 10.0% and 8.7% respectively ($P = 0.9$).

Biochemical investigations were performed in a subset of 270 patients. Subclinical hypothyroidism was seen in 18.4% of subjects and anti-TPO antibodies were present in 14.8%. The median urinary iodine concentration (UIC) of this subset was 150 µg/L (range 0-300 µg/L). However, 18.5% of the subjects had a UIC less than 100 µg/L. The UIC of the population is shown in Figure 2. Iodized salt was being consumed by 97.4% of subjects. The salt iodine concentration (by titration method) ranged from 7 ppm to 42.3 ppm (mean 24.5, SD 5.7 ppm). In this subset of 270 patients, goiter was present in 22 patients (8.1%). Fifteen (5.5%) had grade 1 goiter and seven (2.6%) had grade 2 goiter. Among those with goiter, subclinical hypothyroidism was seen in five (22.7%) and positive anti-TPO antibodies were seen in three (13.6%). Among those with goiter, 11.1% had UIC below 100 µg/L while UIC between 100-199 µg/L and ≥200 µg/L was seen in 50% and 38.9% respectively.

Discussion

Our study showed a low prevalence of goiter with a significantly higher prevalence in females in Delhi. This difference existed mainly in the 6–8 years age group. Iodization indicators reflected adequate iodization in the population. Thyroid autoimmunity was found in nearly a fifth of the

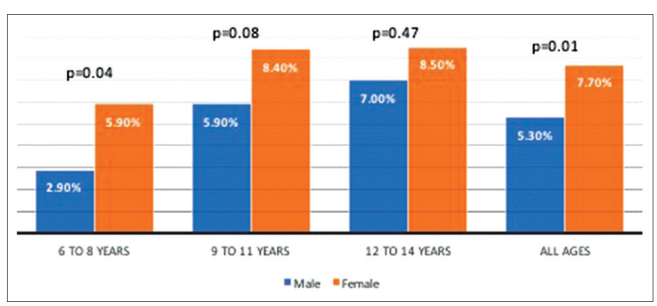

Figure 1: Goiter prevalence (as percentage) between sexes by age group

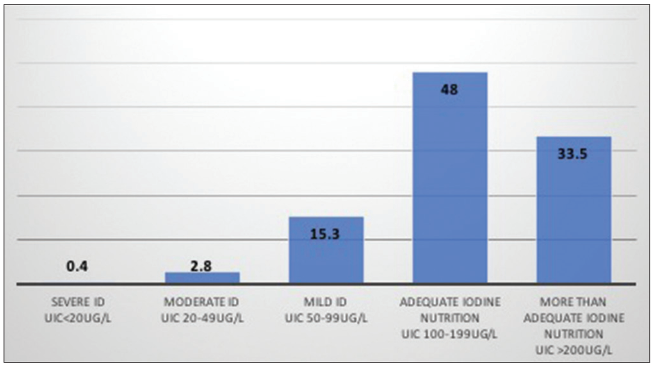

Figure 2: Urinary iodine concentration (UIC) of the study population

children while subclinical hypothyroidism was seen in one of every seventh child.

The prevalence of goiter in our study is markedly lower than what has been reported earlier. After the adoption of universal salt iodization, the prevalence of goiter has been reported ranging from 15 to 37.6% in smaller studies.[4,7,8] Two nationwide studies conducted on goiter prevalence showed that the goiter prevalence was 23% in 2003 and subsequently fell to 15.5% in 2012.[9,10] While these studies show a remarkable improvement, they appear to severely fall short of the WHO target value of less than 5% goiter prevalence.[5] The lower prevalence in our study may be attributable to the period (which was much later than prior studies) and the area of study (National Capital Territory of Delhi). A large-scale study, similar to our study, in 7009 school children in Delhi showed a goiter prevalence of 6.2% in 2010.[11] This may reflect lower baseline prevalence of goiter or possible earlier attainment of USI in the national capital.

Despite the universal salt iodization, 2.6% of subjects were not using iodized salt. However, recent national data also suggests that 92% of households are using iodized salt.[2] The use of rock salt and other forms of non-iodized salt represents the remaining salt consumption.

The cause of goiter in our study merits some discussion. The iodine status of the population is normal as evident from the median UIC values. Further autoimmunity, evidenced by anti-TPO antibodies was absent in 86.4% of the goitrous children. This data suggests the role of alternative goitrogens in this population. Thiocyanates have been implicated as a cause of goiter in studies from India and other parts of the world.[9,12,13] Other goitrogens including peroxidase inhibitors from various plant species including millets are also known to cause goiter.[14] Further iron deficiency, selenium deficiency and nitrate consumption may be an additional factors in causing goiter.[4,15,16]

The strengths of our study include a sizeable sample derived from the most validated method of sampling. Our limitations include lack of assessment for puberty, other goitrogens, and conduct of the biochemical testing in a small subset of the sample.

In conclusion, our study shows a low goiter prevalence in Delhi but still, goiter rates are above 5% suggesting presence of other causes of goiter in this area. Further studies to ascertain other possible causes of goiter in this population are required.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

Aknowledegements

We acknowledge the role of Madhulika Rathi, Swati Gupta, Vandana Sharma and Bharat Arya in data collection and laboratory work.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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