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Goiter prevalence and iodine deficiency disorder among school-age children (6–12 years) in district Ganderbal of Kashmir valley

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Abstract:

BACKGROUND: Iodine deficiency is a major cause of brain damage in childhood which can be prevented. Dietary deficiency of iodine is mainly responsible for iodine deficiency. This study was done to determine the prevalence of goiter among school-aged group of 6–12 years in district Ganderbal.

MATERIALS AND METHODS: This was a cross-sectional study done among children of 6–12 years in district Ganderbal.

RESULTS: Out of 2700 children examined, Grade 1 goiter was found in 90 (3.3%) children and Grade 2 goiter was found in 6 (0.3%) with a total goiter rate (sum of grade first and grade second) of 3.6%. On analyzing the urine samples, about 19.1% of the children had mild to moderate iodine deficiency.

CONCLUSION: The study showed mild goiter prevalence in school-aged children of 6–12 years in the Ganderbal district of Kashmir valley. Continuous periodic surveys to assess the magnitude of the iodine deficiency disorders (IDD) should be undertaken to ensure that we achieve sustainable elimination of IDD in India.

Keywords:

Goiter, iodine deficiency disorder, total goiter rate

Introduction

The thyroid gland is important for growth and development in the growing young children. For the normal human growth and development, iodine is an essential micronutrient. For pregnant women and young children, iodine deficiency is a major public health problem around the globe. They hamper the social and economic development of the countries. In children, iodine deficiency is the main cause of preventable brain damage. The main factors that are responsible for iodine deficiency is a low dietary supply of iodine.[1] Iodine is present in the human body in very minute amounts and mainly in the thyroid gland. Iodine plays an important role in the synthesis of thyroid hormones. When iodine requirements are insufficient, synthesis of thyroid hormone is impaired, resulting in hypothyroidism and multiple functional and developmental abnormalities which are termed as "iodine deficiency disorders (IDD)." Goiter is the most visible manifestation of IDD. Endemic goiter results from increased thyroid stimulation by thyroid stimulating hormone to increase the utilization of available iodine and thus represents maladaptation to iodine deficiency.[1,2]

The total goiter rate is estimated to remain between 10% and 20%

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globally (approximately 700 million people). Similar estimates for low urinary are generally in the 30–40% range, and about 1.7 billion people are affected, of whom Asians contribute to 1.3 billion.[3] A nationwide survey conducted by ICMR shows that no state in India is free from Iodine deficiency and is "at risk" of developing IDD.[4] Iodized salt coverage shows that around 350 million people in this country are at risk of IDD. In India, IDD is endemic with 303 districts out of 365 districts reporting a total goiter rate (TGR) >10%.[5] As per the coverage evaluation survey of 2009, the accessibility of iodized salt has a wide gap among rural (85.6%) and urban communities (46.4%).[6] There are many studies conducted in India that show a high incidence of goiter.[7-10] A nationwide goiter survey revealed that out of 283 districts in India, 235 have an incidence of endemic goiter.[11] There is a variation of figures across J&K. Zargar *et al*.[12] in 1995 reported a prevalence of about 45% in school-going children. Due to the high prevalence in the state, the present study was carried out to find out the magnitude of the problem so that necessary recommendations are taken.

Ganderbal is one of the ten districts of Kashmir valley situated in its central region. According to the 2011 census Ganderbal district had a population of 297446 with 158720 males and 138726 females. The district headquarter is in Ganderbal which consists of 06 tehsils, viz, Ganderbal, Kangan, Tullamulla, Wakura, Lar, and Gund.[13]

In view of the topographic and physical characteristics of the Ganderbal district of Kashmir valley, this study was conducted with the objectives to determine the prevalence of goiter among school age children of 6–12 years in district Ganderbal and to determine the association of age and gender with the prevalence of goiter. We also wanted to determine the median urinary iodine in urine samples and iodine content in salt samples.

Materials and Methods

Study design and setting

This study was a cross-sectional study conducted from March 22, 2022 to March 31, 2022 in the school children aged 6–12 years of the Ganderbal district of Kashmir valley.

Study participants and sampling technique

Selection of children

Line listing of all the villages/wards along with the population from the latest census was obtained. A sample of 30 villages was selected from the district Ganderbal using population proportionate to size, which formed the clusters. For the study within the school children of age group 6–12 years, permission was obtained from the Directorate of School Education Kashmir and Chief Education Officer, Ganderbal. A list of schools in the selected clusters was obtained from the office of CEO Ganderbal.

Data collection

A random sample of 90 children (45 boys and 45 girls) in the age group of 6–12 years was selected randomly from the selected schools/out of schools from each selected cluster as shown above. Sampling was done in such a way that there were equal number of boys and girls in the sample in each age group. Thus, 6–7 boys and girls of each group were selected from each selected cluster. A total of 2700 children were examined after obtaining proper assent. All selected children were clinically examined by trained doctors and their age and gender were also recorded. A standard procedure was used to inspect and palpate the neck for the presence of any goiter and the findings were recorded. The presence of any nodules was noted and recorded separately. Goiter was classified as per World Health Organization guidelines as below:

Grade 0: No palpable or visible goiter/no goiter.

Grade 1: A mass visible in the neck that is consistent with an enlarged thyroid that is palpable but not visible, when the neck is in a normal position. It also moves upward in the neck as the subject swallows. Nodular alteration(s) can occur even when the thyroid is not enlarged/goiter is palpable but not visible.

Grade 2: A swelling in the neck that is visible when the neck is in a normal position and is consistent with an enlarged thyroid when the neck is palpated/goiter is visible and palpable.

The sum of Grade 1 and Grade 2 is taken as the TGR.

Collection of urine and salt samples

Every fifth child selected for the survey was covered for the collection of salt samples by visiting the corresponding houses. For urinary iodine estimation, every tenth child out of those selected in the earlier step for the salt sample was taken for collection of the urine sample. Thus a total of nine urine samples and 18 salt samples were collected from each cluster. The urine samples were analyzed for iodine estimation using the Sandell Kolthoff method, and salt samples were also analyzed for iodine estimation in the Multidisciplinary Research Unit (ICMR) and Public Health Laboratory of the Department of Community Medicine, Government Medical College Srinagar. A total of 298 urine samples and 557 salt samples were analyzed.

Analysis: Goiter prevalence was reported as a percentage with a goiter grade > 0. Urinary iodine was summarized as the median. IDD prevalence indicators and criteria for classifying IDD as a significant public health problem are as below:

Indicators	Severity of public health problem		
	Mild	Moderate	Severe
Goiter grade >0	5–19.9%	20–29.9%	≥30%
Median UIE (μg/L)	50–99	20–49	<20

Ethical consideration

The study was approved by the institutional review board of Government Medical College, Srinagar with Ethical clearance no: IRBGMC/21-10psm dated October 21, 2022.

Results

A total of 2700 children were surveyed in the 30 clusters (schools) of district Ganderbal with 90 children in each cluster being surveyed and this accounted for about 1351 boys and 1349 girls. Age, class, and gender distributions of the sample are given in Table 1.

Out of 2700 children examined, Grade 1 goiter was found in 90 (3.3%) children, and Grade 2 goiter was found in 6 (0.3%) as shown in Table 2 with a TGR (sum of grade first and grade second) of 3.6% as shown in Table 3.

Prevalence varied with sex and age. In this study, the overall prevalence of goiter was found to be higher in boys than girls. TGR was higher in boys (4.5%) in comparison to girls (2.6%). The prevalence of Grade 1 and Grade 2 goiter in boys was 4.4% and 0.1%, respectively, whereas it was 2.3% and 0.3% in females as shown in Table 3. The prevalence of goiter was higher among older children. The study showed Grade 1 goiter was more common in the age group of 8 years (5.4%) followed by the age group 11 years (4.9%) and then the age group of 9 years (3.3%). Grade 1 goiter was lowest in the age group of 6 years (0.8%). Regarding the prevalence of goiter in relation to the gender of children, it was found that the prevalence was higher among boys (8.8%) in the age group of 8 years followed by the age group of 11 years, where it was 8.3% among boys. In girls, TGR was higher in the age group of 7 years (3.8%) followed by the age group of 11 years (3.2%) as shown in Table 3.

About 75% of the salt samples had 6.54 ppm of iodine at the consumer level. On analyzing the urine samples, 19.1% of the children had mild to moderate iodine deficiency. Adequate salt intake was present in 19.5%, followed by 26.7% and 30.3% who had an above requirement and excess amount of salt in urine samples [Table 4].

Discussion

Universal salt iodization is the most widely used strategy to control iodine deficiency.[14] In India, the essential iodization of all table salts was introduced in 1983. Urinary iodine (UI) is a more sensitive indicator of recent changes in iodine intake and is, therefore, the

Table 1: Demographic characteristics of the study population

		Gender		Total
		Males (*n*)%	Females (*n*)%	
Age group (in years)	6	161 (44.7)	199 (55.3)	360
	7	260 (66.7)	130 (33.3)	390
	8	160 (41.1)	230 (58.9)	390
	9	213 (54.6)	177 (45.4)	390
	10	231 (59.2)	159 (40.8)	390
	11	168 (43.1)	222 (56.9)	390
	12	158 (40.5)	232 (59.5)	390
	Total	1351	1349	2700

Table 2: Prevalence of goiter in the study population

Goiter grade	Frequency	Percent
0	2604	96.4
1	90	3.3
2	6	0.3
Total	2700	100.0

Table 3: Relationship of goiter grade with gender and age

Age	Gender	Goiter Grade			TGR (%)	Total
		0	1	2		
6	Male	161	0	0	0 (0)	161
	Female	196	3	0	3 (1.5)	199
	Total	357 (99.2)	3 (0.8)	0 (0)	3 (0.8)	360 (100)
7	Male	252	8	0	8 (3.1)	260
	Female	125	3	2	5 (3.8)	130
	Total	377 (96.7)	11 (2.8)	2 (0.5)	13 (3.3)	390 (100)
8	Male	146	14	0	14 (8.8)	160
	Female	223	7	0	7 (3.0)	230
	Total	369 (94.6)	21 (5.4)	0 (0)	21 (5.4)	390 (100)
9	Male	203	10	0	10 (4.7)	213
	Female	172	3	2	5 (2.8)	177
	Total	375 (96.2)	13 (3.3)	2 (0.5)	15 (3.8)	390 (100)
10	Male	224	7	0	7 (3.0)	231
	Female	155	4	0	4 (2.5)	159
	Total	379 (97.2)	11 (2.8)	0 (0)	11 (2.8)	390 (100)
11	Male	154	12	2	14 (8.3)	168
	Female	215	7	0	7 (3.2)	222
	Total	369 (94.6)	19 (4.9)	2 (0.5)	21 (5.4)	390 (100)
12	Male	150	8	0	8 (5.1)	158
	Female	228	4	0	4 (1.7)	232
	Total	378 (96.9)	12 (3.1)	0 (0)	12 (3.1)	390 (100)
Total	Male	1290	59 (4.4)	2 (0.1)	61 (4.5)	1351
	Female	1314	31 (2.3)	4 (0.3)	35 (2.6)	1349
	Total	2604 (96.4)	90 (3.3)	6 (0.3)	96 (3.6)	2700 (100)

Table 4: Iodine levels (ppm) in salt samples and UI levels (ppm) according to WHO in salt and urine samples of district Ganderbal

Salt Iodine Level (ppm)	Minimum	25th percentile	50th percentile	75th percentile
	0	5.28	5.99	6.54
UI Level (ppm)	Up to 99.9	100–199.9	200–299.9	300 and above
	Mild-Moderate deficiency	Adequate intake	Above requirement	Excessive
	33 (19.1)	27 (19.5)	40 (26.7)	193 (30.3)

preferred indicator for assessing iodine nutrition in the population and monitoring iodine interventions.[9] IDDs affect the entire population but a school based sampling method is recommended for UI and TGR as the most efficient and practical approach to monitor IDD as this group is usually easily accessible and can be used as a proxy for the general population.[9] Iodine deficiency is considered to be a public health problem in populations of school-age children where the median UI is below 100 µg/l.

In this study, TGR was found to be 3.6%. TGR was higher in boys (4.5%) in comparison to girls (2.6%). 3.3% of children had Grade 1 goiter with figures higher in boys (4.4%) than in girls (2.3%). Grade 2 goiter was present in 0.3% of surveyed children with figures slightly higher in girls (0.3%) than boys (0.1%). An earlier study conducted by Zargar *et al*.[15] (1997) found the TGR to be 52.08% with Grade 1 in 41.95% and Grade 2 in 10.1% in children of the Baramulla district of Kashmir valley. The prevalence was higher in boys (52.08%) than in girls (49.23%). Another study conducted by Zargar *et al*.[12] in the same area in 1995 showed a TGR of 45.2% with 43.9% among boys and 46.2% in girls, respectively. Grade 1 goiter was found in 37.74% of children and Grade 2 goiter was in 7.44%. The overall prevalence of goiter has declined in the Kashmir valley in past years as shown by the findings of a study conducted by Muhammad Salim Khan *et al*.[16] (2014) among school-going children of 6–12 age group conducted in district Kulgam of Kashmir valley, where TGR was found to be 18.9% with Grade 1 goiter at 18.5% and Grade 2 goiter at 0.4%. This decline in the prevalence of goiter can be attributed to better awareness and sustained information, education, and communication (IEC) activities by the government about the use of iodized salt. Also the efforts made by both government and non-government agencies toward reducing the prevalence of IDD caused by deficiency of iodine.

The prevalence of Grade 1 goiter was more common in the age group of 8 years (5.4%) followed by the age group of 11 years (4.9%). TGR was 5.4% for each age group 8 and 11 years, respectively. The prevalence was higher among boys (8.8% and 8.3%) in age groups of 8 and 11 years, respectively, which is consistent with the findings of the study conducted by Chandra *et al*.[17] (1997) in Tripura which also showed the maximum involvement in the age group of 11 years to the extent of 24.1%. Another study by Rajiv Kumar Gupta *et al*.[18] also showed similar findings. TGR was higher in boys (17.8%) in comparison to girls (14.6%). The other study that showed a higher prevalence in boys was conducted by Muhammad Salim Khan *et al*.[16] (2014) among school-going children of the 6–12 age group conducted in district Kulgam of Kashmir valley which showed a significantly higher prevalence among boys (21.2%) in comparison to girls (16.7%). Another study conducted by Junaid Kousar *et al*.[19] (2013) in district Kargil region (Jammu and Kashmir) also showed male preponderance with the prevalence of 36.7% in males as compared to females (27.1%). In most other studies, girls had a higher prevalence of goiter than boys. A study conducted by Biradar *et al*.[20] (2016) in Ramanagara district, Karnataka, India showed females had a higher prevalence of 35.3% as compared to males with the prevalence of 31.4%. Another study conducted by Gurdeep Singh *et al*.[21] (2003) also found the prevalence of goiter higher among girls (12.9%) as compared to boys (11.3%). Sahu *et al*.[22] (2005) also found a higher prevalence among girls (33.1%) as compared to boys (27.3%). Study by Rafiq *et al*.[23] (2013) conducted in Srinagar district of Kashmir valley also showed that the rate was higher to an extent of 17% in girls as compared to boys where it was 13.67%. Grade 2 goiter was about 0.96% in girls and 0.29% in boys.

Limitations

Firstly, this study was conducted in only school children aged 6–12 years, so the results cannot be generalizable to those children not going to school. Secondly, there may have been a misclassification bias in determining iodine levels in salt and urine samples in the lab.

Conclusion

This study showed mild goiter prevalence in school-aged children of 6–12 years in the Ganderbal district of Kashmir valley. There is a continuous need for periodic surveys to assess the magnitude of the IDD with respect to the impact of iodized salt (IS) intervention, providing iodized salt in public distribution system, strengthening, monitoring, and evaluation of IDD program, and ensuring the sustainability of IDD control activities are essential to achieve sustainable elimination of IDD in India.

Goiter is still a major public health problem in J&K although a notable decrease in the magnitude of the problem has occurred in a few years. In this connection we would like to suggest the following measures:

1. A goiter cell needs to be established and strengthened of the same with expertise from the community

medicine department to monitor the situation of IDDs in the state. With regard to this, proper laboratory facilities for estimation of UI excretion as well as for checking the iodine content of salt which is essential for monitoring the proper implementation of the IDD control program.
2. Salt production units are to be made available at the state level so that the consumers have the access to fresh salt and the environmental loss of iodine is checked and kept at the minimum.
3. Food and drug control organization should make sure that the salt available in the market is iodized and the salt packets are not older than 5 to 6 months.
4. Sustained IEC involvement should be ensured so that people are made aware of the consumption of IS. The help of the field publicity wing of the information Department of J&K and Health Education Bureau also should be taken. To intensify the IEC activities, a communication package by way of video films, posters/danglers, and radio/TV spots need to be finalized.

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Conflicts of interest

There are no conflicts of interest.

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