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Original Research Article

Prevalence of iodine deficiency disorders and its determinants among school children aged 6 to 12 years in rural areas of Koppal district, Karnataka

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ABSTRACT

Background: Iodine deficiency disorders are recognized as major public health problem in India and the simplest, most effective and inexpensive preventive method is the consumption of Iodized salt. The objective of this study is to estimate the prevalence of goitre among children aged 6 to 12 years in rural areas of Koppal district, to determine various factors associated with goiter among children, to estimate the level of urinary iodine excretion among urine samples collected from children and to estimate the level of iodine content among salt samples collected in the study setting.
Methods: A cross sectional study was conducted for a duration of 6 months from June 2018 to November 2018 in rural areas of Koppal district among 3047 school children aged 6 to 12 years selected by cluster sampling technique. Goiter was detected and graded using standard techniques and the collected salt and urine samples were sent to MRHRU, Sirwar, Raichur for analysis. Data was collected using pretested and semistructured questionnaire and was analyzed using WHO Epi info software version 3.5.4.
Results: The prevalence of goitre among school children in Koppal district was 442 (14.5%) and it was found to be significantly associated with age and source of drinking water. Majority i.e., 65.96% of urine samples had iodine content less than 100 µg/l and majority i.e., 79.15% of salt samples had iodine content less than 15 PPM.
Conclusions: Goiter is mild public health problem in Koppal district with majority of urine samples excreting iodine below optimum levels and majority of salt samples being inadequately iodized.

Keywords: Child, Drinking water, Goiter, Urine

INTRODUCTION

Iodine is an essential dietary micronutrient that helps the body to produce thyroxin hormone which regulates normal growth, development and functions of body. Inadequate/ poor intake of iodine can cause a spectrum of disorders like stillbirth, mental retardation, deaf mutism, squint, dwarfism, goiter, neuromotor defects etc. collectively referred as Iodine deficiency disorders (IDD). It affects people of all ages, both sexes and of different socio-economic backgrounds. It is the world's most prevalent, yet easily preventable, cause of brain damage.[1-4]

Globally, about 2 billion people including 266 million school aged children are at risk of Iodine deficiency disorders due to insufficient intake of iodine and the estimated prevalence of goiter is 15.8%. In India alone,

200 million people live in iodine deficient areas and 71 million persons are already suffering from goiter and other disorders. Surveys conducted in various states showed that no state in the country is free from IDD and revealed that out of 282 districts surveyed, IDD poses a major public health problem in 241 districts where the prevalence is more than 10%.[1,2,4-7]

The Government of India launched National Goiter Control Program (NGCP) in the year 1962 considering the burden of IDD in the country and renamed it as National Iodine Deficiency Disorders Control Program (NIDDCP) in the year 1992. Universal salt iodization was identified as the main strategy to eliminate IDD form India and was made mandatory in the year 1997. Despite this, only half of households in India are currently using sufficiently iodized salt.[4,6,8,9] All health interventions require an effective system for monitoring and evaluation and assessment of Iodine status of population by goiter survey and iodine levels of salt are the two important components of NIDDCP program monitoring.[5,6] With this background, the following study was undertaken.

Objectives

The objectives of this study was to estimate the prevalence of Goitre among children aged 6 to 12 years in rural areas of Koppal district, to determine various factors associated with goiter among children, to estimate the level of urinary iodine excretion among urine samples collected from children and to estimate the level of iodine content among salt samples collected in the study setting.

METHODS

Study design

The present study was a community based cross sectional study done by the department of Community Medicine, KIMS, Koppal (rural areas) for a duration of 6 months from June 2018 to November 2018 in Koppal district as per guidelines from IDD cell, Directorate of Health and Family Welfare, Bangalore.

***Study population*:** All the children aged 6 to 12 years residing in rural areas of Koppal district

Sampling technique

Cluster sampling technique was used for sample selection as per guidelines. All the villages in Koppal district were considered as Individual clusters and 30 such clusters/ villages were selected by population proportional to size sampling. As the school enrolment rate was more than 90% in Koppal district, the survey was restricted only to children aged 6 to 12 years studying in schools located in selected villages of the district. In each of the selected cluster/ village, one school was selected by simple random sampling and in each selected school a total of 105 children (15 each from class 1 to 7) were selected and included as study participants by systematic sampling technique as per guidelines. If the required number of children were unavailable at that particular school, other schools in the vicinity were visited till a sample of 105 children was reached for that particular cluster. As per protocol, we also collected 10 urine samples from children at each school and 20 salt samples from households of children at each school by systematic sampling technique.

Detection of goiter

Goiter was detected and graded by inspection and palpation of the neck of study participants as per standard techniques mentioned in guidelines for the survey after obtaining their accent and informed consent from Headmasters of the schools. Goiter was graded as follows: Grade 0- no palpable or visible goiter/ no goiter, Grade I- A mass in the neck that is consistent with an enlarged thyroid, which is palpable but not visible, when the neck is in normal position. It moves upward in the neck as the subject swallows, Grade II- 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 visible and palpable.

Analysis of iodine content of iodized salt by iodometric titration method

Salt samples were sent to Model Rural Health Research Unit (MRHRU), Sirwar, Raichur for analysis.

Estimation of urinary iodine excretion (UIE) by Sandell Kolthoff reaction

Urine samples were sent to MRHRU, Sirwar, Raichur for estimation and were classified as per guidelines.[10]

Data collection

Data were collected using pretested and semi structured questionnaires from study subjects after taking their accent and consent from teacher.

Statistical analysis

Data were entered and analyzed using Epi info software version 3.5.4.

RESULTS

The survey team examined a total of 3150 school children for goitre and collected 600 salt samples and 300 urine samples from 30 clusters as per protocol. However, some of the questionnaires and urine/ salt samples collected had to be discarded for being incomplete and for being insufficient for analysis respectively thereby making a final sample of 3047 children, 282 urine and 566 salt samples. The prevalence of goitre among school children aged 6 to 12 years in rural areas of Koppal district was

442 (14.5%), out of which 367 (12.04%) were found to have Grade I goiter and the rest 75 (2.46%) were suffering from Grade II goiter.

Figure 1 demonstrates gender wise prevalence of goitre in Koppal district. The prevalence of goiter (both Grade I and II) was little higher i.e., 235 (15.72%) among male children as against 207 (13.32%) among females as seen in the figure but this difference was not found to be statistically significant (p>0.05).

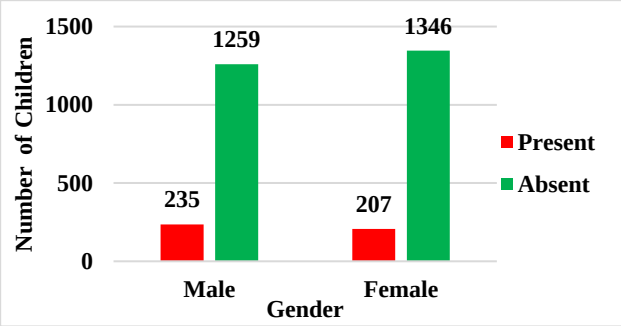

Figure 1: Gender wise prevalence of goitre (n=3047).
Chi square=3.5382; p=0.059.

Figure 2 shows age wise prevalence of goitre in Koppal district. It is evident that the prevalence was highest in children aged 8 years i.e., 81 (18.75%) followed by 68 (18.42%) among children aged 6 years and the least prevalence was found among children aged 7 years i.e., 37 (8.39%) and the association between prevalence of goiter and age of study participants was found to be statistically significant (p<0.05).

Table 1 demonstrates prevalence of goiter among children according to certain dietary factors and source of drinking water. As seen in Table 1, none of the dietary factors were found to be significantly associated (p>0.05) with prevalence of goiter among children in the present study. However, the prevalence of goiter was significantly more (p<0.05) in children who relied on surface water sources for drinking purposes compared to those whose source of drinking water was ground water.

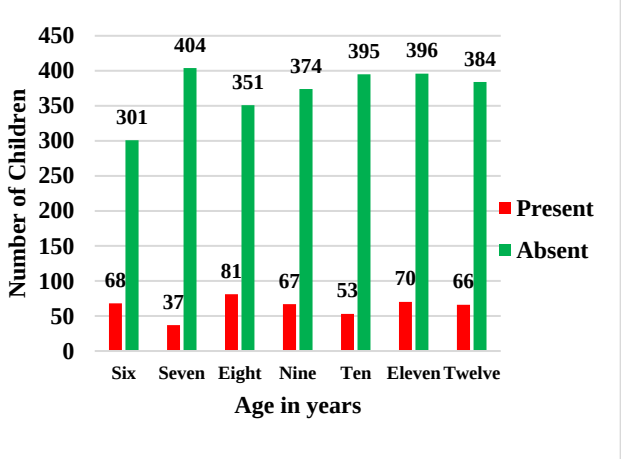

Figure 2: Age wise prevalence of goitre (n=3047).
Chi square=27.025, p=0.000.

Table 2 shows distribution and classification of urine samples according to iodine content in them. Majority i.e., 154 (54.60%) of the urine samples in the present survey had mild iodine deficiency as indicated by urinary excretion followed by 96 (34.04%) of samples with no iodine deficiency as seen in the Table 2. Mean iodine content among urine samples was 84.95 µg/l and median was 75 µg/l.

Figure 3 shows distribution of salt samples according to iodine content in Koppal. Majority i.e., 448 (79.15%) of the salt samples collected during the survey had iodine content less than 15 PPM and the rest had more than that as seen in the Figure 3.

Table 1: Prevalence of goiter among children according to certain dietary factors.

Dietary factors	Classification	Children Observed	Goiter status		
			Present	Absent	
		N	N (%)	N (%)	
Type of diet	Vegetarian	727	92 (12.65)	635 (87.35)	χ^2=2.638 p=0.104
	Mixed	2320	350 (15.08)	1970 (84.92)	
Intake of pickle	No	244	24 (9.83)	220 (90.17)	χ^2=4.889 p=0.086
	Occasional	1978	299 (15.11)	1679 (84.89)	
	Regular	825	119 (14.42)	706 (85.58)	
Intake of papad	No	285	34 (11.92)	251 (88.08)	χ^2=2.086 p=0.352
	Occasional	2523	376 (14.90)	2147 (85.10)	
	Regular	239	32 (13.38)	207 (86.62)	
Intake of cabbage	No	344	47 (13.66)	297 (86.34)	χ^2=4.559 p=0.102
	Occasional	2505	376 (15)	2129 (85)	
	Regular	198	19 (9.59)	179 (90.41)	
Intake of cauliflower	No	302	44 (14.56)	258 (85.44)	χ^2=2.222 p=0.329
	Occasional	2591	382 (14.74)	2209 (85.26)	
	Regular	154	16 (10.38)	138 (89.62)	

Continued.

Dietary factors	Classification	Children Observed	Goiter status		
			Present	Absent	
		N	N (%)	N (%)	
Intake of chutney	No	90	9 (10)	81 (90)	χ^2=1.813 p=0.403
	Occasional	2320	344 (14.82)	1976 (85.18)	
	Regular	637	89 (13.97)	548 (86.03)	
Intake of additional salt	Yes	544	84 (15.44)	460 (84.56)	χ^2=0.466 p=0.494
	No	2503	358 (14.30)	2145 (85.70)	
Source of drinking water	Surface	993	173 (17.42)	820 (82.58)	χ^2=10.098 p=0.001
	Ground	2054	269 (13.09)	1785 (86.91)	

Table 2: Distribution of urine samples according to iodine content (n=282).

Iodine content (µg/l)	Status of iodine deficiency	Urine samples
		N (%)
Below 20	Severe	21 (7.44)
20–49.9	Moderate	11 (3.92)
50–99.9	Mild	154 (54.60)
100 and above	Normal	96 (34.04)
Total		282 (100)

Mean=84.95 µg/l and Median=75 µg/l.

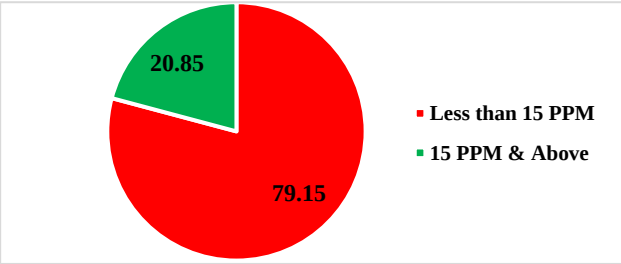

Figure 3: Distribution of salt samples according to iodine content (n=566).

DISCUSSION

The prevalence of Goiter among school children aged 6 to 12 years in rural areas of Koppal district was found to be 14.5%, thereby making Koppal district endemic for IDD and the public health problem is of mild grade as per WHO, UNICEF and ICCIDD guidelines.[10] This finding was similar to the findings of a number of studies done in different parts of the country.[4,6,7,9,12] Few other studies have found even lesser prevalence of goiter in their studies and a study by Shinde et al has however, found a little higher prevalence in a study conducted in Madhya Pradesh.[1,8,11,13] This difference in prevalence of Goiter could be due to differences in study settings, differences in study periods, differences in profile of study participants, sampling errors etc.

The present study found significant association between the prevalence of goiter and the age group of study participants similar to the findings of a number of studies done both within and outside the country.[7,8,14-16] Similarly, prevalence of goiter was significantly more among children who relied on surface water sources for drinking purposes in the present survey. But the role of source of drinking water was not evaluated by any of the studies mentioned earlier. However, neither gender nor any of the dietary factors were found to have any significant association with the prevalence of goiter among children, as opposed to many studies which found prevalence to be significantly more among female children.[5,7,12,14-17]

Nearly two third of the urine samples collected from study subjects in the present survey had iodine excretion levels less than optimum with median of 75 µg/l similar to the findings of many other studies.[6,9,12,13,15,18] However, while few other studies had median urinary excretion in their urine samples more than the optimum, another study by Sebotsa et al in South Africa had median urinary excretion levels much lesser than the present study.[4,11,14,16] In the present survey, only one in every five salt samples had adequate iodine content which is highly worrisome, as confirmed by other studies.[6,11,15,19] On the contrary, many other studies[1,8,12-14,16] found more than half of the salt samples adequately iodized.

CONCLUSION

Goiter constitutes a mild public health problem in the study setting and was significantly associated with age and source of drinking water among school children. Majority of the urine samples collected from them were excreting iodine below optimum levels indicating poor iodine nutrition. Only 20% of salt samples collected, had adequate Iodine content emphasizing the need to improve the same.

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Ethical approval: The study was approved by the Institutional Ethics Committee, KIMS, Koppal

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