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Original article

Prevalence of Endemic Goiter in School Children during Post Salt Iodization Period in Churachanpur District, Manipur, India

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ABSTRACT

Background: Manipur lies in the conventional goiter endemic belt of India because of its geographical location. Endemic goiter was found prevalent in valley districts of Manipur during post salt iodization period without biochemical iodine deficiency but certain goitrogens in plants grown in the region and consumed by the people have role in goiter formation. Therefore the present study has been undertaken to evaluate goiter prevalence in a hill district of Manipur. **Objectives:** The present investigation was aimed to study the goiter prevalence among school children (6-12 yrs) in Churachanpur district of Manipur, and to evaluate the goiter formation by assessing the urinary iodine and thiocyanate concentration, and iodine content in edible salt and drinking water. **Methods:** A total of 1416 school children were clinically examined for the enlargement of thyroid, 160 urine samples were analyzed for iodine and thiocyanate concentration. Iodine content was also measured in 140 edible salt samples and 20 drinking water samples. **Results:** Total goiter prevalence was found to be 28.39%, median urinary iodine level was 160.50 µg/l and the mean urinary thiocyanate concentration was 0.985 ± 0.046 mg/dl. All the salt samples had iodine above the recommended level of 15 ppm but the region was found environmentally relatively iodine deficient. **Conclusions:** The study showed that the region is clinically moderately goiter endemic without biochemical iodine deficiency. Consumption of certain plant foods containing cyanogenic glycosides might have played a role for the development of goiter during post salt iodization phase in this region.

KEYWORDS: Goiter, Goitrogen, Iodine nutrition, School children

INTRODUCTION

One of the major global problems of public health is iodine deficiency disorders (IDD). The important clinical features of IDD are goiter (enlargement of thyroid gland than normal), deaf mutism, still birth, mental disorder, miscarriages, weakness and paralysis of muscles, physical and mental dysfunctions, etc [1]. Iodine deficiency in early life is a major cause of preventable mental impairment worldwide. It affects 7% of the world population. It is estimated that in India alone, more than 6.1 crore people are suffering from endemic goiter and 88 lakh people are mental/ motor handicaps. A national level survey has been carried out in 25 states and 5 union territories in the country and found that out of 282 districts surveyed, 263districts had major public health problem having goiter prevalence rate of more than 10% [2].

Every year, in developing countries, 38 million newborns are born iodine deficient. But newborns in industrialized countries, such as UK, USA, and Australia, are also vulnerable [3]. Iodine deficiency also affects the socio-economic development of a community. Even during the use of iodized salt, endemic goiter has been reported from many parts of North Eastern India including Manipur [4,5,6, 7, 8]. The present investigation was thus undertaken to study the prevalence of goiter even after prolonged use of iodized salt by the people in Churachanpur district, Manipur, India.

MATERIALS AND METHODS

Selection of study areas

Manipur is one of the north eastern states situated in the foot hills of eastern Himalayas. The whole state is in the classical

goiter endemic belt of India [9]. Churachanpur is the southwest district of Manipur with a distance of about 65 km from Imphal and covers an area of 4570 sq. km. The district terrain is mainly hilly with narrow valley. Four areas/localities were randomly selected for goiter survey and sample collection following random purposive sampling method [10].

Selection of target population

As per guidelines of WHO/UNICEF/ICCIDD, 1993 [11], school children in age group 6 – 12 years from both the sexes were selected. One Primary School, one Junior High School and one High School located in the area were selected to get the target population. A target population of 1416 was considered for the present investigation.

Clinical goitre survey

The school children were clinically examined for the enlargement of thyroid (goiter) by palpation method and the goiter was classified into three: Grade 0: no goitre; Grade 1: thyroid palpable but not visible and Grade 2: thyroid visible with neck in normal position [12]. Physical/Clinical examination of goiter was conducted by expert investigators.

Iodine and thiocyanate in urine

As per guidelines of WHO/UNICEF/ICCIDD, 1994 [12], a total number of 160 (40 from each area) urine samples were collected from the clinically examined children irrespective of thyroid size. The samples were put in air tight screw capped sterilized plastic bottles. One or two drops of xylene or toluene were added to each sample to prevent the growth of microbes and to reduce the bed smell of urine. The samples were brought to the laboratory and kept at 4^{o}C till analysed. The urinary iodine level was measured by Arsenite method following dry ashing in presence of potassium carbonate [13]. The thiocyanate concentration was also measured in the urine samples collected for iodine by the method of Aldridge (1946), modified by Michajlovski and Langer [14].

Iodine in edible salt and drinking water

One hundred forty edible salt samples (35 from each area) were collected in air tight plastic containers from the houses of the students and brought into the laboratory, and iodine content was measured within a week using iodometric titration method [15]. Twenty drinking water samples (5 from each area) available in the study areas were collected in screw capped air tight plastic bottles and the iodine concentration was measured by the method of Karmarkar*et al*, 1986 [13]. The study was carried out between July 2012 and December 2013.

For the analysis of data, mean, median and standard deviation have been used.

RESULTS

Goitre prevalence: The endemic goiter was found prevalent among school children of Churachanpur district with a total goiter rate of 28.39% and most of the goitre were of grade 1 (26.48%) and the grade 2 was very few (1.91%) [Table 1].

Table 1: Goiter prevalence in different study areas of Churachanpur district

Study areas	Rural/Urban	Total no. of children examined	Number of children with goiter			Goiter Status
			Grade 1	Grade 2	Total	
Salem	Rural	509	107 (21.02)	8 (1.57)	115 (22.59)	Moderate
Torbung	Rural	310	96 (30.97)	10 (3.23)	106 (34.19)	Severe
New Lamka	Rural	327	121 (37.00)	5 (1.53)	126 (38.53)	Severe
Loktak project	Rural	270	51 (18.89)	4 (1.48)	55 (20.37)	Moderate
Total		1416	375 (26.48)	27 (1.91)	402 (28.39)	Moderate

Parentheses indicate percentage

Urinary iodine: The median urinary iodine level in the studied population was 160.50 µg/l. The urinary iodine levels less than 100 µg/l were seen only in 17% of the samples tested, and the iodine levels less than 50 µg/l were found only in 3% of the samples tested [Table: 2].

Urinary thiocyanate: The mean urinary thiocyanate level was found to be 0.985 ± 0.046 mg/dl [Table 2]. The consumption pattern of cyanogenic foods among the studied population was also reflected from the dietary interview during survey. It was found that the studied population were exposed to thiocyanate load.

Iodine in edible salt: The edible salt of the households in the studied region had adequate iodine, 92.45% of the tested salt samples had iodine level from 15.1 to 29.9 ppm, and 7.55% of the salt samples had iodine level of 30 ppm and above. It means that 100% of the households consumed iodized salt at adequate level [Table 2].

Iodine in drinking water: The mean iodine content in drinking water samples collected from the studied region was found to be 15.62 ± 3.85 µg/l [Table 2].

Table 2: Urinary iodine, urinary thiocyanate, and iodine content in edible salt and drinking water samples from Churachanpur district

Study areas	Urinary iodine level (µg/l)			Urinary SCN level mg/dl (Mean ± SD)	Iodine in edible salt			Iodine content in drinking water (µg/l)
	Median µg/l	% urine samples <100 µg/l	% urine samples <50 µg/l		% Salt samples with iodine < 15 ppm	% Salt samples with iodine 15.1-29.9 ppm	% Salt samples with iodine ≥30 ppm	
Salem Veng	175	7.5	7.5	0.917 ± 0.112	-	94.29	5.71	20.2 ± 6.22
Torabung	195.75	5	-	0.945 ± 0.077	-	71.43	28.57	8.28 ± 4.18
New Lamka	135	25	5	0.896 ± 0.058	-	85.71	14.29	4.48 ± 3.84
Loktak project	105.00	30	0	0.955 ± 0.037	-	94.29	5.71	10.98 ± 2.25
Total	160.50	17	3	0.985 ± 0.046	-	92.45	7.55	15.62 ± 3.85

DISCUSSION

The most widely accepted marker to evaluate the severity of IDD in a region is the prevalence of endemic goiter in school children (6-12 years). The present result of total goiter rate (28.39%) indicated that the studied region is moderately goitre endemic as per criteria of WHO/UNICEF/ ICCIDD (1994) [12]. According to these criteria, a prevalence rate of 5.0 – 19% is taken as mild, 20.0 – 29% as moderate and 30% and above is considered as a severe public health problem. The urinary iodine is also used as a valuable marker for the assessment of IDD in a region because 90% of body's iodine is excreted through urine [16].

As per recommendation of WHO/UNICEF/ICCIDD (1994), measurement of iodine in urine samples should be done in school-aged children (6 – 12 years) for the assessment of iodine nutritional status of a region. A median urinary iodine concentration of 100µg/l and when not more than 20% of the samples are below 50 µg/l in an area indicates no iodine deficiency [12].The median urinary iodine level of the present study (160.50 µg/l) indicates that there is no biochemical iodine deficiency in the studied population, it means that the population are consuming sufficient iodine. The urinary thiocyanate truly reflects the consumption pattern of cyanogenic foods. Certain plants such as those of the family Brassicaceae are the sources of cyanogenic glycosides and glucosinolates.

These cyanogenic compounds are the precursors of thiocyanate [17]. Thiocyanate inhibits the iodide uptake by the thyroid and also blocks the organic binding of iodine by competing with iodide. It also increases iodine efflux. The urinary thiocyanate concentration in non-goitrous population of India is 0.504 ± 0.197 mg/dl [6]. Marwaha*et al* (2003) [18] reported that thoiocyanate might play an important role in the development of goiter among poor children in India during the post salt iodisation phase. The present mean urinary thiocyanate level of 0.985 ± 0.046 mg/dl indicates that the children of this region might have taken sufficient foods containing cyanogenic glycosides and glucosinolates.

The people of the region regularly consume bamboo shoot items which are rich in cyanogenic glycosides, glucosinolates and thiocyanate [19].Therefore bamboo shoot may be one of the possible contributes for the high thiocyanate concentration in urine of the studied population.

According to WHO/UNICEF/ICCIDD (2001) [20], 90% of the households should get iodized salt at the recommended level of 15 ppm, but in our present study 100% of the households consumed iodized salt with the recommended level indicating that the Universal Salt Iodization programme is successful in Manipur. To monitor the soil iodine concentration of a region, the iodine content in drinking water of the region can be assessed. According to Zeltser*et al*, [21], three types of iodine deficient zones can be established: severe deficient zone (iodine < 4 µg/l water), moderate deficient zone (4 – 10 µg/l) and relative deficient zone (11 – 20 µg/l). On the basis of these criteria, the iodine content in drinking water indicates the bioavailability of iodine. The present mean iodine content in drinking water of 15.62 ± 3.85 µg/l suggests that the region is relatively iodine deficient zone.

CONCLUSION

Therefore, from the study it may be concluded that the studied region is clinically moderately goiter endemic without biochemical iodine deficiency, as well as the Universal Salt Iodisation programme is successfully operating in this region. It also concludes that the frequent and excess consumption of plant foods (e.g., bamboo shoot) containing cyanogenic glycosides among the population might have played role in the persistence and development of goiter in this hill district in spite of adequate iodine intake.

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ETHICAL CLEARANCE:
The necessary permission for ethical clearance was taken from the Institutional Ethical Committee, D.M. College of Science, Imphal, Manipur, India.

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