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Iodine Deficiency Disorders among School Children of Malda, West Bengal, India

Akhil Bandhu Biswas, Indranil Chakraborty, Dilip Kumar Das, Srabani Biswas, Saswati Nandy, and Jayasri Mitra

R.G. Kar Medical College, Kolkata 700 004, West Bengal, India

ABSTRACT

A community-based, cross-sectional study was conducted among 2,392 school children, aged 8-10 years, in Malda district of West Bengal, India, in January 2001 to assess their iodine status. The children were selected through a multistage 30 cluster-sampling technique to determine the status of iodine deficiency disorders (IDD) using recommended quantifiable indicators. The prevalence of goitre was assessed clinically using the standard palpation method by the teachers of Community Medicine, and a total goitre rate of 11.3% was found with no significant gender difference ($p>0.05$). Urinary iodine excretion (UIE) levels of 341 study subjects, selected through systematic random sampling, were analyzed by the wet digestion method to determine biochemical iodine deficiency by the teachers of Biochemistry Department. The median UIE was 15 mcg/dL, and no child had UIE value less than 5 mcg/dL. Iodine content of 1,060 salt samples tested with spot-testing kit revealed 85.1% with adequate iodine content of ≥15 ppm. The finding of 11.3% of total goitre rate but with no evidence of current iodine deficiency (median UIE 15 mcg/dL) indicates that the Malda district is in the transition phase from iodine-deficient to iodine-sufficient.

***Key words**:* Goitre; Iodine deficiency; Salts; Cross-sectional studies; India

INTRODUCTION

Iodine deficiency is one of the most common preventable causes of mental retardation in the world today (1). Iodine deficiency disorders (IDD) are a major public-health problem in India. An estimated 167 million people in India are at risk of IDD, of whom 54 million have goitre, and over 8 million have neurologic handicaps (2). Of 457 districts in the country, 275 have been surveyed for IDD, and 235 have been found to be endemic. These districts cover all the states and Union Territories of India (3).

Organized efforts to deal with the problem of IDD were intensified in 1992 with the change of National Goitre Control Programme to National Iodine Deficiency Disorders Control Programme (NIDDCP) to connote the wider implications of iodine deficiency in the population. The progress of the programme needs to be monitored using quantifiable indicators as recommended by the International Council for the Control of Iodine Deficiency Disorders (ICCIDD), WHO, and UNICEF.

Table 1 shows the indicators for monitoring progress toward eliminating IDD as a public-health problem (4).

Some districts of West Bengal were surveyed in phases, but those reports deemed not to be credible. Those goitre surveys were done in an isolated and incomplete manner by district health authorities through paramedical staff (5). In this perspective, it is highly relevant to assess IDD status in at least one of the North Bengal districts urgently using quantifiable indicators by applying standardized methodology and competent manpower. Therefore, the study was conducted to assess the current status of IDD in the Malda district and to estimate the iodine content of salt consumed by the population in the same district.

Correspondence and reprint requests should be addressed to: Dr. A.B. Biswas
4/4, Viveknagar
Kolkata 700 075
West Bengal, India
Email: uchakrabarty@hotmail.com

Table 1. Indicators of monitoring progress toward eliminating IDD

Indicator	Goal
Salt iodization	
Proportion of households consuming iodized salts effectively	>90%
Urinary iodine	
Proportion below 100 mcg/L	<50%
Proportion below 50 mcg/L	<20%
Thyroid size:	
In school children aged 6-12 years	
Proportion with enlarged thyroid, by palpation or ultrasound	<5%

MATERIALS AND METHODS

The study was conducted among school children, aged 8-10 years, in the Malda district of West Bengal, India, in January 2001. School children of this age group are recommended for assessing IDD because of their combined high vulnerability to disease, easy accessibility, and representativeness of their age group in the community (4). High school enrollment and low drop-out rates in Malda justify the study among school children only.

The sample size of children surveyed was based on the assumed goitre prevalence rate of 50% (as there was no available information on likely prevalence in the study district), confidence interval (CI) of 95%, a design effect of 3, and a relative precision of 10%. A sample size of 1,200 children was considered sufficient to establish whether IDD was present. Since we also intended to assess the degree of severity, the sample size had to be larger; in most cases, 2,250 children would be sufficient, i.e. 75 children per cluster in a 30-cluster sampling technique (4).

The multistage cluster-sampling methodology was followed for selecting the study population. All the rural and urban units in the district with their respective population were enlisted. The 30 clusters were selected using the ‘probability proportional to size’ (PPS) sampling method. In each identified cluster, all primary schools were enlisted. From the sampling frame of all primary schools, one was selected following the simple random-sampling technique, using a random number table for detailed survey. All children, aged 8-10 years, of the selected school were enlisted agewise from school records. From this sampling frame, the required number of children, i.e. at least 75 children per cluster, was selected following the simple random-sampling technique for inclusion in the study. An attempt was made to select an equal number of children in the age of 8, 9, and 10 years as far as possible. In total, 2,392 school children were included in the study.

Prior intimation was given to the identified school authority one week before the survey to ensure maximum attendance of students. During the actual survey, attendance of students was 95-100%.

The school teachers and children were briefed about the activities to be undertaken during the survey.

A pre-designed pretested proforma was used for collection of data. Data were recorded in the proforma by clinical examination along with urinary iodine estimation and by testing of salt with spot-testing kit by a team of trained investigators comprising teachers from the Department of Community Medicine and Biochemistry of R.G. Kar Medical College, Kolkata, West Bengal.

During clinical examination by the standard palpation method, grading of goitre was done according to the criteria recommended by the joint WHO/UNICEF/ICCIDD into three categories, viz. grade 0, grade I, and grade II as follows (4,6):

Grade 0: No palpable or visible goitre

Grade I: A mass in the neck consistent with an enlarged thyroid that 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

The sum of grade I and II provided the total goitre rate.

The recommended sample size for collection of biological specimens, such as urine, is 300 (i.e. 10 children x 30 clusters) (6). In the present study, casual on-the-spot urine samples (0.5 to 1.0 mL) were collected from 341 students, every seventh child selected from those who were clinically examined. Plastic bottles with caps were used for collecting the samples. The urine samples were stored in a refrigerator at 4 ºC until analysis. The urinary iodine excretion (UIE) level was analyzed by the wet digestion method (7). The result was expressed as mcg iodine/dL urine.

In each cluster, about 35 subjects, selected by the simple random-sampling technique, were asked to bring about 20 g of salt that was routinely being consumed in their respective homes in auto-seal polythene pouches. Iodine content of the salt was estimated using spot-testing kit.

RESULTS

A total of 2,392 school children, aged 8-10 years, were studied, of whom 47.7% were males, and 52.3% were females. Of these children, 28.4% were aged eight years, 32.3% nine years, and 39.3% 10 years.

The total goitre prevalence rate was 11.3% (95% Cl=10.01–12.59%). The prevalence rates of goitre in males and females, respectively, were 10.7% and 11.9%. No significant difference (c^2=0.86, df=1, p>0.05) was found in the prevalence of goitre among the male and female children (Table 2).

The prevalences of goitre among 8, 9, and 10 years old children, respectively, were 10.8%, 11.0%, and 12.0% (Table 2).

The UIE levels were estimated in 341 casual urine samples. Fifty (14.7%) children had UIE levels of 5–9.9 mcg/dL, while 291 (85.3%) had UIE levels of 10 mcg/dL and above (Table 3). The median UIE level was 15 mcg/dL (range 7.2–40.1 mcg/dL).

Spot-testing of 1,060 salt samples with spot-testing kit revealed that 85.1% of the families had adequate iodine content (≥15 ppm), 13.6% consumed salt with iodine content of less than 15 ppm, and only 1.3% consumed salt without iodine (Table 4).

DISCUSSION

Children aged 8-10 years were included in the present study, because they are the representatives of iodine nutriture of a community. It has been recommended that if more than 5% of school children aged 6-12 years suffer from goitre, the area should be classified as endemic to iodine deficiency (4). In the present study, a total goitre prevalence rate of 11.3% was found. Thus, the Malda district may be classified as still endemic for iodine deficiency. The prevalence of goitre found in the present study cannot be compared with the finding of earlier studies due to lack of reliable previous survey data in the district.

Table 2. Age and sexwise distribution of prevalence of goitre

Age (years)	Male (n=1,140)				Female (n=1,252)				Combined
	Goitre grade			TGR (%)	Goitre grade			TGR (%)	TGR (%)
	0	I	II		0	I	II		
8 (n=679)	299	32	1	9.9	307	39	1	11.5	10.8
9 (n=773)	334	37	1	10.2	354	46	1	11.7	11.0
10 (n=940)	385	50	1	11.7	442	59	3	11.9	12.0
All	-	-	-	10.7*	-	-	-	11.9*	11.3

TGR=Goitre prevalence rate

*χ^2 =0.86, df =1, p>0.05

Table 3. Distribution of children according to urinary iodine excretion level

Urinary iodine level (mcg/dL)	Children (n=341)	
	No.	%
<2.0	0	
2.0–4.9	0	
5.0–9.9	50	14.7
≥10	291	85.3

Table 4. Iodine content of salt at beneficiary level

Iodine content (ppm)	Beneficiaries (n=1,060)	
	No.	%
Nil	14	1.3
<15	144	13.6
≥15	902	85.1

The WHO/UNICEF/ICCIDD have recommended that no iodine deficiency is indicated in a population when the median urinary excretion level is 10 mcg/dL or more, i.e. more than 50% of the urine samples have UIE level of 10 mcg/dL and not more than 20% of the samples have UIE level of 5 mcg/dL (4). In the present study, the median UIE level of children was 15 mcg/dL, and no child had UIE level of less than 5 mcg/dL. This finding suggests the study children had no biochemical deficiency of iodine.

Salt, a cheap commodity in India, is universally consumed by all socioeconomic groups. In the present study, 85.1% of the beneficiaries consumed iodized salt with adequate iodine (≥15 ppm) which is still below the recommended goal of >90% (4). Adequate iodine nutriture could be possible if efforts are made to ensure the availability of iodized salts to the population in the district along with intensified information, education, and communication (IEC) activities.

The prevalence of goitre indicates past iodine nutriture, while the UIE level indicates the current iodine status in a population. In the present study, the total goitre rate was 11.3% which indicates the prevalence of mild iodine deficiency, while the median UIE level was 15 mcg/dL indicating no biochemical iodine deficiency in the age group. This was reflected by the prevalence of goitre of 11.3% in children aged 8-10 years and the median UIE level of 15 mcg/dL. Similar findings have been reported in earlier studies in India (8-10). The prevalence of goitre was documented to be as high as 20.5% in the Bikaner district of Rajasthan to as low as 0.8% in the Pauri district of Uttar Pradesh.

However, when the median UIE cut-off of ≥10 mcg/dL was used as a criterion for assessing iodine deficiency in a population, no state included in the study was deficient. It was observed that 68-100% of population in the study area were consuming iodized salts (8).

The findings of the present study suggest that the Malda district is in a transition phase from iodine-deficient to iodine-sufficient. Sustained monitoring and intensified IEC activities are needed to eliminate IDD.

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