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Full Length Research Paper

Prevalence of goitre and assessment of iodine nutritional status in 6-12 years primary school children of Narmada District, Gujarat, India

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Iodine deficiency disorders (IDD) are major public health problems in India, including Gujarat. Narmada district is a tribal area. The present study was conducted to estimate the prevalence of goitre in primary school children; to determine median urinary iodine concentration; to assess level of iodine in salt samples at household and retail shop level; and to study profile of salt sold at retail shops in Narmada district, Gujarat. 30 cluster survey method was used for the study in primary schools of Narmada District. Children studying in 1st to 7th standard were used in this study. A total of 70 students including five boys and five girls from 1st to 7th standard present in class on the day of visit were selected randomly for Goitre examination, so, total 2100 students were examined in schools. Urine sample was collected from one boy & one girl from each standard in each cluster. From community, at least 28 students including two boys and two girls from each standard in same age group were examined and also salt samples were tested from their households. So, total 2100 students were examined in schools and 858 students were examined out of schools in the selected villages. From each village, one retail shop was visited and salts were purchased and tested for iodine on the spot with spot kit. Goitre prevalence was found 18.1% among primary school children including grade 1 - 12.4% and grade 2 - 5.7%. As the age increases the Goitre prevalence also increases except in the age group of 9 years. Median urinary iodine excretion level was found 110 µg/L. Iodine level >15 ppm was found in 93.7% salt samples tested at household level. Present study showed mild Goitre prevalence in primary school children in Narmada District of Gujarat and iodine content of salt found adequate at household level.

Key words: Goitre survey, IDD, prevalence, primary school children, household level.

INTRODUCTION

Iodine is an important micronutrient required for human nutrition. Iodine deficiency disorders (IDD) refers to a complex clinical and subclinical disorder caused due to the lack of adequate dietary intake. Globally, 2.2 billion people live in areas with iodine deficiency and risk its complications, while in India, 167 million people are at risk of IDD, 54.4 million people have goitre and 8.8 million people have IDD related mental/motor handicaps (Directorate General of Health Services (DGHS), 2003).

IDD prevails in all states and union territories. Out of 587 districts in the country, 282 have been surveyed for IDD and 241 have been found to be goitre endemic (Kapil, 2000). Several studies conducted all over India have shown high prevalence of goitre (Chandra et al., 2006, 2008; Misra et al., 2007). In 1983, compulsory iodization of all table salt was introduced in India in an attempt to eliminate iodine deficiency. Government of India has re-launched National Iodine Deficiency Disorders Control Programme (NIDDCP) in the year 1992 with a goal to reduce the prevalence of IDD to non endemic level. After implementation of NIDDCP, India has made considerable progress towards IDD elimination. Less than 5% total goitre rate was found in 9 out of 15 districts studied in 11 states by an Indian Council of Medical Research (ICMR) (Toteja et al., 2004). NIDDCP included IDD surveys, supply

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of iodized salt, re-surveys every five years, monitoring iodized salt consumption, laboratory monitoring of iodized salt, urinary iodine concentration and health education.

In February 2009, Government of Gujarat has started IDD re-survey in all the districts of Gujarat state. The national programme was implemented in Narmada District in 1992 after the result of baseline survey conducted in 1989, which indicated moderate goitre prevalence. The resurvey was done in 1998-99 and again in 2009. The present goitre survey was done in Narmada district with the objectives to estimate the prevalence of goitre in primary school children aged 6-12 years; to determine median urinary iodine concentration in sample of children; to assess the level of iodine in salt samples at household and retail shop level; and to study the profile of salt sold at retail shops.

MATERIALS AND METHODS

Selection of study area

The present study was done in Narmada District of Gujarat State. The district is located in southern part of Gujarat State and surrounded by Vadodara, Bharuch, Surat and Tapi Districts. The main source of water is rain. Almost all types of routine vegetables are available and consumed by the people. The district is divided into 4 talukas (blocks), having 5, 14,404 total populations as per 2001 census (Narmada census, 2008).

Selection of study population and sample size

As per guidelines provided by State Nutrition Cell, Ministry of Health and Family Welfare, Government of Gujarat, cross sectional study of children aged 6-12 years age groups studying in 1st to 7th standard in primary schools of rural areas were selected for the study. The study included two types: (1) School survey and (2) Community survey. Five boys and five girls from each standard present in class on the day of visit were selected randomly for examination. In total, 70 students were examined from each school in selected villages. As per guidelines provided, almost 30% school children were considered absent at any given time and so, at least 28 students were examined from community from each selected villages. Out of those students examined in the community, at least two boys and two girls from each standard in age group 6-12 years were examined. A total of 2100 students were examined in schools and 858 students were examined out of schools in the selected villages.

Sampling method

Cluster sampling method was used for selection of villages. A list of villages of all talukas of Narmada District was obtained from Jilla Panchayat, office of District Health Office (DHO). Then cumulative population was counted by using MS Excel. By calculating cluster interval, 30 villages were selected from the list. Only rural areas were included and urban population was excluded in calculating cumulative population. Only primary schools of the 30 selected villages were visited for school survey. When desired sample size of five boys and girls, each from each standard, was not achieved, primary schools of nearest villages were approached. As a result desired sample size was achieved and at the same time community survey was also done. The children were examined by palpatory method. The following classification was used for goitre: (a) grade 0 – not visible, not sdpalpable, (b) grade 1- palpable, but not visible, and (c) grade 2- palpable and visible, as per the WHO/UNICEF/ICCIDD guidelines (WHO, 1992).

Urine samples

One boy and one girl from 1st to 7th standard were selected randomly for taking urine sample. In each cluster 14 urine samples were collected including 7 samples from boys and 7 from girls. In 30 clusters, a total of 420 urine samples were collected and tested for urinary iodine excretion. Plastic bottles with screw caps were used to collect the urine samples, which were stored in a cool dry place and sent to state IDD laboratory at Surat, for testing by expert technician. Few drops of toluene were added to each urine sample to inhibit bacterial growth and to minimize bad odor. Child no., cluster no. and date of urine collection were mentioned on every bottle of urine sample to identify it. Ammonium per sulfate titration method was used to detect the urinary iodine excretion level.

Salt samples

As per the guidelines provided, randomly 10 salt samples were tested out of all the children of 6-12 years examined for goitre during community survey at their homes in each village. A total of 300 salt samples were tested. These samples were tested on the spot with MIB kit provided by UNICEF and iodine concentration was recorded as 0, <15 and >15 ppm (WHO, 2001). From each village, one retail shop was visited and salts were purchased and tested for iodine on the spot with spot kit.

Data analysis

All the data were entered in MS Excel 2007 and analyzed by using Epi Info software, version 3.5.1.

RESULTS

Goitre prevalence in Narmada District was found to be 18.1% among primary school children (Table 1). Highest goitre prevalence was found in Rajpipla taluka (27%) while in the rest of the talukas it was around 12%.

Table 2 shows age specific goitre prevalence in Narmada District. As the age increases the goitre prevalence also increases except in age group of 9 years. In the age group of 10-12 years, it is almost same.

Another significant finding observed was that prevalence was higher among girls (19.2%) than boys (17%).

A total of 420 urine samples were collected in Narmada District, out of which 60.8% samples were found with urinary iodine excretion (UIE) level 100 µg/L or more, while 30.9% samples showed UIE between 50 - 99.9 µg/L, 7.4% between 20 - 49.9 µg/L and 0.9% below 20 µg/L (Table 3).

Taluka specific assessment of iodine at consumer level was found satisfactory in all taluka where more than 85%

Table 1. Goitre prevalence in different study areas of Narmada District.

Studied Talukas	Total no. of children examined	No. of children with goitre (%)			Severity as public health problem*
		Grade 1	Grade 2	Total (1+2)	
Rajpipla	1176	234 (19.9)	83 (7.1)	317(27)	Moderate
Dediyapada	888	65 (7.3)	42(4.7)	107 (12)	Mild
Sagbara	494	45 (9.1)	16 (3.2)	61 (12.3)	Mild
Tilakwada	400	24 (6.0)	27 (6.8)	51 (12.8)	Mild
Total	2958	368 (12.4)	168 (5.7)	536 (18.1)	Mild

*Severity of public health problem: No <5%; Mild- 5-19.9%; Moderate- 20-29.9%; Severe >30% (10).

Table 2. Age specific goitre prevalence in Narmada District.

Age (years)	Total no. of children examined	Goitre prevalence		
		Grade 1 (%)	Grade 2 (%)	Total Goitre* (%)
6	429	39 (9.2)	8 (1.8)	47 (11.0)
7	420	47 (11.2)	21(5.0)	68 (16.2)
8	421	50 (11.8)	23 (5.5)	73 (17.3)
9	421	49 (11.6)	22 (5.2)	71 (16.8)
10	422	69 (16.4)	27 (6.4)	96 (22.8)
11	420	59 (14.0)	28 (6.7)	87 (20.7)
12	425	55 (12.9)	39 (9.0)	94 (21.9)
Total	2958	368 (12.4)	168 (5.7)	536(18.1)

*P = 0.57.

of the salt samples found with >15 ppm iodine (Table 4). Out of 300 salt samples tested, 93.7% salt samples showed >15 ppm iodine at consumer level. Low consumption of salt was also found in some households.

Table 5 shows summary of salt sold at retail shop in Narmada District where all salt samples found well packed, branded, powdered and iodized as per manufacturer`s status.

DISCUSSION

To evaluate the severity of IDD in a region, the most widely accepted marker is the prevalence of endemic goitre in school children. WHO/UNICEF/ICCIDD on the basis of IDD prevalence, recommended the criteria to understand the severity of IDD as a public health problem in a region (WHO/UNICEF/ICCIDD, 1994). According to these criteria, a prevalence rate of 5.0 - 19.9% is considered as mild; 20 - 29.9% as moderate and a prevalence rate of above 30% considered as severe public health problem.

In studied district, the total goitre prevalence rate was 18.1% (grade 1- 12.4%; grade 2- 5.7%) indicating that IDD is a mild public health problem. Similar study from another district of Gujarat, reported 20.5% total goitre prevalence (Misra et al., 2007) which was little higher than present study mentioning withdrawal of notification banning the sale of non-iodized salt from Gujarat since January, 2001. Present study reports mild prevalence rate, most probably due to availability of iodized salt now at all places from cities to smallest villages, but low consumption among population. The underlying causes for low consumption are not clear. However, the previous study conducted in same district suggested that behavioural and environmental factors at community level could contribute to goiter prevalence (CoHFW, 1999). For example, most people are unaware of IDD and manage iodized salt poorly. The environment within which iodized salt is stored is insufficient for maintaining proper salt iodization at the consumer level. It was also pointed out that local cultural and commercial factors can severely limit the impact of IDD programme among residents of Narmada district. That may be one of the reasons of no association found between age of school children and prevalence of goitre compared to earlier studies (Chandra et al., 2008; Misra et al., 2007). In addition prevalence among girls was more than boys, which was also reported by various studies (Misra et al., 2007; Chandra et al., 2006). As per National Family Health Survey (NFHS)-3, the prevalence of goitre or other thyroid disorders found 2.5 times higher for women than

Table 3. Urinary iodine excretion level in different study areas of Narmada District.

Studied Talukas	n	Urinary iodine excretion level (µg/L)*			
		< 20.0 (%)	20.0-49.9 (%)	50.0-99.9 (%)	≥ 100 (%)
Rajpipla	126	2(1.59)	14 (11.1)	48 (38.1)	62 (49.21)
Dediyapada	98	1 (1.0)	7(7.1)	22 (22.5)	68 (69.4)
Sagbara	112	1(0.9)	8(7.1)	45 (40.2)	58 (51.8)
Tilakwada	84	0 (0)	2 (2.4)	15 (17.8)	67 (79.8)
Total	420	4 (0.9)	31 (7.4)	130 (30.9)	255 (60.8)

*Median urinary iodine excretion level for Narmada district was found to be 110 µg/L.

Table 4. Taluka specific assessment of iodine in salt samples by spot kit at household level.

Talukas	No. of salt samples tested	Iodization of salt (ppm)			% of salt samples adequately iodized
		0	<15	>15	
Rajpipla	90	4	8	78	86.7
Dediapada	70	0	1	69	98.6
Sagbara	80	0	6	74	92.5
Tilakwada	60	0	0	60	100
Total	300	4	15	281	93.7

for men and number of persons with goitre or thyroid disorders increases with age, especially among women (Ministry of Health and Family Welfare(MoHFW, 2007).

In present study, the urinary iodine excretion level 100µg/L and above was found in almost 60.8% samples. As per the national guidelines (DGHS, 2003), severity of IDD as public health problem was classified in three categories including, (1) <20 µg/L – severe, (2) 20 - 49.9 µg/L – moderate, and (3) 50-99.9 µg/L - mild. Value 100µg/L or above considered as normal. The median urinary iodine level was 110µg/L in current study. Still, mild deficiency found in 30.9% children, moderate in 7.4% and severe in 0.9% children. These findings indicate that 39.2% children having biochemical deficiency of iodine. It also indicates continued though inadequate efforts of ensuring a supply of iodized salt to the population. Different median urinary iodine levels were reported by different authors indicating deficiency or no deficiency of iodine in respective populations in their areas (Kapil et al., 2005; Chandra et al., 2008, 2005; Shankar et al., 2006; Chandra et al., 2005).

WHO/UNICEF/ICCIDD also recommends that 90% of household salts should get iodized at the recommended level of 15 ppm (ICCIDD/UNICEF/WHO, 2001) and the study also shows that about 93.7% of households consuming salts at adequate level while about 6.3% households though consuming iodized salt but not at the recommended level. Chandra et al. (2006) reported more than 95% of households consuming salts at adequate level, while Kamath et al. (2009) and Biswas et al. (2008) reported only 50% of households respectively consuming salts at adequate level which was very low. All these results suggest that there is a need to strengthen the system of monitoring quality of salt to ensure availability of 15 ppm of iodine at household level.

In present study, only 68.1% branded packed salt samples claiming iodization shown ≥30 ppm iodine level sold at retail shops (consumer level), while 19.1% samples have < 30 ppm iodine level which may be the reason for 6.3% of households using though iodized salt but not having adequate (> 15 ppm) level. Mishra et al. (2007) reported 39% such salt samples claiming iodization was found with < 30 ppm iodine level at retail shops.

Conclusion

Present study showed mild goitre prevalence in primary school children in Narmada district of Gujarat and iodine content of salt was found inadequate at household level and these calls for further evaluation of the problem in these areas to identify factors to strengthen the national programme.

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Table 5. Summary of salt sold at retail shop in Narmada District.

	Summary	No.	Percentages
Salt status	Packed	47	100
	Unpacked	0	0
Salt characteristics	Branded	47	100
	Unbranded	0	0
Salt type	Powdered	47	100
	Crystal	0	0
Iodine status from manufacturer	Iodized	47	100
	Non-iodized	0	0
Iodine status (samples with claim of iodization)	0	6	12.8
	<30	9	19.1
	≥30	32	68.1
Batch No.	Yes	41	87.2
	No	6	12.8
Logo	Yes	39	83
	No	8	17
Address of manufacturer	Yes	41	87.2
	No	6	12.8
Maximum retail price (Rupees/kilogram)	≤1	0	0
	2-5	36	76.6
	6-9	4	8.5
	≥10	7	14.9

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