Research Article

Is iodine deficiency still a big threat? A descriptive cross-sectional study on iodine deficiency disorders among children aged 6–12 years in Shimoga district, Karnataka, India

Praveen Kumar N, MV Sagar, R Revathy, Manu Krishna

Department of Community Medicine, Shimoga Institute of Medical Sciences, Shimoga, Karnataka, India.
Correspondence to: Praveen Kumar N, E-mail: drpraveenbhat@yahoo.com

Received November 3, 2014. Accepted November 17, 2014

Abstract

Background: Iodine is an essential trace element for adults and children alike. Iodine deficiency manifests as goiter and cretinism, which causes developmental delays and other health problems.

Objectives: To ascertain the prevalence of goiter in children aged 6–12 years and to determine iodine content in the salt they consume.

Materials and Methods: All the taluks in Shimoga district were covered in the study. Population proportionate to size (PPS) sampling was done among children aged 6–12 years. Thirty villages (clusters) were selected using the PPS sampling method. In each identified cluster, all primary schools were enlisted, from where one was selected following the simple random sampling technique using a random number table for detailed survey. Total number of children surveyed was 2,700. A predesigned pretested pro forma was used to record data. Goiter was detected and graded by standard palpation method. Totally, 546 salt samples were collected for estimation of iodine content and 270 urine samples for urinary iodine excretion. The result was expressed in micrograms of iodine per deciliter urine (μg/dL). Salt and urine samples were sent to the IDD Monitoring Laboratory, Public Health Institute, Bangalore, Karnataka, India.

Results: Total cases of goiter in Shimoga district were 251, which accounts for a total prevalence rate of 9.3%. Prevalence of goiter was found to be highest in the age group of 8–9 years (10.84%). The study showed a high goiter prevalence rate among girls aged 12 years (11.59%); 60.8% (332) salt samples had iodine levels of less than 15 ppm; 214 salt samples had iodine levels more than 15 ppm; 74.7% of all the urine samples showed iodine deficiency; and 183 showed severe iodine deficiency, whereas 11 showed moderate and 1 showed mild iodine deficiency. All the 27 urine samples collected from Sagar taluk showed severe iodine deficiency.

Conclusion: Shimoga was found to be endemic for iodine deficiency disorders. Awareness generation activities have to be intensified so as to make people understand the importance of consuming iodized salt and about iodine deficiency disorders, if failed.

KEY WORDS: Iodine deficiency disorders, prevalence of iodine deficiency disorders, urinary iodine excretion, estimation of iodine content in salt, iodine deficiency in Shimoga

Access this article online	
Website: http://www.ijmsph.com	Quick Response Code:
DOI: 10.5455/ijmsph.2015.0311201478	

Introduction

Iodine deficiency disorders (IDDs) are a major public health problem. Worldwide, there are nearly 2 billion people with IDDs.[1] In India, district-level surveys conducted in 324 districts have revealed that IDD is a major public health problem in 263 districts, that is, a total goiter prevalence rate of 10% and more in the population.[2] Iodized salt has been recognized as the most effective way to control and prevent IDD. Universal salt iodization has been remarkably successful in many countries.[3]

For the elimination of IDD in India, the Ministry of Health and Family Welfare, Government of India, issued a notification in November 2005 banning the sale of noniodized salt for direct human consumption throughout the country under the Prevention of Food Adulteration Act to be effective from May 17, 2006.[4]

The NIDDCP launched in 1992 envisages to reduce the prevalence of IDD to less than 10% in endemic districts by activities such as IDD surveys, supply of iodized salt, resurveys every 5 years, monitoring iodized salt consumption, laboratory monitoring of iodized salt, urinary iodine concentration, and education.[5] High prevalence of goiter has been reported in many surveys conducted in all parts of India.[5–9] So, with the objectives to ascertain the prevalence of goiter in children aged 6–12 years, to know their urinary iodide excretion levels, and to determine iodine content in the salt they consume, we conducted a survey in the district of Shimoga, Karnataka, India, in the month of July 2009.

Materials and Methods

All the taluks in Shimoga district were covered in the study. Population proportionate to size (PPS) sampling was done among children aged 6–12 years. 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. A sample of 30 villages/wards was selected from the district. The 30 clusters were selected using the 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. The total number of children surveyed was 2,700.

Activities that would be undertaken during the survey were discussed with the school teachers and briefed to the students. A predesigned pretested pro forma was used to record data. Goiter was detected and graded by the standard palpation method.

Grading of goiter was done by the criteria given by the WHO–UNICEF–ICCIDD recommendations into three categories: grade 0, no palpable or visible goiter; 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 and moves upward in the neck as the subject swallows; and grade II, a swelling in the neck, which is visible when the neck is in normal position and is consistent with an enlarged thyroid when the neck is palpated. The sum of grades I and II provided the total goiter rate.[10]

For the estimation of iodine content, 546 salt samples were collected. Students were asked to bring about 20 g of salt that was routinely being consumed in their homes in polythene pouches. Totally, 270 urine samples were collected for urinary iodine excretion (UIE). The result was expressed in micrograms of iodine per deciliter urine (μg/dL). Salt and urine samples were sent to the IDD Monitoring Laboratory, Public Health Institute, Bangalore, Karnataka, India.

Median iodine concentration of >100 mg/L defines a population with no iodine deficiency, that is, at least 50% of the samples should be above 100 mg/L according to the epidemiological criteria for assessing iodine nutrition based on median urinary iodine concentration in school-aged children. In adults, urinary iodine concentration of 100 mg/L corresponds roughly to a daily intake of about 150 mg/L under steady state conditions.[11]

Results

A total of 2,700 children in the age group of 6–12 years were examined in the study, with boys and girls 1350 each. Of them, 664 (24.59%) children were in the age group of 6–7 years, 664 (24.59%) children in the age group of 8–9 years, 682 (25.26%) children in the age group of 10–11 years, and 690 (25.55%)

Table 1: Prevalence rate of goiter among boys and girls of different age groups in Shimoga district

Age (years)	Sex	Total examined	Grades			Total cases	%
			0	I	II		
6–7	Boy	332	308	21	3	24	7.23
	Girl	332	313	13	6	19	5.72
	Total	664	621	34	9	43	6.48
8–9	Boy	332	298	32	2	34	10.24
	Girl	332	294	27	11	38	11.45
	Total	664	592	59	13	72	10.84
10–11	Boy	341	310	22	9	31	9.09
	Girl	341	306	24	11	35	10.26
	Total	682	616	46	20	66	9.68
12 years	Boy	345	315	27	3	30	8.7
	Girl	345	305	33	7	40	11.59
	Total	690	620	60	10	70	10.14
Grand total		2700	2449	199	52	251	9.3

Table 2: Taluk-wise breakup of cases of goiter

Taluk	No. of children examined	No. (%) of children with goiter			Total cases	%
		Grade 0	Grade I	Grade II		
Bhadravathi	450	433	14	3	17	3.78
Shimoga	540	486	39	15	54	10
Thirthahalli	270	246	21	3	24	8.89
Sorab	360	320	32	8	40	11.11
Sagar	270	247	20	3	23	8.52
Hosanagara	450	390	46	14	60	13.33
Shikaripura	360	327	27	6	33	9.17
Total	2,700	2,449	199	52	251	9.29

Table 3: Taluk-wise breakup of iodine levels in salt samples

Taluk	Total	<15 ppm	>15 ppm	% <15ppm
Shikaripura	73	59	14	80.0
Bhadravathi	92	47	45	51.0
Shimoga	110	35	75	31.8
Thirthahalli	55	38	17	69.9
Soraba	72	49	23	68.0
Sagar	54	36	18	66.6
Hosanagara	90	68	22	75.5
Total	546	332	214	60.8

children aged 12 years. Total cases of goiter in Shimoga district were 251, which accounts for a total prevalence rate of 9.3%.

Of the 251 cases, 199 children had grade I goiter and 52 had grade II goiter. Prevalence of goiter was found to be highest in the age group of 8–9 years (10.84%). This study showed a high goiter prevalence rate among girls aged 12 years (11.59%). Detailed breakup showing prevalence rates of goiter among boys and girls in different age groups in Shimoga district is shown in Table 1.

Prevalence of goiter was found to be 10% in Shimoga, 3.78% in Bhadravathi, 8.89% in Thirthahalli, 11.11% in Sorab, 8.52% in Sagar, 13.33% in Hosanagara, and 9.17% in Shikaripura taluks. Hosanagara taluk showed highest prevalence of goiter (13.33%), where of 60 children with goiter, 46 had grade I and 14 had grade II goiter. Bhadravathi taluk showed least prevalence with 3.78%. The taluk-wise breakup of cases is presented in Table 2.

Iodine content was estimated in 546 salt samples: 60.8% (332) salt samples had iodine levels of less than 15 ppm; 214 salt samples had iodine levels more than 15 ppm. Fifty-nine (80%) of 73 salt samples collected in Shikaripura taluk showed iodine levels of less than 15 ppm. In Shimoga taluk, only 35 (31.8%) of 110 salt samples collected had iodine levels less than 15 ppm. The taluk-wise breakup of iodine levels in the salt samples is shown in Table 3.

Of the 261 urine samples analyzed for iodine estimation, 74.7% showed iodine deficiency; 70.11% (183) showed severe iodine deficiency, whereas 4.2% (11) showed moderate and 0.38% (1) showed mild iodine deficiency. All the 27 urine samples collected from Sagar taluk showed severe iodine deficiency, closely followed by Hosanagara where 98% of the collected urine samples showed iodine deficiency. The taluk-wise breakup of results of iodine estimation in urine samples is shown in Table 4.

Discussion

Children aged 6–12 years were included in the study as they represent the iodine nourishment of the community. It has been recommended that goiter prevalence of more than 5% among the children aged 6–12 years classifies the area as endemic for iodine deficiency. This study has shown

Table 4: Taluk-wise breakup of results of iodine estimation in urine samples

Place of collection (taluk)	Total	Severe IDD	Mild IDD	Moderate IDD	% IDD	No deficiency of iodine
Shikaripura	36	29	Nil	02	86	05
Bhadravathi	45	35	Nil	02	82	08
Shimoga	54	25	Nil	Nil	46	29
Thirthahalli	18	12	Nil	02	77.7	04
Soraba	36	15	Nil	02	47	19
Sagar	27	27	Nil	Nil	100	Nil
Hosanagara	45	40	01	03	98	01
Total	261	183	01	11	74.7	66

IDD, iodine deficiency disorder.

prevalence of 9.3% in Shimoga district, thus showing the endemicity of iodine deficiency diseases in Shimoga district. Highest prevalence was found among girls aged 12 years. The data from previous surveys on iodine deficiency in Shimoga were unreliable and, hence, unsuitable for comparison with the results of this study.

Fortification of salt with iodine has long been devised as an effective strategy to tackle the problem of iodine deficiency diseases in the community. In this study, 60.8% of the salt samples analyzed for iodine content were found to have iodine levels of less than 15 ppm. Intensified information, education and communication campaigns, and improving the current availability of iodized salt for cooking can help address this problem.

Almost 75% of urine samples analyzed for UIE showed iodine deficiency. Biochemical deficiency of iodine was found in all the urine samples collected from Sagar taluk.

In any community, the status of iodine nourishment over the past few years is indicated by the prevalence of goiter in the children aged 6–12 years. Biochemical assessment of urinary excretion of iodine is an indicator of the current iodine status. This study has brought out findings that show Shimoga district to be endemic for iodine deficiency. Intensification of information, education, and communication activities for generating awareness among the people about the importance of consuming iodized salt and the health problem of iodine deficiency can help improve the current iodine nourishment status in Shimoga. Simultaneously, sustained monitoring should be undertaken to eliminate iodine deficiency.

Conclusion

Shimoga district, Karnataka, India, was found to be endemic for IDDs. Awareness generation activities have to be intensified so as to make people understand the importance of consuming iodized salt and about IDDs, if failed.

Acknowledgments

We acknowledge the financial support provided by the Iodine Deficiency Disorders Cell, Bangalore, India, for undertaking this study. We also thank the faculty members of the Department of Community Medicine at Shimoga Institute of Medical Sciences, Shimoga, Karanataka, India, Dr. HL Prashanth (Associate Professor), Dr. SV Chandrashekar (Assistant Professor), Dr. MV Madhusudana (Assistant Professor), Dr. A Santosh Kumar (Assistant Professor), and Dr. Raghavendraswamy Koppad (Assistant Professor) for their cooperation and suggestions.

References

1. Andersson M, Takkouche B, Egli I, Allen HE, de Benoist B. Current global iodine status and progress over the last decade towards the elimination of iodine deficiency. Bull World Health Organ 2005;83:518–25.
2. Tiwari BK, Ray I, Malhotra RL. *Policy Guidelines on National Iodine Deficiency Disorders Control Programme—Nutrition and IDD Cell*. Directorate of Health Services, Ministry of Health and Family Welfare. New Delhi, India; Government of India, 2006. pp. 1–22.
3. WHO/UNICEF/ICCIDD. *Assessment of Iodine Deficiency Disorders and Monitoring Elimination*, 3rd edn. Geneva: WHO, 2007.
4. *Iodine Deficiency Disorders Control Programme*. Annual Report 2005–06. New Delhi, India: Ministry of Health and Family Welfare, Government of India. pp. 89–90.
5. Kishore J. *National Health Programmes of India*, 7th edn. New Delhi: Century Publications, 2007. pp. 370–3.
6. Directorate General of Health Services (DGHS). Ministry of Health & Family Welfare, Government of India. *Policy Guidelines on National Iodine Deficiency Disorders Control Programme*. New Delhi: DGHS, Ministry of Health & Family Welfare, Government of India, 2003. pp. 1-10.
7. Control of iodine deficiency through safe use of iodised salt. ICMR Bull 1996;26:41–6.
8. Mohapatra SSS, Bulliyya G, Kerketta AS, Acharya AS. Thyroxine and thyrotropin profile in neonates and school children in an iodine deficiency disorders endemic area of Orissa. Indian J Nutr Dietet 2001;38:98–101.
9. Revised Policy Guidelines on National Iodine Deficiency Disorders Control Programme. New Delhi, India: IDD and Nutrition Cell; Ministry of Health and Family Welfare, October 2006. pp. 1–2.
10. Joint WHO/UNICEF/ICCIDD Consultation. *Indicators for Assessing Iodine Deficiency Disorders and Their Control Programmes*. Geneva: World Health Organization, 1992. pp. 14–8.
11. Joint WHO/UNICEF/ICCIDD Consultation. *Indicators for Assessing Iodine Deficiency Disorders and Their Control Programmes*. Geneva: World Health Organization, 1992. pp. 22–9.

How to cite this article: Kumar PN, Revathy R, Krishna M. Is iodine deficiency still a big threat? A descriptive cross-sectional study on iodine deficiency disorders among children aged 6–12 years in Shimoga district, Karnataka, India. Int J Med Sci Public Health 2015;4:365-368

Source of Support: Nil, **Conflict of Interest:** None declared.