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Original Research Article

A Study of Prevalence of Iodine Deficiency Disorders among 6-12 Years Children of Rajnandgaon District of Chhattisgarh

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ABSTRACT

Objective: To estimate prevalence of Iodine Deficiency Disorders among 6-12 years of children.
Study Design: A Cross-sectional study was conducted in selected schools of Rajnandgaon district. Children in the age group of 6-12 years were selected for study using latest NIDDCP guidelines of Government of India. Clinical examination of 90 children (45 boys and 45 girls) in each cluster for goiter was done. Every 10th child examined for Goiter was selected for urine sample and Median urinary Iodine excretion (MUIE) was estimated by wet digestion method. Salt samples were collected from 4 randomly selected households and 1 sample from retail shop from each identified clusters, salt samples were tested on the spot using rapid salt testing kit. Iodine concentration was recorded as 0, <15, > 15.
Results: Prevalence of Goiter was found to be 17.56%. In male Goiter prevalence was 17.59% and in females 17.51%. High prevalence (19.97%) was found in the age group 8-9 years. Block wise prevalence was maximum in Manpur block (28.88%) and lowest in Chowki block (12.77%). Median urinary Iodine excretion (MUIE) was found to be 44.80 mcg/l. 29.07% salt samples brought by school children were found inadequately iodized (Iodine content<15ppm) 16.07% salt samples among visited households had unsatisfactory (<15PPM) iodine content. 87.1% children had insufficient iodine intake.
Conclusion: Rajnandgaon district is highly endemic for Iodine Deficiency Disorders (IDD). This needs immediate public health measures. Universal salt iodization with periodic monitoring of IDD should be undertaken.

Key words: Iodine Deficiency Disorder, Prevalence, goiter, Urinary Iodine excretion.

INTRODUCTION

Globally Iodine Deficiency Disorders (IDDs) are a major public health problem. [1] The single most important preventable cause of brain damage is Iodine deficiency (ID). [2] Iodine deficiency disorders (IDDs) refer to all the consequences of Iodine deficiency in a population. More than 1.5 billion people all over the world are at risk of IDD. Iodine Deficiency Disorders are permanent and incurable with few exceptions. It may lead to Goiter, still births, abortions; congenital anomalies increased infant mortality, mental deficiency, deaf mutism, squint & dwarfism. However, all these disorders can be easily prevented before they occur by consuming iodated salt daily. Daily requirement of Iodine is 100-150 micrograms. Even less than a small teaspoon of Iodine is required for whole life. The daily requirement of iodine can be met by consuming

approximately 10 gms of iodized salt. Iodine is required for the synthesis of the thyroid hormones, thyroxine (T4) and triiodothyronine (T3). When iodine intake falls below the recommended levels, the thyroid may no longer be able to synthesize sufficient amounts of thyroid hormones. The resulting low level of thyroid hormones in the blood (hypothyroidism) is the principal factor responsible for damage to the developing brain of fetus. [3] When taken in a large quantity, Iodine is easily excreted through the kidney into urine; the consumption of iodated salt is absolutely safe for each and everyone. [2] The Govt. of India took a policy decision to iodate the entire edible salt in the country by 1992. The program commenced in 1986 in phased manner. [4] In 1962, Government of India launched National Goiter Control Program and in 1992, it was renamed as National Iodine Deficiency Disorders Control Program. [2] Out of 582 districts in the country, district level surveys conducted in 324 districts have revealed that IDD is a major public health problem in 263 districts, i.e. prevalence rate of Goiter is 10% and more in the population. [5] According to WHO/UNICEF/ICCIDD, a total goitre rate of 5% or more in primary school children (6-12 yr) is used to signal the presence of a public health problem. [6] Present study was done in district Rajnandgaon Chhattisgarh to assess the impact of Iodine deficiency disorder control programme with following objective:

1. To estimate the prevalence of goiter among children of age group 6-12 years by clinical examination.
2. To evaluate the iodine uptake status reflected by Urinary Iodine Excretion (UIE) levels in sub sample of 6-12 year children covered for clinical examination.
3. To assess coverage of iodized salt at community (i.e. at Household and Retail shops) level by on-the-spot testing through Rapid Salt Testing Kit.
4. To assess storage practice and Knowledge regarding benefits of Iodized salt.

MATERIALS AND METHODS

Study Design: Cross sectional observational study

Study Area: Rajnandgaon district of Chhattisgarh

Study Sample: As per the Government of India recommended methodology

Sampling technique: 30 cluster sampling

Sample Size: 2700 children {90 children (45 boys & 45 girls) from 30 clusters}

Sampling was done by using the method of Population Proportionate to Size (PPS) sampling method in the age group of 6-12 years children (as per GOI guideline)

Study tool: Clinical Examination of 6-12 years children for enlargement of thyroid (i.e. Goiter), Rapid Salt Testing kit for assessment of iodine content in edible salt, Estimation of Urine Iodine Excretion (UIE) by wet digestion method (i.e. The Sandell Kolthoff reaction).

Entire Rajnandgaon district was covered during June 2015. The survey team consisted of trained Medical Personnel (i.e.PG scholar/Junior Resident/ Demonstrator/ Interns) of Department of Community Medicine, Pt. JNM Medical College, and Raipur (C.G)

A. Clinical examination for enlargement of thyroid

For clinical examination 45 boys & 45 girls in age group of 6-12 years were taken from identified cluster to fulfil Sample size of 90 children using population proportionate to size (PPS). If desired number of children were not found in identified cluster, nearby schools were taken to fulfill the criteria of prerequisite number of study subjects. In this way total 2700 children were covered during survey from Rajnandgaon district.

Operational Definition

Classification of goiter

- Grade 0- Neither Palpable nor visible-No Goiter

- Grade1- Goiter palpable but not visible when the neck is in normal position
- Grade 2- A swelling in the neck that is visible when the neck is in a normal position.

B. Collection of Urine Sample and Urinary iodine Estimation

- Every 10th child examined for Goiter Survey was selected for urine sample. 9 urine samples were collected from each cluster i.e. a total of 270 (9/cluster). After collection of urine samples from the field, it was stored at room temperature and transported to public health laboratory of Medical College, Raipur for estimation of Urine Iodine Excretion as per the standard protocols by wet digestion method (The Sandell Kolthoff reaction)

C. Collection of Salt Sample and iodine estimation

- Every 5th child examined for Goiter was asked to bring edible salt from their houses for salt testing. A total of 540 (18/cluster) salt samples were analyzed for Iodine content on the spot using Rapid salt Testing Kit.
- Salt Samples were also collected from 4 randomly selected households i.e. 120 (4/cluster) and 1salt sample from retail shops from each identified clusters i.e. 30 (1/cluster).
- Storage practice was also observed in household and retail shops.

Statistical analysis

Data was checked for its completeness & correctness before it was compiled. Data was entered in MS excel and result presented in actual figures and percentages.

RESULTS

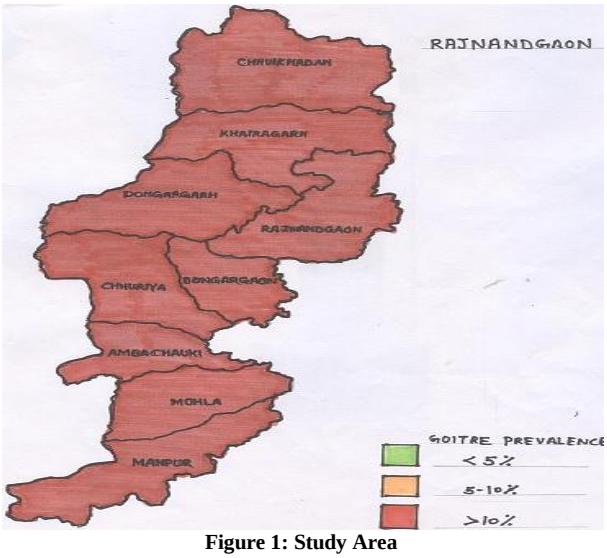

Figure 1: Study Area

Table 1: Block wise prevalence of Goitre in Rajnandgaon District.

Block	Children Examined	Goiter Cases	Prevalance rate (%)
Chowki	180	23	12.77
Chhuikhadan	990	159	16.06
Churia	540	80	14.81
Dongargarh	180	24	13.33
Dongargaon	180	29	16.11
Khairagarh	180	50	27.77
Manpur	180	52	28.88
Mohla	90	23	25.55
Rajnandgaon	180	34	18.88
Total	**2700**	**474**	**17.56**

Table 2: Age and Grade Specific Prevalence of Goitre among surveyed children in Rajnandgaon District

Age Group (years)	Total examined	Goiter grade		Total Goiter cases	Prevalence Rate (%)
		Grade 1	Grade 2		
6-7 Years	670	90	23	113	16.86
8-9 Years	671	110	24	134	19.97
10-11 Years	691	89	23	112	16.20
12 Years	668	102	13	115	17.21
TOTAL	**2700**	**391**	**83**	**474**	**17.56**

Goiter prevalence

Out of 2700 school children clinically examined prevalence of Goiter in surveyed district was found to be 17.56% (Table no.1, 2, 3). Block wise prevalence was highest in Manpur block (28.88%) and lowest in Chowki block (12.77%) (Figure no. 1). Age wise prevalence was Highest

(19.97%) in 8-9 years age group of children whereas low (16.86%) in 6-7 years of children (Table no. 2, 3). There was no sex wise significant difference in goiter in surveyed district. Median urinary Iodine excretion (MUIE) was found to be 44.80 mcg/l (Table no. 4). As evaluation of urinary iodine estimation showed that majority (87.1%) of children had insufficient iodine intake. 31% of children had mild Iodine deficiency followed by 28.9% moderate and 26.7% had severe Iodine deficiency (Table no.4). On analysis of salt samples brought by School children reveals that 70.92% (383 out of 540) salt samples were found adequately iodized whereas 29.07% (157 out of 540) salt samples were found inadequately iodized (Iodine content <15 ppm) (Table no.4).

Table 3: Age and Sex wise Prevalence of Goiter among surveyed children in Rajnandgaon District.

Age group	Sex	Total Examination	Grade of Goiter			Total cases Goiter (1^{st} & 2^{nd})	Percentage
			0	1	2		
6-7 Years	M	321	270	45	6	51	15.88
	F	349	287	45	17	62	17.76
	Total	**670**	**557**	**90**	**23**	**113**	**16.86**
8-9 Years	M	330	263	52	15	67	20.30
	F	341	274	58	9	67	19.64
	Total	**671**	**537**	**110**	**24**	**134**	**19.97**
10-11 Years	M	353	295	46	12	58	16.43
	F	338	284	43	11	54	15.97
	Total	**691**	**579**	**89**	**23**	**112**	**16.20**
12 Years	M	343	282	55	6	61	17.78
	F	325	271	47	7	54	16.61
	Total	**668**	**553**	**102**	**13**	**115**	**17.21**
TOTAL		**2700**	**2226**	**391**	**83**	**474**	**17.56**

Table 4: Distribution according to indicators of iodine deficiency disorder as per IDDCP targets

Indicators	IDDCP targets	Observation in Rajnandgaon district
Goiter Prevalence	< 5%	17.56%
Urinary iodine excretion	Proportion <100mcg/l (<50%)	87%
	Proportion <50 mcg/l (<20%)	82.3%
Median Urinary Iodine Excretion (MUI)	> 100mcg/l	44.80%
Salt iodization coverage of school children	>15PPM >90% household	70.92%
Status of Iodine Deficiency as per UIE level		
UIE level	**Proportion of observed children**	**Interpretation**
< 20 mcg/L	26.7%	Severe Iodine Deficiency
<50 mcg/L	28.9%	Moderate Iodine Deficiency
<100 mcg/L	31.5%	Mild Iodine Deficiency

Table 5: Distribution of edible salt and Iodine content of Salt sample in Household Survey/Retail shop and Knowledge about benefits of Iodized Salt

		Iodine Content		Total
		>15 PPM	<15 PPM	
1	**Source of Edible Salt in household survey**			
	Public Distribution System (PDS)	12(21.05%)	45(78.95%)	57(47.50%)
	Local Retail Shop	8(12.70%)	55(87.30%)	63(52.5%)
	Total	**20(16.67%)**	**100(83.33%)**	**120(100%)**
2	**Storage practices in household survey**			
	Closed Container	77(90.59%)	8(9.41%)	85(70.83%)
	Open Container	23(65.72%)	12(34.28%)	35(29.17%)
	Total	**100(83.34%)**	**20(16.67%)**	**120(100%)**
3	**Type of Salt**			
	Powder Salt	95(90.48%)	10(9.52%)	105(87.5%)
	Crystal Salt	5(33.34%)	10(66.67%)	15(12.5%)
	Total	**100(83.33%)**	**20(16.67%)**	**120(100%)**
4	**Salt coverage of Retail Shop**	1 (3.33%)	29(96.66%)	30(100%)
5	**Knowledge about benefits of Iodized Salt**			
	Yes	21(21.00%)	1(5.00%)	22(18.33%)
	No	79(79.00%)	19(95.00%)	98(81.67%)
	Total	**l 00(83.33%)**	**20(16.67%)**	**120(100%)**

Out of all visited household (i.e. 120 household) 16.67% of (20 out of 120) had unsatisfactory (< 15 PPM) iodine content (Table no.5). Majority 47.50% (57 out of 120) of them procure edible salt from Public Distribution System (PDS) (Table no.5).

Almost all the 96.66% (29 out of 30) retail shops surveyed had iodine content >15 ppm (Table no. 5). Faulty storage practice was observed in 29.17% (35 out of 120) of visited households (Table no.5). 90.48% (95 out of 105) of powdered salt had iodine content >15 ppm whereas only 33.34% (5 out of 120) of crystal salt had iodine content >15 ppm (Table no.5). Only 18.33% (22 out of 120) had knowledge about benefits of iodized salt among visited households (Table no.5).

DISCUSSION

Goiter prevalence

In present study Prevalence of Goiter was found to be 17.56%. Our study finding was in accordance with a similar study done by Sambit Das et al which reported Prevalence of Goiter to be 15.1% [7] and a study in Ambala, Haryana 2010-2011, showed 12.6% prevalence of Goiter. [8] Contrary to these findings, low prevalence was found in a study by Praveen Kumar N, Karnataka in which total goiter prevalence rate of 9.3% with highest (10.84%) in the age group of 8-9 years, whereas present study reveals highest (20.3%) prevalence of goiter among male children of 8-9 yrs of age and lowest (15.88%) in male children of 6-7 years. [9] A similar study in West Bengal by Akhil Bandhu Biswas, 2011 reports goiter prevalence rate to be 8.67% with prevalence of grade I (8.08% and prevalence of grade II (0.58%). [10] In a prevalence study in Gandhinagar, goiter prevalence was found to be 7.75%. [11] In another study in Jammu region the prevalence of goiter was found to be 11.9%. [12] A cross-sectional study conducted in Delhi, 2013 reported 3.9% prevalence of goiter among preschool children. [13] Contrary to the findings of present study that there is no sex wise significant difference in prevalence of goiter as in similar study Gandhinagar reveals maximum goiter prevalence (9.52%) in children of age 9 years with more prevalence among male child which is in accordance with the present study [11] but Praveen Kumar N et al and Akhil Bandhu Biswas et al. West Bengal depicts total Goiter rate highest (11.59%) among girls of 12 years and higher among girls (10.54%) than boys (7.05%) respectively in similar community based study. [9,10] Similar community based study in Ambala reports high prevalence of goiter in females than male with high prevalence in the age group of 11-12 years. [8]

Urinary Iodine Estimations

In present study 87.1% children had insufficient iodine intake. Mild iodine deficiency was found among 31.5% surveyed children whereas 28.9% and 26.7% had moderate and severe iodine deficiency. A similar study in Karnataka by Praveen Kumar N et al. 74.7% of urine samples showed Iodine deficiency, out of which 0.3% had mild Iodine deficiency, 4.07% had moderate and 67% had severe Iodine deficiency. [9] Another study by Akhil Bandhu Biswas, West Bengal, 2011 shows 0.28% children had urinary iodine level in severe range and 0.56% children had mild urinary iodine level. [10] Median urinary Iodine excretion (MUIE) of 44.80 mcg/l was found in present study. In a similar study in Gandhinagar the Median urinary Iodine excretion was found to be 165 mcg/l. [11] another study in Delhi, 2013 reported Median urinary Iodine excretion 200mcg/l. [14]

Iodine content in Salt Samples: In present study out of 540 (18/cluster) salt samples brought by school children 29.07% (157 out of 540) salt samples were found inadequately iodized (i.e. Iodine content <15 ppm), Contrary to this finding, Karnataka study showed 60.8% salt samples had iodine content <15 ppm. [9] But in similar study by Akhil Bandhu Biswas, West Bengal, 2011, only 5.6% of salt sample was found inadequately iodized. [10]

In present study 96.66% (29 out of 30) salt sample from retail shops had iodine content >15 ppm in comparison to other studies conducted by Sambit Das et al 98.1%, by Shridhar V. Rawal et al 90.5% of salt samples in Gandhinagar and by B. K.

Potra et al 70.9% from shops reported >15 ppm iodine in similar study. [7,11,15] Household survey of salt samples 120 (4/cluster) in present study reveals, 16.67% (20 out of 120) had iodine content < 15 PPM and 83.34% had iodine content >15 ppm. This finding is in accordance with a coverage study of status of Iodized salt in Cuttack, Orrisa which reports out of 336 households surveyed, 23.8% household were using non-Iodized salt and 16.1% households were using salt with iodine content < 15 PPM. [16] Another similar study in Ambala 2010-2011, reports adequately iodized salt sample (88%) from household surveyed whereas only 3.2% were non-iodized. [8] In a prevalence study in Gandhinagar 90.5% of salt samples were found to be adequately iodized. [11] We observed faulty storage practices in 29.17% (35 out of 120) of households which could be due to lack of knowledge about benefits of iodized salt which is only 18.33% (22 out of 120). Similar observation was reported in Coverage evaluation study in cuttack Orissa which reports 20.7% of salt samples having faulty storage. [16] Our study reveals that 90.48% (95 out of 105) powdered salt had iodine content >15 ppm whereas Haryana reported in only 11.7% salt samples. [8]

CONCLUSION AND RECOMMENDATIONS

Study observations show poor implementation of Iodine deficiency Disorder Control Programme (IDDCP) in Rajnandgaon district. High Goiter prevalence and unacceptable level of MUIE and gap in universal salt iodization seems to be reason of endemicity for IDD in surveyed district. After launch of Chhattisgarh Amrit Namak brand to BPL family through PDS government failed to access the quality of iodized salt in the district. Survey findings are eye opening findings and needs urgent attention to overcome this public health problem. There is need to address this problem on top priority. Although government is trying the level best but it does not suffice to achieve IDD standard of public health goals made by government of India for implementation of NIDDCP. Poor implementation may corroborate with faulty storage practice and poor awareness about the use of iodized salt usage. These findings also reflect that felt needs could not be converted into demand generation in the surveyed district leads to gap in the implementation of IDDCP.

Since this is a baseline survey for surveyed district with high endemicity of IDD, these findings may be similar or higher in other unsurveyed district. So we recommend baseline survey for all the district of Chhattisgarh. Since Rajnandgaon district is highly endemic for IDD therefore for monitoring purpose periodic assessment of IDD, through monitoring of iodine intake supported by other preventive perspective as well as curative care should be started immediately in the district. We recommend IDD lab in the district. Since we observed poor coverage of iodized salt in the district, government should ensure adequately iodized salt at household level. The poor quality of iodized salt may be due to established fact of bulk procurement, long duration and faulty storage practice (i.e. open container) of the same. Hence author strongly make advocacy for low volume pack in close airtight plastic container of ½ Kg instead of polythene bag of 1 Kg to procure through public distribution system. This study was restricted to school aged children only and household observations were also limited to some households. Therefore wide household based representative sample survey needs to be planned by inclusion of other high risk groups especially among pregnant and lactating women who are at high risk of developing IDD.

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REFERENCES

1. Revised guideline of Iodine deficiency disorder control programme Oct.2006 IDD and Nutrition Cell Directorate General of Health Services, Ministry of Health and Family Welfare Government of India New Delhi
2. Bleichrodt N, Born MP. A meta-analysis of research on iodine and its relationship to cognitive development. The damaged brain of iodine deficiency, New York: Cognizant Communication. 1994:195-200.
3. Umesh K. Iodine deficiency disorders, Chapter in the recent advances in Pediatrics. New Delhi: Jaypee Brothers. 1998:310-27.
4. Sundar lal. Texbook of community medicine Preventive and social medicine. 4th edition. New Delhi. CBS publishers and distributors Pvt. Ltd: 2014. Pg.224-227.
5. Delhi N. Ministry of Health and Family Welfare, Government of India; 2006. National Health Policy. 2006:1-39.
6. World Health Organization, International Council for Control of Iodine Deficiency Disorders, UNICEF. Indicators for assessing iodine deficiency disorders and their control through salt iodization.
7. Das S, Bhansali A, Dutta P, Aggarwal A, Bansal MP, Garg D, Ravikiran M, Walia R, Upreti V, Ramakrishnan S, Sachdeva N. Persistence of goitre in the post-iodization phase: micronutrient deficiency or thyroid autoimmunity?. The Indian journal of medical research. 2011 Jan 1; 133(1):103.
8. Chaudhary C, Pathak R, Ahluwalia SK, Goel RK, Devgan S. Iodine deficiency disorder in children aged 6-12 years of Ambala, Haryana. Indian pediatrics. 2013 Jun 1; 50(6):587-9.
9. Kumar P, Sagar MV, Revathy R, Krishna M. Int J Med Sci Public Health. 2015; 4 (3): 365-368. Int J Med Sci. 2015; 4(3):365-8.
10. Biswas AB, Das DK, Chakraborty I, Biswas AK, Sharma PK, Biswas R. Goiter prevalence, urinary iodine, and salt iodization level in sub-Himalayan Darjeeling district of West Bengal, India. Indian journal of public health. 2014 Apr 1; 58(2):129.
11. Rawal SV, Kedia G. A prevalence study of iodine deficiency disorder in children of primary schools in Gandhinagar district. Natl J Community Med. 2011 Oct 1; 2(3):478-82.
12. Bhat IA, Pandit IM, Mudassar S. Study on prevalence of iodine deficiency disorder and salt consumption patterns in Jammu region. Indian journal of community medicine. 2008 Jan 1; 33(1):11.
13. Laxmaiah A, Arlappa N, Balakrishna N, Mallikarjuna Rao K, Galreddy C, Kumar S, Ravindranath M, Brahmam GN. Prevalence and determinants of micronutrient deficiencies among rural children of eight states in India. Annals of Nutrition and Metabolism. 2013 Apr 6; 62(3):231-41.
14. Kapil U, Sareen N, Bhadoria AS. Status of Iodine Deficiency among Children in National Capital Territory of Delhi-A Cross-sectional Study. Journal of tropical pediatrics. 2013 May 6:fmt025.
15. Patro BK, Saboth P, Zodpey S, Shukla A, Karmarkar MG, Pandav CS. Tracking progress toward elimination of iodine deficiency disorders in Jharkhand, India. Indian Journal of Community Medicine. 2008 Jul 1; 33(3):182.
16. Panigrahi A, Mishra K, Mohapatra B. Status of iodized salt coverage in urban slums of Cuttack City, Orissa. Indian journal of community medicine: official publication of Indian Association of Preventive & Social Medicine. 2009 Apr; 34(2):145.

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