International Journal of Research in Medical Sciences
Sinha AK et al. Int J Res Med Sci. 2016 Aug;4(8):3590-3594
www.msjonline.org
pISSN 2320-6071 | eISSN 2320-6012

DOI: http://dx.doi.org/10.18203/2320-6012.ijrms20162334

Research Article

Prevalence of goitre, iodine uptake and salt iodization level in Mahasamund district of Chhattisgarh: a baseline study in Central India

Ashish K. Sinha*, Hemant Sharma, Prem S. Panda, Aditi Chandrakar, Somen K. Pradhan, Srishti Dixit

Department of Community Medicine, Pt. J.N.M Medical College, Raipur, Chhattisgarh, India

Received: 27 June 2016
Accepted: 13 July 2016

***Correspondence:**
Dr. Ashish K. Sinha,
E-mail: ashishsinha.md@gmail.com

ABSTRACT

Background: Iodine deficiency disorder (IDD) is the single most important preventable cause of brain damage. Iodine deficiency disorders (IDDs) refer to all of the consequences of iodine deficiency in a population, which can be prevented by taking adequate amount of Iodine. The objectives was to ascertain the prevalence goitre among 6-12 year children by clinical examination in Mahasamund district; 2) to document the iodine uptake status reflected by random urinary excretion levels in a sub-sample of 6-12 year children covered for clinical examination, and 3) to evaluate the coverage of iodized salt at community level (i.e. at household and retail shop) on-the-spot test by using rapid salt testing kit.

Methods: A cross sectional community based survey was done in Mahasamund district during April 2015 to September 2015. The study population was children in the age group of 6-12 years. 30 cluster sampling methodology was applied using PPS sampling technique, based on latest survey guidelines of NIDDCP of Govt. of India. The parameters studied were prevalence of goitre, urinary iodine excretion, and iodine content in salt at community level (i.e. household and shop).

Results: A total of 2700 children aged from 6-12 years were assessed clinically for goitre. The total goitre prevalence was 4.29% (95% CI: 3.3-5.27). The median urinary iodine excretion (MUIE) was 106.67µg/L (range 11-216.7µg /L) among surveyed children. 37.4% of the urinary iodine excretion values were <100 µg/L. The households consuming inadequately iodized salt (i.e. iodine content ≤15 ppm) was 20% in the surveyed district.

Conclusions: Although prevalence of goitre and median urinary iodine excretion among surveyed population was found satisfactory against the norms set by NIDDCP in surveyed district but universal salt iodization (USI) is yet to achieve in surveyed district.

Keywords: IDD, Goitre, Urinary iodine excretion, USI

INTRODUCTION

According to the World Health Organisation (WHO), iodine deficiency disorders (IDD) is the single most preventable cause of mental retardation and brain damage. The term iodine deficiency disorders (IDD) coined by Hetzel in 1983, includes the collective clinical and subclinical manifestations of iodine deficiency. Iodine deficiency disorders (IDD) affect all stages of human growth and development.[1,2] Iodine deficiency disorders (IDD) are estimated to result in loss of 2.5 million disability adjusted life-years (DALYs) (0.2% of

total) globally.[3] Goitre, being the only visible manifestation of IDD, has drawn the attention of the international community. IDD causes abortion, stillbirths, dwarfism, deafness, squint, impaired mental function, neonatal cretinism and hypothyroidism and its complications. Iodine deficiency poses a threat to health, well-being and economic productivity of the community.[4] Recognizing the importance of preventing IDD, the World Health Assembly adopted in the year 1990 the goal of eliminating iodine deficiency as a public health problem. In 1993, WHO and UNICEF recommended universal salt iodization (USI) as the main strategy to achieve elimination of IDD.[5]

In India, it is estimated that more than 71 million individuals suffer from IDDs, while another 200 million people stay in iodine deficient areas.[6] Considering the public health importance of IDD in India, national goitre control program (NGCP) was launched by Government of India in 1962. The program was renamed as National Iodine Deficiency Disorders Control Programme (NIDDCP) in the year 1992 and universal salt iodization (USI) was identified as the main strategy to eliminate IDD from India. In 1997, salt iodization was made mandatory in India. Although the prohibition on the sale of non-iodized salt was lifted in 2000, it was again reinstituted in 2005. Despite mandatory salt iodization, in India only half of households (51%) are currently using sufficient amount of iodized salt (≥15 ppm).[7]

According to CES 2009–The household level consumption of adequately Iodized Salt (>15ppm) is 39.6% while use of Non-Iodized (0 ppm) is 9.2%. Inadequately Iodized (0.1–15 ppm) is 59.2%. It varies according to area (rural, urban), caste (ST, SC, OBC, Others) & class. Finding of previous baseline survey. Adequately Iodized salt consumption (≥15 ppm) was maximum in urban (85.6%) than rural (46.4%). It is less among lower class (40.6%) and more among higher class (90.1%). This signifies inequitable consumption of iodated edible salt in C.G.[8]

Chhattisgarh Govt. has aimed to achieve wider coverage of population by iodized salt. A survey in 4 districts of Chhattisgarh during financial year 2014-15 showed Iodized Salt coverage was in range of 51.11-71.37%. But recent baseline data apart from other surveyed districts of the state was still unknown. Keeping this in mind, this study was proposed to assess the prevalence of goitre, urinary iodine excretion and salt iodization level in Mahasamund district of Chhattisgarh.

METHODS

Study design

A cross sectional observational study was done as per the protocol recommended by the NIDDCP/WHO/UNICEF.[9]

Study duration

Study was conducted from April 2015 to September 2015.

Study participants

Children 6-12 years, households in the community, and retail shops.

Variables

Total goitre prevalence, urinary iodine excretion, salt iodine content at household and retail shops and storage practices of iodized salt.

Sampling technique

30 cluster sampling by using PPS technique.

Method for Identification of clusters: A sample of 30 schools was selected as follows:-

Sample interval = Total number of school children (Primary and Middle standard) in the district/30= J, Selection of random number starts from 1 to K = J

Selected random numbers= J, J+K, J+2K, J+3K……J+29K

After identification of 30 clusters, a list was prepared with the identified clusters.

Sample size

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 guidelines. Total Sample size: 90 children (45 each boy & girl) from each cluster. Total 90*30 =2700 children, 4 households from each cluster, Total 4*30=120 households, at least one retail shop from each cluster Total 1*30= 30 retail shops.

Study tool

Clinical examination of 6-12 years children for enlargement of thyroid (i.e. Goitre). A sample size of 90 children (45 boys and 45 girls) from the schools of identified cluster was taken for the survey. If desired number of children were not found in identified cluster nearby schools were taken to full fill the criteria of prerequisite number of study subjects.

As per NIDDCP guidelines, every 5th child examined for goitre were asked to bring edible salt from their houses and were tested for salt iodine content on the spot by using rapid salt testing kit. Salt samples were also collected from 4 randomly selected households, also 1 sample from retail shops from each identified clusters.

Every 10th child examined for goitre survey was selected for urine sample. In this way 18 salt samples and 9 urine samples were collected from each cluster. Predesigned and pretested Proforma was used for data collection.

Rapid salt testing kit was used for iodine content in edible salt. Estimation of urine iodine excretion (UIE) was done by wet digestion method (i.e. The Sandell Kolthoff reaction). Salt storage practices at household level were also observed at household level.

Samples of urine were collected as predefined protocol and stored at room temperature after its collection from the field. Samples were transported to public health laboratory of Dept. of Community Medicine Pt. JNM Medical College, Raipur for further analysis.

Data entry, analysis and interpretation

Data entry was done in MS-Excel and was checked for its completeness & correctness before it was compiled and analyzed by MS Excel and SPSS 16.0 Version.

RESULTS

The total goitre prevalence was 4.29% (95% CI: 3.3-5.27), prevalence of Grade I goitre being 4.11% (95% CI: 3.08-5.13) and Grade II being 0.18% (95% CI: 0.2-1.1) among surveyed children (Table 1). The total goitre rate in boys and girls was 4.07% (95% CI: 3.44-4.7) and 4.52% (95% CI: 3.86-5.18) respectively.

The median urinary iodine excretion (MUIE) was found 106.67µg/L (range, 11-216.7µg/L). The proportion of the population with urinary iodine excretion below 100 µg/L was 37.4% and the proportion of the population with a urinary iodine excretion below 50 µg/L was 12.96%. (Table 1). 20.8% (93 out of 540) salt samples were found inadequately iodized (i.e. Iodine content <15 ppm). 20.0% (i.e.24 out of 120) of salt samples found unsatisfactory level of iodine (<15 PPM) (Table 2). Among households visited by us 33.33% (40 out of 120) had faulty storage practices. In retail shops 8.57% (3 out of 35) salt samples were found inadequately iodized.

Table 1: Iodine level status assessment indicators of children and households in Mahasamund district of Chhattisgarh, India.

Indicator	Value
Total goitre prevalence	4.29% (95% CI: 3.3-5.27)
Goitre grade I	4.11% (95% CI: 3.08-5.13)
Goitre grade II	0.18% (95% CI: 0.2-1.1)
UIE (µg/L) (median)	106.67
Proportion <100 µg/L	37.4
Proportion <50 µg/L	12.8
Proportion of households consuming adequately iodized salts	80%

Table 2: Iodine content of household samples in Mahasamund district, Chhattisgarh, India.

Iodine content (in PPM)	No. of samples	Percentage
0 PPM	0	0
<15 PPM	24	20
15-29.9 PPM	48	40
≥30 PPM	48	40

DISCUSSION

As evident from this study, the total goitre prevalence was 4.29% among 6-12 years children, the median urinary iodine excretion (MUIE) was 106.67 µg/L with 12.8% of children having a urinary iodine excretion <50 µg/L. and the proportion of households using adequately iodized salt was only 80% (Table 3). Based on WHO/UNICEF/NIDDCP criteria (goitre prevalence, urinary iodine excretion, and iodine content of salt), IDD does not seem to be much more a public health concern in Mahasamund district.

Table 3: Criteria for tracking progress toward eliminating IDD as a public health problem in Mahasamund District, Chhattisgarh, India.

Indicator	Goal	Mahasamund	Remark
Thyroid enlargement (Age 6-12 years)	<5%	4.29%	Not a public health problem
Urinary iodine excretion			
Median urinary iodine excretion (µg/L)	>100	106.67	Not a public health problem
Proportion below 100 µg/L	<50%	37.4	Not a public health problem
Proportion below 50 µg/L	<20%	12.8	Not a public health problem
% of households consuming adequately iodized salt (≥15 ppm)	>90%	80%	**Public health problem**

Similar community based studies have been done by various researchers where prevalence of goitre was in range of 7.74-23.4%.[12,16] District surveys carried by State Goitre cell from 1995 to 2001 reported greater than 5% goitre prevalence in 28 out of 29 districts in Tamil Nadu.[11]

The predominant type of salt consumed in Mahasamund was mostly powdered form. The proportion of retail shops selling adequately iodized salt was 91.4%. Only a small percentage of the population was aware of the importance of iodized salt. The poor implementation of prohibition on the sale of non-iodized salt, low awareness among household regarding iodization of salt and faulty storage practices resulted in overall mild iodine deficiency in the study population.

Our study results are robust and are internally valid as standard internal quality assurance and control procedures were followed. The results of our study showed a higher (80%) iodization level as compared to an earlier community based survey in Tamilnadu state where 16.2% of the population was consuming salt with the stipulated level of iodine, i.e., 15 ppm and more. Similar study by Sinha AK et al showed that 51.11%-71.37% households were consuming adequate iodised salt in surveyed districts of Chhattisgarh.[17] The NFHS-2 (1998-1999) survey revealed that 21.5% of population consumed adequately iodized salt (≥15 ppm of iodine). The other state level IDD survey carried out in seven states (Kerala, Tamilnadu, Orissa, Rajsthan, Bihar, Goa & Jharkhand) also showed that the household consumption of adequately iodised salt (>15PPM) ranged from low (18.2%) in Tamilnadu to highest (91.9%) in Goa.[19] Similar study in West Bengal the consumption of adequately iodised salt was 55% at household level.[18] The target of universal salt iodization is yet to achieve at the consumer level in the surveyed district of Chhattisgarh. In a national level survey conducted by ICMR in 1989 goitre prevalence of 6.9% (all age groups) and 14.1% (in 5-14 years age group) was reported in Nilgiri district of Tamil Nadu.[11]

The percentage of population reporting urinary iodine excretion less than 100µg/L was 15.6%, less than 50µg/L was 4.3% in study by Kapil et al**.** This was less from our study where population reporting urinary iodine excretion less than 100µg/L was 37.4%, less than 50µg/L was 12.8%. In similar studies done at Kullu and Kangra district of Himachal Pradesh, the Median Urinary Iodine Excretion level was found to be >100µg/L except at Solan district of Himachal Pradesh where it is found to be 62.5µg/L.[12-14]

A dissemination workshop involving different sectors was held after the completion of survey of Mahasamund. The objective of the workshop was to "link research to policy and program in context of IDD in state of Chhattisgarh." A detailed plan to address both demand and supply of iodized salt was made. Advocacy and monitoring mechanism of Universal Salt Iodization was discussed to strengthen by involving all stake holders.

Due to multisectorial involvement it inculcated a sense of ownership among one team regarding the results of IDD survey. The decision makers, the IDD cell of Directorate of Health Services Chhattisgarh, who themselves had conducted the study with the support from Medical College, Raipur and Jagdalpur along with technical support from UNICEF. All stake holders focussed on increasing quality and quantity of salt provided through Public Distribution system. Govt. authorities planned to provide the salt in appropriate sized container to avoid faulty storage practices to sustain recommended level of iodine in the edible salt. The partnerships that were built during the survey contributed substantially to distribution of iodized salt in the state. Strengthening of iodized salt distribution is done through public distribution supply free of cost under the name "Mukhyamantri Amrit Namak Yojna" scheme to BPL families' in state of Chhattisgarh, India. This demonstrated a successful model of linking research to policy and program.

CONCLUSION

For monitoring progress toward the elimination of IDD, the recommended parameters are to be interpreted carefully because urinary iodine excretion level reflects the short term iodine status, while the prevalence of goitre indicates the long-term iodine status in a population. Findings of high total goitre prevalence rate and optimal urinary iodine excretion have been reported in many studies in India reflecting a transition from iodine deficiency to sufficiency. Observation in Mahasamund district also corroborates with findings of those studies indicating that the district is also in a transition phase from iodine deficiency to sufficiency. This process of transition needs to be augmented towards successful elimination of IDD with sustained consumption of adequately iodized salt, intensified awareness activities with BCC and an appropriate monitoring system.

ACKNOWLEDGEMENTS

Authors would like to acknowledge the support and co-operation of the district authorities, as well as Department of Primary Education, Govt. of Chhattisgarh. They would also like to express our sincere gratitude to the IDD Cell, Directorate of Health Services, Government of Chhattisgarh and UNICEF, Chhattisgarh for providing financial and logistic assistance and other support to carry out the study smoothly.

Funding: Funded By IDD Cell, Directorate of Health Services, Government of Chhattisgarh and UNICEF, Chhattisgarh, India
Conflict of interest: None declared
Ethical approval: Not required

REFERENCES

1. Hetzel BS. Iodine Deficiency Disorders (IDD) and their eradication. Lancet. 1983;2:1126-9.
2. Pandav CS, Moorthy D, Sankar R, Anand K, Karmarkar MG. National iodine deficiency disorders control programme. (National health programme series; Vol 5). New Delhi: National Institute of Health and Family Welfare; 2003. p. 3-6,23-4,26-7,74-6.
3. World Health Organization. The world health report: Reducing risks, promoting healthy life. Geneva: World Health Organization; 2002.
4. 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 of WHO. 2005;83:518-25.
5. UNICEF-WHO Joint Committee on Health Policy. World Summit for Children - Mid Decade Goal: Iodine Deficiency Disorders. Geneva, United Nations Children's Fund, World Health Organization, 1994 (JCHPSS/94/2.7).
6. Ministry of Health and Family Welfare. Revised Policy Guidelines on National Iodine Deficiency Disorders Control Programme; IDD and Nutrition Cell; Ministry of Health and Family Welfare, Oct 2006.
7. International Institute for Population Sciences. National Family Health Survey (NFHS) -India NFHS-3 (2005-06): Main Report, International Institute for Population Sciences, Mumbai, India.
8. New Delhi: 2010. UNICEF. Coverage Evaluation Survey 2009, All India Report. Ministry of Health and Family Welfare, Government of India. Available from: http://www.unicef.org/ india/health.html . [accessed on July 1, 2011]
9. WHO/NHD. Assessment of iodine deficiency disorders and monitoring their elimination: A guide for programme managers. 3rd ed. 2007.
10. Kapil U, Singh P, Dwivedi SN, Pathak P. Profile of iodine content of salt and urinary iodine excretion levels in Selected districts of Tamil Nadu. Indian J Pediatr. 2004;71:785-7.
11. An ICMR Task Force Study. Epidemiological survey of endemic goitre and endemic cretinism. New Delhi:ICMR;1989.
12. Revised Policy Guidelines on National IDD Control Programme Oct. 2006 IDD and Nutrition Cell Director General of Health and Family Welfare Govt. of India New Delhi.
13. Chander S, Kapil U, Jain V, Sareen N. Iodine Deficiency Disorders in School Age Children in Kullu District, Himachal Pradesh. Indian Pediatr. 2013;50:883-4.
14. Kapil U, Pandey RM, Jain V, Kabra M, Sareen N, Bhadoria AS, et al. Increase in iodine deficiency disorder due to inadequate sustainability of supply of iodized salt in District Solan, Himachal Pradesh. J Trop Pediatr. 2013;59:514-5.
15. Kapil U, Pandey RM, Kabra M, Jain V, Sareen N, Bhadoria AS, et al. Status of iodine deficiency in district Kangra, Himachal Pradesh after 60 years of salt iodization. Eur J Clin Nutr. 2013;67:827-8.
16. Ahmed M, Zama SY, Nagarajarao V, Mudassir A. Khan. Iodine deficiency in children: A comparative study in two districts of south-interior Karnataka, India. J Family Community Med. 2014;21(1):48-52.
17. Sinha AK, Jain K, Singh SP, Daniel A, Parihar A. Tracking progress towards sustainable elimination of Iodine deficiency disorders in 4 districts of Chhattisgarh- Pointer from Central India. Indian J. of PSM. 2015;46:3-4;168.
18. Arlappa N, Laxmaiah A, Balakrishna N, Harikumar R, Kodavanti MR, Gal Reddy Ch, et al. Micronutrient deficiency disorders among the rural children of West Bengal, India. Annals of Human Biology. 2011;38(3):281-9.
19. Zama SY, Ahmed M, Vadiraja N. Prevalence of goiter in school children of Chamarajanagar district, Karnataka, India. J Clin Diagn Res. 2013;7:2807-9.

Cite this article as: Sinha AK, Sharma H, Panda PS, Chandrakar A, Pradhan SK, Dixit S. Prevalence of goitre, iodine uptake and salt iodization level in Mahasamund district of Chhattisgarh: a baseline study in Central India. Int J Res Med Sci 2016;4: 3590-4.