Original Article

Tracking Progress towards Sustainable Elimination of Iodine Deficiency Disorders in Orissa

D. Moorthy[1], B.K. Patro[2], B.C. Das[3], R. Sankar[4], M.G. Karmakar[5], *C.S. Pandav[6]

Abstract

Objective: To assess the status of iodine deficiency in the population of Orissa and track progress of the elimination efforts. **Methods:** A community based field survey was conducted. Data was collected using quantitative and qualitative research methods. Standard internationally recommended protocol and methodology was followed. Thirty clusters were selected using population proportionate to size sampling technique. School children aged 6 to 12 years were selected as target group. Goiter prevalence, urinary iodine excretion in the target group and iodine content of the salt at household were used as outcome variables. **Results:** A total of 1200 children were studied. The total goiter rate was found to be 8.0%, of which 7.6% were grade I and 0.4% was grade-II goiter. The median urinary iodine excretion was found to be 85.4 µg/L and 32.2% of the subjects had urinary iodine levels less than 50 µg/L. Estimation of iodine content by titration method revealed that in only 45 % of households salt was found to be adequately iodised. (Salt with iodine level ³ 15 ppm). **Conclusion:** Iodine deficiency continues to be a public health problem in Orissa and the need to accelerate efforts to iodine sufficiency cannot be overemphasized.

Key Words: Iodine deficiency; Iodised salt; Urinary iodine; Goiter prevalence; Orissa.

Introduction

Iodine deficiency disorders (IDD) - a term coined by Hetzel in 1983, encompasses the collective clinical and sub-clinical manifestations of iodine deficiency[1]. Iodine deficiency disorder impact "refers to all of the ill-effects of iodine deficiency in a population, which can be prevented by ensuring that the population has an adequate intake of iodine"[2]. IDD occurs when the availability of iodine is lower than the required amount and the thyroid gland is not able to synthesize sufficient amount of thyroid hormone. The spectrum of manifestations of IDD includes impaired scholastic performance, goiter, mental retardation, cretinism, abortions, deafness etc. Iodine deficiency is claimed to be world's single most significant cause of preventable brain damage and mental retardation.

Iodine deficiency disorders continue to threaten the health and well being of the population of India. Recognizing the importance of elimination of iodine deficiency disorders as health and developmental goal, the Government of India launched National Goiter Control Programme (NGCP) in 1962 and the same was renamed as National Iodine Deficiency Disorders Control Programme (NIDDCP) in 1992. Surveys conducted by Director General Health Services, Indian Council of Medical Research, Health Institutions and State Health Directorates, it has been found out of 321 districts surveyed in 28 states and 7 Union Territories, 260 districts are endemic for IDD (i.e. prevalence of IDD is more than 10%)[3]. It is estimated that more than 71 million persons are suffering from goiter and other iodine deficiency disorders. Salt iodisation is the main strategy adopted under NIDDCP for elimination of IDD in India. On 17th November 2005 Ministry of Health & Family Welfare, Government of India issued notification banning the sale of non

[1]Consultant, ICCIDD, [2]Senior Resident, [5]Senior Advisor, ICCIDD, [6]Professor & Head, Centre for Community Medicine, New Delhi, [3]Director, State Institute of Health & Family Welfare, Orissa, [4]Consultant Physician, New Delhi.
*Corresponding author: cpandav@iqplusin.org

iodised salt for direct human consumption in the entire country under Prevention of Food Adulteration Act to be effective from 17th May 2006[4].

Orissa state has a total population of 36 million people spread over an area of 155,707 square kilometers. Sex ratio of the state is 972 as compared to national average of 933 per 1000 males. Most of Orissa resides in villages, only 15% of total population lives in urban areas. State literacy rate is 63.1% comparable to national average of 64.8%[5]. Existence of moderate to severe iodine deficiency is well established in many districts of the state. Legislative measures are in place on ban of sale of non-iodised salt for direct human consumption. There is a state IDD cell placed at state capital to monitor activities for elimination of IDD. Till date, no statewide survey was carried out using all the three indicators namely, goiter prevalence, urinary iodine excretion and iodine content of the salt at consumption level. The present study was undertaken to track progress towards elimination of IDD in Orissa, using both quantitative and qualitative research methodologies.

The objectives of the study were to determine the status of iodine deficiency in the state, to find out availability and cost of adequately iodised salt at the retail shops and to study the perceptions of the community about iodine deficiency, salt and iodised salt.

Materials and Methods

The methodology prescribed by WHO/UNICEF/ICCIDD[2] was used for this present community based survey. The study was carried out in the year of 2003-04. All the inhabited villages and urban areas (wards in urban areas) in the state were listed with their population. Thirty clusters were selected from this list using population proportion to size (PPS) technique.

School children in the age group of 6-12 years constituted the target population for the study[6] . The target children were studied by house-to-house visit. In the selected cluster households were selected using electoral lists. In a selected household if a target child was not available, the adjacent houses were visited till a house with a target child was found. In houses with more than one eligible child, one of them was selected using random selection method.

Sample size was calculated[7] using the survey results of National Family Health Survey - 2 (1988-89). Considering the prevalence of consumption of adequately iodised salt at 35% and absolute precision of 5 and design effect of 3 required sample size came to 1092. To account for anticipated 10% wastage of sample a total of 1200 children were enrolled into the study. A total of 40 target children were studied from each cluster. The survey was conducted by three survey teams, each covering ten clusters.

A pre-tested household and retail shop socio-economic interview schedule, with components on social marketing and knowledge, attitude and practices and beliefs about IDD and iodised salt was prepared. The household questionnaire was administered to a member of the household where children were examined for the quantitative study. The interview schedule was administered by physicians in the local dialect (Oriya) and the answers were translated into English and recorded. The respondent was usually a lady or head of the household who was involved in the purchasing of the salt. Two retail shops were selected from each cluster by purposive sampling. For the qualitative component of the study, a total of 60 focus group discussions were carried out among different stakeholders i.e. school teachers, Panchayati Raj Institution members, Anganwadi workers, health workers, Government doctors and Private practitioners. All the members of the survey team were trained about the methodology at the state headquarter before the start of the field survey.

Enlargement of the thyroid gland was examined by the physician and graded as per WHO/UNICEF/ICCIDD classification. In case of uncertainty, the lower grade was recorded.

On-the-spot causal urine samples were collected in wide mouthed plastic bottles from all the study subjects for estimation of urinary iodine excretion. The samples were transported safely to ICCIDD reference laboratory at Centre for Community Medicine, AIIMS New Delhi for estimation of urinary iodine. Urinary iodine estimation was done using micropipette method[8].

Salt samples were collected from households and selected retail shops in sealed plastic bags and transported to ICCIDD reference laboratory at New

Delhi for estimation of iodine in salt by iodometric titration method[9].

Quality Assurance: For intra and inter observer variability for goiter grading two training workshops were conducted before the actual field survey. Two validation teams were formed which visited 30% of the clusters to validate the data collected. The analysis of iodine levels in salt and urine samples were carried out at ICCIDD reference laboratory. Standardized internal and external quality assurance protocols were followed.

The quantitative data were entered in to an Excel spreadsheet. Descriptive statistical analysis was done using SPSS version 10.0. Measures of central tendency (Mean, Standard Deviation and Range etc) were calculated to describe the distribution of different variables. For the qualitative part of the study, the responses to open ended questions were free listed. The main domains were identified; the individual responses were categorized and finally summarized using qualifiers.

Results

Quantitative component:

A total of 1200 children aged between 6 to 12 years were studied. There were 657 boys (54.8%) and 543 girls (45.2%) with mean age of 8.6±2.0 years and 8.7± 2.0 years respectively. The total goiter rate (TGR) was found to be 8.0% (95% Cl: 6.5 to 9.5%), of which 7.6% were grade I and 0.4% were grade-II goiters. The total goiter rates in boys and girls were found to be 6.4% and 10.2% respectively and this difference is statistically significant (p <0.01)

Table 1: Iodine content of salt from household samples (n=1200)

Iodine content(ppm)	Number	Percentage
0	158	13.1
>0 - 6.9	39	3.3
7 - 14.9	463	38.6
15 - 30	301	25.1
> 30	239	19.9

ppm = Parts per million

Forty five percent of households were consuming adequately iodised salt (salt with iodine level more than 15 ppm). The range of iodine levels from household samples was 0 to 164 ppm. The distribution of iodine content in household salt samples is depicted in Table- 1.

The median urinary iodine excretion was found to be 85.4 μg/L. The range of urinary iodine varied from 15.4 to 204.4 μg/L. Almost one-third (32.2%) of the samples had urinary iodine levels less than 50 μg/L, while 60.3% of the samples had values less than 100 μg/L (Table-2).

Table 2: Distribution of Urinary Iodine values in the population (n=1200)

Urinary Iodine (mg/L)	No of Samples	Percentage
0-19.99	124	10.3
20-49.99	263	21.9
50-99.99	337	28.1
100-199.99	285	23.8
200-299.99	96	8.0
³ 300	95	7.9

A total of 84 salt samples from the 30 clusters surveyed across different salt types (crystal, powered, refined) were collected from retail shops were analyzed. A total of 16 (19%) samples had either no iodine or less than 5 ppm iodine which is considered non-iodised for all practical purposes. Another 28 (33.3%) samples had iodine content between 7 and 14.9%, in the remaining 40 (47.7%) samples iodine content was 15 ppm or more. The range of iodine content varied from 0 to 63.5 ppm. Cost of the salt available at the retail outlets ranged from Rs. 2 to Rs. 8 per kilogram.

Qualitative component:

A total of 60 focus group discussions were carried out across different types of stakeholders i.e. school teachers, Panchayat Raj Institutions members, Anganwadi workers, health workers, Government doctors and private Doctors.Misconception about iodised salt was prevailing across all groups.

School teachers knew about iodised salt and had some knowledge of iodine and its role in brain development. Some teachers did not know about the source or availability of iodised salt in the state.

Panchayat Raj Institution members were worried about the cost of the iodised salt. Their knowledge about iodine deficiency and the spectrum of disorders that is caused by iodine deficiency was poor.

Some of the Anganwadi workers had the knowledge that the iodised salt can prevent goiter and many had the misconception that iodised salt is more clean and pure than the crystal salt. About one-third of them were storing the household salt in closed containers and the rest were storing in open vessels, plastic jars.

Health workers (Females) had the knowledge of using iodised salt in the prevention of goiter. Their knowledge about role of iodine in brain development was limited. Almost all the health workers had the belief that crystal salt is non-iodised salt and only refined salt is iodised.

All the physicians were aware about iodine deficiency and goiter. However, less than half of them knew about the spectrum of iodine deficiency disorders. Their knowledge on the link between iodine deficiency and brain development was found to be limited.

Discussion

Geographically Orissa is located along the eastern coast of the peninsula. Significant proportion of the population lives in the coastal areas. It was assumed that iodine deficiency is not likely to be a major health problem in the state. Four districts surveyed by Director General Health Services during 1987-1999 were found endemic for goiter. The prevalence rate ranged from 15.8% to 30.3%[10]. However, there has been no statewide survey.

Table 3: Status of indicators for tracking progress towards elimination of IDD in Orissa

Variable	Value in Orissa	Goal
Total Goiter Rate	8.0%	< 5%
UIE (mg/L)	85.4	> 100
UIE (< 100 mg/L)	60.3%	< 50%
UIE (< 50 mg/L)	32.2%	< 20%
Households consuming adequately iodised salt	45.0%	> 90%

Status of indicators for tracking progress towards elimination of IDD is presented in Table 3. The results clearly shows that iodine deficiency continue to threaten the health and well being of the population of Orissa. Total Goiter Rate (TGR) was found to be 8.0% is in consistence with the results of study carried out by SS Mahapatra et al[11] in Bargarh district of Orissa in 1996-99, while the results are lower than the surveys carried out by Director General Health Services (1987-1999) and study carried out by T Sahu et al in 2003[12].

Urinary Iodine Excretion (UIE) results showed 32.2% of the samples had value less than 50 μg/L in comparison to 89.3% reported by SS Mahapatra et al[11]. Only 39.7% of the samples had normal urinary iodine excretion level (> 100μg/L).

The National Family Health Survey -2 (1998-99)[13] showed that 70.4% of households use iodised salt in Orissa, while only 35% households consume adequately iodised salts. The Reproductive Health Survey (DLHS- RCH 2002 - 04)[14] results showed that only 30% of households in Orissa consume adequately iodised salt. The present study shows that 45% of the population consume adequately iodised salt.

Awareness about iodised salt among the consumers was found to be limited across all the sections. Another common perception among all the stakeholders was iodised salt is equivalent to refined salt is equivalent to costly salt. Cost of iodised salt was not cited as reason for non-consumption of iodised salt by any of the stakeholders. Low awareness and perception of iodised salt is equivalent to costly salt was the reason for low consumption of iodised salt.

The entire state has a legal provision that bans sale of non-iodised salt for direct human consumption. Less than half of the samples from retail shops were found to have adequate iodine and 55% of the households consuming salt with iodine content < 15 ppm indicate that the salt is poorly iodised.

Damage to growth and development of the fetus and newborn is the most important consequence of iodine deficiency[15,16]. The fetal brain is particularly

vulnerable to maternal hypothyroidism in iodine deficiency, and iodine deficiency is the leading cause of preventable mental retardation worldwide. The best way to supplement iodine to deficient populations is through salt iodisation. For salt iodisation to have the desired impact and protect children from brain damage, adequately iodised salt should be accessible and used by at least 90 percent of the households on a regular basis.

Data from this study shows that iodised salt coverage is low and consequently iodine deficiency continues to be a major public health problem in Orissa, as indicated by all the three indicators. Sustainable elimination of IDD in the state is possible with active involvement of stakeholders, monitoring iodisation at production and retail level and targeted IEC (Information Education & Communication).

Acknowledgement

The study was funded by UNICEF, ICCIDD, Micronutrient Initiative (MI) India. None of the funding agencies were involved in implementation, data collection, analyses or authorization of publication.

References:

1. Hetzel BS. Iodine Deficiency Disorders (IDD) and their eradication. Lancet 1983; 2: 1126-1129
2. Assessment of Iodine Deficiency Disorders and Monitoring their Elimination - A guide for Program Managers, 2nd edition. ICCIDD, UNICEF, WHO. 2001.
3. Govt. of India. Revised Policy Guidelines on National Iodine Deficiency Disorders Control Programme; IDD & Nutrition Cell; Ministry of Health & Family Welfare, October 2006;1-2.
4. Govt. of India. Iodine deficiency disorders control programe. Annual Report 2005-06; Ministry of Health & Family Welfare, Government of India; 89-90
5. Govt. of India. Population Profiles (India, States & Union Territories), Census of India 2001; Office of Register General, 2004; 48-49.
6. WHO/UNICEF/ICCIDD. Chapter 2: Selecting target groups and Chapter 5: Selecting appropriate indicators: Biochemical indicators. In.- Indicators for Assessing Iodine Deficiency Disorders and their Control Through Salt Iodination. Geneva.*World Health Organization* WHO/N-LJT/94.6, 1994.
7. Cluster Surveys, Monitoring Universal Salt Iodization Prgrammes:WHO/ICCIDD/UNICEF/ PAMM/MI. 1995.
8. Ohashi T, Yamaki M, Pandav CS, Karmarkar MG, Irie M. Simple Microplate Method for Determination of Urinary Iodine. *Clin Chem* 2000; 46 : 529-536.
9. Tyabji R. The Use if Iodated Salt in the Prevention of Iodine Deficiency Disorders: *A Handbook ofMonitoring and Quality Control.* UNICEF, 1985.
10. Pandav CS, Moorthy D, Sankar R, Anand K, Karmarkar MG, and Prakash R. National Iodine Deficiency Disorders Control Programme, National Health Programme Series 5. *National Insitute ofHealth and Family Welfare,* 2003.
11. Mohapatra SS, Bulliyya G, Kerketta AS, Marai NS, Acharya AS. Iodine deficiency disorders in Bargarh district of Western Orissa. Indian Pediatr. 2000 May;37(5):536-9.
12. T. Sahu, N.C. Sahani, D. M. Satapathy, T.R. Behera. Prevalence of Goiter in 6-12 Year Children of Kandhamal District in Orissa.Ind Journal of Comm Med. April-June 2005; 30(2).
13. National Family Health Survey (NFHS-2), Orissa 1998-99, International Institute for Population Sciences, Mumbai, India; 170-171.
14. District Level Household Survey - Reproductive and Child Health (DLHS - RCH) 2002-2004, Accessed from www. rchi ridia.org/dIhs india/ apdx2.pdf.
15. Delange F. The role of iodine in brain development. Proc Nutr Soc 2000; 59 : 75-79.
16. Glinoer D, Delange F. The potential repercussions of maternal, foetal and neonatal hypothyroxinemia on the progeny. *Thyroid* 2000; 10: 273-279.