Original Article

Tracking Progress Towards Sustainable Elimination of Iodine Deficiency Disorders in Bihar

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ABSTRACT

Objectives. To assess the status of the iodine deficiency in the population of Bihar and track progress of the elimination efforts.

Methods. A community based field survey was conducted. Using quantitative and qualitative research methods, data was collected by following internationally recommended protocol and methodology. Thirty clusters were selected using population proportionate to size technique. School age children (6 to 12 years) were the target group studied. Urinary iodine in target children and iodine content of salt at households were the indicators used.

Results. Total of 1169 children were studied. The median urinary iodine concentration was found to be 85.6 µg/L. Urinary iodine concentration was less than 50 µg/L in 31.5% of the subjects. Only 40.1% of the household salt samples were found to be adequately iodised as determined by titration method (>=15 ppm iodine).

Conclusions. Study results show existence of iodine deficiency in the state. There is need to accelerate our efforts to achieve iodine sufficiency and this should be done on a war-footing. **[Indian J Pediatr 2006; 73 (9) : 799-802]**
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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 (IDD) as a health and developmental goal, the government of India launched the National Goitre Control Programme (NGCP) in 1962 and the same was re-named as National Iodine Deficiency Disorders Control Programme (NIDDCP) in 1992. Salt iodisation is the strategy adopted for IDD elimination in India. In all states and Union Territories except Kerala and Gujarat, there is ban on the sale of non-iodised salt for human consumption. On 15th June 2005 the government of India announced its decision to ban the sale of non-iodised salt in the entire country and this law will come into effect in the next few months.

Bihar is the third most populous state in the country. Geographically parts of the state lie in the severely iodine-deficient sub-Himalayan goiter-belt. Frequent flooding and rivers changing course over a period of time has also led to leaching of iodine from the soil. Existence of moderate to severe iodine deficiency is well established in many districts of the state. Legislative measures are in place for over two decades that ban the sale of non-iodised salt for human consumption. No salt is produced in the state and all salt is imported from Gujarat, Tamil Nadu and / or Rajasthan. The primary objective of this study was to track progress towards elimination of IDD in Bihar, using both quantitative and qualitative research methods.

MATERIALS AND METHODS

The ICCIDD / WHO / UNICEF[1] recommended methodology for assessment was used. The study was a cross sectional community based field survey. 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 proportionate to size (PPS) technique.

School children in the age group of 6 to 12 years

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constituted the target population for the study.[2, 3] The target children were studied by house-to-house visit. In the selected clusters, using the electoral lists, households were selected. If in the selected household, a target child was not available, 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 a random selection method. This was done to provide a wider scatter of households.

Urinary iodine excretion was the biochemical indicator used. Urinary iodine estimation was done using simple micropipette method.[4] The process indicator studied was the availability and use of iodised salt at households. Iodised salt availability at the retail outlets in the selected clusters was also collected as additional information.

Salt samples were collected from the houses visited. The salt that was used in cooking on the same or previous day was collected. In all the clusters visited, salt samples were collected from at least one retail shop. The iodine content was estimated by iodometric titration.[5]

The survey was conducted by five teams, each team covering six clusters. Two validation teams comprising of senior physicians with vast experience in IDD surveys were formed. These teams visited at least one cluster surveyed by each of the teams. Table 1, shows the assumptions and basis of sample size calculation for the study.

TABLE 1. Sample Size Calculation

State	Coverage of iodized salt	Confidence level (%)	Absolute precision (%)	Design Effect (Rounded off)	Sample Size	No of children per cluster
Bihar	47	95	± 5	3	1148 (1200)	40

A pre-tested household and retail shop socio-economic interview schedule, with components on social marketing and knowledge, attitude, practices and beliefs about IDD and iodised salt, was prepared. The household questionnaire was administered to a member of the households where children were examined for the quantitative study. The respondent was usually the lady of the house or the head of the household who was involved in purchasing salt for the house. Purposive sampling was carried out to select retail shops. The questionnaires were administered by the physicians who conducted the quantitative IDD assessment, with the help of local coordinators.

RESULTS

Total of 1169 children aged between 6 to 12 years (Mean ± SD: 8.6 ± 1.9 years) were studied. There were 728 boys (62.3%) and 441 girls (37.7%) with a mean (± SD) age of 8.7 ± 1.9 years and 8.5 ± 1.9 years, respectively.

A total of 1132 urine samples were analyzed for iodine content. The median urinary iodine excretion was found to be 85.6 µg/L. In 31.5% of the samples values were ≤ 50 µg/L and 55.3% of the samples had values ≤ 100 µg/L. The distribution is shown in Fig. 1. The dark line in the figure represents the recommended cut off value of 100 µg/L.

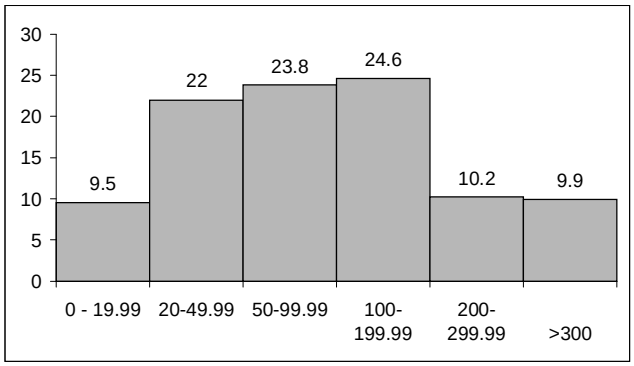

Fig 1. Distribution of urinary iodine values in the population

A total of 1199 salt samples collected from houses in 30 clusters were analyzed. The proportion of households consuming adequately iodised salt [salt with iodine levels of at least 15 parts per million (ppm) – 15 milligrams of iodine per kilogram of common salt] was 40.1%. The range of iodine levels in salt in the samples from the households was 0 to 68.8 parts per million (PPM). The distribution is presented in the Table 2.

TABLE 2. Iodine Content of Salt at Household Level

Iodine content (PPM)	Number of samples	Percentage		
0	183	15.3%	100%	
5 – 6.9	187	15.6%	84.7%	
7 - 14.9	348	29.0%		
15 - 30	241	20.1%	40.1%	
30 – 68.8	240	20.0%		
TOTAL	1199	100.0%		

Salt samples from retail shops showed that only a quarter to half of the samples had iodine content conforming to the standards. Crystal salt sold in loose had a poor probability of being iodised and only 28% had adequate iodine. Of the salt samples sold in packets, 40% of the powdered salt and 45% of the refined salt samples had adequate iodine. In all varieties, nearly 28% of the samples had no iodine at all.

The survey team members collected information from 1200 households. The summary of the findings is given in table 3. At the retail level, interviews revealed that most of the shopkeepers (54%) claimed that they sold only iodised salt, while one third said they sold both common salt and iodised salt. Most of the retail shops bought salt

in bulk, once a month. Most of the shopkeepers reported that the demand for refined and powdered salt is increasing. Observation by the survey team revealed that salt was always stored properly.

DISCUSSION

Geographically, Bihar lies in the "sub-Himalayan goiter belt". When National Goiter Control Programme started in 1962, goitre was thought to be endemic only in the districts of East and West Champaran, Sitamarhi and parts of Muzaffarpur districts. Subsequently, surveys showed the existence of iodine deficiency to be more widespread in the state. However, there has been no statewide survey.

Summary of the results of the present study are shown in table 3. The results point to the fact that iodine deficiency continue to threaten the health and well being of the population of Bihar. Re-evaluation of IDD status after introduction of iodised salt was done in the districts of East and West Champaran. These surveys revealed significant decrease in the goiter prevalence. From the year 1979 to 1993-94, the goiter prevalence decreased from 64.5% to 24.6% in East Champaran and from 57.2% to 25.1% in West Champaran.[6]

TABLE 3. Overview of the Results

Variable	Value	Goal
Number of children studied	1169	-
Mean age	8.6±1.9	-
Number of urine samples analysed	1132	-
UIE (Median)	85.6 μg/L	> 100
Proportion of values ≤ 100 μg/L	55.3%	< 50%
Proportion of values ≤ 50 μg/L	31.5%	< 20%
Proportion of salt samples analysed	1199	-
Proportion of households consuming adequately iodised salt (measured by titration)	40.1%	> 90%

TABLE 4. Summary of Results of Qualitative Study

1. Most of the respondents were aware of iodised salt
2. Most of them bought salt sold in packets
3. Most preferred powdered salt because of ease of use.
4. Most of the respondents were aware of the precautions to be taken with the storage of iodised salt at home
5. Most did not know the health benefits of consuming iodised salt
6. Most of them were influenced by the commercial endorsements that are heard or seen on the mass media.
7. The health system did not appear to play a part in informing the community
8. Most of the retailers reported a steady increase in demand and sale of packet salt and refined salt.

   Lack of awareness on the benefits of iodised salt in the community means that the increase in the demand for packet and refined salt is probably due to the increasing trend in moving towards packet culture. This is important to bear in mind from the point of view of sustainability of salt iodisation.

The entire state of Bihar has legal provision that bans the sale of non-iodised salt in the state. The first ban notification was issued in few districts in April 1988 and subsequently the entire state is covered under the notification. Bihar does not produce any salt and all the salt is imported from one of the salt producing states. Household coverage of iodised salt in Bihar in NFHS-2 [7] was 47.0% in 1998-99 and this dropped to 25.2% in the RCH [8] survey in conducted in 2002.

What are the probable factors for this! The following are some likely causes: the steep rise in the railway freight, repeal of the central ban on sale of non-iodised salt by the central government in the year 2000, and some complacency on the part of programme managers in the face of competing priorities.

Since the inception of the IDD control programme in the country, transportation of edible iodised salt was provided some subsidy and priority for movement by the Indian Railways. With effect from April 2002, the freight for iodised salt was hiked by 135%. With the hike in freight, the cost advantage of railway transportation of salt has decreased substantially and transportation of salt by road increased substantially since 2002.[9] Road transportation up to a distance of 1000 kms appears to be economical. All the salt that is transported by rail is quality checked by the Salt Department whereas there is no quality check of the salt that moves by road. Road transport is also undertaken by small producers as it involves much less capital compared to moving salt by railways.

The IDD Cell in Bihar was established in the year 1986-87 and a technical officer is posted. A state level IDD Control Task Force was set up in 1988. But this body has not been functioning at all. Although the entire state is covered by ban notification, enforcement of the ban is practically non-existent. Polio eradication, vitamin A campaigns are two examples that became high priority programmes with political support and high visibility. Because of the pressure to perform in these programmes, performance with respect to other programmes is faltering.

Damage to reproductive function and to the development of the fetus and newborn is the most important consequence of iodine deficiency.[10, 11] The fetal brain is particularly vulnerable to maternal hypothyroidism in iodine deficiency, and iodine deficiency is the leading cause of preventable mental retardation worldwide.[12, 13] Even mild or sub clinical maternal hypothyroidism during pregnancy can impair mental development of the newborn.[14, 15] 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 by 90 percent of the households on a regular basis.

Data from this study show that iodised salt coverage is low and consequently iodine deficiency continues as a

major public health problem in Bihar, as indicated by both the process and impact indicators. A series of steps have been initiated in the state following a dissemination workshop held in March 2005. In the dissemination workshop several important recommendations were arrived at to improve the availability and accessibility of adequately iodised salt in the state. The recommendations address both supply and demand issues and it is hoped that these measures should lead to improved availability and use of iodised salt at household level.

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