ASSESSMENT OF IODINE DEFICIENCY IN SELECTED BLOCKS OF EAST AND WEST CHAMPARAN DISTRICTS OF BIHAR

Umesh Kapil, Jaipal Singh*, R. Prakash*, S. Sundaresan*, Shoba Ramachandran and Monica Tandon

*From the Department of Human Nutrition, All India Institute of Medical Sciences, Ansari Nagar, New Delhi 110 029 and *Salt Department, Lavan Bhawan, Government of India. Jaipur 302 004.*

Reprint requests: Dr. Umesh Kapil, Additional Professor, Department of Human Nutrition, All India Institute of Medical Sciences, Ansari Nagar, New Delhi 110 029.

Manuscript received: June 6,1997; Initial review completed: July 23,1997; Revision accepted: August 8,1997

Objective: *A survey conducted in 1964 reported a goitre prevalence of 40.3% in East and West Champaran districts of Bihar. No recent survey has been documented on the prevalence of iodine deficiency in these districts. The present study was therefore undertaken(i) to assess the prevalence of 1DD in these districts, and (ii) to estimate the iodine content of salt consumed by population.* ***Methodology:*** *In each district, one block was selected. In each block more than 630 children in the age group of 6-12 years were included in the study and were clinically examined. Urine samples were collected from 261 children and were analyzed using standard laboratory procedures. A total of 456 salt samples were collected from children and 35 from traders from the two districts and analyzed using the standard iodometric titration method. Results: The total goiter prevalence was 11.6%. The percentage of children with <2, 2.0-4.9, 5.0-9.9 and > 10 meg/ dl of urinary iodine excretion level were 12.3, 13.4, 23.4 and 51.0, respectively. The median urinary iodine excretion of the children was 10.0 mcg/dl. None of the families were consuming salt with a nil iodine content and about 29.3%, were consuming salt with less than 15 ppm of iodine. Of the 35 salt samples collected from traders, all had iodine and about 17% had less than 15 ppm of iodine.* ***Conclusion:*** *The study stresses the need for strengthening the existing system of monitoring of quality of salt being provided in the East and West Champaran districts by Government of Bihar.*

Key words: *Goiter, Iodine deficiency disorders, Urinary Iodine.*

THE East and West Champaran districts of Bihar, are known iodine deficiency endemic areas. A survey conducted in 1964 in these districts reported a goiter prevalence of 40.3%(l). To ensure adequate availability and use of iodised salt, the Government of Bihar issued a ban on the sale of non-iodised salt for human consumption in 1976(2). Under this ban notification, iodised salt with a minimum of 30 ppm iodine at the manufacturer's level and 15 ppm iodine at the consumer level should be available in the state(3). A resurvey conducted in 1979, reported a goiter prevalence of 64.5% in East Champaran and 51.2% in West Champaran districts(l). Thus, in view of the reported high prevalence of IDD, the present study was conducted: (z) to assess the current prevalence of IDD, and *(ii)* to estimate the iodine content of salt consumed by the population in East and West Champaran districts.

Subjects and Methods

The study was conducted in the East and West Champaran districts of Bihar. One block, more than 30 km away from the district headquarters in each district was selected. Each block had a total population of about 1,20,000. The expected total population of children in 6-12 years in each block was 18,000. A sample of 3.5% of the total children in the age group of 6-12 years, *i.e.,* more than 630, constituted the sample size and were studied in each block to assess the iodine deficiency.

Children in the age group of 6-12 years studying in school were included in the study because of their combined high vulnerability to disease and representativeness of this age group for the community diagnosis and easy accessibility(4). In the blocks selected for the survey, the school enrollment of primary classes was more than 70% and hence the school approach was adopted.

In each of the selected block, one school was randomly selected and about 660 children in the age group of 6-12 years who attended the primary school on the day of the survey were studied. If the sample could not be covered in one school, adjoining schools in the area were included to complete the sample of a block. In each class, children were assembled and briefed about the study objectives. All the children were clinically examined for goitre by the palpation method by the first author. Goiter size was graded according to the criteria recommended by the WHO(4). The sum of grades I and II goiter provided the total goiter prevalence in the study population.

Casual urine samples were collected from 20% (every fifth child included in the study) of subjects and analyzed for urinary iodine excretion level using the wet digestion method(5).

Autoseal polyethylene pouches were given to the school children and they were requested to bring 20 g of salt which was routinely being consumed by their family. A total of 456 salt samples were collected. A total of 35 salt samples were also collected from traders at the block and village levels in the two districts. The iodine content was estimated using the standard iodometric titration method(6).

Results

A total of 1328 school children in the age group of 6-12 years were included in the study. The total goiter prevalence in the two districts studied was 11.6% *(Table I).*

In East Cahmparan district, 12.8% children had grade I goiter and none had grade II enlargement. The total goiter prevalence (TGP) was 12.8% *(Table I).* Casual urine samples from 138 children was collected and analyzed. It was found that the percentage of children with < 2 mcg/dl, 2-4.9 mcg/dl, 5-9.9 mcg/dl and > 10 mcg/dl of urinary iodine excretion (UIE) level were 8.7, 14.5, 26.1 and 50.7, respectively. The

TABLE I–*Goiter Prevalence Among Children in East and West Champaram Districts.*

Goiter Size Code	East Champaran (n=662)		West Champaran (n=666)	
	Number	Percentage	Number	Percentage
0	577	87.2	597	89.6
1	85	12.8	69	10.4

median urinary iodine excretion was 10.0 mcg/dl *(Table II). A* total of 292 salt samples were collected and analyzed. None of the samples had a nil iodine content, and 26.7% had iodine content of less than 15 ppm *(Table III).*

In West Champaran district, 10.4% children had grade I goiter and none had grade II enlargement. The total goiter prevalence was 10.4% *(Table I).* Casual urine samples from 123 children were collected and analyzed. The percentage of children with < 2 mcg/dl, 2-4.9 mcg/dl, 5-9.9 mcg/dl and > 10 mcg/dl of urinary iodine excretion (UIE) level was 16.3, 12.2, 20.3 and 51.2, respectively. The median urinary iodine excretion of the children studies was 10.0 mcg/dl *(Table II). A* total of 164 salt samples were collected and analyzed. None of the samples had a nil iodine content: however, 34.2% had iodine content of less than 15 ppm *(Table III).*

A total of 35 salt samples were collected from the traders at block and village levels in the two districts. All traders were selling only powdered salt. None of the salt samples had a nil iodine content. Only 17% of the salt samples had iodine content of less than 15 ppm *(Table IV).*

Discussion

According to WHO-UNICEF-ICCIDD, if more than 5% of the school age children have goiter then the area should be classified as endemic for iodine deficiency(4). In the present study, the goiter prevalence in . school children was 12.8% and 10.4% in East and West Champaran district, respectively. Thus, these districts may be classified as still endemic for iodine deficiency. However, the UIE median value of 10.0 mcg/dl in both the districts indicated that no biochemical iodine deficiency existed in the children studied. The prevalence of goiter indicates the past iodine status while urinary iodine excretion level indicates the current iodine nutriture in a population.

TABLE II – Urinary Iodine Excretion Level (UIEL) in the Two Districts

Iodine deficiency status	UIEL (mcg/dl)	East Champaran (n=138)		West Champaran (n=123)	
		No.	%	No.	%
Severe	< 2	12	8.7	20	16.3
Moderate	2.0-4.9	20	14.5	15	12.2
Mild	5.0-9.9	36	26.1	25	20.3
No deficiency	≥ 10	70	50.7	63	51.2

TABLE III– *Iodine Content of Salt Samples Collected from Children*

Iodine content (ppm)	Number of salt samples East Champaran (n=292)	West Champaran (n=164)
1-14	78 (26.7)	56 (34.2)
≥ 15	214 (73.3)	108 (65.8)

Figures in parentheses denote percentages

TABLE IV– *Iodine Content of Salt Samples Collected from Traders*

Iodine content (ppm)	Number of salt samples East Champaran (n=17)	West Champaran (n=18)
1-14	1 (5.9)	5 (27.8)
≥ 15	16(94.1)	13 (72.2)

Figures in parentheses denote percentages

The findings of the present study suggested that the iodine nutriture in the subjects was in the transition phase from iodine deficient to iodine sufficient. This was also reflected in the combined picture of indicators for measuring the iodine status, TGP indicated presence of iodine deficiency while UIE levels suggesting no iodine deficiency.

The Government of Bihar has banned the sale of non-iodised salt since 1976(2). However, in the present study it was found that 27% and 34% of the subjects in East and West Champaran districts, respectively were consuming salt with less than 15 ppm iodine. It was also observed that 17% of salt samples collected from traders in the two districts had less than 15 ppm of iodine. This finding revealed that although the salt was being iodised; either an inadequate quantity of iodine was added to it at the production level or there were losses of iodine at the different points of distribution. Similar findings have been reported in earlier studies from Himachal Pradesh and National Capital Territory of Delhi (7-10). In the present study, the TGP of 11.6% was possibly due to continued consumption of salt with inadequate quantity of iodine.

The possible reason of reduction of TGP from 50-60% to 10-12% was due to supply of salt to Bihar by railway which transported only iodised salt from production centers in Gujarat and Rajasthan(2). At the production center iodine content of salt is vigilantly monitored by the functionaries of salt department before it is loaded to railway rakes for transportation. The study revealed the need for strengthening the existing system of monitoring of quality of salt being provided in the East and West Champaran districts by Government of Bihar to eliminate iodine deficiency from the area. An inbuilt system to monitor quality of salt can be established in the ICDS network. This could help in strengthening of universal salt iodisation programme activities.

Acknowledgements

The present research study was conducted as a part of implementation of GOI-UNICEF project to eliminate IDD in Bihar. Authors would like to thank State Programme Officer IDD, Bihar, Dr. Sheila Vir, Project Officer, UNICEF, India Country Office and Mr. P.V.S. Narayanan, Project Officer, UNICEF State Office, Bihar for their help extended during the different stages of the survey. We would also like to thank school principals, teachers and students for their kind co-operation in the data collection.

REFERENCES

1. Universal Salt Iodisation (USI)-India. Progress and Current Status. Salt Department, Ministry of Industry, Government of India Press, Jaipur, August 1996; pp 39-44.
2. Banning the Sale of Edible Non-iodised Salt-An Urgent Measure. The Salt Department, Ministry of Industry, Government of India, 1995; pp 12-17.
3. Vir S. Universal iodisation of salt: A mid decade goal. *In:* Nutrition in Children-Developing Country Concerns. Eds. Sachdev HPS, Choudhary P. New Delhi, National Update on Nutrition, 1994; pp 525-535.
4. Report of a Joint WHO/UNICEF/ ICCIDD Consultation on Indicators for Assessing IDD and their Control Programmes. Geneva, World Health Organization, 1993; pp 14-18.
5. Dunn JT, Crutchfield HE, Gutekunst R, Dunn D. Methods for Measuring Iodine in Urine. A Joint Publication of WHO/ UNICEF/ICCIDD 1993; pp 18-23.
6. Karmarkar MG, Pandav CS, Krishnamachari KAVR. Principle and

Procedure for Iodine Estimation. A Laboratory Manual. New Delhi, Indian Council of Medical Research, 1986; pp 1-17.

7. Kapil U, Nayar D. Supply of Iodised salt and its iodine content in Himachal Pradesh, India. Hlth Popn Persp Iss 1994; 17:137-144.

8. Kapil U, Sohal KS, Nayar D. Process of Implementation of National Iodine Deficiency Disorders Control Programme activities in Himachal Pradesh, India. Indian J Public Health 1995; 39:172-175

9. Kapil U. Distribution and Management of Iodised salt in Himachal Pradesh, IDD Newsletter 1995,11:47-51.

10. Kapil U, Bhasin SK, Shah AD, Nayar D. The iodine content of salt in 1311 households in the National Capital Territory of Delhi, India. Aust J Nutr Diet 1996; 53: 72-75.