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Assessment of Iodine Deficiency Disorders in School Age Children in Jodhpur dictrict of Rajasthan

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ABSTRACT In the present paper magnitude of Iodine deficiency disorders(IDD), total goiter rate, nutritional deficiencies and their association with related factors have been studied. The sample of 105 school children (12-15 years) of Jodhpur district were assessed by clinical examination of thyroid gland using the standard method as recommended by the joint WHO / UNICEF / ICCIDD consultation, morbidities, Iodine in urine and salt using standard laboratory technique. Total goiter rate was 11.4 %, all of them had grade I goiter. The goiter prevalence in male and female was found to be 7.4 % and 15.7% respectively. The median urinary iodine excretion was 166.2 µg/l. Proportion of the children in severe grade (<20 µg/l) was 5.0 %. Overall high proportion of school children (81.5%) consumed salt having inadequate iodine content and proportion was significantly higher in females than males (P<0.05).The proportion of households consuming adequate iodized salt increased with decline of income. The proportion of households consuming adequate iodized salt increased with increase of housing conditions grades, found statistically significant. Sickness at the time of survey was 16.2 % and the overall morbidities observed were significantly higher in females (19.6 %) than males (P<0.05). Total goiter rate was high and only 18.5 percent of salt had adequate iodine content indicating that the consumption of iodized salt in desert area is extremely low in spite of the national programs in operation and needs more attention. In addition to iodization of salt, there is a strong need of formulating nutritional intervention packages for this region.

INTRODUCTION

Micronutrient malnutrition is one of the burning problems in developing countries, out of which those of major public health significance are deficiency of one or more of the three micronutrients iron, iodine and vitamin A. Iodine deficiency disorders refer to all of the ill-effects of iodine deficiency in a population that can be prevented by ensuring that the population has an adequate intake of iodine. In Iodine deficiency disorders, iodine intake falls below the recommended level, the thyroid may no longer be able to synthesize sufficient amount of thyroid harmone. The resulting low level of thyroid harmones in blood (hypothyroidism) is the principal factor responsible for damage done to the developing brain and other harmful effects (Hetzel 1983). In its most extreme form, these result in cretinism, but of much greater public health importance are the more subtle degrees of brain damage and reduced cognitive capacity which affects the entire population. Iodine deficiency disorder constitutes a major nutrition deficiency disorder in India. According to WHO/NHD (2001), school aged children are a useful target group for IDD surveillance because of their combined high vulnerability, easy access, and applicability to a variety of surveillance activities.

Magnitude and extent of Iodine deficiency disorders in school age is not known for this area. Therefore, present study was carried out with the aim to study the extent of the iodine deficiency disorder through clinical and biochemical examination and the study of morbidity profile of diseases in school age children of Jodhpur district of Rajasthan.

MATERIAL AND METHODS

The great Indian desert or Thar, as it is commonly called, is spread over 2,85,680 km^2 area between 22° 30° N and 32° 50° N and from 68° 05° E to 75° 45° E. Within India, it forms a part of the country's north-west arid zone in the States of Rajasthan (69%), Gujarat (21%) and Punjab and Haryana (10%). The desert is bordered by the irrigated plains of river Indus in the west, the Aravalli hill ranges in the east, the Rann of Kutch in the south and the plains of Punjab and Haryana in the north and north-east.

The study was conducted on randomly selected 105 children in the age group12-15 years from 8 schools of Jodhpur, desert district of Rajasthan. Equal proportion of boys and girls

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and proportionate distribution of children was done in the selected school.

From each selected child, information for socio-demographic aspects was collected. Each child interviewed / examined for the nutritional deficiency signs along with morbidity survey. Iodine deficiency disorders assessed by clinical examination of thyroid gland using the standard method as recommended by the joint WHO / UNICEF / ICCIDD consultation (1992). Casual urine samples were collected for estimation of Urinary Iodine Excretion (UIE) levels to asses the Iodine nutriture status. Iodine was determined by WET digestion method using standard laboratory technique (Dunn et al. 1993). UIE level less than 100µg/l was considered as indicator of iodine deficient nutriture. Students were requested to bring the salt sample (20 gm) consumed in their families in auto seal LDPE pouches. Iodine content of salt sample was estimated using standard iodometric titration method. Salt samples having iodine content less than 15 ppm classified as with inadequate iodine.

RESULTS

Analysis of 105 school children revealed that 51.4% were males and 48.6% females. A total 57.2 % school children belongs to low income group, 20.9 to middle and 21.9% to high income group. In the low income group, 64.8 % were males and 49.0 % were females, similarly in middle income group, 24.1 % were males and 17.7 % were females and in high income group, 11.1 % were males and 33.3 % were females. The school children were also categorized in to three groups, poor, fair and good according to their housing conditions and grading was done. A total 4.8 % school children belongs to poor housing conditions, 71.4 % to fair and 23.8 % to good housing conditions.

Table 1 revealed that the total goiter rate was 11.4 %, all of them had grade I goiter. The goiter prevalence in male and female was found to be 7.4 % and 15.7% respectively. The goiter prevalence was found higher in females than males though statistically insignificant in the studied school age children. Out of 105 school children examined, 16.2 % were found sick at the time of survey. At the time of survey, 5.7 percent school children suffered from fever and gastrointestinal morbidity and 2.9 % from respiratory morbidities. The overall morbidities observed were higher in females (19.6 %) than males (13.0 %) (P<0.05).

Table 1: Distribution of school children according to goiter prevalence

Grade	*Male N=54*		*Female N=51*		*Total N=105*	
	N	%	N	%	N	%
Grade 0	50	92.6	43	84.3	93	88.6
Grade I	4	7.4	8	15.7	12	11.4
Grade II	-	-	-	-	-	-
Total	54	100.0	51	100.0	105	100.0

P>0.05

A total of 80 urine samples were analyzed for urinary iodine excretion levels as shown in Figure1. The median urinary iodine excretion was 166.2 µg/l. Proportion of the children in severe grade (< 20 µg/l) was 5.0 %. The proportion was slightly higher in females (5.2 %) than males (4.8 %). Proportion of the children below < 100 µg/l was 40.0 % which was slightly higher in females (42.9. %) than males (36.8 %). Overall percent prevalence of school children suffering from Mild IDD was 22.5 % and Moderate IDD was 12.5 percent.

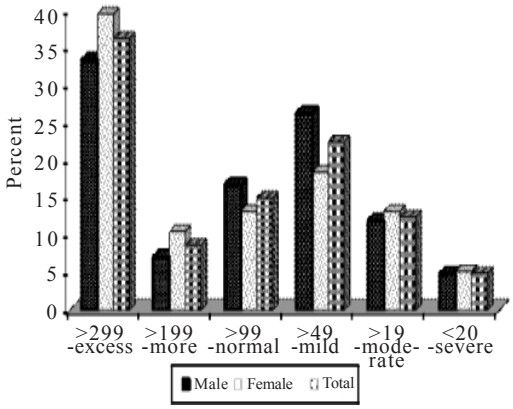

Fig. 1. Distribution of urinary lodine values in school age children

Overall proportion of the children deficient in urinary iodine excretion levels were increasing with decline of income group i.e. 43.7 percent in MIG group and 37.4 percent in HIG group though statistically insignificant. Overall proportion of the children deficient in urinary iodine excretion levels were increasing with decline of housing conditions i.e. 40.0 percent in poor housing conditions and 33.4 percent in good housing per conditions grades.

A total of 92 salt samples were analyzed using the standard idometric titration method (Table 2). The proportion of households consuming

Table 2: Distribution of school age children according to iodine content in salt consumed at their home

Iodine content in salt| → *N = 92* ↓	*Normal > = 15 ppm*		*Mild 7 – < 15 ppm*		*Moderate 5 – < 7 ppm*		*Severe < 5 ppm*	
	N	*%*	*N*	*%*	*N*	*%*	*N*	*%*
Male * N=45	6	13.3	9	20.0	7	15.6	23	51.1
Female N=47	11	23.4	12	25.5	7	14.9	17	36.2
Total N=92	17	18.5	21	22.8	14	15.2	40	43.5

χ^2 $M_{vs}F$ = 2.35* P<0.05

adequate iodized salt (salt with iodine level of at least 15 parts per million- 15 milligrams of iodine kilogram of common salt) was only 18.5% and proportion was significantly higher in females than males (P<0.05). Overall high proportion of school children (81.5%) consumed salt having inadequate iodine content. The school children were distributed in to four categories Normal (>=15 ppm), Mild (7 - <15 ppm), Moderate (5- <7 ppm) and Severe (< 5 ppm). Overall 43.5 percent school children were in the severe category i.e. almost consuming no iodine through edible salt.

Table 3 revealed that the proportion of households consuming adequate iodized salt (salt with iodine level of at least 15 parts per million- 15 milligrams of iodine per kilogram of common salt) was increasing with decline of income i.e. 15.7 percent in LIG group and 22.7 percent in HIG group though statistically insignificant. Table 4 revealed that the proportion of households consuming adequate iodized was increasing with increase of housing conditions grades i.e. 16.9 percent in fair housing conditions and 25.0 percent in good housing conditions and found statistically significant.

DISCUSSION

The World health Organization (WHO), United Nations Children's Fund (UNICEF), International Council for control of Iodine Deficiency Disorder (ICCIDD), and the Micronutrient Initiative (MI), People against Micronutrient Malnutrition (PAMM) are the international agencies involved in IDD elimination programs all over the world. These bodies have published several guidelines for tracking the progress in this direction. The indicators have been categorized in into process indicators and outcome indicators (Karmarkar and Pandav 1999). Process indicators include iodine content of salt at the consumer and production level and outcome

Table 3: Distribution of school children according to income and iodine content in salt consumed at their home

Iodine content in salt| → *Income (N=92) = 92* ↓		*Normal > = 15 ppm*		*Mild 7 – < 15 ppm*		*Moderate 5 – < 7 ppm*		*Severe < 5 ppm*	
		N	*%*	*N*	*%*	*N*	*%*	*N*	*%*
Low Income Group	N=51	8	15.7	10	19.6	8	15.7	25	49.0
Middle Incoome Group	N=19	4	21.0	5	26.3	1	5.3	9	47.4
High Income Group	N=22	5	22.7	6	27.3	5	22.7	6	27.3
Total	N=92	17	18.5	21	22.8	14	15.2	40	43.5

P>0.05

Table 4: Distribution of school children according to housing condition and iodine content in salt consumed at their home

Iodine content in salt| → *Housing condition (N=92)*↓		*Normal >=15ppm*		*Mild 7–<15ppm*		*Moderate 5–<7 ppm*		*Severe < 5 ppm*	
		N	*%*	*N*	*%*	*N*	*%*	*N*	*%*
1. Poor*	N=3	0	0.0	2	66.7	0	0.0	1	33.3
2. Fair	N=65	11	16.9	13	20.0	10	15.4	31	47.7
3. Good	N=24	6	25.0	6	25.0	4	16.7	8	33.3
Total	N=92	17	18.5	21	22.8	14	15.2	40	43.5

χ^2 $1_{vs}2_{vs}3$ = 5.45 * P<0.05

indicator include goiter grading and urinary iodine excretion (Biochemical).

In the present studied children, total goiter rate was 11.4 % which was significantly higher in females than males. It is lower than other studies at international level i.e in Nepal 1998 (40.0 %), Bhutan area (14.0 %) (Karmarkar and Pandav 1999), and at national level i.e. Delhi (20.5 %) (Pandav et al. 1997), Kerala 2001 (16.6 %) whereas higher than study in Rajasthan (2004) i.e. 3.3 percent and ICMR (2001 and 2004) (9.86 %).

Another outcome indicator is urinary iodine excretion (UIE) level. In the studied group, median urinary iodine excretion value observed was 166.2 µg/l which was lower than Delhi study by Pandav et al 1997, (198.0 µg/l), Nepal study 1998 (230.0 µg/l) but higher than other studies in Rajasthan 2004 (138.7 µg/l), ICMR (2001) (118.0 µg/l), and DMRC study by Singh et al (2009) in Jodhpur district in control group women. Proportion of the children below < 50 µg/l was 17.5 % and the proportion below < 100 µg/l was 40.0 % which was higher than other study in Rajasthan (2004), in which proportion of children below <= 50 mcg / L were 16.9 % and proportion of children below <= 100 mcg / L were 36.9 % in school age children.

Overall high proportion of school children (81.5 %) consumed salt having inadequate iodine content i.e. less then 15 ppm. In the present study, consumption of Normal Iodized Salt was very low (18.5 %) in comparison to other studies i.e. NIN (MND) 2003 (30.7 %), NFHS II (1998) (46.0 %), ICMR (2001) (55.5 %), Singh et al. (2009) (19.6 %) and Kapil et al. (1997 and 1999) leading to mild to moderate iodine deficiency disorder high among males than females. Income showed negative association with consumption of normal iodized salt i.e. it was observed to be more in low income family. To overcome the problem of IDD, the Government of India started intervention programs in the last decade, including National Iodine Deficiency Disorder Control Program and Universal Salt Iodization (USI). USI involves the iodization of all human and live stock salt, including salt used in food industry. Adequate iodization of all salt will deliver iodine in the required quantities to the population on a continuous and self-sustaining basis. During the present study, it was found only 18.5 percent of salt had adequate iodine content. This indicates that the consumption of iodized salt in desert area is extremely low in spite of the national programs in operation and needs more attention.

Children of desert area have to face the harsh conditions of the desert i.e. frequent occurrence of drought, low rainfall and high temperature, which affect the economy, which in turn affects agriculture leading to poor food intake of the inhabitants (Singh et al.2002 , 2006). In addition to iodization of salt, there is a strong need of formulating nutritional intervention packages for this region by introducing the adequacy i.e. bio-availabilty of iron, Iodine and vitamin A etc., in the usual local diets which can be improved by altering meal pattern to favour enhancers or lower inhibitors.

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