

## Iodine Deficiency Disorders in 6-12 Years - Old Rural Primary School Children in Kutch District, Gujarat

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**Objective:** To compare prevalence of goitre in primary school children; to determine median urinary iodine concentration in children; and, to assess level of salt iodization at retail trader level.

**Design:** 30 cluster survey study.

**Settings:** Primary schools of Kutch district, Gujarat, India.

**Methods:** Total 70 students including five boys and five girls from 1st to 7th standard, present in class on the day of visit were selected randomly for Goitre examination ( $n=2100$ ). Urine sample was collected from one boy and one girl from each standard in each cluster. From the community, 28 children, including two boys and two girls from each standard in the same age group were examined, and salt samples were tested from their

households. From each village, one retail shop was visited and various salts available were purchased and tested for iodine on the spot with spot kit.

**Results:** Goitre prevalence of 11.2% was found among primary school children (grade 1- 8.6% and grade 2- 2.6%). As the age increased, the Goitre prevalence also increased except in age group of 8 years. Median urinary iodine excretion level was 110  $\mu\text{g/L}$ . Iodine level more than 15 ppm was found in 92.3% salts samples tested at the household level.

**Conclusion:** Present study showed mild goitre prevalence in primary school children in Kutch district of Gujarat

**Key words:** Goitre survey, India, Iodine deficiency disorder, Prevalence, School children.

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Iodine Deficiency Disorders (IDD) refers to a complex clinical and subclinical disorder caused for the lack of adequate dietary intake of iodine [1]. Out of 587 districts in India, 282 have been surveyed for IDD and 241 were found goitre endemic [2]. Several studies conducted all over India have shown high prevalence of goitre [3-5]. After implementation of National Iodine Deficiency Disorders Control Programme (NIDDCP) in the year 1992, India has made considerable progress towards IDD elimination. Recently, less than 5 % total goitre rate was found in 9 out of 15 districts studied in 11 states by the Indian Council of Medical Research (ICMR) [6].

In February 2009, Government of Gujarat started

IDD re-survey in all the districts of Gujarat state. In Kutch district, first baseline IDD survey was done in 1990-91, and then re-survey was done in 1999-2000. The present goitre survey was done in Kutch district in 2009 to document the prevalence of goitre in primary school children aged 6-12 years; to determine median urinary iodine concentration in sample of children; to assess the level of iodine in salt samples at retail trader level; and to study the profile of salt sold at retail shops.

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### METHODS

The present study was done in Kutch district of Gujarat state. The main source of water is rain.

Almost all type of routine vegetables are available and consumed by the people. The district has a total populations of 15,83,225, as per 2001 census [7]. The national program was implemented in the district in 1992 after the result of baseline survey conducted in 1990, which indicated low goiter prevalence.

A cross sectional study of children aged 6-12 years age group studying in 1st to 7th standard in primary schools of rural areas (excluding urban areas) was conducted. The study included two types (a) school survey and (b) community survey. As per State Nutrition Cell guidelines, school enrollment of children in primary school was considered 70% as per the data available at state level for different districts. Five boys and five girls from each standard, present in class on the day of visit were selected randomly for examination. So total 70 students were examined from each school in selected villages. As per guidelines provided, almost 30% school children were considered absent at any given time and so, 28 students were examined from the community from each selected village. Out of 28 students examined out of schools in community, two boys and two girls from each standard in age group 6-12 years were examined. Thus, a total of 2100 students were examined in schools and 840 students were examined out of schools in the selected villages.

*Training and survey technique:* A state level training workshop was conducted by State Nutrition Cell, including various medical colleges participants for cases identification and grading of goiter. The current survey included the WHO grading system as per the revised guidelines under NIDDCP [9]. The child was examined by examiner in sitting position with neck in normal position. The following classification was used for goiter: (a) grade 0 – not visible, not palpable, (b) grade 1- palpable, but not visible, and (c) grade 2- palpable & visible, as per the WHO/UNICEF/ICCIDD guidelines [10].

*Sampling method:* Cluster sampling method was used for selection of villages. A list of villages of all talukas of Kutch district was obtained from *Zila Panchayat*, Office of District Health Office (DHO). Then cumulative population was counted by using MS Excel. By calculating cluster interval, 30

villages were selected from the list. Only rural areas were included and urban population was excluded in calculating cumulative population. The study was confined only to rural areas of Kutch district. The primary schools of these 30 selected villages were visited for school survey. When desired sample size of five boys and girls each from each standard was not achieved, primary school of nearest village was approached and desired sample size was achieved and similarly, community survey was also done.

*Urine samples:* One boy and one girl from 1st to 7th standard were selected randomly for taking urine sample. So, in each cluster 14 urine samples were collected, 7 samples from boys and 7 from girls. In 30 clusters, total 420 urine samples were collected and tested for urinary iodine excretion. Plastic bottles with screw caps were used to collect the urine samples, which were stored in a cool dry place and sent for testing to state IDD laboratory at Surat. Few drops of toluene were added to each urine sample to inhibit bacterial growth and to minimize bad odor. Ammonium per sulfate titration method was used to detect the urinary iodine excretion level.

*Salt samples:* As per the guidelines provided, 28 salt samples were tested of all the children of 6- 12 years examined for goitre during community survey at their homes in each village. A total 840 salt samples were assessed and iodine concentration was recorded as 0, less than 15, and 15 ppm and more [11]. From each village, one retail shop was visited and various salt varieties available were purchased and tested for iodine on the spot with spot kit.

Data were entered in MS Excel 2007 and analyzed by using Epi Info software, version 3.5.1.

## RESULTS

Goitre prevalence of 11.06% was found among 2940 primary school children in the present survey (8.61% grade 1 goiter, 1.2% grade 2 goiter). This goiter status indicates that it is a mild (5-19.9%) public health problem. Seven blocks had mild prevalence and two blocks had zero prevalence of goiter in the present study. Goiter prevalence increased with age, 7.8% at 6 years age and reaching upto 14.2% by 12 years age.

**TABLE I** URINARY IODINE EXCRETION LEVEL IN RURAL AREAS OF KUTCH DISTRICT

Talukas	n	Urinary iodine excretion	
		< 50 µg/L (%)	> 50 µg/L (%)
Lakhpat	14	0	14 (100)
Rapar	70	3 (4.3)	67 (95.7)
Bhachau	56	0	56 (100)
Anjar	42	2 (4.8)	40 (95.2)
Bhuj	84	11 (13.1)	73 (86.9)
Nakhatrana	70	6 (8.6)	64 (91.4)
Nalia	42	2 (4.8)	40 (95.2)
Mandvi	42	3 (7.1)	39 (92.9)
Total	420	27 (6.4)	393 (93.6)

Of the total 420 urine samples collected (**Table I**), 81.4% samples were found with urinary iodine excretion (UIE) level 100 µg/L or more, while 11% samples shown UIE between 50-99.9 µg/L, 7.1% between 20-49.9 µg/L and 2.4% below 20 µg/L. Out of 840 salt samples tested, 92.3% salt samples shown adequate iodine i.e. 15 ppm and more at retail trader levels (**Table II**). The salt packs sold at retail shops were found to be well packed, branded, powdered and having symbol of iodized salt on the pack.

## DISCUSSION

To evaluate the severity of IDD in a region, the most widely accepted marker is the prevalence of endemic goitre in school children. WHO/UNICEF/ICCIDD [12] on the basis of IDD prevalence, recommended the criteria to understand the severity of IDD as a public health problem in a region. According to these criteria, a prevalence rate of 5.0-19.9% is considered as mild; 20-29.9% as moderate and a prevalence rate of above 30% considered as a severe public health problem.

In the present study, the total goitre prevalence rate was 11.2%, indicating that IDD is a mild public health problem. Since January, 2001 in Gujarat, the ban on sale of non-iodized salt was withdrawn. With this withdrawal of ban, the availability of non-iodized salt in the market increased. In November, 2005, the Central government issued notification banning the sale of non-iodized salt for direct human consumption in the entire country [13]. A study from another district of Gujarat reported goitre prevalence of 20.5% [4] which was very high compared to the present study.

In the present study, the urinary iodine excretion level 100 µg/L and above was found in 81.4% samples. Present study indicates continued and adequate efforts of ensuring a supply of iodized salt

**TABLE II** TALUKA SPECIFIC ASSESSMENT OF IODINE IN SALT SAMPLES BY SPOT KIT AT RETAIL TRADER LEVELS IN RURAL AREA OF KUTCH DISTRICT

Talukas	No. of salt samples tested	Iodization of salt in ppm			% of salt samples adequately iodized
		0 ppm	<15 ppm	> 15 ppm	
Lakhpat	28	0	0	28	100
Rapar	140	2	2	136	97.1
Bhachau	112	3	4	105	93.8
Anjar	84	0	0	84	100
Bhuj			22	146	86.9
Nakhatrana	140		18	120	85.7
Nalia	84	1	4	79	94.0
Mandvi	84		4	77	91.7
Total				775	92.3

**WHAT IS ALREADY KNOWN?**

- Goitre is mainly prevalent in hilly and also in plain areas of India.

**WHAT THIS STUDY ADDS?**

- More than 92% samples salt had iodine content of 15 ppm or more at beneficiary levels in Kutch, District of Gujarat.

to the population. Different median urinary iodine levels were reported by different authors indicating deficiency or no deficiency of iodine in respective populations in their areas [15-18].

WHO/UNICEF/ICCIDD recommends that 90% of retail trader levels salts should get iodized at the recommended level of 15 ppm [19], and the study shows that about 92% of retail trader levels salts have adequate level (15 ppm and more). Chandra, *et al.* [5] reported more than 95% of population consuming salts at adequate level, while others [20, 21] reported only 50% of community consuming salts at adequate level. These results suggest that there is still need to strengthen the system of monitoring quality of salt to ensure availability of 15 ppm of iodine at retail trader levels.

In the present study, 100% branded packed salt samples claiming iodization shown 30 ppm or more iodine level sold at retail shops (consumer level). Mishra S, *et al.* [4] reported 39% such salt samples having less than 30 ppm iodine level at retail shops, which indicates higher availability of iodine in iodized salts in the present study.

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