ORIGINAL ARTICLE

# The Status of Iodine Deficiency n Mehrauli area of South Delhi

Bini Dua[1], Tapas Kumar Ray[2], Balraj Dhiman[3]

[1]Resident, [2,3]Professor, Department of Community Medicine, LHMC, Delhi

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## Corresponding Author

Address for Correspondence: Tapas Kumar Ray, Department of Community Medicine, LHMC, Delhi,
E Mail ID: tapasr60@hotmail.com

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## Abstract

**Background:** Iodine deficiency disorders (IDDs) are important public health problem affecting almost the entire country. It means not only goiter but all related disorders of physical growth and brain development. The literature on the magnitude of Iodine deficiency among children in Delhi is limited. Present community based study was conducted to obtain better knowledge on Iodine deficiency in Delhi. **Objective:** To find out the prevalence of goiter and iodine level in urine and household salt among children of 6-12 years in Mehrauli area of Delhi. **Methodology:** Both boys and girls of age 6-12 years were selected from all the eight existing wards of Mehrauli, Delhi. A total of 1456 children were examined for goiter .Urine samples for estimating iodine excretion level were collected from 146 children and 292 household salt samples were collected for estimating iodine level in salt. The study subjects were spread over 1016 households. **Results:** In the study, total goiter rate (TGR) was found to be 1.7% (n=25) which is below the level of WHO defined public health problem. Median urinary iodine excretion level was found to be 248.5µg/l in overall 146 urinary samples ruling out iodine deficiency in the area. Excess iodine (above acceptable levels i.e. >200µg/l) was found to be present in 91 samples (62.3%). However iodine content was found to be adequate in 271 (93%) salt samples. Mean iodine content in salt was found to be 35.7±11.1 ppm. **Discussion and conclusion**: The urinary and salt iodine content in the study area are above the recommended cut off suggested by WHO/ICCIDD/UNICEF for defining of iodine deficiency disorders. Thus iodine deficiency is no longer a public health problem in the study area. However there is a need for periodic monitoring of salt samples as about 7% of households still consumed salt of below 15 ppm of iodine. Community based awareness campaign may be an effective strategy to motivate more people for consuming iodised salt and knowing about the dangers of iodine deficiency .

## Key Words

Iodine deficiency; goiter; iodized salt; urinary iodine

## Introduction

Iodine deficiency disorders (IDDs) is single most common cause of preventable mental retardation and brain damage in the world today.(1) Deficiency of iodine in body results in hypothyroidism which manifests usually in the form of goiter. Thyroid hormones are vital for growth and development in humans, the production of which decreases in hypothyroidism. Unfortunately iodine deficiency disorders have been widely prevalent across the world affecting 50 million children and giving birth to 1, 00,000 cretins every year.(2)

Traditionally India has been one of the most affected goiter endemic countries. But over the past few decades considerable efforts have been made to universalize the iodized salt which has significantly brought down the burden of goiter and other IDDs in the country. But still IDDs is a major nutritional deficiency disorder in the country. The surveys carried out by the Central and State Health Directorates, Indian Council of Medical Research

(ICMR) and Medical Institutes have clearly demonstrated that not even single State/ Union territory is free from the problem of Iodine deficiency. Sample surveys conducted in 28 states and 7 Union Territories in recent years have shown that 263 districts were endemic for IDDs with more than 10% goiter prevalence.2Of all children who are born mentally retarded, 19% are due to IDDs in India. It is estimated that 200 million people are at risk for IDDs in India and out of them around 71 million are suffering from goiter and other IDDs.(3)

Despite considerable improvement in consumption of iodized salt as a result of universal ban on sale of non-iodized salt in India, its underutilization still exists particularly in disadvantaged group. Unfortunately monitoring systems for salt quality as well as urinary iodine are not adequate enough in India.(3)

The population in Delhi belongs to different socioeconomic and cultural background. In addition large proportions of its habitants are migratory from various parts of country. The wide sociocultural differences are likely to play an important role in consumption of various types of salts.

## Aims & Objectives

Keeping all these factors in mind the present community based study was conducted among Delhi children to assess the status of IDDs in the area.

## Material and Methods

The study was carried out at Mehrauli area of South Delhi district with the objective to find out the goiter prevalence and level of iodine in urine and household salt. Mehrauli area was selected for study as families in the area are usually migratory and belong to different socioeconomic strata and religion, which may influence usage of various types of salt. The study population comprised of children between 6-12 years of age. Mehrauli consists of eight wards inhabited by people of various religion and socioeconomic background. There were 19,000 children both boys and girls of 6-12 years spread over 31000 households in Mehrauli. A sample of 1454 children was taken for the study based on 6.2% goiter prevalence, 95% confidence interval and 20% allowable error. The study subjects were covered from all existing wards according to proportion of population of each ward. Considering each household to have at least one eligible child, the households were selected by systematic random sampling method. In case no eligible child was found from any selected house the next house was chosen. If there were more than one eligible child in a household all were studied. If an eligible child enlisted was not found at the time of survey in the house, at least three subsequent visits were made before excluding him or her from the study. The parents / guardian were explained the purpose of the study and informed consent was taken. Only those who agreed to participate were included. In our study a total of 1016 parents /guardian were interviewed. The response rate in the study was 100%.

A semi structured interview schedule was designed for collection of information. The interview schedule was made in local language and pretested before applying in the community. Data was collected on general information of the subjects, demographic and socio economic profile of parents, salt consumption pattern of the family and other relevant aspects. Study subjects were surveyed as per the guidelines for surveying IDDs recommended by Ministry of Health and Family Welfare, Government of India.3 According to the guidelines study subjects were surveyed in 3 stages. In the first stage all children were examined for the presence of goiter by standard palpation method. The joint WHO/UNICEF/ICCIDD recommended criteria were used for grading the goiter. Assessment of iodine content of household salt was done in stage 2. Iodine level in salt was measured by titration method. Twenty gram of salt samples were collected from every fifth surveyed child's family (n=292).Finally 3rd stage involved collection of urine samples from every alternate child of whom salt samples were collected. The spot urine samples of selected children were collected in screw capped wide mouth plastic bottles. Urine and salt samples were transported to the Indian Council of Medical Research (ICMR) laboratory on the same day of collection. This laboratory is NABL (National Accreditation Board for Testing and Calibration Laboratories) accredited and its external quality assurance is certified by CDC Atlanta, USA. The Sandell-Kolthoff titration method was used for analysis of urine and salt samples. The method is based on iodide's role as a catalyst that reduces ceric ammonium sulfate (yellow colour) to the cerous form (colorless) in the presence of arsenious acid.

## Results

A total of 1456 children aged 6-12 years were surveyed. Out of the total 1456 subjects enrolled in study 726 (49.9%) were male and 730 (50.1%) were females. Mean age among the study subjects was found to be 9 years (SD ± 2.0). Mean age among the male and female children was found to be 9.01 and 8.99 years respectively. The total goiter prevalence rate was 1.7% (n=25). All the goiters were of Grade1 and almost equally distributed through all the age groups. (Table 1).

A total of 292 salt samples were collected for assessment of iodine level by titration method. Iodine content was found adequate in 271 (93%) samples. Mean iodine content was found to be 35.7±11.1 ppm. In 21 samples (7.2%) the iodine level was inadequate which also included 10 samples (3.4%) with nil iodine (Table 2). Mean iodine content was found to be 35.7±11.1 ppm. Out of 146 urine samples collected 84.9% (124/146) had no iodine deficiency. Severe (<20µg/l), moderate (20-49.9 µg/l) and mild iodine deficiency (50-99.9 µg/l) were seen in 1.4%, 4.1%, and 9.6% of samples respectively. Excess iodine (above acceptable levels i.e. >200µg/l) was found to be present in 91 (62.3%) samples. The median urinary iodine excretion level was found to be 248.5µg/l in overall 146 urine samples analyzed while in male and female the median urinary iodine level was found to be 262.5µg/l and 217.5µg/l respectively.(Table 3)

A direct linear relationship was found between the adequacy of urinary iodine level (acceptable level and above) and socioeconomic status of the families. The proportion of urine samples having adequate iodine (acceptable level and above) was increased along with improvement of socioeconomic status of the families (Table 4& figure 1) and this relationship was found statistically significant (p<0.001).

## Discussion

The studies done in the field of iodine status in India are mostly school based. Though the children of any community are easily available and accessible in school setting, the community based studies have their own weightage. Therefore being community based, the present study is expected to provide more valid information in comparison to school based studies. In the present study the number of urine and salt samples collected was determined by the guidelines of Ministry of Health and Family Welfare, Government of India for surveillance of IDDs.

The TGR was lower in present study as compared to the study done by Kapil et al (4) in year 2002 in which goiter prevalence was found to be 6.2% among MCD school children in Delhi. Higher prevalence in previous study could be due to lower socioeconomic status of the subjects studying in MCD schools, who were likely to have consumed non iodized salts. Moreover, the sample size was also many times higher than the present study which might have enabled the investigator to land up with a higher prevalence. The result of present study indicates a decreasing trend in the prevalence of goiter in Delhi which might have been contributed by number of factors, the most important being the increased consumption of adequately iodized salt at the household level. Comparable results with the present study was observed in a study conducted by Khan et al (2005) (5) from Amreli, Gujarat in which goiter prevalence was found to be 2.65%. The decreasing trend in goiter prevalence in present study was further supported by the iodine level in urine. We found only 5.5% subjects deficient in urinary iodine level <50µg/l and median urinary iodine excretion level was found to be 248.5µg/l. The result were comparable with other studies conducted by Bhasin (1996) (6), Kapil (2002) (4) and Agrawal J et al (2011) (7) which also revealed that Delhi was not an iodine deficient area. The proportion of samples having low urinary iodine level below acceptable limit (<100µg/l, mild deficiency) in present and other Delhi based studies were also found to be similar.

Majority of children in the present study showed high level of iodine (above the acceptable limit) in urine (Table 3). Children with high level of urinary iodine may be at an increased risk of adverse health consequences in the form of iodine induced hyperthyroidism according to some literature8but further studies are needed to be carried out to understand if there are really any harmful consequences due to excess iodine in body.

As per WHO / UNICEF / ICCIDD recommendation 2 more than 90% of households in any community should have > 15ppm iodine in edible salt, to be accredited as iodine deficiency free status. According to this guideline Mehrauli, Delhi is not an iodine deficient area as 93% of households were found to have iodine level>15 ppm in edible salt in present study. (Table 2).

The salt iodine level is in accordance to the findings observed in urinary iodine levels too. The salt iodine

level in present study indicate a considerable improvement in iodine status over a period of a decade, as evident from a study by Bhasin in the year 19969,where only 17 % households were found to have iodine content >15 ppm. The huge discrepancies could be due to difference in study settings ranging from East Delhi slums (Bhasin) (9) to the heterogeneous community of Mehrauli in present study. Also, universalization of iodized salt was not strictly advocated before late 1990s. Apart from these differences, it also cannot be denied that there has been an improvement in the salt consumption patterns in Delhi over the period of time as supported by a recent study done by Aggarwal et al (2011) (7) which revealed that a little less than 90% (i.e. present study area (Table 5). However periodic monitoring of iodine level and community based awareness campaigning must be carried out regularly as there were families still consuming low and or non-iodized salt.88% )of the households were consuming adequately iodized salt. It is evident from the result of the present study that significant progress has been made in the field of iodine deficiency disorders in Delhi. The iodine status indicators show no deficiency in iodine level in the
It is evident from the result of the present study that significant progress has been made in the field of iodine deficiency disorders in Delhi.

## Conclusion

The iodine status indicators show no deficiency in iodine level Mehrauli area, South Delhi.

## Recommendation

Periodic monitoring of iodine level and community based awareness campaigning must be carried out regularly as there were families still consuming iodine deficient or non-iodized salt.

## Authors Contribution

All authors have contribute equally.

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## Tables

**TABLE 1 DISTRIBUTION OF GOITER ACCORDING TO AGE OF CHILDREN**

| Age in completed years | Number of children examined | Grades of goiter | | |
|---|---|---|---|---|
| | | I (%) | II (%) | Total Goiter Rate (TGR) |
| **6** | 209 | 3 (12) | - | 1.4 |
| **7** | 206 | 3 (12) | - | 1.5 |
| **8** | 209 | 4 (16) | - | 1.9 |
| **9** | 208 | 3 (12) | - | 1.4 |
| **10** | 207 | 4 (16) | - | 1.9 |
| **11** | 208 | 4 (16) | - | 1.9 |
| **12** | 209 | 4 (16) | - | 1.9 |
| **Total** | 1456 | 25 (100) | - | 1.7 |

**TABLE 2 IODINE CONTENT OF EDIBLE SALT AT HOUSEHOLD LEVEL**

| Iodine content (ppm) | No of house holds | Percentage |
|---|---|---|
| **0** | 10 | 3.4 |
| **0.1 14.9** | 11 | 3.8 |
| **15 - 29.9** | 29 | 9.9 |
| **30 & above** | 242 | 82.9 |
| **Total** | 292 | 100 |

**TABLE 3 DISTRIBUTION OF CHILDREN ACCORDING TO URINARY IODINE LEVEL**

| Urinary iodine level (µg/l) | Number of study subjects | | Total (%) |
|---|---|---|---|
| | Male (%) | Female (%) | |
| **<20 (severe deficiency)** | 1 (1.4) | 1(1.4) | 2(1.4) |
| **20-49.9 (moderate deficiency)** | 3(4.1) | 3(4.2) | 6(4.1) |
| **50-99.9 (mild deficiency)** | 8(10.7) | 6(8.3) | 14(9.6) |
| **100-199.9 (acceptable)** | 15(20.3) | 18(25.0) | 33(22.6) |
| **≥200 (above acceptable)** | 47(63.5) | 44(61.1) | 91(62.3) |
| **Total** | 74(100) | 72(100) | 146(100) |
| **Median (µg/l)** | 262.5 | 217.5 | 248.5 |

**TABLE 4 URINARY IODINE LEVEL OF CHILDREN ON THE BASIS OF SOCIOECONOMIC STATUS OF FAMILIES**

| Socioeconomic status | Urinary iodine excretion levels(µg/l) | | Total(%) |
|---|---|---|---|
| | Below acceptable level <100 | Acceptable level or above >100 | |
| | No (%) | No (%) | |
| **Upper and upper middle** | 5(22.7) | 71(57.3) | 76(52.1) |
| **Lower middle** | 4(18.2) | 30(24.2) | 34(23.3) |
| **Upper lower and lower** | 13(59.1) | 23(18.5) | 36(24.6) |
| **Total** | 22(100) | 124(100) | 146(100) |
| | *χ2=17.02* *df =2* *p<0.001* | | |

**TABLE 5 THE OVERALL IODINE ASSESSMENT STATUS INDICATORS IN MEHRAULI, DELHI**

| Indicators | Present study value | Recommended value |
|---|---|---|
| **Total goitre rate** | 1.72% | <5% |
| **Median Urinary iodine excretion levels (µg/l)** | 248.5 | ≥100 |
| **Proportion of urine samples having iodine excretion levels<100µg/l** | 9.6% | <50% |
| **Proportion of urine samples having iodine excretion levels <50µg/l** | 5.5% | <20% |
| **Proportion of households using adequate iodine content(>15 ppm)** | 92.8% | >90% |

## Figures

**FIGURE 1 URINARY IODINE LEVEL OF CHILDREN ON THE BASIS OF SOCIOECONOMIC STATUS OF FAMILIES**