

Research Article

Assessment of Iodine in Salt Samples from North Delhi Schools

Anshu Sharma¹, KL Ramesh², Rinku Sharma³, Navin Verma⁴, Robin Marwal⁵,
Atindra Kumar Pandey⁶, Radhakrishnan VS⁷

¹Additional Director and Head, Biochemistry & Non-Communicable Diseases (NCD) Division.

²Advisor, Biochemistry Division, ³Deputy Director, NCD Division, ⁴Assistant Director, NCD Division, ^{5,6,7}Assistant Director, Biochemistry Division, National Center for Disease Control (NCDC), Delhi, India.

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Corresponding Author:

Navin Verma, NCD Division, National Center for Disease Control (NCDC), Delhi, India.

E-mail Id:

drnavinverma@rediffmail.com

Orcid Id:

<https://orcid.org/0000-0002-8356-1318>

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A B S T R A C T

Iodine is an essential micronutrient required for normal thyroid function, growth, and development. Iodine deficiency can lead to a variety of health and developmental consequences known as Iodine Deficiency Disorders (IDDs). Realizing the magnitude of the problem and to ensure its prevention by 100% consumption of adequately iodized salt (≥ 15 ppm), National Iodine Deficiency Disorders Control Programme (NIDDCP) is being implemented in India. However, periodic assessment of the salt used is needed to ensure the same. Hence, with the objective of assessment of iodine, household salt samples were collected from students of four schools in North Delhi in October 2019. Awareness programme was also planned among the school children in view of Global Iodine Deficiency Disorders Prevention Day. The iodine content of the salt was estimated by standard iodometric titration method. 10 (10.4 %) salt samples were found to have iodine content < 15 ppm. Reasons for low iodine content in the 10 samples need to be assessed along with the information regarding the type of salt used. Measures need to be taken to ensure 100 % consumption of adequately iodized salt (≥ 15 ppm). Also, such periodic assessment should be undertaken to find out the situation in different schools.

Keywords: IDD, Iodized Salt, Delhi

Introduction

Iodine is an essential micronutrient required for normal thyroid function, growth and development. Iodine deficiency can lead to a variety of health and developmental consequences known as IDD. Iodine deficiency is a major cause of preventable mental retardation. Iodine deficiency is especially damaging during pregnancy and in early childhood. In their most severe forms, IDD can lead to

cretinism, stillbirth and miscarriage; even mild deficiency can cause a significant loss of learning ability.¹

Magnitude of IDD

IDDs are a worldwide major public health problem. More than 1.5 billion people all over the world are at risk of IDD. In India, it is estimated that more than 200 million people are at risk of IDD and 71 million persons are suffering from goitre and other IDD. However, all these disorders can be

easily prevented before they occur. The simplest method to prevent the broad spectrum of IDD is to consume iodized salt daily.¹

Realizing the magnitude of the problem the Government of India launched a 100 per cent centrally assisted National Goitre Control Programme (NGCP) in 1962. In August, 1992 the NGCP was renamed as National Iodine Deficiency Disorders Control Programme (NIDDCP) with the inclusion of wide spectrum of IDD. The programme is being implemented in all the states/ UTs for entire population.¹

Goal of NIDDCP

- To bring the prevalence of IDD to below 5% in the country.
- To ensure 100% consumption of adequately iodized salt (15 ppm) at the household level.

To ensure the use of iodized salt, the Government of India has issued the notification banning the sale of non-iodized salt for direct human consumption in the country with effect from May, 2006 under the Prevention of Food Adulteration Act 1954.¹ Periodic assessment of the salt used is needed to ensure the same. With this background, the following study was planned in four schools in North Delhi. Children of class 6 & 7 were chosen as they form part of the age group of 6-12 years which is physiologically vulnerable for IDDs and is easily accessible.²

Objectives

- Assessment of iodine in salt samples collected from students of four schools in North Delhi.
- Create awareness among school children regarding prevention of IDDs.

Methods of Salt Iodine Testing

The overall study duration was 1 month (October 2019). Permission was taken from the Directorate of Education: School Branch, Government of National Capital Territory of Delhi for conducting the activity in view of Global Iodine Deficiency Disorders Prevention Day which is observed every year on 21st October to raise awareness of iodine deficiency and its devastating effects on brain development. Four government schools were identified in North Delhi in close proximity to the institution/ laboratory where the study was planned. For convenience and better coordination, those schools were selected, which were in close proximity to the parent organization NCDC, Delhi. 25 children of class 6/ 7 from each school were asked to get around 5 tablespoons of household salt sample each in air tight polythene bag for iodine testing. They were also asked to mention their name and locality with the sample for identification.

Method of Creating Awareness

Awareness programme among children of class 6/ 7 of the same four schools was also planned. Awareness activity

was conducted in the four schools one after the other over a period of 2 weeks according to the time slot given by the school. Awareness was brought about by imparting health education, distribution of IEC material related to IDDs, demonstration of rapid salt iodine testing kit and conducting poster making competition for the school children of class 6/ 7.

Statistical Analysis

The results of salt iodine testing were entered in MS Excel and analysis was done using the same over a period of 1 week including the graph & chart preparation.

Result

A total of 96 salt samples were collected and tested at NCDC within a period of one week. The remaining samples were of insufficient quantity. The iodine content of the salt was estimated by field test kit as well as standard iodometric titration method.^{3,4,5}

Table 1. Results of iodine in salt samples according to field test kit

| Iodine content (in ppm) | No. of salt samples (n = 96) |
|-------------------------|------------------------------|
| 0 | Nil |
| 5 | 4 |
| 15 | 13 |
| Above 30 | 79 |

As shown in Table 1, according to the field test kit, iodine content was 5 ppm in four salt samples, 15 ppm in 13 salt samples and above 30 ppm in 79 salt samples.

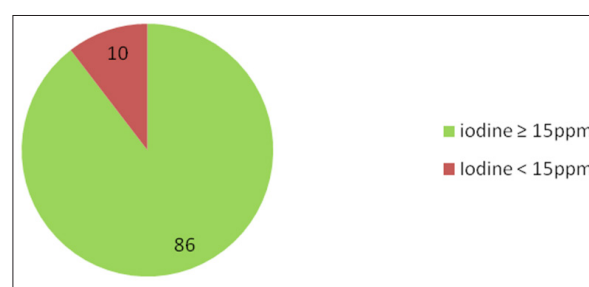


Figure 1. Iodine values of 96 salt samples

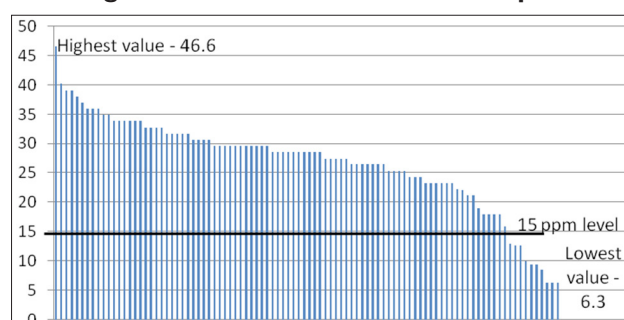


Figure 2. Proportion of salt samples based on iodine content (n=96)

As shown in Figure 1, according to the standard iodometric titration method, the salt iodine levels ranged from 6.3 ppm to 46.6 ppm. Out of the total 96 salt samples, 86 (89.6%) samples were found to have iodine ≥ 15 ppm as shown in Figure 2. The remaining 10 (10.4%) samples had iodine < 15 ppm.

A total of 257 students participated in the competition and five prizes were given in each of the four schools.

Altogether 705 students of class 6 / 7 and 30 teachers were made aware about various aspects of IDD's.

Topics Covered in Awareness Programme

- Basic information about iodine, it's functions, sources and daily requirement in diet.
- IDD's and prevention of iodine deficiency by use of iodized salt.

Discussion

According to a study in the year 2012, 87% of salt samples collected from Delhi school children had stipulated level of iodine of 15ppm and more.⁶ Another study among a slum population of North-East Delhi in the year 2008 had shown that 75.6 % households were consuming adequately iodized salt (≥ 15 ppm iodine).⁷ A multi-center study of household salt from high school students of four centers in India, published in 2011, had shown that the proportion of samples with iodine content > 15 ppm was 48.4% in Jodhpur, 80.2% in Vadodara, 91.5% in Delhi and 98.8 % in Dibrugarh.⁸

district, Uttar Pradesh, published in 2014, it was found that around 96 % of household salt samples were having iodine content ≥ 15 ppm.¹⁰ Regarding school children of Kangra district, Himachal Pradesh, a study done in the year 2012 showed that 82.3 % of families of the school children were consuming salt with iodine content ≥ 15 ppm.¹¹

In a recent study from Begusarai district of Bihar, published in 2019, 79 % household salt samples were found to be adequately iodized (> 15 ppm iodine).¹² In another study in BellurHobli in Mandya district, Karnataka, in the year 2005-06 estimation of iodine content of salt samples revealed that 90.75 % school children consumed adequately iodized salt (> 15 ppm).¹³

Findings of National family health survey-4 (NFHS, 2015-16) show that 93% of households are using iodized salt as compare to 73% in NFHS-3(2005-06).¹

Conclusion

Despite widespread availability of iodized salt and attempts to spread awareness regarding consumption of iodized salt, this study found that 89.6% salt samples had iodine content ≥ 15 ppm and remaining 10.4% had iodine content < 15 ppm. Reasons for low iodine content in the ten samples need to be assessed along with the information regarding the type of salt used. Probable reasons may be at the production/ manufacturing level or loss of iodine during improper transportation/ storage, exposure to sunlight, high temperature or humidity, long duration of storage, impurities, etc.

Table 2. Results of other similar studies in past regarding iodine in sale samples

| Year | Site | Subjects | Samples with iodine ≥ 15 ppm |
|----------------------|--|----------------------|---|
| 2005-6 ¹³ | Mandya | School children | 90.75% |
| 2005-6 ¹ | NFHS | Household samples | 73% |
| 2008 ⁷ | N-E Delhi | Slum population | 75.6% |
| 2011 ⁸ | Jodhpur, Vadodara, Delhi and Dibrugarh | High school students | 48.4%, 80.2%, 91.5% and 98.8%, respectively |
| 2012 ⁶ | Delhi | School children | 87% |
| 2012 ¹¹ | Kangra | School children | 82.3% |
| 2014 ¹⁰ | Meerut - Urban | Household samples | Around 96% |
| 2015 ⁹ | North India | Pregnant women | More than 90% |
| 2015-16 ¹ | NFHS | Household samples | 93% |
| 2019 ¹² | Begusarai | Household samples | 79% |

As seen in Table 2, other similar studies done in the past in areas of Delhi and other states have shown different results.

In a study in the year 2015, about status of iodine nutrition from Northern India, it was observed that more than 90 % of pregnant women were using adequately iodized salt (≥ 15 ppm iodine).⁹ In another study in urban area of Meerut

Recommendation

Measures need to be taken to ensure 100% consumption of adequately iodized salt (≥ 15 ppm). Also, such periodic assessment should be undertaken to find out the situation in schools in different geographical areas along with the added benefit of increasing awareness among school children.

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Ethic Approval

No biological samples were collected from any individual. Only household salt samples were collected. No personal identifiable information was included in the study. Permission was taken from the Directorate of Education: School Branch, Government of National Capital Territory of Delhi. Also, approval was taken from the Director, NCDC Delhi

Source of Financial Support: NCDC, Delhi

Conflict of Interest: None

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