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*Original Research Article*

# Estimation of Iodine Content of Edible Salt in Rural Areas of Meerut District, Uttar Pradesh

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## ABSTRACT

The aim is to verify that adequate concentrations of iodine are attained in salt, primarily at the consumer level; and if the level is inadequate there, the concentration at higher levels of the distribution system (retail level) are to be verified in order to determine the level at which excessive losses are occurring. The objective of the study was to investigate the iodine content of salt at both retail and household level in the rural areas of Meerut district. A total no of 64 (48 from household and 16 from retail) samples of salt were estimated by iodometric titration method for the iodine content. Legal requirement for iodine level in India ranges from 30 parts per million (ppm) at retail level and 15 ppm at consumption level. We found that, at retail level the range of concentration of iodine in salt samples from Khajoori, Qila, Baadla and Sona was from 9.1 to 22.6 ppm, 0.0 to 27.3 ppm, 11.4 to 29.8 ppm & 22.3 to 25.7 ppm respectively, while at house hold level it was 0.0 to 39.7 ppm, 4.2 to 36.2 ppm, 5.3 to 29.6 ppm & 11.4 to 32.2 ppm respectively.

***Key words***- Iodine Deficiency Disorder (IDD), Iodine, Iodometric Titration, Salt Iodization

## INTRODUCTION

Iodine belongs to Halogen group (group VII) of Mendeleev's periodic table of elements. It is a micronutrient and an essential component of thyroid hormones that is tri iodothyronine (T3) and tetra iodothyronine (T4). Daily requirement of iodine for normal function of thyroid gland is 150-200 micro grams (µg) in adults, 90-120µg in children and 250µg for pregnant & lactating mothers. [1] Best source of iodine are sea food (e.g. sea fish, sea salt) and cod liver oil. Small amount of iodine is present in milk, meat, vegetables, cereals and fresh water. Iodine content of fresh water is 1-50µg per liter. [2] Total body contains 25-30 mg of iodine, 80% of which is present in thyroid gland and rest in all other cells. Iodine level in blood is 5-10 micro grams per deciliter. [3]

Levels of severity of Iodine Deficiency Disorders (IDD) are high in South East Asia than anywhere else in the world. [4] IDD is major health problem in India and its neighboring countries like Nepal, Bhutan & Bangladesh. Iodine deficiency is found in significant extent in Himalayan goiter belt of India – the world's

biggest goiter belt stretching from Jammu & Kashmir (J&K) in north to Naga hills in east, affecting states of J&K, Himachal Pradesh, Uttarakhand, Uttar Pradesh, Bihar, West Bengal, Sikkim, Assam, Arunachal Pradesh, Mizoram, Meghalaya and Nagaland. [5] In the Sub Himalayan goiter belt of India alone 55 million persons are estimated to be suffering from endemic goiter with average goiter prevalence rate of about 36 percent. [6]

With severe and prolonged iodine deficiency, the effects of a deficient supply of $T_3$ and $T_4$ hormones may occur (WHO-UNICEF-ICCIDD,1994). [7] Goiter is an important consequence of iodine deficiency leading to significant morbidity from compression and altered thyroid function. IDD are not limited to goiter, but to a wider spectrum of disability including deaf mutism, mental retardation, short stature and various degree of intellectual & motor function. [6] IDD can be prevented by iodization of all edible salt. [8,9] After legislation of salt iodization of more than 30 parts per million (ppm) in 1983, goitre was still endemic and urinary iodine concentration remained low in many states of India. [10] Out of 587 districts in the country, 282 districts have been surveyed by Government of India institutions like Indian Council of Medical Research and Central Goiter Survey Teams in different States and Union Territories, for IDD and 241 districts have been found to be endemic. [11]

## MATERIAL AND METHODS

The present study was approved by the ethical committee of our institution. The study was conducted by the Department of Biochemistry in collaboration with Community Medicine of Subharti Medical College, Meerut. Salt samples were collected from villages coming under the Rural Health & Training Centres (RHTC) of the institute that is Khajoori, Qila, Baadla, and Sona of Meerut district. In each village 12 household were chosen systematically using the chief's house as the centre point. A structured questionnaire was generated which gave information on type of salt whether coarse or fine, package available, brand name, whether it was labeled iodized or not, method of salt storage. Similarly four shops were chosen randomly from each of the village for estimation of iodine in salt. A structured questionnaire was also generated which gave information on brand name of salts, their prices, whether they were labeled iodized or not and also how long it was stored in the shop.

Different companies have their salt packed in different quantities. Packets of different brand/companies were collected and stored for analysis for retail content of iodine. In case of house hold level about 10grams (2 teaspoonfuls) of salt from each house was collected and kept in a closed plastic bag in dark room till analysis was done.

An iodometric titration method [12] was used for analyzing the iodine content of salt samples. This was done in the laboratory of the department of biochemistry. A total of 10 g of salt was dissolved in distilled water and made up to 50 ml solution. 1 ml of 2 N sulphuric acid and 5 ml 10% potassium iodide was added. The liberated iodine was titrated with sodium thiosulphate solution using 1 ml of 1 % starch indicator near the end of titration. The level of thiosulphate in the burette was recorded and converted to part per million (ppm) using a conversion table recommended by Mannar and Dunn. [13]

Preparations of 0.005 M sodium thiosulphate ($Na_2S_2O_3$), 2N sulphuric acid ($H_2SO_4$), 10% potassium iodide (KI) and soluble chemical starch were performed according to the methods of Mannar and Dunn. [13]

## RESULT

After analyzing the salt samples, we found following results At retail level the range of concentration of iodine in salt samples from Khajoori, Qila, Baadla and Sona was from 9.1 to 22.6 ppm, 0.0 to 27.3 ppm, 11.4 to 29.8 ppm, 22.3 to 25.7 ppm respectively, while at house hold level it was 0.0 to 39.7 ppm, 4.2 to 36.2 ppm, and 5.3 to 29.6 ppm 11.4 to 32.2 ppm respectively (Table 1).

**Table 1 - Iodine content of edible salt (Mean ± SD) samples of RHTC (Rural Health& Training centres)**

| RHTC | Category | No of samples | Mean ± SD | Iodine content range (ppm) | Median | *SEM |
|---|---|---|---|---|---|---|
| Khajoori | Household | 12 | 19.1 ± 13.8 | 0.0 -39.7 | 16.2 | 4.0 |
| | Retail | 4 | 14.1 ± 6.06 | 9.1 -22.6 | 12.5 | 3.0 |
| Qila | Household | 12 | 18.22 ± 11.04 | 4.2 -36.2 | 20.7 | 3.1 |
| | Retail | 4 | 12.9 ± 11.6 | 0.0 -27.3 | 12.3 | 5.8 |
| Baadla | Household | 12 | 20.7 ± 7.5 | 5.3 -29.6 | 21.8 | 2.1 |
| | Retail | 4 | 20.12 ± 7.5 | 11.4 – 29.8 | 19.6 | 3.7 |
| Sona | Household | 12 | 18.4 ± 8.2 | 11.4 – 32.2 | 13.7 | 2.3 |
| | Retail | 4 | 24.5 ± 1.5 | 22.3 – 25.7 | 25.1 | 0.7 |

*SEM standard error of mean

## DISCUSSION

In India, 167 million people are at risk of iodine deficiency disorders (IDDs). Out of which 54.4 million were having goiter. About 8.8 million people were having IDD-related mental/motor disability. IDD is a problem in every state and union territory. [14]

Salt is considered as most common food source for iodine fortification due to following reasons, first salt is universally consumed by all individuals irrespective of socioeconomic status, cast, community and religion and secondly Iodine is added to salt as potassium or sodium iodide or iodate as it doesn't impart any change in taste, odor and color to the salt. [15]

Our study has shown that 96% of the households from the rural area were consuming iodized salt but all the house hold samples were not having recommended level of iodine for the consumers by WHO/UNICEF/ICCIDD. Four % household were using salt that contains no iodine while around 42% of the household samples from the rural area collected were having iodine content less than 15 ppm i.e. not incompliance with the legal requirements as laid during salt iodization program in India under National Iodine Deficiency Disorders Control Program (NIDDCP). [16] We also found that salt was not stored in closed containers in the household, so exposing it to moisture, heat & sunlight.

Kapil U et al [17] in their study found that 53% of the school going children of Meerut was consuming salt with an iodine content of less than 15 ppm.

A situational analysis was carried out in Ethiopia by United Nations Children's Fund (UNICEF) and Ministry of Health (MoH) Ethiopia. [18]

## CONCLUSION

Iodine deficiency is risk factor for mental and physical retardation, hypothyroidism, endemic goiter and childhood mortality. Goiter control program was commenced in India in 1962 based on iodized salt. At end of three decades the prevalence of disease still remains high. [19] The failure was mostly due to operational and logistic difficulties i.e. the production of iodized salt did not keep pace with requirement. It was decided as national

policy to fortify all edible salt in phased manner by the end of 8th five year plan. [20]

In our study as 42% household samples were having iodine less than 15 ppm, so they are at risk of developing IDD & around 4% households sample that contain no iodine are highly susceptible to IDD. So to prevent this there is a need to rethink for proper salt iodization by National and provincial authorities of health to inform, educate and convince both consumers and salt producers about the health benefits of adequate usage of iodized salt level as recommended by WHO/UNICEF/ICCIDD.

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