J Obstet Gynecol Ind Vol. 53, No. 6 : November/December 2003 Pg 554-557

Iodine Status of Pregnant Women Residing in an Urban Resettlement Colony of Delhi

Kant *Shashi*, Misra *Puneet*, Baridalyne *Nongkynrih*, Goswami *Anil Kumar*, Pandav *Chandrakant S*, Karmarkar *Madhu*

Centre for Community Medicine, All India Institute of Medical Sciences, New Delhi – 110 029.

OBJECTIVE – To assess the magnitude of iodine deficiency among pregnant women residing in an urban resettlement colony of Delhi. **METHODS** – A cross-sectional community based-survey was done. Pregnant women were identified through house visits. Urinary iodine was estimated by Ammonium Persulphate Digestion on Microplate method. Iodine content of salt was estimated by Field Test kit as well as by iodometric titration methods. **RESULTS** – Fifty of the 149 women (33.6%) were deficient in iodine (urinary iodine concentration less than 100 µg/L). Magnitude of the iodine deficiency was similar to a previous study reported from Delhi. Ninety five percent of the households were using adequately iodized salt. **CONCLUSION** – One-third of the pregnant women were iodine deficient. However, there is a need to repeat the study with a greater sample since a study from Mumbai had reported iodine deficiency of 94% among pregnant women.

Key Words : iodine deficiency, pregnancy, urinary iodine excretion, iodized salt

Introduction

Iodine is a constituent of thyroid hormones, which are essential for the normal growth and development of humans and animals[1]. Deficiency of iodine results in a wide spectrum of diseases collectively called iodine deficiency disorders (IDD)[2]. IDD is a public health problem in 9 out of 10 South East Asian countries[3]. The data is insufficient for the remaining one country. IDD is a public health problem in all the States and Union Territories of India[4,5].

Daily iodine requirement of a pregnant woman is 200 microgram as compared to 150 microgram in the non-pregnant state. The recommended daily allowance is enhanced during pregnancy to allow for the increased demand of the growing fetus. Iodine deficiency during pregnancy affects the development of the brain in the fetus[1]. The critical period when iodine deficiency causes brain damage is between the second trimester of the pregnancy and the first three years of life. It is well recognized that children born and staying in the iodine deficient areas have intelligent quotient (IQ) 13 points less than those living in the iodine sufficient areas[6]. Thus, the total accumulated loss to the country in terms of social and economic development is formidable.

Data on iodine status of pregnant women would be useful in deciding whether to include iodine status estimation as a part of routine antenatal checkup. Moreover, it would help in formulating informed policy guidelines regarding the usefulness of iodine supplementation during pregnancy. However, data on iodine deficiency among the pregnant women in India is limited. Therefore, we decided to estimate the iodine status of pregnant women residing in an urban resettlement colony of Delhi. The iodine content of salt being consumed at homes was also ascertained.

Methods

The study site was Ambedkar Nagar, which was a resettlement colony located in the southern part of Delhi. Study subjects were pregnant women resident of Ambedkar Nagar. House-to-house visits were made for the enrolment purpose. Women who reported that they were pregnant were eligible for enrolment. Houses that were locked at the time of visit were not revisited. Pregnant women, irrespective of the period of gestation, were included in the study. The study objective was explained to the eligible women and their informed verbal consent was sought. Women that agreed to participate in the study were administered a structured interview schedule. Twelve medical undergraduates collected the data and performed the laboratory tests. The interview schedule was pre-tested. Urine specimen was collected on the spot. Small amount of salt that was being consumed in the household was also collected. An experienced faculty member who is also one of the authors (MGK) trained the students in laboratory work. The study was conducted during June 2002. The data was analyzed using software Epi-info version 6. This study was a part of the project work carried out by the IVth semester medical undergraduate students.

Paper received on 17/10/02 ; accepted on 13/8/03

Correspondence :
Dr. Shashi Kant
Centre for Community Medicine, All India Institute of Medical Sciences, New Delhi - 110 029.

The required sample size, assuming the prevalence to be 25%, α-error 5% and a power of 80% with a permissible error of 15%, was 533. However, due to the paucity of time and logistic constraints, only 175 pregnant women could be identified. Urine samples were collected in plastic corkscrew bottles. The estimation of urinary iodine was done at the International Council for Control of Iodine Deficiency Disorders (ICCIDD) laboratory located at All India Institute of Medical Sciences, New Delhi. The procedure for iodine estimation was by Ammonium Persulphate Digestion on Microplate (APDM) method[7]. The iodine content of salt was estimated in front of the subjects using the semi-quantitative Field Test Kits (MBI Kits, Chennai, India). An aliquot of salt sample was tested for iodine at the ICCIDD laboratory by iodometric titration method[7].

Results

Of the 175 eligible women, 14 (8%) refused to participate in the study. Salt samples could be obtained from all the 161 households. However, only 149 (92.5%) pregnant women consented to give their urine samples for analysis.

Women in the age group of 20-29 years comprised 87.6% of the study subjects. Only 5.6% were in the lower age group and only 6.8% in the higher one. One-fourth of the women were illiterate. Majority of the women (79%) were either first or second gravid. Very few (8%) of them were fourth gravid or above. Almost three-quarters (71.5%) of the women had heard about iodized salt. Television was the primary source of information in 91.3% of the women.

Urinary iodine excretion is graded as normal (≥ 100 µg/L), mild deficiency (50-99 µg / L), moderate deficiency (20-49 µg/L) and severe deficiency (<20 µg/L)[8]. The median urinary iodine excretion was 139 µg/L (range 2.52-274.9 µg/L). About one-third of the women (33.6%) had urinary iodine excretion that was below the normal level (100 µg/L). A small number of the women (4.7%)had urinary iodine level that was suggestive of severe iodine deficiency (Table I).

Field Test Kit is a semi quantitative method for estimating the iodine content of salt. It is recommended for use in the field settings. Salt from 95% of the households was adequately iodized i.e., contained more than 15 part per million (ppm) of iodine at the consumer level (Table II).

The iodine content of salt samples was analyzed by titration method. The proportion of adequately iodized salt samples by this method was 91.3% (Table III).

The findings of iodine content of salt differed slightly among the two methods employed. The agreement between these two methods was calculated by using the Kappa statistic. The Kappa value was 0.93 which denotes a high degree of agreement (Table III).

Discussion

The ascertainment of pregnancy was through self-reporting by the women. Traditionally, women in our area do not disclose early pregnancy. Therefore, those who participated in the study might not be true representatives of all the pregnant women residing in the study area. However, we could not find any reason(s) that could result in systematic differences in the iodine status between early and advanced pregnant women. The number of eligible women that declined to participate in the study was small. Therefore, its impact on the overall findings of the study was expected to be minimal.

Six houses were found locked during the house visit and were excluded from the study. The data collection was done between 10 AM and 12 PM. It is possible that some of the eligible women might have left their home for the work place. However, since most of the women in our area were housewives, very few eligible women would have been missed during the house visit. Students had carried out the laboratory work. Despite the training provided to them, some inter-observer variations in laboratory findings could not be ruled out.

One-third of the pregnant women (50/149) in our study had urinary iodine levels less than normal i.e.<100 µg / L (Table II). The reported range of iodine deficient status among pregnant women in India is from 10% to 94%[8,9,10]. A study among pregnant women attending an antenatal clinic in the urban slums of Delhi in 1998 revealed that 22.9% of the women had urinary iodine less than 100 µg / L[9]. The median urinary iodine excretion was 139 µg/L. The indicator of iodine deficiency "elimination" is a median value of 100 µg/L and not more than 20% of samples should be below 50 µg/L[11]. In our study 14.8% samples had urinary iodine concentration of less than 20 µg/L (Table II). Thus from an epidemiological point of view, one could say that iodine deficiency was not a public health problem in the study population. However, on an individual level, there were many women who could experience the adverse effect of iodine deficiency during pregnancy.

The proportion of iodine deficient women in our study was slightly higher than the earlier figure reported from Delhi[9]. We could not achieve the required sample size. This resulted in a decrease in the power of the study. It is possible that the observed difference was due to inadequate sample size.

Table I : Urinary Iodine Excretion Levels

Urinary iodine concentration (µg / L)	No. (%)
≤20	7 (4.7)
20-49	15 (10.1)
50-99	28 (18.8)
100-199	42 (38.2)
≥200	57 (38.2)
Total	149 (100)

Table II : Iodine Content of Salt

Iodine content (Part per million)	By Field Test Kit No. (%)	By Titration Method No. (%)
0-7 ppm	8 (5.0)	11 (6.8%)
7-15 ppm	0 (0)	3 (1.9%)
15-30 ppm	5 (3.1)	22 (13.7%)
>30 ppm	148 (91.9)	125 (77.6%)
Total	161 (100)	161 (100)

Table III : Comparison of Iodine Content of Salt by Field Test Kit and Titration Method

Iodine content (Part per million)	Field Test Kit Method No. (%)	Titration Method No. (%)
Inadequate (<15 ppm)	8 (5%)	14 (8.7%)
Adequate (≥ 15 ppm)	153 (95(%)	147 (91.3%)
Total	161 (100%)	161 (100%)

Kappa value 0.93.

The proportion of households using inadequately iodized salt was approximately 10% (14/161 or 8.7% in titration method) in our study (Table IV). Similar figures were observed by another study done in Delhi[9]. National Family Health Survey-II had also reported that 10% of the households in Delhi used inadequately iodized salt[12]. The iodine deficient state was noticed despite the fact that the iodine content of salt was mostly adequate. Salt is not the only source of iodine. Therefore, it is possible that urinary iodine level was overall reflection of dietary habit of the pregnant women Moreover, the dietary pattern might change during pregnancy. It is expected that an adult consumes about 10gm of salt daily[13]. It is possible that women consume less than the expected amount of salt during pregnancy. The iodine content of salt at consumer level may vary between different batches of salt due to the storage and climatic conditions. Finally, since the sample size in our study was not sufficient, the differences in the observations might be due to chance.

The estimation of iodine in salt was done by two different methods. The degree of agreement between the two methods was very high. We therefore feel that the use of field test kit in field setting is appropriate.

Since one third of the pregnant women were deficient in iodine, we need to identify iodine deficient pregnant women that require iodine supplementation. Therefore, screening of pregnant women for urinary iodine excretion should be a part of routine antenatal check-up, and early iodine supplementation, whenever appropriate, should be considered. However, the study should be repeated with adequate sample size to arrive at a firm conclusion.

Acknowledgement

We acknowledge the following second year M.B.B.S. students of All India Institute of Medical sciences, New Delhi, that were involved in data collection and performing laboratory tests :

Shaon Sengupta, Shashank Chauhan, Swaraj Sathyan, Tarun Goel, Tripti Singh, Vikas Kumar Soral, Neetesh Biswas, Noufal Basheet, Gunsham Porusram, Navin Bajaj, Sonam Tashi and Imtiakum Jamir.

References

1. Kochupillai N, Pandav CS. Iodine Nutrition. Thyroxine and Brain Development. *Proceedings of International Symposium-Workshop, New Delhi, India, 1985: 1-3.*
2. Hetzel BS. S.O.S for a billion. The nature and magnitude of iodine deficiency disorders. In:

Hetzel BS, Pandav CS eds. SOS For A Billion. *Oxford University Press, Delhi 1995: 3-26.*

3. WHO/UNICEF/ICCIDD. Assessment of Iodine Deficiency Disorders and Monitoring their Elimination. *A guide for porgramme managers. 2nd Edition. WHO/NHD/01.1 2001: 19.*
4. Indian Council of Medical Research Task Force Study. Epidemiological survey of endemic goiter and cretinism. *ICMR, New Delhi, 1989: 10-17.*
5. Bleichordt N.A meta-analysis of research on iodine and its relationship to cognitive development. In: Stanbury J ed. The damaged brain of iodine deficiency; neuromotor, cognitive, behavioral, and educative aspects. *Report of the Franklin Institute Symposium, Publ Cognizant Communication Corporation, 1994. Chapter 19: 195-200.*
6. Iodine estimation in salt. In : Karmarkar MG, Pandav CS, Krishnamachari KAVR, eds. Principle and Procedure for Iodine Estimation. A Laboratory Manual. *Indian Council of Medical Research, New Delhi 1986: 3-10.*
7. WHO / UNICEF/ICCIDD. Assessment of Iodine Deficiency Disorders and Monitoring their Elimination. *A guide for programme managers. 2nd Edition. WHO/NHD/0.11 2001: 36.*
8. Dodd NS, Madan J. Iodine status in pregnancy. *Asia Pacific J Clin Nutr 1993; 2:119-123.*
9. Kapil U, Pathak P, Tandon M et al. Micronutrient deficiency disorder amongst pregnant women in three urban slum communities of Delhi. *Ind Pediatrics 1999;36:983-9.*
10. Kapil U, Saxena N, Ramachandran S et al. Iodine status of pregnant mothers residing in a district of endemic iodine deficiency in the state of Himachal Pradesh, India. *Asia Pacific J Clin Nutr 1997; 6:225-6.*
11. WHO/UNICEF/ICCIDD. Assessment of Iodine Deficiency Disorders and Monitoring their Elimination. *A guide for programme managers. 2nd Edition. WHO/NHD/01.1 2001: 59.*
12. International Institute of Population Sciences. (IIPS) and ORC Macro 2002. *National Family Health Surey (NFHS-2) India, Mumbai IIPS. 1998-1999: 159.*
13. Venkatesh Mannar MG, Dunn JT. Salt iodization for the Elimination of iodine deficiency. *ISBN 90-70785-13-7. MI/ICCIDD/ UNICEF/WHO, Netherlands. 1995: 7.*