

## Pregnancy Outcome of Iodine Deficiency: A Study on Tribal Women in Orissa

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### Abstract

Iodine Deficiency Disorders (IDD) is a major public health problem in India including Orissa. An adequate intake of iodine during pregnancy is essential for the synthesis of maternal thyroid hormones needed to support normal fetal development. This study aimed to assess the magnitude of Iodine Deficiency Disorder among Tribal women of reproductive age group along with the pregnancy outcomes. A community based cross-sectional study was carried out in Sundargarh district of Orissa, India among tribal women of reproductive age group. A total of 300 tribal women of 15 to 45 years were enrolled in the study. Cluster sampling technique was employed. Outcome measures in terms of urinary iodine estimation, household salt iodine level and pregnancy outcome were

assessed. The household survey for edible salt showed that 95.13% were using powdered salt compared to 4.87% using crystal salt. 86.34% women consumed salt with iodine >15 ppm and 13.66% women consumed salt with iodine content <15 ppm. Urinary iodine excretion found that 33.33% of women had Urinary Iodine Excretion (UIE) < 100 mcg/l and 66.66 % women had UIE > 100 mcg/l. Median Urinary Iodine Excretion for the study population was 125mcg/l. 33.33% women had UIE <100mcg / l out of which 10% of women consumed salt < 15 ppm as found out during the household survey of salt. History of still birth and abortion was found in 20.10% women out of which 11.36% women had UIE level below acceptable.

**Key Words:** India, Iodine Deficiency, Pregnancy outcome, Tribal women

### Introduction

Worldwide, Iodine Deficiency Disorder (IDD) remains a significant public health problem in 130 countries, although it has been eliminated in 61 countries (UNICEF / WHO, 2001). It is estimated that approximately 740 million people (13% of total population) are affected by goiter while 2,225 million people (38%) are at risk of IDD. Eastern Mediterranean (32% of its population), Africa (20%), Europe (15%) and Southeast Asia (12%) have high prevalence of goiter. In Asia, IDD is widespread with prevalence of total goiter rate (TGR) among school children ranging from 4% to

50%. IDD is particularly severe in India near the Himalayas, Indonesia, Myanmar, Maldives and Sri Lanka [1].

There are several manifestations of iodine deficiency now termed iodine deficiency disorders. Majority of these disorder manifests in infants and children mainly due to maternal iodine deficiency. Hearing loss, learning deficits, brain damage, and myelination disorders can occur due to fetal or perinatal hypothyroidism. Infant mortality rates have decreased 65 percent in communities where iodine deficiencies have been eliminated. Maternal iodine deficiency manifests as low thyroxin, elevated thyroid stimulating hormone (TSH), and subclinical thyroid enlargement (subclinical goiter). As pregnancy and lactation increase iodine loss, the risk for goiter continues, and even after

lactation ceases it may manifest as multinodular goiter and hyperthyroidism. Iodine deficiency in women can lead to overt hypothyroidism and consequent anovulation, infertility, gestational hypertension, spontaneous first-trimester abortion [2]. The importance of iodine as an essential micro-nutrient arises from the fact that it is a constituent of the Thyroid hormone, Thyroxin T4 and Tri-iodo Thyroxin T3 essential for normal physical and mental development in humans and animals and also for the development of the brain and maintenance of body temperature. A deficiency of thyroid hormone from any cause will lead to severe retardation of growth and maturation of almost all organ systems. Healthy adult human body contains 10 to 20 mg of iodine of which 70% to 80% is found in the Thyroid gland [3]. Iodine is rapidly absorbed through the gut. The normal intake and requirement per person is 100-150 µg/day. Excess iodine is excreted through the kidney, which correlates well with the level of intake. About 90% of iodine is excreted in urine [4].

Although IDD affects all age group but the population most affected are children 0 – 6 yrs and women of reproductive age group especially pregnant women most probably due to increased metabolic demand [5]. Iodine deficiency is a major threat to health and development the world over, particularly among preschool children and pregnant women in low-income countries [6].

It is estimated that out of 200 million people residing in goiter endemic areas, in India more than 50 million have goiter and about 9 million suffer from different degrees of mental and motor disabilities. It is also estimated that iodine deficiency accounts for 90,000 still births and neonatal deaths every year. Prevalence of goiter in these regions ranges from 1.5% (Assam) to 68.75 (Mizoram). Recent surveys suggest presence of goiter beyond the known endemic areas. An ICMR survey in 14 districts indicates that prevalence of cretinism is alarmingly high [7].

Following the National IDD control program, the state of Orissa enforced universal salt iodization, under which the entire population is to receive exclusively iodized salt.

Few studies have been carried out to assess the iodine status of tribal women, who are the socioeconomically deprived and nutritionally vulnerable sections of the society. The nutrition and health status of women is important both for the quality of their lives and for the survival and healthy development of their children. yet relatively little attention has been given on this area; further women should not be considered solely with respect to their reproductive roles as mothers, adequate nutrition is a human right for all and the nutritional benefits to women's social and economic capabilities need to be viewed as goals [8].

## Objectives

1. To estimate the magnitude of Iodine Deficiency Disorder among Tribal women of reproductive age group (15-45 years.)
2. To assess the pregnancy outcome of Iodine deficiency Disorders (i.e. abortion & stillbirth) among women of reproductive age group in tribal population.

## Material and Methods

It was a community based cross-sectional study carried out in Kuarmunda, Lepripada and Hemgir blocks of Sundargarh district of Orissa, India for the period of February 2008 to January 2010. Tribal women of reproductive age group (15-45 years) were enrolled for this observational study and outcome measures in terms of urinary iodine estimation, household salt iodine level and pregnancy outcome were assessed. Necessary permission and ethical clearance was taken from Institutional Ethical Committee & Institutional Review Board, VSS Medical College, Burla, Orissa. (2007).

Studies by Mohapatra et al [9] showed 60% moderate Iodine Deficiency prevalence in Orissa. Taking 95% confidence interval and accepting the error to be 10% of the proportion, the sample size was calculated to be 267. Assuming 10% nonresponse rate, the figure comes out to be 294.

A total of 300 women were enrolled in the study. Cluster sampling technique was employed. Out of 17 blocks in the district, those blocks with more than 50% of tribal population was taken into account and out of these blocks 3 blocks were selected by lottery method. Total number of village visited was 30; selection of the respondent within the village was done by a systematic random sampling technique, from the list of eligible names or household maps. 10 respondents from each village were selected.

During the household visit salt sample from kitchen was tested for iodization level by "Rapid salt testing kit" MBI, Chennai. Urine sample of 2-3 ml was collected in a screw tight plastic container and transported back to Bio-Chemistry laboratory of Sambalpur University for estimation of Urinary iodine excretion by Spectrophotometric method. History of abortion and still birth was enquired from the respective married respondents and other corresponding relevant household data were recorded by a pre-designed and pre-tested proforma.

**Table 1: Epidemiological criteria for assessing the severity of IDD based on median urinary iodine level. (WHO criteria) [4].**

| Median UI value µgm / litre. | Severity of IDD |
|------------------------------|-----------------|
| <20                          | Severe IDD.     |
| 20-49                        | Moderate IDD.   |
| 50-99                        | Mild IDD.       |
| >99                          | No Deficiency.  |

Collected data were checked for their completeness and correctness before analysis. Microsoft Excel was used for analysis. Chi-square test was applied for association and  $p \leq 0.05$  was taken as statistically significant for interpretation of the findings.

## Results

Total of 300 women were studied between the age of 15 -45 years. 158 (56.27%) women were in the age group of 35-45 years, 85 (28.33%) women belonged to 25-35 years and 57 (19%) women were in 15-25 years. The mean age was found to be 36.33 years with a SD of 0.89, 95% CI (31.58 - 35.14).

The education statuses of these tribal women were found to be low in constraints of low economic conditions. 142 (47.33%) women were educated till primary and secondary level, 12% were just literate while 40.34% were illiterate. Only 1 (0.33%) was educated above college level. 55.34% women were multipara bearing three or more children, 17.66% were primipara, 15% were second para and 12% were nulipara or unmarried. 20.08% women had history of still birth or abortion.

As the tribal diet comprised of locally available fruits, vegetables, cereals, milk, poultry and meat, 243 (81%) women were having mixed diet while 57 (19%) women were vegetarians. The household survey for edible salt showed that out of 266 households 95.13% were using powdered salt compared to 4.87% using crystal salt. 86.34% women consumed salt with iodine >15 ppm and 13.66% women consumed salt with iodine content <15 ppm.

Urinary iodine excretion determined by spectrophotometric method after treating urine samples with Ammonium persulfate for neutralizing reducing substances found that 33.33% of women had Urinary Iodine Excretion (UIE) < 100 mcg/l and 66.66 % women had UIE > 100 mcg/l (Table 2). Median Urinary Iodine Excretion for the study population was 125mcg/l. 33.33% women had UIE <100mcg / l out of which 10% of women consumed salt < 15 ppm as found out during the household survey of salt,  $\chi^2 = 33.94$ , d.f = 2,  $p < 0.001$  (Table 3).

**Table 2: Distribution of Urinary Iodine Excretion in Women of Reproductive age groups**

| Age group.    | Below acceptable level.<br>(UIE = 1-99mcg/L) |      |                            |      |                         |       | Acceptable level. |       | Above acceptable level.<br>(UIE > 200 mcg/L.) |      | Total.     |       |
|---------------|----------------------------------------------|------|----------------------------|------|-------------------------|-------|-------------------|-------|-----------------------------------------------|------|------------|-------|
|               | Severe ID.<br>< 20 mcg/l                     |      | Moderate ID<br>20-49 mcg/l |      | Mild ID.<br>50-99 mcg/l |       | 100-199 mcg/l     |       | Excess.<br>200-299mcg/l                       |      | No.        | %     |
|               | No.                                          | %    | No.                        | %    | No.                     | %     | No.               | %     | No.                                           | %    |            |       |
| 15-25 yrs.    | 02                                           | 0.66 | 07                         | 2.33 | 22                      | 7.33  | 26                | 8.67  | 0                                             | 0    | 57         | 19.0  |
| 25-35 yrs.    | 01                                           | 0.33 | 03                         | 01   | 31                      | 10.33 | 49                | 16.33 | 01                                            | 0.33 | 85         | 28.33 |
| 35-45 yrs.    | 01                                           | 0.33 | 01                         | 0.33 | 32                      | 10.67 | 123               | 41.0  | 01                                            | 0.33 | 158        | 52.67 |
| <b>Total.</b> | 04                                           | 1.33 | 11                         | 3.67 | 85                      | 28.33 | 198               | 66.0  | 02                                            | 0.66 | 100<br>300 |       |

**Table 3: Urinary Iodine Excretion and consumed Salt Iodine content by women of Reproductive age group**

| Salt Iodine level at household. | Urinary Iodine excretion.                |       |                                                       |       |       |       |
|---------------------------------|------------------------------------------|-------|-------------------------------------------------------|-------|-------|-------|
|                                 | Below acceptable level.<br>UIE < 99mcg/l |       | Acceptable level.<br>UIE = 100-199 mcg/l & <200 mcg/l |       | TOTAL |       |
|                                 | No.                                      | %     | No.                                                   | %     | No.   | %     |
| < 15 ppm                        | 30                                       | 10    | 11                                                    | 3.66  | 41    | 13.67 |
| >15 ppm                         | 70                                       | 23.33 | 189                                                   | 62.34 | 259   | 86.33 |
| <b>Total.</b>                   | 100                                      | 33.33 | 200                                                   | 66.0  | 300   | 100   |

History of still birth and abortion was found in 20.10% women out of which 11.36% women had UIE level below acceptable. The  $\chi^2 = 11.26$ ; d.f = 1 and  $p < 0.001$  (Table 4).

**Table 4: Urinary Iodine Excretion and History of Still Birth & Abortion in Women of Reproductive age group**

| History of Still Birth & Abortion. | Urinary Iodine Excretion.              |       |                                      |       |                                         |      |        |      |
|------------------------------------|----------------------------------------|-------|--------------------------------------|-------|-----------------------------------------|------|--------|------|
|                                    | Below acceptable level. UIE < 99 mcg/l |       | Acceptable level UIE = 100-199 mcg/l |       | Above acceptable level. UIE > 200 mcg/l |      | Total. |      |
|                                    | No.                                    | %     | No.                                  | %     | No.                                     | %    | No.    | %    |
| <b>Absent.</b>                     | 67                                     | 25.38 | 143                                  | 54.17 | 01                                      | 0.38 | 211    | 79.9 |
| <b>Present.</b>                    | 30                                     | 11.36 | 22                                   | 8.33  | 01                                      | 0.38 | 53     | 20.1 |
| <b>Total.</b>                      | 97                                     | 36.74 | 165                                  | 62.5  | 02                                      | 0.76 | 264    | 100  |

## Discussion

The mean age of women in the study was found to be 33.36 years. Kant Sashi, Misra Puneet et al observed that women in the age group of 20-29 yrs comprised 87.6% of the study subjects. Only 5.6% were in the lower age group and only 6.8% in the higher one. The prior finding may be due to the fact that the study was conducted in week days and only women in higher age group were available at household.

The proportion of 40.34% of women being illiterate and 12% just literate shows that the literacy rate in these women is far below national average. A study by R.J.Yadav and P Singh. et al observed that among 503 women, 25.2% had primary level of education and only 14.1% were

illiterate. In wake of economic constrains either there is no enrolment in school or discontinuation from school to be employed as agricultural labour or as daily labourer in factories in suburbs of cities like Rourkela or Rajgangpur.

The tribal population is considered to be one of the most disadvantaged groups in accessing the health care services and various other health policies. The adoption of family planning methods is way behind in this group and the finding of the study of 55.34% women as multipara reflects the same. 20.08% of the women in the study had the history of abortion & still birth. Abortion and still birth is one of the most dreadful results due to subnormal intake of iodine during the reproductive age [10]. The pathophysiology of iodine deficiency during pregnancy can be summarized as:-

During pregnancy there is increased Renal clearance of Iodine and low dietary intake of iodine



Decreased placental Thyroid hormone transfer (due to decreased production) and decreased Iodine placental transfer



Abnormal skeletal, connective tissue, facial and fetal thyroid gland development  
(Iodine dependant at 5-7 weeks)



Decreased fetal thyroid gland hormone secretion (10-12 weeks) and low maternal thyroid hormone placental transfer



Decreased proliferation of Neurons of Cerebral cortex, Cochlea and Basal ganglia  
(During 2<sup>nd</sup> trimester)



Low brain maturation in the 3<sup>rd</sup> trimester (Thyroxin dependent). T4 primarily affects neuronal differentiation, formation of neuronal processes and synaptogenesis

In the present study it was observed that out of 300 women of reproductive age group 33.33% of women have Urinary Iodine Excretion (UIE) < 100 mcg/l and 66.66 % women had UIE > 100 mcg/l. As per the criteria given by WHO / ICCIDD /UNICEF < 20% target population should have UIE < 50 mcg/l in addition to this > 50% target population should excrete > 100 mcg/l. Chandra, Amar K, Ray Indrajit observed that the median urinary iodine values > 100 mcg/l indicated no biochemical iodine deficiency. However the iodine intake 40% in the studied population. Cheryl A Travers, Kamala Guttikonda, et al. There were 132 (16.6%) women with a UIE < 50 mcg/l<sup>7</sup>. Median Urinary Iodine Excretion was 125.0 mcg/l for the study population. As per the criteria given by WHO / UNICEF / ICCIDD Median Urinary Iodine excretion (MUIE) for the population under study should be > 100 mcg/l. 10% of women had < 15 ppm intake of iodine and 23.33% women had > 15 ppm of iodine intake through the iodized salt they consume. The  $\chi^2 = 33.94$ ; d.f = 1 and  $p < 0.001$  which is highly significant, which shows that there is a strong association between the salt iodine content in the edible salt consumed and the urinary iodine excretion, which shows the current iodine status of the individuals.

History of still birth & abortion in previous pregnancies with decreased Urinary Iodine Excretion levels was more (11.36% in the women who had UIE level below acceptable in comparison to 8.33% in acceptable level of UIE). The  $\chi^2 = 11.26$ ; d.f = 1 and  $p < 0.001$  which is highly significant. Abortion & still birth are one of the most dreadful outcomes with subnormal iodine intake during the reproductive period. A similar observation was observed by Chandra A.K., Smiritiratan et al most prevalent abnormality in the fetus of women suffering from IDD was feeble mindedness (49.18%) followed by hypothyroidism (29.2%), stunted growth (12.20%), deaf mutism (6.59%), gait defect (0.62%) and squint (0.42%). Miscarriages (18.26%) and still births (4.26%) were also recorded in the population.

## Conclusion

Nearly one third of the study population is having iodine deficiency disorder based on median urinary iodine level estimation. A statistically significant association was found between the salt iodine content in the edible salt consumed by tribal women of reproductive age group in the study area and the urinary iodine excretion, which shows the current iodine status of the individuals. Abortion & still birth are one of the most dreadful outcomes with subnormal iodine intake during the reproductive period. Nearly one fifth of the study population had history of abortion and stillbirth. There was a strong statistical significance between history of still birth & abortion with below acceptable level of urinary iodine excretion among the study subjects.

## Recommendations

- (1) 66.0% of women of reproductive age group had UIE> 100 mcg/l with MUIE of 125 mcg/l which is higher than the minimum permissible level recommended by WHO. To further assess the endemicity of IDD, studies should be conducted in other risk groups like school aged children.
- (2) Salt iodine content >15 ppm was 86.34% against the NIDDCP objective of > 90%, the district is on the verge of attaining the objective. Periodic assessment of IDD, by monitoring salt iodine, promoting use of iodized salt and IDD related IEC activities should be reinforced in the district monitored by State IDD cell.
- (3) Crystal salt was still available in 4.87% household, which may be true for other parts of the district also. The State IDD Cell should recommend to the Government for strict enforcement of the Ban on the Sale and Storage of non-iodized salt.

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