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Screening of pregnant women for micronutrient deficiency during early pregnancy in urban population

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ABSTRACT

Objective: To screen pregnant women for micronutrient deficiency specially iodine and iron deficiency during early pregnancy. **Methods:** Pregnant women (≤ 16 weeks) attending antenatal clinic in Hi-Tech medical college and hospital were enrolled for the study. Urine and blood samples were collected from 300 pregnant women for estimation of urinary iodine, haemoglobin and thyroid hormones. **Results:** Out of the total study group ($n=300$), 65% had normal thyroid hormone levels. Median urinary iodine concentration (UIC) was $276.82\mu\text{g/l}$ and 21.6% of the population had $\text{UIC} < 150\mu\text{g/l}$, indicating iodine deficiency. Mean TSH and FT4 was $2.27 \pm 1.4 \mu\text{IU/ml}$ and $10.0 \pm 2.3 \text{pmol/dl}$, respectively, with 16% pregnant women having $\text{TSH} > 2.5 \mu\text{IU/ml}$ and normal FT4 (sub clinical hypothyroidism), 11% having normal TSH and $\text{FT4} < 8.36 \text{pmol/dl}$ (hypothyroxenemia) and 8% having both (overt hypothyroidism). Mean haemoglobin was found to be $9.4 \pm 2.1 \text{g/dl}$. About 85% of study group had haemoglobin levels below 11g/dl . **Conclusion:** Since iodine and iron deficiency during pregnancy may affect the growth and development of the foetus, it is very important that the pregnant women attain sufficiency of iodine and iron before pregnancy. It will be better if during adolescence the girls should be supplemented with adequate iodine and iron.

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1. Introduction

Micronutrient deficiency specially iodine and iron during pregnancy can have life-long effects on child's cognitive development and put women at greater risk of death during childbirth. Iodine is essential for brain development and iron is critical for mental and physical ability [1]. Iron deficiency anemia (IDA), the most wide-spread nutritional deficiency, can have lifelong effects on a child's cognitive development and learning abilities and put women at greater risk of death during childbirth. Iodine is an integral part of thyroid hormones, and thus plays a crucial role in foetal organogenesis, and in particular in brain development. This takes place during early gestation and involves delicate targeting throughout the central nervous system [2]. As per World Health Organization (WHO) the daily requirement of iodine intake during pregnancy is $200-250\mu\text{g/day}$ [3]. However if pre-conceptional dietary intake is deficient the increasing demands during pregnancy may produce a deficit, this if remained untreated can result in a hypothyroxinaemic state [4]. During early pregnancy

the foetus is entirely dependent on maternal thyroid hormone supply as the foetal thyroid does not develop until 13-15 weeks of gestation [4, 5]. Hence, to prevent foetal brain damage; the present study was carried out among pregnant women for detecting iodine deficiency and iron deficiency anaemia as early as possible.

2. Material and Methods

The study was carried out in antenatal clinic of Hi-Tech medical college and hospital, Bhubaneswar between January-June 2011. Only those pregnant women were included for screening that came before 16 weeks of gestation, who were not a known thyroid patient.

All the pregnant women were given a consent form and the purpose of the study was explained to them. After obtaining consent from them, background information, socio-economic status, medical history and anthropometric measurements were recorded.

Blood and urine samples were collected from pregnant women during their first visit to hospital for thyroid hormone, haemoglobin and iodine analysis. Haemoglobin estimation was done using Acid Heamatin method (Sahali's

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Haemoglobinometer). Urinary iodine concentration (UIC) was assessed using Simple Micro plate method (Sandell-Kolthoff reaction) [6]. Thyroid function was assessed by measuring the concentration of thyroid stimulating hormone (TSH, Immunotech), free thyroxine (FT4, Immunotech), total thyroxine (TT4) and thyroglobulin (Tg) by radioimmunoassay.

Maternal Overt Hypothyroidism (OH) can be defined as TSH concentration $>2.5 \mu\text{IU/ml}$ and FT4 concentration below normal range. In maternal Sub clinical Hypothyroidism (SCH), patient may not have symptoms but the concentration of TSH is $>2.5 \mu\text{IU/ml}$ with normal FT4 concentration. Maternal Hypothyroxinemia (HT) can be defined as normal TSH concentrations with FT4 concentration below normal range.

Simple descriptive analysis of the data was carried out using SPSS (version 14) and the results are expressed as mean \pm SD and percentages.

3. Results

The mean age of study population was 24.41 ± 4.2 years. Maximum women were belonging to low socio economic status and most of them completed their education till primary level only (70%). No alcohol intake and smoking habits were found in the study population. Mean height and weight was found to be 151 ± 0.4 cm and 42 ± 8.2 kg, respectively. Anthropometric data reveals that 40% of the pregnant women were underweight.

As per world Health Organization (WHO), haemoglobin concentration of $\geq 11 \text{g/dl}$ is considered as normal [7]. Haemoglobin concentration between $10.0-10.99 \text{g/dl}$ is considered as mildly deficient, between $7.0-9.9 \text{g/dl}$ is moderately deficient and $<7 \text{g/dl}$ is considered as severely deficient. The mean haemoglobin concentration in our study was found to be $9.5 \pm 2.1 \text{g/dl}$ and 15% of the pregnant women had normal haemoglobin concentrations. In our study, out of 85% pregnant women who were anaemic, 23% were having mild anaemia, 59% had moderate anaemia and 3% had severe anaemia.

Median urinary iodine concentration (UIC) was $276.82 \mu\text{g/l}$ and 21.6% of the population had UIC $<150 \mu\text{g/l}$, indicating iodine deficiency.

TABLE-1: DEMOGRAPHIC CHARACTERISTICS OF THE STUDY POPULATION

Characteristics	Percentages
Religion	
Hindu	70
Muslim	30
Occupation	
Housewife	100
Working	-

Education	
Illiterate	-
Primary	6
SSCE	58.3
Graduation	30.7
Smoking habits	5
Never	100
Not in pregnancy	-
Alcohol intake	100
Never	-
Not in pregnancy	-

Out of the total population ($n=300$) screened, 65% had normal thyroid levels. Mean TSH, FT4, TT4 and Tg were found to be $2.27 \pm 1.4 \mu\text{IU/ml}$, $10.0 \pm 2.3 \text{pmol/dl}$, $10.0 \pm 2.0 \mu\text{g/dl}$ and $5.5 \pm 5.6 \text{ng/dl}$, respectively. Table 2 gives median values for TSH, FT4, TT4 and Tg.

Prevalence of overt hypothyroidism, sub clinical hypothyroidism and hypothyroxinemia was found to be 8%, 16% and 11% respectively.

Table-2: Thyroid Hormones of Pregnant Women During Early Pregnancy (<16 Weeks)

Thyroid hormone	Median (range)	Normal value (kit)
TSH $\mu\text{IU/ml}$	1.96 (0.106-12.44)	0.25-5.10
FT ₄ pmol/dl	10.20 (1.52-17.82)	8.36-27.02
TT ₄ $\mu\text{g/dl}$	10.20 (5.12-16.24)	4.20-13.0
Tg ng/ml	3.5 (0.1-22.3)	0.0-50.0

4. Discussion

Iron requirements are greater in pregnancy and in our study population iron status was found to be alarming. Only few of them had haemoglobin levels above 11g/dl (15%). Moderate anaemia was found in majority of study subjects (59%). In developing countries large numbers of women are anaemic at the onset of pregnancy [8] which reflects the similar finding in our study. Human foetal ontogeny begins at 10-12 weeks of gestation and continues to develop until delivery, but during early pregnancy, foetal thyroid hormone requirement is dependent on maternal supply [9, 10]. Perinatal outcomes are therefore dependent not only on maternal thyroid status during pregnancy but also on the gestational age at which maternal hypothyroidism occurs. According to Glinioer [11], when severe enough iodine deficiency may induce maternal and foetal hypothyroxinemia from early gestation onwards. As per a study by Kapil et al in urban slum communities of Delhi, 15.1% of pregnant women were having combined prevalence of iodine deficiency disorder (IDD) and iron deficiency anaemia (IDA) [12]. In our study both IDD and IDA were found

5. Conclusion

Iodine and iron deficiency may affect infant's development. Hence it is very important and crucial that the pregnant women attain sufficiency of iodine and iron before pregnancy. Rather it is recommended that during adolescence the girls should be supplemented with adequate iodine and iron. So that they enter pregnancy with sufficient enough stores to give birth to a healthy baby and herself remains healthy.

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