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**Original Research Article**

# Association of thyroid status with hemoglobin levels in pregnancy

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## ABSTRACT

**Background:** The association of hemoglobin levels with thyroid status in pregnancy was not studied in detail. Therefore, in this study, we assessed the levels of hemoglobin, thyroid function and its association with hemoglobin levels in first trimester of pregnancy.
**Methods:** Fifty pregnant women who didn't start any supplementation were recruited from the obstetrics and gynecology outpatient department. Fifty age matched controls were recruited from the residents and staff of the hospital. Thyroid profile and hemoglobin levels were measured in both the groups. The association was seen between hemoglobin levels and thyroid stimulating hormone (TSH) levels.
**Results:** The hemoglobin levels are significantly low in first trimester pregnant women. Further, the increased TSH levels are negatively correlated with low hemoglobin levels.
**Conclusions:** Screening of hemoglobin levels in first trimester itself will be beneficial to prevent the complications of pregnancy. Further, hypothyroidism also present and associated with reduced hemoglobin. So, early diagnosis of these deficiencies will be useful to start giving supplements to avoid unwanted effects in pregnancy.

**Keywords:** Hemoglobin, First trimester of pregnancy, Thyroid stimulating hormone

## INTRODUCTION

Diseases of the thyroid gland are common, affecting about 5% of the general population, and predominantly affect females.[1] Thyroid gland dysfunction is relatively common during pregnancy. The prevalence of hyperthyroidism is approximately 0.4%, subclinical hyperthyroidism about 3.3%, hypothyroidism about 0.3%, and subclinical hypothyroidism may reach 2.5% or more.[2-4] Dietary adequacy is different among different geographical areas in the world. The World Health Organization (WHO) estimates that two billion people are iodine-deficient, and hypothyroidism due to iodine deficiency can occur at any time in life, but the most critical period is when it occurs during fetal development and early childhood.[5] When occurring early in pregnancy, hypothyroidism and the development of thyroid autoantibodies during pregnancy associated with maternal morbidity later in life.[6] Treated maternal hypothyroidism is not associated with adverse perinatal outcome.[7]

The significance of detecting maternal thyroid abnormalities during pregnancy is that hypothyroidism may be associated with miscarriages, low birth weight, anemia, pregnancy-induced hypertension, preeclampsia, abruption placenta, postpartum hemorrhage, congenital circulation defects, fetal distress, preterm delivery, and poor vision development, in addition to the probable neuropsychological defect in the child.[8]

Multiple micronutrient deficiencies are still a major public health problem faced by developing countries. Such deficiencies have adverse effects on growth and development, especially in pregnant women.[9] Thyroid hormones influence a number of metabolic pathways.

Excess thyroid hormones cause hyperthyroidism whereas deficiency causes hypothyroidism.[10] Iodine deficiency and iron deficiency are considered as the most common cause of preventable brain damage and anemia respectively in developing countries.[11]

Anemia and iron deficiency have been found to be highly prevalent.[12] Iron deficiency with or without anemia affects child development and also has multiple adverse effects on thyroid metabolism.[13]

However, the role of reduced hemoglobin levels with thyroid status in pregnancy was not studied in detail. Therefore, in this study, we assessed the levels of hemoglobin, thyroid function and its association with hemoglobin levels in first trimester of pregnancy.

## METHODS

This study was conducted in the department of Biochemistry, Santosh Medical College and Hospital, Ghaziabad (NCR). The study was approved by Institute Ethical Committees, then all the procedures were explained to the participants and written informed consent was obtained.

Sample size was calculated with expected association between TSH and Hemoglobin levels will be 0.5. In order to show that this is significantly different from 0 (no correlation) at alpha error 5% (0.05) and power 80%, with 2 sided test, we need to study 40 subjects in each group. Pregnant Group (PG=40), Control Group (CG=40).

The study participants were pregnant women attending the outpatient department of obstetrics and gynecology. The pregnant women coming for routine obstetrical evaluation in the first trimester of pregnancy, who had not initiated any kind of vitamin preparation and had no history of neural tube defect were included in the study. Participants with previous history of renal disease, alcohol consumption, evidence of malabsorption, smokers were excluded. Age matched controls are female staff and residents of the hospital. The exclusion criteria were same as in pregnant group.

Blood was collected after 8-10 hours of fasting by venipuncture from all participants. Hemoglobin levels were estimated by cynameth hemoglobin method.

### *Statistical analysis*

Data expressed as mean±standard deviation (SD). To analyze the differences between groups, the independent student t test was used. Pearson correlation was used to study the association of TSH with Iron status. Statistical analysis was performed using the R 3.2.3 for windows. P values less than 0.05 were considered statistically significant.

## RESULTS

Two hundred and forty six low-middle income pregnant women were recruited for the study. One hundred and ninety six were excluded from the study, since they had already started vitamin pills. The mean age and other baseline characteristics of study population and controls were depicted in Table 1. There were no significant differences in age, height and weight of pregnant and controls.

**Table 1: Between comparison of baseline parameters.**

| Parameter | Pregnant Group (n=50) | Control Group (n=50) |
|---|---|---|
| Age (years) | 21.60±1.79 | 22.30 ±2.48 |
| Height (cms) | 157.86 ±5.60 | 155.18±5.83 |
| Weight (kg) | 67.40±10.50 | 63.60 ±11.53 |
| HR (beats/min) | 80.04 ±1.94 | 79.04±2.22 * |
| SBP (mmHg) | 118.68±6.34 | 119.88 ±5.98 |
| DBP (mmHg) | 76.60±4.08 | 77.42 ±4.51 |

Data expressed as mean±SD* = p<0.05.

Table 2 shows the between group comparisons of Hb% and hematocrit HCT levels. The levels of these parameters are significantly less in pregnant when compared to healthy age matched controls. This was statistically significant (p<0.000).

**Table 2: Between group comparison of hemoglobin levels and haematocrit.**

| Parameter | Pregnant group | Control group |
|---|---|---|
| HCT (%) | 37.64±1.25 | 39.42±2.32 *** |
| Hb % | 10.20±1.16 | 11.99±0.87 *** |

HCT: Hematocrit, Hb: Hemoglobin; Data expressed as mean±SD *** = p<0.000.

As depicted in Table 3, the TSH levels were significantly high in pregnants (p<0.000) when compared to controls. The fT3 and fT4 levels are significantly low in pregnant (p<0.000). Further, the increased TSH levels were negatively correlated with reduced hemoglobin levels (r = -0.748, p<0.00) (Table 4).

**Table 3: Between group comparisons of thyroid function tests.**

| Parameter | Pregnant group | Control group |
|---|---|---|
| TSH (uIU/ml) | 6.68±2.42 | 3.46±0.89*** |
| fT3 (pg/ml) | 1.18±0.73 | 2.96±0.57*** |
| fT4 (ng/dl) | 0.51±0.34 | 1.35±0.29*** |

Data expressed as mean±SD *** = p<0.000.

**Table 4: Association of TSH and hemoglobin.**

| Parameter | TSH (uIU/ml) | |
|---|---|---|
| | r value | p value |
| Hb (%) | - 0.748 | 0.00 |

## DISCUSSION

In this study, we assessed the thyroid profile and hemoglobin levels in first trimester pregnants and age matched controls.

The hemoglobin levels are significantly less in pregnant when compared to healthy age matched controls and the TSH levels were significantly high in pregnants ($p<0.000$) when compared to controls. The fT3 and fT4 levels are significantly low in pregnant ($p<0.000$). Further, the increased TSH levels were negatively correlated with reduced hemoglobin levels ($r = -0.748$, $p<0.00$) (Table 4). The increased TSH levels and decreased fT3 and fT4 levels indicates hypothyroidism. Earlier studies also reported that hypothyroidism is the most common pregnancy-related thyroid disorder, affecting 3-5% of all pregnant women. Subclinical hypothyroidism is more common than is overt hypothyroidism, and is usually defined as a serum TSH concentration greater than the pregnancy-specific reference range for each laboratory value, or by serum TSH concentrations greater than 2·5 mIU/L in the first trimester and greater than 3 mIU/L in the second and third trimesters. Some authors have defined subclinical hypothyroidism as a serum TSH between 5 and 10 mIU/L, and overt hypothyroidism as a serum TSH greater than 10 mIU/L, but this is not the commonly accepted definition. Once overt hypothyroidism is diagnosed, treatment with levothyroxine should be started to achieve serum TSH concentrations within the reference ranges for pregnancy as soon as possible.[14]

During the past three decades, the high prevalence of anemia has persisted among low-income pregnant women attending public health nutrition programs in the United States. Defined as a hemoglobin level below the fifth percentile of a trimester-specific hemoglobin reference level in iron-supplemented pregnant women, the prevalence of anemia among women participating in public health nutrition programs is approximately 8% in the first trimester, 12% in the second trimester, and 29% in the third trimester.[15] Observational studies in the United States and Europe have produced conflicting results concerning the clinical relevance of maternal anemia during pregnancy.[16] Although several researchers have reported an association between anemia and low birth weight (LBW), preterm birth, or both, others have not found such an association.[17,18] One study indicated that anemia due to iron deficiency but not other causes was associated with both LBW and preterm delivery.[5] Past studies differ in the criteria used to define anemia and adjustment for factors associated with LBW and preterm birth.[19]

However, the information about the association of reduced hemoglobin levels with thyroid dysfunction was not well documented in North India. The novelty of this study was, we explored the association of thyroid dysfunction with reduced hemoglobin levels.

## CONCLUSION

From this study, we can conclude that screening of hemoglobin levels in first trimester itself will be beneficial to prevent the complications of pregnancy. Further, hypothyroidism also present and associated with reduced hemoglobin. So, early diagnosis of these deficiencies will be useful to start giving supplements to avoid unwanted effects in pregnancy.

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