 Thyroid Function Status during Different Trimesters in Bangladeshi Women

Shyamal Chandra Banik1, Mahmuda Begum2, Farjana Ahmed3, Md. Shamsuzzaman4, Kartick Chandra Saha5

**Abstract**

**Introduction:** Gradual alteration of thyroid function status during different trimesters of gestation. **Objective:** To observe thyroid function status in normal pregnancy. **Materials and Methods:** This cross sectional study was conducted in the Department of Physiology, Sir Salimullah Medical College, Dhaka from July 2016 to June 2017. The study was approved by Institutional Ethical Committee. Total 120 female subjects; age ranged from 20 to 35 years were included in this study, among them 90 were healthy pregnant women and 30 were nonpregnant women. Serum TSH, FT4 & FT3 levels were measured. The statistical analysis was done by ANOVA test and Bonferroni test. **Results:** In this study, mean serum TSH level was lower in 1st & 2nd trimester and higher in 3rd trimester than that of nonpregnant group. Again it was gradually higher from 1st to 3rd trimesters of gestation and the difference was statistically significant (p<0.05, p<0.001, p<0.01) in between the groups. Mean serum FT4 & FT3 levels were higher in 1st trimester and lower in 2nd & 3rd trimesters of gestation than that of nonpregnant group. Again, both these levels were gradually lower from 1st to 3rd trimesters of gestation and the difference was statistically significant (p<0.001, p<0.001, p<0.01) in between the groups. **Conclusion:** Gradual alterations of thyroid function status were observed during pregnancy. Serum TSH level was gradually higher and both serum FT4 & FT3 levels were gradually lower from 1st to 3rd trimesters of gestation.

**Key words:** TSH, FT4, FT3, Trimester, Pregnancy.

**Number of Tables:** 02; **Number of References:** 22; **Number of Correspondence:** 02.

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**Introduction:**  
The continuous physiological adjustments of the body during pregnancy are often grouped by period of gestation in three trimesters of pregnancy1. During pregnancy various physiological and biochemical changes including hormonal changes, increase nutritional requirements, increase metabolic demand etc. take place to meet the demand of the growing fetus2-3. Almost all endocrine glands of the mother react markedly to pregnancy due to increase metabolic load of the mother and also in response to placental hormones4. Among the hormonal changes during pregnancy, thyroid hormone change is a remarkable one5. The production, circulation and disposal of thyroid hormones are all altered during pregnancy6. Thyroid hormone is an important metabolic hormone, necessary for both mother and the fetus during pregnancy7. First trimester of pregnancy which is up to 12 weeks of gestation is the most important period, as organogenesis of fetus takes place at this stage8. During 1st trimester the fetus completely depends on transplacental passage of maternal thyroid hormone as fetal thyroid gland is not functional until 12 weeks of gestation9. In normal pregnancy, the higher concentration of hCG during 1st trimester stimulates the thyrocytes and increase the level of FT4, FT3 and decrease the level of TSH10. But after 1st trimester the concentration of hCG falls and reaches a plateau during mid gestation, where it persists until delivery11,12. So, there is a tendency for serum FT4 and FT3 values to decrease progressively during later gestational stages13. Serum TSH value which is lower during 1st trimester, is gradually increased in 2nd and 3rd trimester of gestation14.

**Materials and Methods:**
This cross sectional study was carried out in the Department of Physiology, Sir Salimullah Medical College (SSMC), Dhaka from July 2016 to June 2017. The study protocol was approved by the Institutional Ethics Committee of SSMC. For this, 90 apparently healthy pregnant women aged 20-35 years of different trimesters were recruited as study group (group II). On the basis of gestational period, group II was further subdivided into groups 1st trimester of gestation (IIa), 2nd trimester of gestation (IIb) & 3rd trimester of gestation (IIc).
gestation (IIc) and each group was consisted of 30 different pregnant women of different trimesters. They were selected from Out Patient Department (OPD) of Obstetrics & Gynaecology of SSMC and Mitford Hospital by consecutive purposive sampling. For comparison, age matched 30 apparently healthy non-pregnant nulliparous (PNP) women were also studied as control group (group I). They were selected by personal contact. All the subjects were belonged to middle socioeconomic status. Subjects having history of any chronic or systemic diseases (hypertension, diabetes mellitus, cardiac disease, renal disease and tuberculosis), known thyroid abnormalities, other endocrine abnormalities, goitre, hyperemesis gravidarum, twin pregnancy, psychiatric illness etc. were excluded from the study.

After selection the aim, benefits, risks and the procedure of the study were explained to each subjects and a written consent was taken. Detailed personal, family, medical and occupational histories were taken and thorough physical examination of all subjects were done and recorded.

With all aseptic precautions, seven (7) ml of venous blood was drawn from ante-cubital vein. Serum TSH, FT4 and FT3 levels were measured by chemiluminescent microparticle immunoassay (CMIA) method in the laboratory of Department of Biochemistry, BSMMU, Dhaka. Data were expressed as mean ± SD (standard deviation). The statistical analysis was done by using SPSS version 22. ANOVA test and Bonferroni test were used to compare the data as applicable. p value <0.05 was considered as level of significance.

**Results:**

All the groups (subjects) were age matched. Whereas, mean (±SD) body weight and BMI were increased during different trimesters (Table-I).

In this study, the mean (±SD) serum TSH level was significantly lower in group IIa (p<0.01), non-significantly lower in group IIb and significantly higher in group IIc (p<0.01) in comparison to that of group I. Again, this value was significantly higher in group IIb and IIc (p<0.05, p<0.001) in comparison to that of group IIa and also significantly (p<0.01) higher in group IIc than that of group IIb (Table-II).

In this study, the mean (±SD) serum FT4 level was significantly higher in group IIa (p<0.01) and significantly lower in group IIb and IIc (p<0.05, p<0.001) in comparison to that of group I. Again, this value was lower in group IIb and IIc in comparison to that of group IIa which was statistically highly significant (p<0.001, p<0.001) and also significantly (p<0.01) lower in group IIc than that of group IIb (Table-II).

In this study, the mean (±SD) serum FT3 level was significantly higher in group IIa (p<0.001) and significantly lower in group IIb and IIc (p<0.01, p<0.001) in comparison to that of group I. Again, this value was significantly (p<0.001, p<0.001) lower in group IIb and IIc in comparison to that of group IIa and also significantly (p<0.01) lower in group IIc than that of group IIb (Table-II).

**Table-I: Age, body weight and BMI of the subjects in different groups (N=120).**

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Groups</th>
<th>I (n=30)</th>
<th>IIa (n=30)</th>
<th>IIb (n=30)</th>
<th>IIc (n=30)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>24.23±1.83</td>
<td>24.70±2.34</td>
<td>24.03±1.71</td>
<td>24.50±2.05</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(21-28)</td>
<td>(21-31)</td>
<td>(22-29)</td>
<td>(21-30)</td>
<td></td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>53.7±3.02</td>
<td>55.7±2.56</td>
<td>61.8±7.17</td>
<td>71.8±2.68</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(49-62)</td>
<td>(52-62)</td>
<td>(59-67)</td>
<td>(68-78)</td>
<td></td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>20.27±1.10</td>
<td>21.42±1.11</td>
<td>23.60±0.79</td>
<td>28.14±0.82</td>
<td></td>
</tr>
</tbody>
</table>

Data are expressed as mean ± SD. Figure in parentheses indicate ranges.

Group I: Control group (Non-pregnant nulliparous), Group II: Study group
Group IIa: 1st trimester of gestation, Group IIb: 2nd trimester of gestation, Group IIc: 3rd trimester of gestation
N= Total number of subjects

**Table-II: Serum thyroid stimulating hormone (TSH), free thyroxine (FT4) and free triiodothyronine (FT3) levels of the subjects in different groups (N=120).**

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Groups</th>
<th>I (n=30)</th>
<th>IIa (n=30)</th>
<th>IIb (n=30)</th>
<th>IIc (n=30)</th>
</tr>
</thead>
<tbody>
<tr>
<td>TSH (mIU/L)</td>
<td>2.33±0.56</td>
<td>1.42±1.47</td>
<td>2.16±1.13</td>
<td>2.82±0.71</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.56-3.35)</td>
<td>(0.52-6.02)</td>
<td>(0.85-5.91)</td>
<td>(1.72-5.59)</td>
<td></td>
</tr>
<tr>
<td>FT4 (pmol/L)</td>
<td>14.44±2.07</td>
<td>16.14±1.45</td>
<td>13.12±2.02</td>
<td>11.75±1.48</td>
<td></td>
</tr>
<tr>
<td>FT3 (pmol/L)</td>
<td>4.09±0.56</td>
<td>4.66±0.58</td>
<td>3.66±0.49</td>
<td>3.33±0.40</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(2.84-5.18)</td>
<td>(3.02-5.27)</td>
<td>(2.88-8.85)</td>
<td>(2.78-4.15)</td>
<td></td>
</tr>
</tbody>
</table>

**Statistical analysis**

<table>
<thead>
<tr>
<th>Groups</th>
<th>TSH</th>
<th>p value</th>
<th>FT4</th>
<th>p value</th>
<th>FT3</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>I vs IIa vs IIb vs IIc</td>
<td>&lt;0.001 ***</td>
<td>&lt;0.001 ***</td>
<td>&lt;0.001 ***</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I vs IIa</td>
<td>0.005**</td>
<td>0.002**</td>
<td>&lt;0.001 ***</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I vs IIb</td>
<td>0.875=</td>
<td>0.030*</td>
<td>0.009**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I vs IIc</td>
<td>0.007**</td>
<td>&lt;0.001 ***</td>
<td>&lt;0.001 ***</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ila vs IIb</td>
<td>0.040*</td>
<td>&lt;0.001 ***</td>
<td>&lt;0.001 ***</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ila vs IIc</td>
<td>&lt;0.001 ***</td>
<td>&lt;0.001 ***</td>
<td>&lt;0.001 ***</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Iib vs Iic</td>
<td>0.009**</td>
<td>0.006**</td>
<td>0.008**</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Data are expressed as mean ± SD. For statistical analysis, ANOVA test was performed for comparison among the groups and then Bonferroni test to compare between two groups. Figure in parentheses indicate ranges. Group I: Control group (Non-pregnant nulliparous), Group II: Study group.
Group IIa: 1st trimester of gestation, Group IIb: 2nd trimester of gestation, Group IIc: 3rd trimester of gestation. ***= Significant at p<0.001, **= Significant at p<0.01, *= Significant at p<0.05, ns = Not significant, N= Total number of subjects.
Discussion:
In this study, the mean serum TSH level was significantly lower in 1st trimester and non-significantly lower in 2nd trimester in comparison to that of non pregnant women. But it was significantly higher in 3rd trimester compared to that of non pregnant women. These findings are in almost consistent with that of some other researchers of different countries. On the contrary, mean serum TSH level was lower in all trimesters as compared to that of non pregnant women. This discrepancy might be due to variation of methodology implied, maternal age, number of non pregnant women, etc. Again, it was gradually higher from 1st to 3rd trimesters of gestation and the difference was statistically significant (p<0.05, p<0.001, p<0.01) in between the groups. Similar findings were also reported by some other researchers of different countries.

In this study, the mean (±SD) serum FT4 level was significantly (p<0.01) higher in 1st trimester in comparison to that of non pregnant women. But this value was significantly (p<0.05, p<0.001) lower in 2nd and 3rd trimester respectively in comparison to that of non pregnant women. Almost similar finding was also reported by different researchers. On the contrary, the mean serum FT4 level was lower during the all trimesters in comparison to that of non pregnant women.

Again, mean serum FT4 level was significantly (p<0.001) lower in 2nd and 3rd trimester in comparison to that of 1st trimester and also significantly (p<0.01) lower in 3rd trimester than that of 2nd trimester. These findings are in agreement with those of some other researchers. On the contrary, it has been found that, mean FT4 level was increased continuously with the increasing age of gestation.

In this study, the mean (±SD) serum FT3 level was significantly (p<0.001) higher in 1st trimester in comparison to that of non pregnant women. But this level was significantly (p<0.01, p<0.001) lower in 2nd and 3rd trimester respectively in comparison to that of non pregnant women. These findings are in almost consistent with that of some other researchers. On the contrary, mean serum FT3 level was significantly lower during different trimesters in comparison to that of non pregnant women.

Again, mean serum FT3 level was significantly (p<0.001) lower in 2nd and 3rd trimester in comparison to that of 1st trimester and also significantly (p<0.01) lower in 3rd trimester than that of 2nd trimester. These findings are in agreement with those of other researchers of different countries. On the contrary, it has been found that, mean serum FT3 level showed no significant change between the trimesters. This discrepancy might be due to variation of methodology, sample size, etc.

The exact mechanism that is involved in alteration of serum TSH, FT4 and FT3 level during different trimesters of pregnant women are not yet clearly established. However, several investigators of different countries proposed various suggestions on these aspects. It has been suggested that, higher concentration of serum human chorionic gonadotropin (hCG) during 1st trimester has thyrotropic activity due to it’s structural similarity with serum TSH by sharing of common alpha subunit with TSH & thereby directly stimulates maternal thyroid gland by binding with TSH receptor and ultimately causes higher thyroid hormone (FT4 and FT3) concentration and lower TSH concentration on that period. Again, it has been stated that, serum hCG concentration gradually lower in 2nd and 3rd trimester of pregnancy and thereby causes lowering of FT4 & FT3 level and rise in TSH level.

However, FT4, FT3 level increases as serum TSH level decreases during 1st trimester and FT4, FT3 level gradually decreases as serum TSH level gradually increases during 2nd and 3rd trimester as a result of negative feedback mechanism.

Again, increase in plasma volume (approximately 50%) as well as changes in deiodinase activity in the placenta leads to a decrease in thyroid hormone concentration as pregnancy advances.

Conclusion:
In this study it was observed that gradual alteration of serum TSH, FT4 & FT3 levels were observed during different trimesters in pregnant Bangladeshi women. Serum TSH level was gradually higher and both serum FT4 and FT3 levels were gradually lower from 1st to 3rd trimesters of gestation. To establish standard data further studies should be done on this aspect.

Conflict of Interest: None.

Acknowledgement:
Authors of this study acknowledge the tremendous support from Biochemistry departments of BSMMU for conducting thyroid function testing. The authors are also thankful to the study subjects for their active & enthusiastic participation.

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