DOI: https://doi.org/10.3329/medtoday.v34i1.58675

ORIGINAL ARTICLE OPEN ACCESS

Thyroid Function Status during Different Trimesters in Bangladeshi Women

Shyamal Chandra Banik*[1], Mahmuda Begum[2], Farjana Ahmed[3], Md. Shamsuzzaman[4], Kartick Chandra Saha[5]

Abstract

Introduction: *Gradual alteration of thyroid function occurs 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 ($p<0.001$, $p<0.001$, $p\leq0.01$) 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.*

***1. Corresponding Author:**
Dr. Shyamal Chandra Banik
Assistant Professor
Department of Physiology
Dhaka National Medical College, Dhaka.
Email: shyamal.9686@gmail.com

2. Dr. Mahmuda Begum
Professor & Head of the Department
Department of Physiology
Sir Salimullah Medical College, Dhaka.

3. Dr. Farjana Ahmed
Assistant Professor
Department of Physiology
Dhaka National Medical College, Dhaka.

4. Dr. Md. Shamsuzzaman
Assistant Professor
Department of Surgery
Dhaka National Medical College, Dhaka.

5. Dr. Kartick Chandra Saha
Assistant Professor
Department of Pharmacology
Dhaka National Medical College, Dhaka.

Introduction:

The continuous physiological adjustments of the body during pregnancy are often grouped by period of gestation in three trimesters of pregnancy[1]. 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 fetus[2,3]. 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 hormones[4]. Among the hormonal changes during pregnancy, thyroid hormone change is a remarkable one[5]. The production, circulation and disposal of thyroid hormones are all altered during pregnancy[6]. Thyroid hormone is an important metabolic hormone, necessary for both mother and the fetus during pregnancy[7]. 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 stage[8]. 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 gestation[9]. 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 TSH[10]. But after 1st trimester the concentration of hCG falls and reaches a plateau during mid gestation, where it persists until delivery[2,4]. So, there is a tendency for serum FT4 and FT3 values to decrease progressively during later gestational stages[11]. Serum TSH value which is lower during 1st trimester, is gradually increased in 2nd and 3rd trimester of gestation[12].

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

Received: 07 July 2021 *Accepted revised version:* 11 December 2021

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 (NPN) 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 antecubital vein. Serum TSH, FT4 and FT3 levels were measured by chemiluminescent microparticle immunoassay (CMIA) method[13] 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).

Parameters	Groups			
	I (n=30)	IIa (n=30)	IIb (n=30)	IIc (n=30)
Age (years)	24.23±1.83 (21-28)	24.70±2.34 (21-31)	24.03 ± 1.71 (22 - 29)	24.50 ± 2.05 (21 - 30)
Weight (kg)	53.37±3.02 (49 - 62)	55.77±2.56 (52-62)	61.87±1.74 (59 - 67)	71.80±2.68 (68 - 78)
BMI (kg/m^2)	20.27±1.10 (18.75–24.22)	21.42±1.11 (19.85–24.22)	23.60 ± 0.79 (21.99 -25.18)	28.14 ± 0.82 (25.94 -29.32)

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).

Parameters	Groups			
	I (n=30)	IIa (n=30)	IIb (n=30)	IIc (n=30)
TSH (mIU/L)	2.33 ± 0.56 (0.56 - 3.35)	1.42 ± 1.47 (0.52 - 6.02)	2.16 ± 1.13 (0.85 - 5.91)	2.82 ± 0.71 (1.72 - 5.59)
FT_4 (pmol/L)	14.44 ± 2.07 (9.85 - 17.75)	16.14 ± 1.45 (12.96 - 19.75)	13.12 ± 2.02 (9.56 - 17.24)	11.75 ± 1.48 (9.86 - 15.19)
FT_3 (pmol/L)	4.09 ± 0.56 (2.84 - 5.18)	4.66 ± 0.58 (3.02 - 5.27)	3.66 ± 0.49 (2.88 - 4.85)	3.33 ± 0.40 (2.78 - 4.15)

Statistical analysis

Groups	p value		
	TSH	FT_4	FT_3
I vs IIa vs IIb vs IIc	<0.001***	<0.001***	<0.001***
I vs IIa	0.005**	0.002**	<0.001***
I vs IIb	0.875^{ns}	0.030*	0.009**
I vs IIc	0.007**	<0.001***	<0.001***
IIa vs IIb	0.040*	<0.001***	<0.001***
IIa vs IIc	<0.001***	<0.001***	<0.001***
IIb vs IIc	0.009**	0.006**	0.008**

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[11]. On the contrary, mean serum TSH level was lower in all trimesters as compared to that of non pregnant women[14]. 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[15].

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[16]. On the contrary, the mean serum FT4 level was lower during the all trimesters in comparison to that of non pregnant women[12].

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[17]. On the contrary, it has been found that, mean FT4 level was increased continuously with the increasing age of gestation[18].

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[19]. On the contrary, mean serum FT3 level was significantly lower during different trimesters in comparison to that of non pregnant women[16].

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[15,16]. On the contrary, it has been found that, mean serum FT3 level showed no significant change between the trimesters[20]. 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[10,21]. 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[11,21].

However, FT4, FT3 level increases as serum TSH level deceases 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[19,22].

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[10].

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.

References:

1. King JC. Physiology of pregnancy and nutrient metabolism. The American Journal of Clinical Nutrition. 2000; 71: 1218S-25S.

https://doi.org/10.1093/ajcn/71.5.1218s

PMid:10799394

2. Keele CA, Neil E, Joels N. Samson Wright's Applied Physiology. 13th ed. New Delhi: Oxford University Press; 1982. p.581-584.

3. Yanamandra N, Chandraharan W. Anatomical and Physiological changes in pregnancy and their implications in clinical practice. Cambridge University Press 2012: 1-10.

https://doi.org/10.1017/CBO9780511842153.002

4. Hall JE. Textbook of Medical Physiology. 12th ed. Elsevier India Private Limited; 2016. 1008p.

5. Barrett, K.E., Barman, S.M., Baitano, S. & Brooks, et al. Review of Medical Physiology. 23rd ed. McGraw-Hill companies, India; 2012.

6. Hamza KM, Bashir AH, Ashir HE. Serum thyroid hormone concentrations of Sudanese pregnant women (free

thyroxine, free triiodothyronine and human chorionic gonadotrophine hormone). Journal of Science and Technology. 2004; 6(2): 510-520.

7. Thevarajah M, Chew YY, Lim SC, Sabir N, Sickan J. Determination of trimester specific reference intervals for thyroid hormones during pregnancy in Malaysian women. Malaysian Journal Pathology. 2009; 31(1): 23-27.

8. Sadler TW. Langman Medical Embryology. 9th ed. Lipincott Willias and Wilkin, Philadelphia, USA; 2003. 87p.

9. Pop VJ, Kuijpens JL, Baar ALV, Verkerk G, Vijlder JJD, Vulsma T, et al. Low maternal free thyroxine concentrations during early pregnancy are associated with impaired psychomotor development in infancy. Journal of clinical Endocrinology. 1999; 50: 149-155.

https://doi.org/10.1046/j.1365-2265.1999.00639.x

PMid:10396355

10. Lazarus JH, Mestman JH. Thyroid disorders during pregnancy and postpartum. In: Braverman LE, Cooper DS. Werner & Ingbars's the thyroid A fundamental and clinical text. 10th ed. New Delhi: Wolters Kluwer (India) Pvt Ltd; 2013. p.815-834.

11. Memon AS, Shaikh AW, Dodani AL. Effects of pregnancy on thyroid hormone levels. PJMHS. 2011; 5(3): 524-528.

12. Sekhri T, Juhi JA, Wilfred R, Kanwar RS, Sethi J, Bhadra K, et al. Trimester specific reference intervals for thyroid hormone in normal Indian pregnant women. Indian Journal of Endocrinology Metabolism. 2016; 20(1): 101-107.

https://doi.org/10.4103/2230-8210.172239

PMid:26904477 PMCid:PMC4743369

13. ARCHITECT, Instruction manual; 2015

14. Manjunatha S, Basavraja GN, Veena HC, Patil RS. Thyroid status in non-pregnant and pregnant women. Scholars Journal of Applied Medical Sciences. 2014; 2(6): 3349-3352.

15. Rajput R, Singh B, Goel V, Verma A, Seth S, Nanda, S. Trimester-specific reference interval for thyroid hormones during pregnancy at a tertiary care hospital in Haryana, India. Indian Journal of Endocrinology and Metabolism. 2016; 20(6): 810-815.

https://doi.org/10.4103/2230-8210.192903

PMid:27867885 PMCid:PMC5105566

16. Elhaj ET, Adam I, Ahmed MA, Lutfi MF. Trimester-specific thyroid hormone reference ranges in Sudanese women. BMC Physiology. 2016; 16(5): 1-8.

https://doi.org/10.1186/s12899-016-0025-0

PMid:27795209 PMCid:PMC5087113

17. Almomin AMS, Mansour AL, Sharief M. Trimester-specific reference intervals of thyroid function testing in pregnant women from Basrah, Iraq using electrochemiluminescent immunoassay. Diseases. 2016; 4(20): 1-11.

https://doi.org/10.3390/diseases4020020

PMid:28933400 PMCid:PMC5456279

18. Mankar J, Sahasrabuddhe A, Pitale S. Trimester specific ranges for thyroid hormones in normal pregnancy. 2016; 13(3): 106-109.

https://doi.org/10.4103/0973-0354.180192

19. Zarghami N, Noubar MR, Khosrowbeyi A. Thyroid hormones status during pregnancy in normal Iranian women. Indian Journal of Clinical Biochemistry. 2005; 20(2): 182-185.

https://doi.org/10.1007/BF02867424

PMid:23105557 PMCid:PMC3453861

20. Marwaha RK, Chopra S, Gopalkrishnan S, Bharma S, Kanwar RS, Sastry A, et al. Establishment of reference range for thyroid hormones in normal pregnant Indian Women. An International Journal of Obstetrics and Gynaecology. 2008; 115(5): 602-606.

https://doi.org/10.1111/j.1471-0528.2008.01673.x

PMid:18333941

21. Koukkou E, Ilias I, Mamalis I, Adonakis GG, Markou KB. Serum thyroglobulin concentration is a weak marker of iodine status in a pregnant population with iodine deficiency. European Thyroid Journal. 2016; 5: 120-124.

https://doi.org/10.1159/000446070

PMid:27493886 PMCid:PMC4949369

22. Pasupathi P, Chandrasekar V, Kumar US. Thyroid hormone change in pregnant and non-pregnant women: A Case-Control study. Thyroid Science. 2009; 4(3): 1-5.