Ibrahim Card Med J 2012; 2(2): 19-23

Study on Serum Levels of Thyroid Hormones and Thyroid Stimulating Hormone in Different Trimester of Normal Pregnancy

Zinat Begum[1], Rezina Akhtar Banu[2], T H Zohra Moon Moon[3]

ABSTRACT

Objective: The present study was conducted to study the changes in serum levels of thyroid hormones and thyroid stimulating hormone (TSH) in different trimesters of normal pregnancy.

Methods: This cross-sectional study was conducted in the Department of Physiology, Rangpur Medical College Hospital over a period 1 year from July 2008 to June 2009. Apparently healthy pregnant women aged between 20 – 35 years were consecutively included in the study. Patients suffering from thyroid disorders or any other systemic diseases and lactating mothers were excluded from the study. A total of 100 subjects – 75 pregnant women (25 selected from each trimester of pregnancy) and 25 non-pregnant women were purposively selected as case and control groups respectively.

Result: The mean age was almost identically distributed between the two group (23.8 ± 3.9 vs. 24.9 ± 4.6, p = 0.343). Lower class patient was predominant in case and control group (68% vs. 64%, p = 0.756). The mean serum T_3 level was higher in case group compared to control group. The mean serum T_3 level was identically distributed in 1st and 3rd trimester (p = 0.536 and p = 0.145 respectively) but significant difference was found in 2nd trimester (p = 0.001). The mean serum T_4 level of control group did not experience any change throughout the whole observation period. The serum T_4 level was 210 nmol/L at 1st trimester then it began to increase almost a plateau at 2nd trimester and then gradually dropped 232.2 nmol/L at third trimester. The mean serum TSH level was 1.1 mIU/L at 1st trimester then it began to increase sharply assumed a mean score 1.3 mIU/L at 2nd trimester. From 2nd trimester onwards it began to decrease upto the end of observation when no change in the non-pregnant women in 1st, 2nd & 3rd trimester.

Conclusion: Thyroid hormones (T_3, T_4) increase in the 2nd trimester of pregnancy and fall again in the 3rd trimester but TSH does not experience any significant change throughout the pregnancy.

Key words: Thyroid hormones, thyroid stimulating hormone (TSH) and normal pregnancy.

ORIGINAL ARTICLE

INTRODUCTION

Pregnant women comprises the most vulnerable population group with respect of iodine deficiency, because of its causative link to a variety of poor fetal outcomes including stillbirth, spontaneous abortion, congenital anomalies, mental retardation, deafness and cretinism.[1] Thyroid hormones are necessary for normal growth and development of bone and brain in the fetal life and for the first few years of postnatal life.[2] There are different effects of thyroid binding globulin, iodine balance, immune function and thyroid function in pregnancy. There is enhanced transplacental uptake of iodine during pregnancy. A pregnant woman needs more iodine during pregnancy to maintain normal metabolism as well as to meet the requirement of T_4 and iodine transfer to the fetus. An insufficient supply of thyroid hormone to the developing brain of the fetus can result in congenital anomalies and intellectual impairment.[3] Due to reduced availability

Authors' Information:

1. ***Dr. Zinat Begum,*** *Asst. Professor, Department of Gynae & Obstetrics, Dhaka Medical College, Dhaka.*
2. ***Dr. Rezina Akhtar Banu,*** *MBBS, M Phil (Physiology) Department of Physiology, Rangpur Medical College, Rangpur.*
3. ***Dr. T H Zohra Moon Moon****, Junior Consultant (Obstetrics & Gynaecolgy), Dohar Upazilla Health Complex, Dohar, Dhaka*

Address of Correspondance: ***Dr. Zinat Begum,*** *Asst. Professor, Department of Gynae & Obstetrics, Dhaka Medical College, Dhaka, Mobile: 01745-798543.*

of iodine the thyroid stimulating hormone (TSH) level is raised to meet this demand. As pregnancy advances, serum TSH values increases than non pregnant women.[4] The recognition of abnormality in thyroid function tests during pregnancy is, therefore important for the welfare of the mothers as well as for their fetus.[4]

Iodine deficiency in pregnant women may be better detected using T_4 as an indicator in the first trimester. A small decrease in serum free T_4 during pregnancy is an important risk factor for impaired psychomotor development in infants.[3] To avoid risk of harm to the fetus, maternal iodine deficiency should be corrected prior to conception. During gestation, fetal iodine deposition is approximately 75 mcg/day. Results from iodine balance studies as well as iodine supplementation trials to prevent thyroid enlargement and goiter during pregnancy corroborate that an additional 70 mcg/day is required to cover the pregnancy needs of 97-98% of the population during pregnancy.[5]

Bangladesh, particularly the northern belt, is an iodine-deficient area and nearly 69% of Bangladeshis are victim of biochemical iodine deficiency (urinary iodine excretion [UIE] <10 mg/dl).[6] By early recognition of thyroid disorders of pregnant women, thyroid disorders in their expecting children can be prevented. So the present study, intended to observe the changes of thyroid hormones (T_3 and T_4) and TSH in different trimesters of normal pregnancy, would be helpful to develop awareness about thyroid status among pregnant mothers.

METHODS

The present cross-sectional study was conducted in the Department of Physiology, Rangpur Medical College, Rangpur over a period 1 year from July 2008 to June 2009. Pregnant women ranged from 20-35 years were the study population. Apparently healthy pregnant women aged 20-35 years were included as case, while healthy non-pregnant, non-lactating women of same age group were included as control. However, women suffering from any thyroid disorder or any other diseases were excluded from the study. A total of 100 women meeting the above enrolment criteria were selected consecutively from the study population. Seventy five of them were pregnant women (cases)-25 selected from each trimester of pregnancy. The control group included 25 non-pregnant women with regular menstrual cycles. The demographic variables included in the study were age and sex. The serum T_3, T_4 and TSH levels were recorded in non pregnant women. The same variables were measured at 1st, 2nd and 3rd trimester of normal pregnancy. Prior permission was taken from Ethical Review Committee of Rangpur Medical College Hospital, Rangpur, Bangladesh to conduct this study. Having obtained informed consent from the study subjects, data were collected using a structured questionnaire containing all the variables of interest.

Data were processed and analysed using SPSS (Statistical Package for Social Sciences). The test statistics used to analyse the data were descriptive statistics and Student's t-Test. For all analytical tests, the level of significance was set at 0.05 and $p < 0.05$ was considered significant.

RESULTS

Table I shows that ≤ 20 years and 21 – 25 years age category was somewhat higher in the case group compared to control group, while above 25 years age category was less in former group than that in later group. The mean age was almost identically distributed between group (23.8 ± 3.9 vs. 24.9 ± 4.6, $p = 0.343$). Lower socioeconomic class women were predominant in both case and control groups (68% vs. 64%) with no significant intergroup difference (p=0.765) (Fig. 1).

TABLE I : Comparison of age between cases and controls (n = 50).

Age (yrs)#	Group		p-value#
	Case (n=25)	Control (n=25)	
≤ 20	5(20.0)	4(16.0)	
21 – 25	12(48.0)	11(44.0)	
> 25	8(32.0)	10(40.0)	
Mean ± SD	**23.8 ± 3.9**	**24.9 ± 4.6**	**0.343**

 # Chi-square (χ^2) Test was done to analyse the data.
**Figures in the parentheses indicate corresponding percentage.*

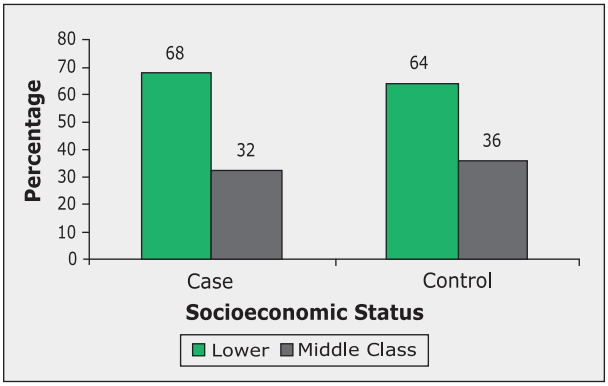

FIGURE 1: *Socioeconomic status between the study groups (n=50).*

The mean serum T_3 level was 2.7 nmol/L which increased sharply to 4.5 nmol/L at 2nd trimester and decreased to 3.2 nmol/L at 3rd trimester. The serum T_3 level of control group (2.5 nmol/L) was stable throughout the whole period of observations. A significant difference was evident between the study groups in 2nd trimester of pregnancy (p=0.001), but no significant difference was observed between the groups with respect to 3rd trimester (p = 0.145) (Table II and Fig. 2).

Table II : Serum T_3 level at different trimesters of pregnancy between two groups.

Serum T3 level (nmol/L)	Group		p-value
	Case (n=25)	Control (n=25)	
1st trimester	2.7±1.3	2.5± 0.6	0.536
2nd trimester	4.5±2.4	2.5±0.6	0.001
3rd trimester	3.2±2.0	2.5±0.6	0.145

#Student t-Test was employed to analyse the data and presented as Mean±SD.

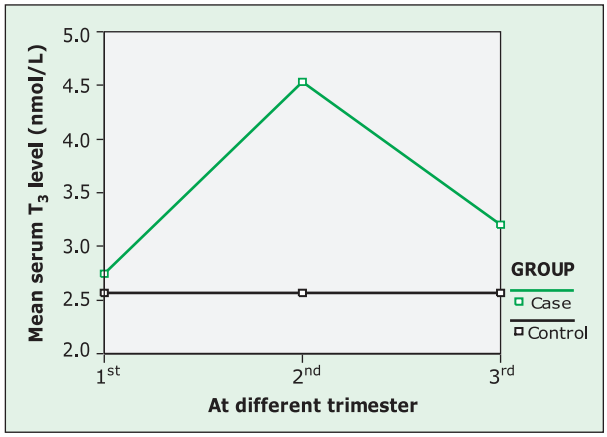

FIGURE 2 : *Serum T_3 level at different trimester.*

Table III & Fig. 3 show the changes in mean T_4 level at different trimesters. The serum level of case group was 210 nmol/L at 1st trimester. It then began to increase almost insidiously and reached a level of 279 nmol/L at 2nd trimester and then gradually dropped to 232.2 nmol/L at 3rd trimester. The serum T_4 level was significantly higher in case group compared to the control group at all level of evaluations (p<0.05). The mean serum T_4 level of control group did not experience any change throughout the whole observation period.

TABLE III : Serum T_4 level at different trimesters of pregnancy between two groups.

Serum T4 level (nmol/L)	Group		p-value
	Case (n=25)	Control (n=25)	
1st trimester	210.0±103.5	158.2±47.8	0.029
2nd trimester	279.0±116.6	158.2±47.7	<0.001
3rd trimester	232.2±103.7	158.2±47.7	0.003

 # Student t-Test was employed to analyse the data and presented as Mean ± SD.

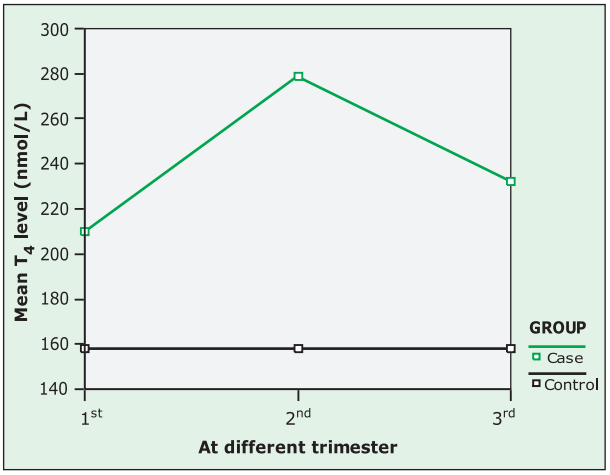

FIGURE 3 : *Serum T_4 level at different trimester.*

The mean serum TSH level of case group was 1.1 mIU/L at 1st trimester which increased gradually to assume a mean level of 1.3 mIU/L at 2nd trimester. The groups were no different at 1st and 2nd trimester in terms of serum TSH (p=0.738 and p=0.729 respectively). From 2nd trimester onwards it began to decrease up to the end of observation (1.2 mIU/L) when no significant difference was noted between the two groups (p=0.850) (Table IV & Fig 4).

TABLE IV : Serum TSH level at different trimesters of pregnancy between two groups.

Serum TSH level (mIU/L)	Group		p-value
	Case (n=25)	Control (n=25)	
1st trimester	1.1±0.8	1.2±1.0	0.738
2nd trimester	1.3±0.7	1.2±1.0	0.729
3rd trimester	1.3±0.9	1.2±1.0	0.850

#Student t-Test was employed to analyse the data and presented as Mean±SD.

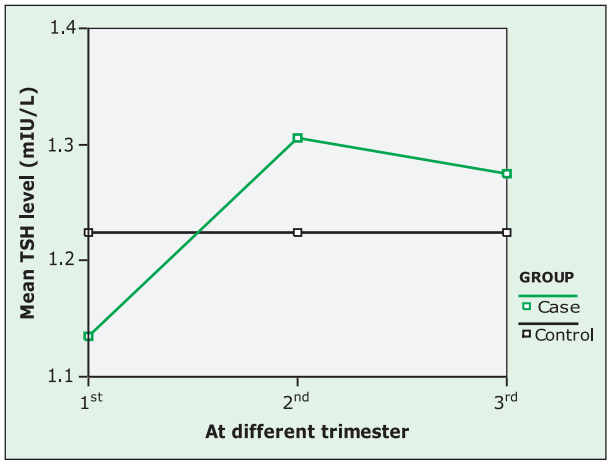

FIGURE 4 : *Serum TSH level at different trimester.*

DISCUSSION

The results of the present study demonstrated that the mean age was almost identically distributed between the two groups (23.8 ± 3.9 vs. 24.9 ± 4.6, p=0.343). Canaris[7] reported mean age to be 56 years.

In the present study, the mean serum T_3 level was 2.7 nmol/L which increased sharply to 4.5 nmol/L at 2nd trimester and decreased to 3.2 nmol/L at 3rd trimester, while the serum T_3 level of control group did not assume any change throughout the whole period of observation. Kumar[4] reported in the first trimester, the mean T_3 values was 1.85 nmol/L, which increased to a mean of 2.47 nmol/L in the second trimester and declined in the third trimester to 1.82 nmol/L. Similar trend was found in our study.

The mean serum T_4 of control group did not experience any change throughout the whole observation period. The serum level of case group was 210 nmol/L at 1st trimester which began to increase insidiously and assumed a plateau at 2nd trimester and finally dropped to 232.2 nmol/L at third trimester. Kumar *et al.*[4] found that mean T_4 levels were also seen to rise from 164.50 nmol/L in the first trimester to 165.80 nmol/L in the second trimester and then decreased in the third trimester to 159.90 nmol/L closely similar to our study.

The mean serum TSH level was 1.1 mIU/L at 1st trimester which increased to 1.3 mIU/L at 2nd trimester. Then it began to decrease up to the end of observation, while no change in the non-pregnant women in 1st, 2nd & 3rd trimester was noted. Reported mean TSH levels were seen to rise progressively through the three trimesters of pregnancy from 1.20 microIU/ml in the first trimester to 2.12 microIU/ml in the second trimester and further to 3.30 microIU/ml in the third trimester of pregnancy[4] which was not consistent with our findings. Chan *et al.*[8] reported that maternal serum TSH-levels return to normal in second trimester and then rise in the third trimester. Chan[9] showed serum TSH values were found to be increasing above the higher limit of normal non-pregnant range. Therefore, reference range of TSH values significantly overlaps those of the non pregnant state.

Finally, it can be stated that both thyroid hormones (T_3, T_4) increase in the 2nd trimester of pregnancy and start falling again in the 3rd trimester but correspondingly TSH does not experience any significant change.

REFERENCES

1. American Academy of Pediatrics. Breastfeeding. In: kleinman RE (ed) Pediatric nutrition handbook, 5th edn. Elk Grove, Ill. 2004;55-86.
2. Thyroid Metabolic Hormones: Thyroid Hormones Increase the Transcription of Large Numbers of Genes. In: Guyton AC, Hall JE. Textbook of Medical Physiology. 11th ed. Philadelphia: Saunders; 2006. P. 934.
3. Cheryl AT, Kamala G, Carol A N, Peter R L, Lyndall J M, Veronica W, *et al.* Iodine status in pregnant women and their newborns: are our babies at risk of iodine deficiency?. MJA 2006; 184(12):617-20.

4. Kumar A, Gupta N, Nath T, Sharma JB, Sharma S. Thyroid function tests in pregnancy. Indian J Med Sci 2003;57(6):252-58.

5. Zhang C, Solomon CG, Manson JE, Hu FB. A prospective study of pregravid physical activity and sedentary behaviors in relation to the risk for gestational diabetes mellitus. Arch Intern Med 2006;166:543-48.

6. Yusuf HK, Quazi S, Khan MR, Mohiduzzaman M, Nahar B, Rahman MM, *et al.* Iodine deficiency disorders in Bangladesh. Indian J Pediatr 1996;63(1):105-10.

7. Canaris GJ, Manowitz NR, Mayor G, Ridggway EC. The Colorado thyroid disease prevalence study. Arch Intern Med 2000;160:526-34.

8. Chan S, Franklyn JA, Kilby MD. Thyroid hormones in pregnancy and the fetus. In Studds J, (ed). Progress in O; bstetrics & Gynaecology. United Kingdom: churchill Livingstone 2002;15:75-101.

9. Chan V, Paraskevaides CA, Hale JF. Assessment of thyroid function during pregnancy. Brit J Obstet Gynaecol 1975;82:137-41.