

Thyroid Profile and Serum Lipid Level in Women with Normal Pregnancy

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Abstract

Objective: To evaluate the changes in thyroid profile and serum lipid level in normal pregnancy.

Methods: This observational study was conducted at the Department of Biochemistry of Santosh Medical College, Ghaziabad, UP, India, from June 2021 to February 2022. In this study, 200 average pregnant women were enrolled. The thyroid profile was estimated using the ELISA method, and the lipid profile was measured using the enzymatic kit method. All data were expressed as means and standard deviations, and SPSS version 17 was used for statistical analysis.

Results: This observational study observed that the mean T3, T4, and TSH levels increased significantly in the second trimester compared to the first trimester. In contrast, the mean value of T3, T4, and TSH decreased in the third trimester as compared to the second trimester. The mean levels of total cholesterol, triglyceride, and LDL-cholesterol increased significantly, while the mean value of HDL-cholesterol decreased significantly in the second and third trimesters when compared to the first trimester.

Conclusion: This study demonstrated abnormal lipid and thyroid metabolism. Changes in thyroid profile may be associated with adverse obstetric outcomes. The altered lipid parameters, mainly High TG and low HDL-C concentrations, may promote vascular dysfunction and oxidative stress.

Keywords: Pregnancy, thyroid hormones, triglycerides, trimester

Introduction

Pregnancy is known as period of gestation. During this period new life grows inside a female's uterus. Pregnancy causes alteration in internal and external physiological status of female. Many external physiological changes are seen in this time, such as changes in blood values which may appear pathological in non-pregnant women. However these changes during pregnancy are beneficial for development and growth of fetus. Therefore this altered physiology has great impact and helps to supply proper nutrients and

protection to developing fetus until delivery.¹ These changes are also due to the many endocrinal change occurs in pregnancy. In this thyroid gland has critical role which regulates the thyroid hormones synthesis that is necessary for the infant's brain and nervous system development. Since the fetus completely depends on the mother's thyroid hormone throughout the first trimester, the mother's thyroid gland is enlarged to produce more thyroid hormone. Dysfunction in thyroid gland is also common during pregnancy. If these are remained untreated then causes many reverse effects on pregnancy and fetal

Thyroid Profile and Serum Lipid Level in Women with Normal Pregnancy

outcomes.² During pregnancy, the mother physically changes, and the increased blood levels of progesterone, estrogens, and pancreatic beta-cell hyperplasia change the mother's metabolic milieu. A significant part of the lipid profile's disturbance is due to insulin resistance and ovaries-estrogens (in women). So identification of these disorders and their treatment are necessary to prevent complications related to pregnancy. Changes in thyroid hormones and in TSH may be a factor in a disrupted lipid profile, particularly in the third trimester. Many studies have been examine the alterations in a pregnant woman's lipid profile, T3, T4, and TSH during their three stages of pregnancy to ascertain why these characteristics change during pregnancy.³ Reports on the relationship between dyslipidemia and pregnancy outcomes and thyroid gland malfunction have produced conflicting results and also the first trimester receives less attention in research, which tends to concentrate on the late stages of pregnancy. Hence this study was aimed to determine serum lipid level and thyroid profile in all trimester of normal pregnancy.

Methods

This research was conducted at the Santosh Medical College in Ghaziabad, Uttar Pradesh, in the Department of Biochemistry, India from June 2021 to February 2022. Institutional ethical committee clearance [SU/2020/536(50)] and inform consent from patient were taken prior to the study. This study included 200 pregnant healthy women with 21–32 years of age. In this study, healthy pregnant women with age more than 20 years were included. Women on hormonal

therapy, steroid therapy, already diagnosed thyroid patients, women having abnormal liver function and kidney function and women having acute or chronic inflammatory disease were excluded. Blood sample were collected after 8-12 hours fasting three times from the women in first, second and third trimester in fluoride/Plain vials under all aseptic precautions. Plasma/ serum were separated and all the parameters were measured on the day of collection. Fasting blood glucose, total cholesterol, HDL-cholesterol, triglyceride and LDL-cholesterol were measured by enzymatic kit method by Fully Automatic analyzer (Beckman Coulter- AU-480). Serum T3, T4 and TSH were done by commercially available ELISA kits by Beckman Coulter-Chemistry Analyzer Access-2. Blood glucose and lipid parameters were measured by using fully automated analyzer (Beckman Coulter -AU-480). Chemistry Analyzer-Access-2's (automated analyzer) was used to measure the thyroid profile. Statistical Package for Social Sciences (SPSS) version 17 was used to conduct the statistical analysis. The results were summarized as mean and standard deviation in several tables. The confidence intervals for each of the presented p-values were determined at the 95% level. $P < 0.05$ was considered significant.

Results

This study included 200 normal pregnant women of more than 20 year of age. The mean value of T3 and TSH increases in 2nd and 3rd trimester of pregnancy as compared to 1st trimester and it was statistically significant. The mean value of T4 increases in 2nd trimester but decreases in 3rd trimester and it was

Table 1 Showing Comparison of Biochemical Parameters in 1st and 2nd Trimester of Pregnancy (n=200)

Variables	1 st Trimester	2 nd Trimester	p-value
T3 (ng/mL)	1.07 ± 0.15	1.19 ± 0.27	0.038
T4 (µg/mL)	5.54 ± 2.06	7.56 ± 2.11	0.004
TSH (µIU/mL)	1.76 ± 0.74	3.97 ± 1.96	<0.0001
Fasting blood Glucose (mg/dL)	81.03 ± 11.89	90.43 ± 15.42	0.01
Total Cholesterol (mg/dL)	155.73 ± 27.61	171.8 ± 30.11	0.035
HDL-cholesterol (mg/dL)	49.67 ± 5.05	46.20 ± 5.80	0.016
Triglyceride (mg/dL)	154.83 ± 26.02	186.30 ± 32.38	0.0001
LDL-cholesterol (mg/dL)	72.10 ± 8.43	85.23 ± 11.23	<0.0001

*p-value less than 0.05 considered as statistically significant

Table 2 Showing Comparison Of Biochemical Parameters in 1st and 3rd trimester of Pregnancy (n=200)

Variables	1 st Trimester	3 rd Trimester	p-value
T3 (ng/mL)	1.07 ± 0.15	1.32 ± 0.17	<0.0001
T4 (µg/mL)	5.54 ± 2.06	6.58 ± 1.06	=0.017
TSH (µIU/mL)	1.76 ± 0.74	4.87 ± 1.45	<0.0001
Fasting blood Glucose (mg/dL)	81.03 ± 11.89	97.12 ± 8.78	<0.0001
Total Cholesterol (mg/dL)	155.73 ± 27.61	194.10 ± 44.33	=0.0002
HDL-cholesterol (mg/dL)	49.67 ± 5.05	41.87 ± 4.50	=0.0001
Triglyceride (mg/dL)	154.83 ± 26.02	208.7 ± 47.71	<0.0001
LDL-cholesterol (mg/dL)	72.10 ± 8.43	111.45 ± 18.91	<0.0001

*p-value less than 0.05 considered as statistically significant

statistically significant. The mean value of total cholesterol, triglyceride and LDL-cholesterol were found to be increased significantly in 2nd and 3rd trimester as compared to 1st trimester and the mean value of HDL-cholesterol decreases significantly in 2nd and 3rd trimester as compared to 1st trimester (Table 1 and 2).

The differences in all the studied parameters in 2nd and 3rd trimester were statistically significant (Table 3).

Discussion

Pregnancy is one of the most vital phases in women life in which many hormonal, immunologic, vascular, metabolic and psychological changes are seen. These changes are beneficial to nurture the developing fetus. These changes also impact on level of normal biochemical parameters while others may mimic symptoms of medical disease. In current study total 200 pregnant women were

taken and were followed up in their all three trimesters. Maximum women were from 20 to 30 age group which was line with previous study that states that the most probable fertile years and reproductive age of woman is 20–30 years and her best reproductive years are in 20s.⁴ Lipid profile is significantly affected by the endogenous sex hormones of females. Endocrine changes during pregnancy (e.g., rising levels of estrogen, progesterone, and cortisol) cause lipogenesis and accumulation of fat associated with hyperphagia. Pregnancy-related increases in lipid synthesis are required as an energy source to meet the metabolic requirements of both the mother and the foetus.⁴ In present study, the mean value of total cholesterol, Triglyceride and LDL-cholesterol in first trimester, second trimester and third trimester of pregnancy were found to be increased significantly. These results were line with the previous studies that reported gradually increase of lipid fractions during in

Table 3 showing comparison of biochemical parameters in 2nd and 3rd trimester of pregnancy (n=200)

Variables	2 nd Trimester	3 rd Trimester	p-value
T3 (ng/mL)	1.19 ± 0.27	1.32 ± 0.17	0.295
T4 (µg/mL)	7.56 ± 2.11	6.58 ± 1.06	0.03
TSH (µIU/mL)	3.97 ± 1.96	4.87 ± 1.45	0.047
Fasting blood Glucose (mg/dL)	90.43 ± 15.42	97.12 ± 8.78	0.04
Total Cholesterol (mg/dL)	171.8 ± 30.11	194.10 ± 44.33	0.026
HDL-cholesterol (mg/dL)	46.20 ± 5.80	41.87 ± 4.50	0.002
Triglyceride (mg/dL)	186.30 ± 32.38	208.7 ± 47.71	0.037
LDL-cholesterol (mg/dL)	85.23 ± 11.23	111.45 ± 18.91	<0.0001

*p-value less than 0.05 considered as statistically significant

Thyroid Profile and Serum Lipid Level in Women with Normal Pregnancy

all three stages of pregnancy.^{4,5} Another related reported the gradually increase mean value of cholesterol and triglycerides in second and third trimester which is similar to the present study.⁴ Kumari et.al. in their study reported significant increase in that cholesterol during all three trimester.⁶ Other study also showed that TC and TG concentration rise up in late pregnancy compared with non-pregnant women.⁷ Evidence also suggests that blood lipids return to pre-pregnancy levels after delivery which recommends that the elevated serum lipids may have significant role in fetal development. However high cholesterol level during pregnancy may lead to pregnancy induced hypertension, cardiovascular risk which can threaten the life of both the mother and child. On the other way, low cholesterol can lead to early and premature labor and low birth weight.⁸

One study that also reported hypertriglyceridemia in pregnancy and reported gradually increased level of TG during trimester and also found significant difference when compared with non-pregnant women.⁹ For this explanation, one study stated that due to high energy demand in pregnancy maternal need of fuel switch from carbohydrate to lipid metabolism for energy production. Therefore, in early pregnancy there is seen increased lipid deposition and decreased lipolysis.⁴ Another explanation of rise in triglyceride and other lipid components during normal pregnancy are seen in parallel with the rise in gestational age which was observed with the rise in estrogen and progesterone level during gestational period.^{4,9} Decreased pattern in HDL-C was found in this study. Low HDL-C levels are said to increase the risk of coronary heart disease, and many pregnancies have had mixed outcomes. It is thought that the fall in serum HDL-C during the third trimester of a typical pregnancy may be a potential risk factor for atherosclerosis. Another explanation of increased LDL-C is high levels of progesterone and estrogen during pregnancy.⁴ The higher LDL-c pattern during pregnancy may be utilized to identify women who may experience atherogenic alterations in the future.¹⁰ Similar pattern of variations in lipid profile was also presented by other previous studies as found in present study.^{4,10} A study stated that there may be two factors for rise in TG, first increased activity of hepatic lipase, which is responsible for the synthesis of hepatic triglycerides; and reduced lipoprotein lipase activity, which results in a reduction in the catabolism of adipose tissues.¹⁰ During

pregnancy significant changes are also seen in thyroid hormone physiology and thyroid gland anatomy.¹⁰

In present study elevated pattern in TSH level was observed in first, second and third phase of pregnancy respectively. However, it was observed in normal limit, but increasing TSH value indicates towards the risk for developing hypothyroidism. In support with this Yoganathan et.al., studied on thyroid status in pregnant women and found increased TSH value in pregnant women with hypothyroidism and showed positive correlation.¹¹ Another study of Mehta *et al.*,¹² reported increased TSH concentration in third trimester compared with second trimester. Study stated that raised TSH value may be considered as a risk factor of decreased neurological development and preterm birth.¹³ In the present study, the mean T3 level was increase significantly in 2nd and 3rd trimester as compared to 1st trimester but it was in normal range. T4 level were increase in 2nd trimester as compared to 1st trimester but decreases in 3rd trimester as compared to 2nd trimester. Iodine is organized and oxidized by the thyroid peroxidase enzyme, which also produces the hormones FT4 and FT3.¹⁴ A glycoprotein called thyroglobulin serves as a substrate for the production and storage of thyroid hormones.¹⁵ Hypothyroidism is the outcome of both antibodies in autoimmune thyroid diseases. Thyroid autoimmunity is linked to recurrent miscarriage, which is probably brought on by generalized immune system activation and trans placental transfer of antibodies that result in fetal rejection.¹⁶

Females are high risk on thyroid dysfunction. Hypothyroidism is linked with increased lipid fraction i.e. TC, LDL, TG and decreased HDL-C. Elevated level of LDL-C results in increased in oxidation of LDL-C which is high risk factor of atherosclerosis. Hypothyroidism is also linked with decreased activity of lipoprotein lipase which leads to decreased clearance of TG rich lipoprotein.¹⁷ Line with present study Sangeeta et.al, also reported elevated levels of TC, LDL-C and TG with elevated level of TSH. Decreased HDL-C is also linked with hypothyroidism due to increased transfer of cholesterol esters from HDL to VLDL mediated through CETP, which effect on increased HDL catabolism.¹⁸ Thyroid profile and lipid profile both have vital role in female pregnancy. In early pregnancy, thyroid impairment was common and prevalent and associated with dyslipidemia. During pregnancy, a poor metabolic phenotype is associated with thyroid dysfunction. Effect of

body weight on association of lipid parameters and thyroid hormones are not studied well. A woman's physiological weight increase during pregnancy may have an impact on her lipid profile and thyroid hormone levels. A bigger sample size and prospective methodological investigations in different centers are required in the future to examine the association of thyroid profile with lipid profile with a larger sample size as the current study was only done in one hospital.

In the present study, it was observed that T3, T4 and TSH levels were raised. Obstetric

problems can result from aberrant thyroid hormones. Thyroid disorder has an impact on both the mother and the fetus. Early in pregnancy, maternal thyroid hormones and TSH are linked to dyslipidemia and a number of unfavorable pregnancy outcomes. Total Cholesterol, Triglycerides, and LDL were shown to have significantly higher levels across all lipid profile indicators as a result of endothelial dysfunction. Conventional screening of maternal thyroid in early pregnancy may help improve lipid levels and decrease several adverse pregnancy outcomes.

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Thyroid Profile and Serum Lipid Level in Women with Normal Pregnancy

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