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Original Article

Lipid Profile among Pregnant and Non-Pregnant Women in Rajshahi City

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Abstract

Background: Pregnancy is a physiological state with rapid hormonal and metabolic changes that helps the growth and survival of the fetus properly. However, biochemical profile derangement may lead to pregnancy complications and, eventually maybe, death.

Objectives: This study aimed to investigate whether lipid profile (Serum total cholesterol, Serum triglyceride, HDL-C, and LDL-C) during 3rd trimester of pregnancy differs from non-pregnant women of similar reproductive life.

Materials & Methods: This cross-sectional type of comparative study was carried out in the Physiology Department of Rajshahi Medical College in collaboration with the Maternity and Child Welfare Centre (MCWC), Rajshahi, over a period of 12 months from January 2019 to December 2019 among the pregnant and non-pregnant women to investigate the lipid profile during 3rd trimester of pregnancy. Approval from the Ethical Review Committee (ERC) was obtained prior to the commencement of the study. A pre-designed, validated, structured questionnaire was used to gather information from 120 women by purposive sampling technique. Of them, 60 were pregnant women, and 60 were non-pregnant healthy women.

Results: The results showed that the total serum cholesterol, serum triglyceride, and LDL-C were raised among pregnant women compared to non-pregnant women, and these were statistically significant ($p < 0.001$). But no significant difference in HDL-C was found between the two groups ($p > 0.05$). In this study, it was found that there was a substantial raised in lipid profile in the 3rd trimester of pregnancy compared with non-pregnant healthy women. So, regular monitoring of the lipid profile of pregnant women should be done to avoid adverse pregnancy outcomes.

Conclusion: Total metabolism is increased due to the needs of the growing fetus and the uterus. Basal metabolic rate may be increased up to 30% higher than that of the average for non-pregnant women.

Keywords: Serum total cholesterol, serum triglyceride, high-density lipoprotein cholesterol, and low-density lipoprotein cholesterol.

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Introduction

Pregnancy is a period from fertilization to the development of offspring, known as a fetus or embryo, in a woman's uterus. It is a physiological state that is natural and accompanied by hormonal and metabolic alterations in the woman's body.[1] More than 200 million women become pregnant yearly worldwide, and in most cases, the outcome

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of labor is successful. Pregnant women develop physiological dyslipidemia due to hormonal and metabolic alterations. The alterations of serum lipid indexes are associated with gestational age in pregnancy.[2]

The lipid change during pregnancy may be due to the formation of a zygote in the uterine wall in the first trimester in response to the maternal switch from carbohydrate to fat metabolism. It is an alternative pathway for energy generation due to high energy demand in the second trimester and the development of the fetal organ in the third trimester.[1] The metabolism of the lipid and lipoprotein reaches the level of cardiovascular risk during the second trimester. Analytically, the average serum LDL-C concentration increases by about 0.80 mmol/L in the second trimester compared with the first trimester and 0.69 mmol/L in the third trimester compared with the second trimester.[2] The major increase in the serum cholesterol level occurs in the second trimester (25-50%). The serum triglyceride level increases more severely than the others, and its major increase occurs during the third trimester (about 200-300%). Serum HDL-C concentration increases during the second trimester but decreases during the third trimester gradually. Hyperlipidemia in the second half of pregnancy may be a purely physiological response to pregnancy or may be indicative of pathology in some women who are suffered from different types of diseases. It must be investigated whether the total serum cholesterol, Serum triglyceride, HDL-C, and LDL-C response to pregnancy are a variable or not and, if so, whether they can predict future hyperlipidemia.

The increase in triglyceride, total cholesterol, and LDL-C serum levels observed in pregnant women may be explained by the fact that lipid metabolism changes during pregnancy due to hepatic lipase (HL) activity. A decrease in lipoprotein lipase (LPL) activity, delayed uptake of the remnant chylomicrons, and hormonal changes are observed in pregnancy. During pregnancy, these changes are manifested by impairing maternal fat depot accumulation, such as hypothyroidism or overt diabetes during the first half of gestation, which greatly affects fetal growth at late gestation.[1] Elevated insulin resistance in pregnancy is associated with the development of dyslipidemia in the form of elevated serum triglycerides, total serum cholesterol & LDL cholesterol while decreasing HDL cholesterol. The presence of dyslipidemia leads to many maternal complications, such as gestational diabetes mellitus (GDM), preeclampsia, intrahepatic cholestasis, etc., and fetal complications, such as macrosomia, intrauterine growth retardation, preterm birth, etc. Mothers with such complications are at higher risk of developing diabetes mellitus, cardiovascular disease, atherosclerosis, hypertension, etc., in later life.[3]

During early pregnancy, there is a rise in serum estrogen and progesterone levels. Furthermore, there is increased peripheral utilization of glucose due to hyperinsulinemia, increased glycogen accumulation in the liver as well as increased storage of lipids and decreased lipid breakdown.[4] Abnormal lipid metabolism with an increased serum lipid profile creates a setting for atherosclerosis which is a panacea for coronary artery disease. The increased lipid profile in pregnancy is traceable to pancreatic beta cell hyperplasia, hyperinsulinemia, hyperestrogenemia, and hyperprogesteronemia.[5] Therefore, the present study was designed to investigate the level of serum lipid profile (Serum triglycerides, Serum total cholesterol, HDL-C, and LDL-C) in pregnant and non-pregnant women.

Materials and Methods

This was a cross-sectional type of comparative study at the Department of Physiology, Rajshahi Medical College, Rajshahi, from January 2019 to December 2019 to assess lipid profiles among pregnant and non-pregnant women in Rajshahi city. Pregnant women in 3rd trimester and non-pregnant healthy women were included in this study. A purposive sampling technique was used, and the total sample size was 120 (60 in each group). Consulting with the supervisor and reviewing the previously published literature researcher developed the research instrument for the study. Then to finalize the procedure and to

evaluate the effectiveness of the questionnaire pretest was carried out among 15 pregnant and non-pregnant women. After the pretest, some correction was made, and the questionnaire was finalized. The pregnant and non-pregnant women who fulfilled the inclusion criteria were enrolled in this study. After taking informed consent, complete history taking and physical examination were done and recorded in a preformed data sheet. After 12 hours of overnight fasting by all the study subjects, 4 ml of fasting venous blood sample was collected from the median cubital vein by disposable syringe with all aseptic precautions.

All efforts were made to collect data accurately. After collecting data, the completeness and internal consistency of questions were checked. Then data were cleaned by editing, coding, recoding, and categorizing. Data were rechecked to detect errors and maintain validity. Then data were imputed into SPSS software. Data were expressed as mean with standard deviation (mean ± SD) and number with a percentage. Differences in categorical variables were determined by a chi-square test, and that in continuous variables were determined by an unpaired t-test. All statistical analysis was done by SPSS (version 23) for windows. In the interpretation of results, p-value < 0.05 was accepted as significant.

Results

Age and BMI of pregnant women were 24.7±4.4 years & 26.3±3.5 kg/m^2, and those of non-pregnant women were 26.1±5.8 years & 27.6±4.5 kg/$m^{2,}$ respectively. Pregnant subjects with a family history of dyslipidemia were 3 (5.0%), and that of non-pregnant subjects were 2 (3.3%). The number of pregnant subjects with primipara and multipara was almost equal, also almost equal in the case of prim gravida and multigravida. Non-pregnant women with primipara, multipara, and nullipara were 24 (40.0), 3 (5.0), and 33 (55.0), respectively. The majority of the pregnant subjects were preterm. Serum total cholesterol, LDL-C, HDL-C, and triglyceride of pregnant subjects were 206.8 ± 25.5 (mg/dl), 130.7 ± 22.6 (mg/dl), 36.5 ± 5.4 (mg/dl) and 195.6 ± 59.7 (mg/dl) respectively and those of non-pregnant subjects were 149.3 ± 14.7(mg/dl), 84.3 ± 10.6(mg/dl), 36.9 ± 4.8 (mg/dl) and 139.1 ± 21.6 respectively. Here, the differences in serum total cholesterol, LDL-C, and triglyceride between the two groups were statistically significant. Whereas the difference in serum HDL-C was not statistically significant.

Table 1: Age and BMI of study subjects (n=120)

Variables	Pregnant (n=60)	Non-pregnant (n=60)
Age (years)	24.7 ± 4.4	26.1 ± 5.8
BMI (kg/m^2)	26.3±3.5	27.6±4.5

Data are shown as mean ± SD.

Figure 1: Parity of pregnant subjects (n= 60)

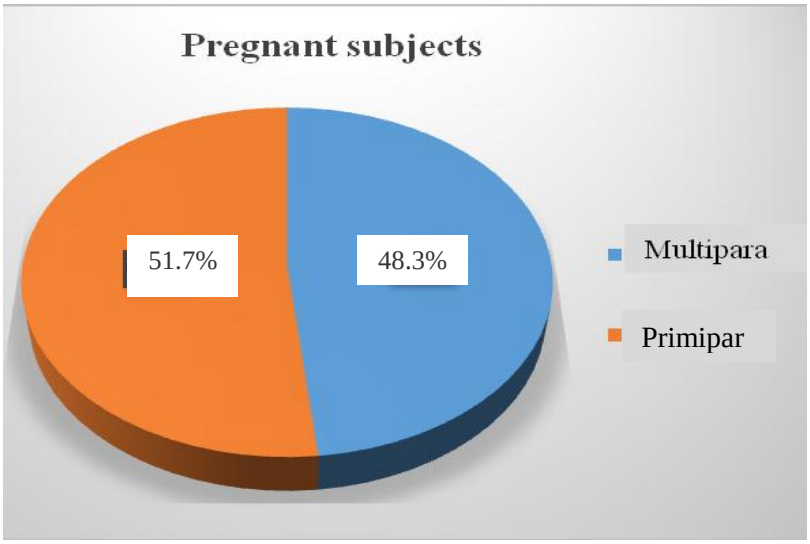

Figure 2: Parity of non-pregnant subjects (n= 60)

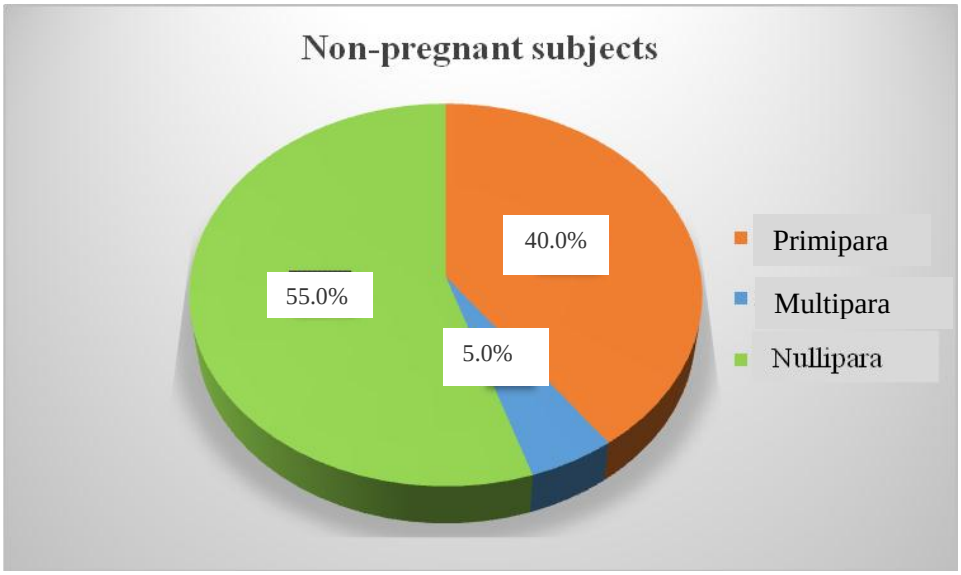

Figure 3: Gravidity of pregnant subjects (n= 60)

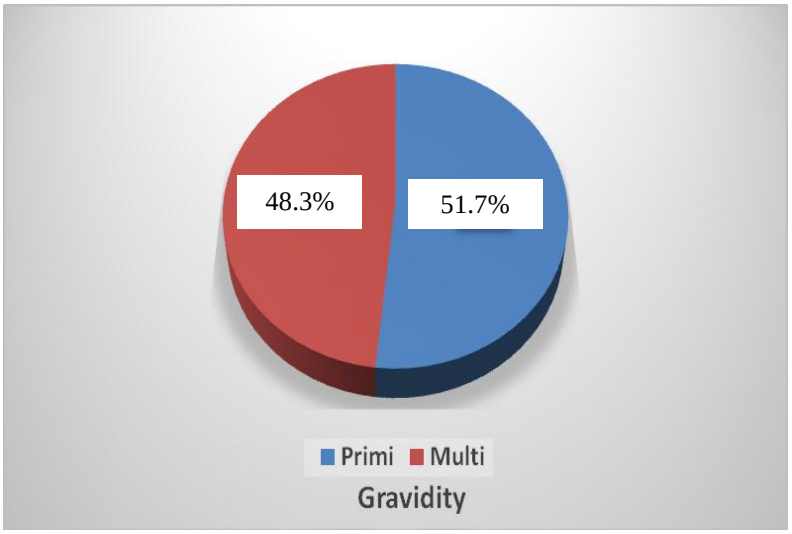

Figure 4: Gestational age of pregnant subjects (n=60)

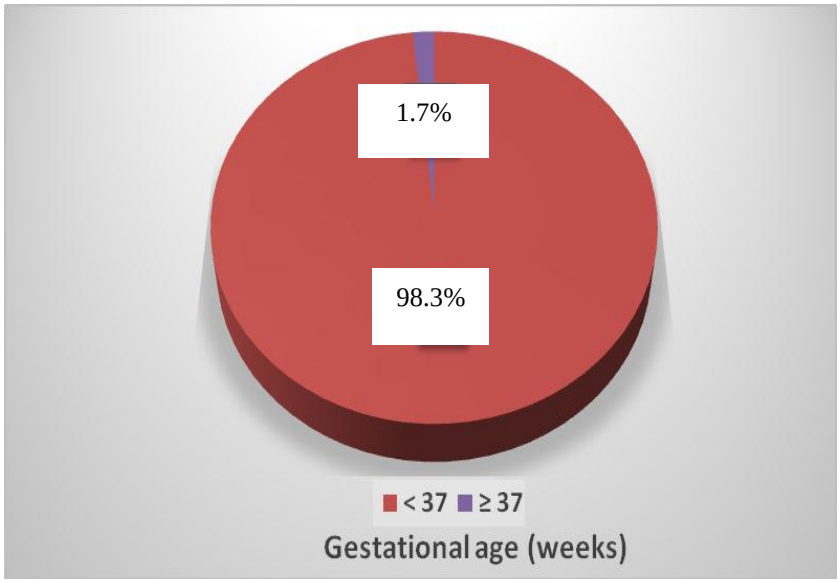

Table 2: Lipid profile and glycemic status of study subjects (n=120)

Variables	Pregnant (n=60)	Non-pregnant (n=60)	p-value
Lipid profile			
• Serum total cholesterol (mg/dl)	206.8 ± 25.5	149.3 ± 14.7	<0.001***
• Serum LDL-C (mg/dl)	130.7 ± 22.6	84.3 ± 10.6	<0.001***
• Serum HDL-C (mg/dl)	36.5 ± 5.4	36.9 ± 4.8	0.631
• Serum triglyceride (mg/dl)	195.6 ± 59.7	139.1 ± 21.6	<0.001***

Data are shown as mean ± SD. Statistical analysis was done by unpaired 't'-test (independent sample 't'-test). *** = statically significant (p<0.001)

Discussion

Pregnancy causes drastic changes in maternal physiology, psychology, and metabolism. This cross-sectional study has been conducted to evaluate any alteration in lipid profile during pregnancy. For that purpose, 60 pregnant women in 3rd trimester and 60 non-pregnant women were selected by purposive sampling technique. Serum triglyceride, total serum cholesterol, and HDL-C were analyzed by enzymatic methods with the help of an automated biochemistry analyzer, while serum LDL-C was calculated by Frederickson-Friedewald's formula of all subjects of both groups.

LDL-C (mg/dl)=Total cholesterol (mg/dl)-HDL-C- $\frac{Triglyceride}{5}$ (mg/dl).

Age is one of the factors which can affect serum lipid profile. So, age-matched cases and controls were taken in order to remove one of the major confounding factors.1 In the current study, we observed significantly increased serum triglyceride, total serum cholesterol, and LDL-C levels during pregnancy in comparison to non-pregnant control subjects. These findings are in accordance with studies done by Alemu et al.[1], Sonagra et al.[3], Mishra et al.[4], Pusukuru et al.[6], Omorogiuwa and Ozor[5], Salawu et al.[7], Wild et al.[8–10], Phuse[9,11], Garabet[10], Ekhator and Ebomoyi[12], Neboh et al.[13], Ochiai et al.[14], Diareme et al.[2].

The increase of those parameters in pregnancy may be explained by the alteration of liver lipase activity, and a decrease in lipoprotein lipase activity. Delayed uptake of the remnant chylomicrons and hormonal changes are also responsible.[1,12] Reduced catabolism of TG at the adipose tissue level is due to decreased activity of lipoprotein lipase and delayed uptake of the remnant chylomicrons by the liver as a result of the accumulation of TGs in plasma.[5,6,12] In addition, plasma lipids and lipoproteins increase during the 3rd trimester of pregnancy due to increased estrogen, progesterone, and human placental lactogen (hPL) levels.[11] Estrogens can increase the concentration of plasma triglyceride by inducing hepatic biosynthesis of endogenous triglycerides that are carried by VLDL and by inhibition of hepatic and adipose tissue lipoprotein lipases.[4,9,14,15] Increased plasma concentration of

LDL-C, total cholesterol, and decreased concentration of HDL-C are mainly due to progesterone.[5,9] In late pregnancy is referred to as the catabolic phase, the release of free fatty acids from the adipocytes is enhanced due to both relative insulin resistance and stimulation of hormone-sensitive lipase by placental hormones.[3,13]

In this study, we also found that pregnant women had slightly lower serum HDL-C levels than non-pregnant women, but that value was non-significant, which was in line with the studies done by Alemu et al.[1], Sonagra et al.[3], Pusukuru et al.[6], Wild et al.[8], Ekhator and Ebomoyi[12]. This finding of our study can be explained by the transfer of more TG molecules from VLDL to HDL in exchange for cholesterol ester (CE), which is caused by cholesterol ester transfer protein (CETP). Serum HDL-C declines due to the formation of TG-rich and cholesterol-ester-poor HDL particles with shorter life spans. As HDL-C causes reverse cholesterol transport in our body, the decline in HDL-C is associated with elevated total cholesterol and LDL-C levels.[3.8] But that value was not consistent with the study done by Mishra et al.[4], Omorogiuwa and Ozor,5 Salawu et al.[16], Neboh et al.[13], Festus OO et al.[14], Diareme et al.[2], Karim et al.[15] found that mean value of HDL was increased in their studies. That might be due to the fact that most of the case group was contemporary clerks that are agricultural jobs and were predisposed to increase physical activity. Increased physical activity is responsible for increasing HDL. Neboh et al.[13] found that HDL level was significantly increased in pregnant women than in non-pregnant women. Most of the study groups were predisposed to increase physical activities as a result of their occupation, and most of them also showed a preference for diets containing fish and enjoyed boiled walnut as snacks. Dietary habits and physical activities-both of these two factors might be helped in increasing HDL.

One of the strengths of our study was that we included only healthy women who were relatively free from any disease. So, it was possible for us to detect any minute change in lipid profile due to pregnancy. One of the weaknesses of our study was that we did a cross-sectional study with a small sample size. We included only 3rd trimester of pregnant women in our study. Hence trimester variation regarding the changes in lipid profile could be studied to get a better result. Our study suggests that the estimation of these biochemical parameters during pregnancy plays an important role in overcoming critical problems of heart diseases during pregnancy. The changes in lipid profile observed during pregnancy may be of potential importance for a women's long-term health. Early detection and effective antenatal services, prompt and proper management will decrease feto-maternal morbidity, mortality, and also perinatal mortality.

Conclusion

Gynecologists should advise lipid profiles at the proper stage of pregnancy so that they can advise regarding dietary intake and physical activity. A balanced diet with a good amount of dietary fiber can be prescribed. Avoidance of a sedentary lifestyle, and mild exercise such as walking, climbing stairs, gardening, etc., can be advised to women during pregnancy.

Conflict of interest: None declared

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