

## Evaluation of Lipid Profile and Fasting Blood Glucose Among Pregnant Women at Omdurman Maternity Hospital

Makawi A. A. Osman<sup>1</sup>, Noon A.Hammed<sup>2</sup>, Elmutaz H.Taha<sup>1</sup>, Mohammed Elshiekh<sup>1\*</sup>

<sup>1</sup>Department of Physiology, Faculty of Medicine and Health Sciences, University of Dongola, Dongola, Sudan

<sup>2</sup>Department of Physiology, Faculty of Medicine, International University of Africa, Khartoum, Sudan

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\*Corresponding author: Mohammed Elshiekh

Department of Physiology, Faculty of Medicine and Health Sciences, University of Dongola, Dongola, Sudan

### Abstract

### Original Research Article

**Background:** During pregnancy, maternal metabolic environment is modified by a rise in serum levels of estrogen and progesterone, pancreatic beta-cell hyperplasia and an increase in the secretion of insulin. Hyperinsulinemia leads to an increase in peripheral glucose utilization, a decline in fasting plasma glucose levels, increased tissue storage of glycogen, increased storage of fats and decreased lipolysis. The aim of our current study to investigate the changes in lipid profile, blood glucose and blood pressure throughout three trimesters in pregnant ladies. **Materials and Methods:** This is a hospital based, descriptive analytical cross-sectional study, performed at refer clinic of Omdurman Maternity hospital in Khartoum state. Included 150 apparently healthy pregnant ladies in the study group and 40 healthy non-pregnant ladies as a control group. Anthropometric measurements and blood pressure were measured and blood sample was obtained to analyzed lipid profile and blood glucose. **Results:** Data analysis showed that the mean level of triglyceride tend to change from slight increase in first trimester and significant increase in the second and third trimester. While mean level of HDL tend to change from slight decrease in the first and second trimester to significant decrease in the third trimester. Whereas there was an increase in both total cholesterol and LDL but was not significant. The mean level of fasting blood glucose was significantly raised in third trimester compared to other first and second Trimesters. Both component of blood pressure was significantly elevated in the first and third trimesters compare to second trimester. **Conclusion:** Normal pregnancy is associated with dyslipidemic changes due to elevated pregnancy related hormones. Increased insulin resistance leads to production of dyslipidemic changes in mother in form of elevated TG, total cholesterol, LDL and decreased HDL in serum and increased random blood glucose.

**Keywords:** Lipid profile, Trimesters, Fasting blood glucose, Blood pressure, Pregnant ladies.

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## INTRODUCTION

Pregnancy is physiological condition which is associated with many physiological, biochemical and hematological changes. Normal pregnancy is associated with increased insulin resistance [1] Decline in maternal insulin sensitivity is reported to be mediated by increase in the levels of estrogen, progesterone, human placental lactogen (hPL), human placental growth hormone (hPGH), cortisol, TNF $\alpha$ , ILs etc [2]. Due to insulin resistance in pregnant women, there is more utilization of fats than carbohydrates for energy by pregnant women and carbohydrates are spared for fetus. Thus, it serves as a physiological adaptation of the mother to ensure adequate carbohydrate supply for the rapidly growing fetus[1]. Pregnancy is known to create profound changes in the body. It not only increases

demand for metabolic fuel for the fetal growth and development of its associated structures, but also causes hormonal changes in the body which may lead to changes in lipid profile during different trimesters of pregnancy [3]. It has been noted that in first trimester, the maternal metabolic environment gets modified due to rise in serum levels of estrogens, and progesterone followed by pancreatic beta-cell hyperplasia leading to increase in insulin secretion [4].

During early pregnancy, glucose tolerance is normal or slightly improved and peripheral (muscle) sensitivity to insulin and hepatic basal glucose production is normal [2]. Glucose production increases with maternal body weight, such that glucose

production per kilogram body weight does not change throughout pregnancy [3].

Lipid profile during pregnancy is one of the major indicators of pregnant women health in terms of problems associated with high levels of cholesterol such as hypertension and diabetes. Regular measure of these indicators will help to control any deviation from the normal range. Thus, the aim of the current study we have to assess the changes in lipid profile, fasting BG in pregnant women throughout the three trimesters.

## MATERIALS AND METHODS

This is a hospital based, descriptive analytical cross-sectional study, conducted within a period from January – March 2018 in the refer clinic at Omdurman Maternity hospital, Khartoum state (Sudan).

### Study population

A total of 160 ladies participants comprising 120 pregnant ladies preserve as case group including all trimesters and 40 healthy non-pregnant ladies preserve as control group. All participants were assessed for exclusion and inclusion criteria. General examination was done to all participants to exclude any abnormality. A questionnaire containing personal data and medical history was filled by the investigator to all participants.

Healthy pregnant ladies, normotensive pregnant ladies and pregnant lady who accept to participate in the study were recruited as cases. Pregnant ladies diagnosed with pregnancy induced hypertension, with elevated blood pressure (hypertension), with proteinuria and with known diabetic were excluded.

### Anthropometric measurements

Patients were made to stand without their sandals, bags or anything of significant weight on the weighing scale (Hospibrand ZT-120, Huaiyin medical instruments Co. Ltd, China) and against the meter rule (Huanan measuring tape). The weight was read to the nearest 0.1 kg and recorded. The value for the height was recorded to the nearest 0.1 cm and then converted to meters. The BMI was calculated using formula (weight/height squared) and expressed in kg/m<sup>2</sup>.

### Blood pressure measurement

Trained personnel used a mercury sphygmomanometer (Germany) and a stethoscope to measure the blood pressure of participants in accordance with recommendations of the American Heart Association [5]. The procedure was repeated for each patient between 5 and 10 min. Mean values of duplicate measurements were recorded as the blood pressure.

### Biochemical analysis

A volume of 5 ml of venous blood samples was collected from participants after an overnight fast

(8-12 h) and immediately transferred into lithium heparin container for lipid profile and florid oxalate container for blood glucose. Sample was centrifuged at 500 g for 5 min and the serum stored at -20°C until assayed.

Total cholesterol, triglyceride, HDL and LDL were measured by using Mindray Bs-200 principle auto analyzer (MINDRAY CHEMISTRY ANALYZER, BS-200(CHINA). Fasting blood glucose levels were determined by using spectrophotometric method.

### Ethical consideration

The study was carried out in accordance with the Declaration of Helsinki and its subsequent modifications. Ethical clearance of the study was obtained from Ethics Committees of Ministry of Health, Northern State, Sudan, (approval number: 451#). Agreement was taken from Medical Administration of Omdurman Teaching Hospital for Obstetrics and Gynecology and from any participants before sample and data collection. A written consent was obtained from all participants. All information was highly secured and is not be used for any purpose's other than this scientific research. Participants were educated about physiological changes in pregnancy and healthy diet; and investigation done was shared with participants

## DATA ANALYSIS

Data was saved in excel sheets and analyzed using SPSS version 24. Descriptive statistic was done. Results were presented as mean  $\pm$  standard deviation. Mean and standard deviation were calculated for both control and study groups. To compare variables between the three-trimester one-way ANOVA and Tukey HSD test was done. A p value of  $< 0.05$  was considered statistically significant.

## RESULTS

### Mean of age and lipid profile for control group

The mean age of the participants in control were  $27.5 \pm 4.32$  years. The minimum age was 18 years and the maximum age was 41 years. The mean triglyceride level in participants was  $99.8 \pm 9.00$  mg/dl. The mean cholesterol level was  $154.05 \pm 12.94$  mg/dl. The mean LDL level was  $105.35 \pm 11.31$  mg/dl. The mean HDL level was  $43.22 \pm 14.20$  mg/dl.

### The mean age and lipid profile for pregnant ladies

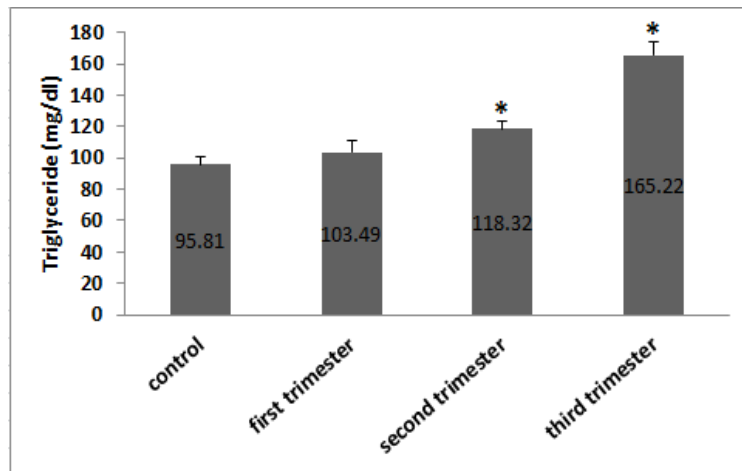
The mean age of the pregnant ladies were  $27.3 \pm 2.30$  years. The minimum age was 14 years and the maximum age was 39 years. The mean triglyceride level in the pregnant ladies was  $125.30 \pm 23.41$  mg/dl. The mean cholesterol level was  $165.21 \pm 50.43$  mg/dl. The mean LDL level was  $108.96 \pm 43.73$  mg/dl. The mean HDL level was  $42.55 \pm 11.20$  mg/dl (Table 1).

**Table-1: The mean data of age and lipid profile among control and case in the total study groups**

Variables	Control	case
	Mean $\pm$ Std	Mean $\pm$ Std
Age (years)	27.5 $\pm$ 4.32	27.3 $\pm$ 2.3
Triglyceride (mg/dl)	95.8 $\pm$ 9	125.3 $\pm$ 23.41
Total cholesterol (mg/dl)	154.05 $\pm$ 12.94	165.21 $\pm$ 50.43
LDL (mg/dl)	105.35 $\pm$ 11.31	108.96 $\pm$ 43.73
HDL (mg/dl)	43.22 $\pm$ 14.2	42.55 $\pm$ 11.2

The serum level of triglyceride in trimester and control group: The mean level of triglyceride in control was 95.81  $\pm$  11.21 mg/dl. In first trimester was slightly increased to 103.49  $\pm$  19.03 mg/dl, and it was

significantly increased in second trimester 118  $\pm$  12.32 mg/dl and third trimester 165.22  $\pm$  23.45 mg/dl respectively (P < 0.05) (Figure 1).

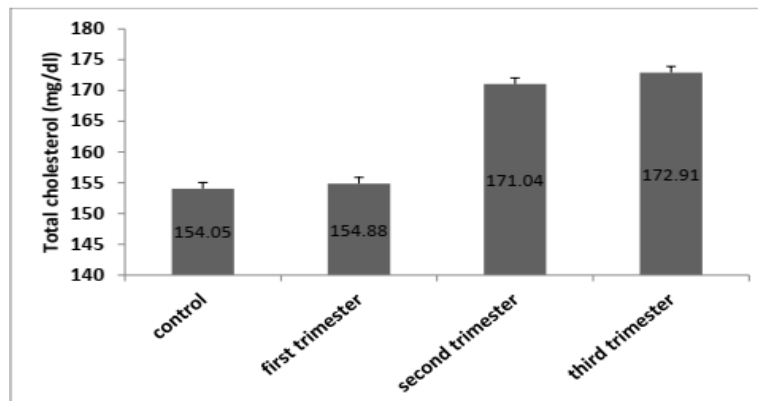


**Fig-1: The Serum of triglyceride level between control group and trimester groups. \*P < 0.05 vs control and first trimester group.**

#### The Serum of total cholesterol in trimester and control group

The mean level of the total cholesterol in the control group was 154.05  $\pm$  10.21 mg/dl. While In first

trimester was 154.49  $\pm$  9.03 mg/dl, and it was slightly increased in second trimester 171.04  $\pm$  12.32 mg/dl and third trimester 172.91  $\pm$  10.45 mg/dl respectively (P < 0.05), figure 2.

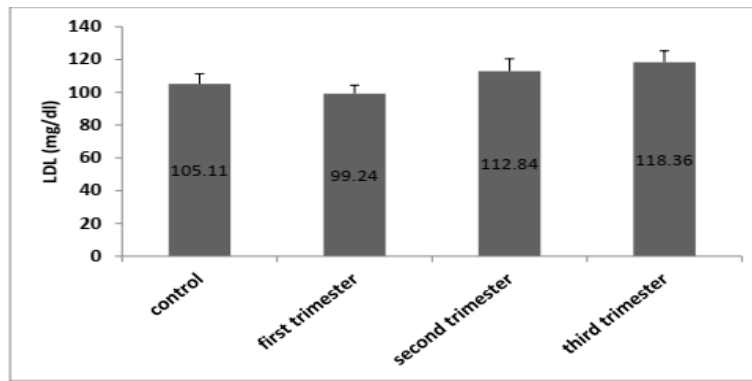


**Fig-2: Serum level of total cholesterol between control group and trimester groups.**

#### The serum level of LDL between trimester and control group

The mean level of LDL in the control group was 105.11  $\pm$  9.81 mg/dl. While in the first trimester

was 99.24  $\pm$  13.11 mg/dl, and was slightly increased in second trimester 112.84  $\pm$  10.17 mg/dl and third trimester 118.36  $\pm$  11.22 mg/dl respectively. Figure 3.

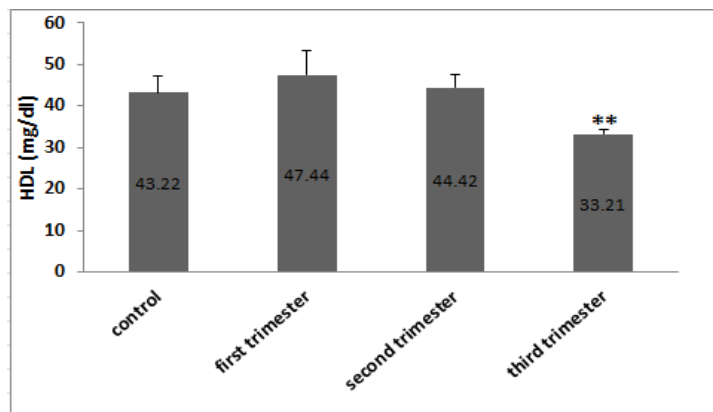


**Fig-3: The serum level of low density lipoprotein (LDL) between control and trimester**

**The serum level of HDL between trimester and control group**

The mean level of HDL in control was  $43.22 \pm 13.22$  mg/dl. In first trimester was  $47.44 \pm 18.24$  mg/dl, and in second trimester was  $44.42 \pm 10.15$  mg/dl and in

the third trimester was  $33.21 \pm 5.31$  mg/dl. In addition, the mean level of HDL in third trimester was significantly lowered compared to other groups  $P < 0.05$ . Figure 4.

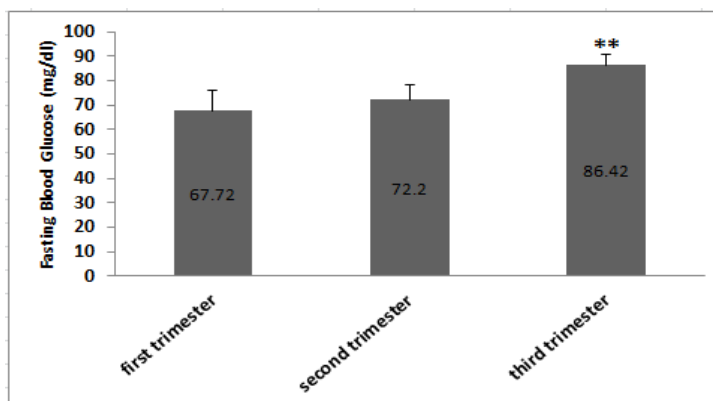


**Fig-4: Serum level of HDL between control group and trimester groups. \*\*P < 0.05 vs other trimester groups**

**Fasting blood glucose between trimesters**

The mean level of fasting blood glucose in the first trimester was  $67.72 \pm 9.34$  mg/dl. While in the second trimester was  $72.2 \pm 8.54$  mg/dl, and in third

trimester was  $86.42 \pm 10.32$  mg/dl. In addition, the mean level of fasting blood glucose was significantly increased in third trimester compared to other first and second trimesters  $P < 0.05$ . Figure 5.



**Fig-5: Fasting blood glucose level between trimesters. \*\*P < 0.05 vs first and second trimester**

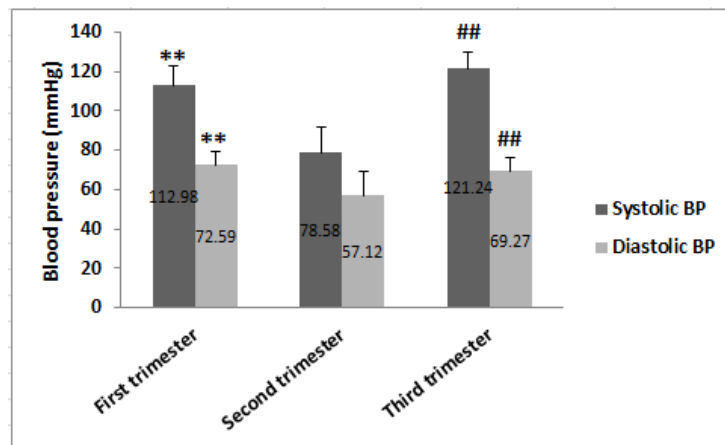
**Systolic and diastolic blood pressure values in pregnant ladies**

The mean level of systolic and diastolic blood pressure, in the first trimester was 112.98 and 72.59

respectively, while in the second trimester was 78.58 and 57.12 respectively, whereas in the third trimester was 121.24 and 69.27 respectively. Both systolic and diastolic blood pressure were highly reduced in the

second trimester in comparison to first and third

trimester, ( $p$  value  $\leq 0.05$ ), figure 6.



**Fig-6: Blood pressure level between trimesters. \*\* $P < 0.05$  vs second trimester ## $P < 0.05$  vs second trimester**

## DISCUSSION

Pregnancy causes drastic changes in maternal physiology and metabolism. These changes are mainly due to alteration in various hormonal levels [6]. In this study, the serum triglyceride level in pregnant ladies were significantly elevated compared to non-pregnant women specially with the progression of pregnancy which agreed with different studies [7-9].

The large rise in triglycerides is due to two factors, increased hepatic lipase activity, leading to enhanced hepatic triglyceride synthesis and reduced lipoprotein lipase activity, resulting in decreased catabolism of adipose tissue [16]. The total Serum cholesterol level was slightly elevated in our study, whereas in other studies it was markedly increased during pregnancy [7-9].

The current study showed slight increase in LDL level in pregnant ladies, but it was not significant in comparison to their control group, which was explained by study showed that the placental synthesis of steroid is facilitated by elevated LDL cholesterol levels [10]. Our study showed initial increase in HDL level and then significantly decrease in the third trimester, which is typically in accordance with the studies done by Brizzi P and Wild R [7, 12], this fall in HDL levels in the third trimester of a normal pregnancy could be a potential risk factor for developing atherosclerosis [11]. Other different study showed decline in HDL is associated with elevated total cholesterol and LDL levels [13]. Our results showed that as pregnancy advances, fasting blood glucose level increases. Such changes are more marked in 3rd trimester compared to first and second trimesters  $P < 0.05$ . Impaired maternal gestational glucose metabolism is a major risk factor for delivering a large-for-gestational-age infant, preterm birth and Caesarean delivery, with even stronger effects among overweight and obese women [14, 15].

Elevated levels of progesterone, estrogen, HPL, HPGH, inflammatory mediators etc. leads to alteration in insulin signaling pathway causing state of insulin resistance [16] Increased IR is associated with development of dyslipidemia [17].

In our study, we found that as pregnancy advances, triglyceride, total cholesterol and LDL increases. This finding is in accordance with studies done by Parchwani D *et al.* [18] & Kumar S *et al.* [19].

In our study, we found that blood pressure (systolic and diastolic) was significantly reduced in the midgestational of normal pregnancies and this was in accordance with many studies which explain it by vascular resistance decreases, accompanied by blood pressure reductions in response to nitric oxide and prostaglandins [20, 21].

## CONCLUSION

Normal pregnancy is associated with elevated insulin resistance due to elevated pregnancy related hormones. Increased IR leads to production of dyslipidemic changes in mother in the form of elevated TG, total cholesterol, LDL and decreased HDL in serum and increased in blood glucose. Dyslipidemia can complicate the pregnancy and increase maternal & fetal morbidity & mortality.

## RECOMMENDATION

Pregnant women should be screened for lipid profile and random blood glucose, and dyslipidemia should be identified. Dyslipidemic and hyperglycemic mothers should be advised for necessary dietary and lifestyle modifications which can reduce maternal and fetal complications.

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### Conflicts of interest

There are no conflicts of interest.

### Fund/support

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