

## Effect of Pregnancy Stages on Changes in Lipid Profiles

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### ABSTRACT

Defines Pregnancy is a physiological process occurring among women and female mammals; it usually begins with the process of fertilization of one egg or more, and the evolution of the atom inside the mother's womb is called a fetus or Embryo and continues the development of the fetus inside the mother until the birth. Usually, Pregnancy in women Aly40-36 continues) almost a week after the end of the last menstrual cycle, more studies on Pregnancy in which women took the biggest in the research and investigation share, compared with studies conducted on female mammals. Pregnancy might result through a traditional male-female partnership or using cutting-edge medical technology. Nevertheless, the fetus grows and develops inside the mother's womb.

Pregnancy is associated with major changes inside lipid profiles During Pregnancy. This study aimed to determine the level of triglycerides (T.G.), high-density lipoprotein (HDL), total Cholesterol (T.C.), low-density lipoprotein (LDL) and VLDL levels in the third trimester of Pregnancy in Tikrit city pregnant women. Ninety blood samples were taken at various times throughout Pregnancy for this prospective investigation. The analysis of variance was used to look at the data, and a significance level of p 0.05 was used. The results showed that the concentration of Cholesterol increased significantly with the progression of Pregnancy, as it was higher in the second and third stages of Pregnancy compared to the first stage of Pregnancy, while no significant differences were shown in the concentration of high-density lipoprotein (HDL) and low-density lipoprotein (LDL) with the progression of Pregnancy. In contrast, the first and last stages of Pregnancy were significantly superior in the concentration of VLDL and triglycerides (T.G.) compared to the second stage of Pregnancy. Delayed T.G. When high blood pressure in Pregnancy is combined with raised blood T.G. levels, a condition known as preeclampsia may develop. This correlation has the potential to provide light on the pathophysiology of preeclampsia and inform the design of interventions aimed at its early identification and prevention.

**Keywords-** Pregnancy Stages, Lipid profiles Cholesterol, LDL, HDL, TG, VLDL.

### I. INTRODUCTION

Pregnancy is a natural condition that the pregnant woman adapts to during the period from fertilization of the egg to childbirth. It lasts for about nine months, as pregnant women undergo many physiological changes to keep pace with the growth and development of the fetus [1].

To facilitate the study of changes that occur during Pregnancy, the researchers divided the pregnancy period of women into three stages, each consisting of three months [2]. Most studies have agreed that the first stage of Pregnancy is one of the most important stages and the most dangerous and influential in perpetuating

Pregnancy and its success because it includes many events such as fertilization of the egg, divisions of the zygote cell, the stages of transmission of the fertilized egg through the oviduct and the process of implanting it in the lining of the uterus, and all these events need to be addressed. A delicate hormonal system and enough blood components to meet the needs of the pregnant mother and her fetus during this stage. Also, this stage is of great importance in the development of the placenta and fetal organs, as the outer layers of the fetal condition grow and form the placenta to receive nutrients through the wall or lining of the uterus (uterine wall). When a fetus is conceived, the placenta attaches to the baby by what is known as the umbilical cord. The second stage of

Pregnancy is marked by the fetus's first signs of movement; nevertheless, the fetus does not reach full maturity until the third stage, which encompasses the last three months of Pregnancy and is characterized by the fetus's fast growth and development. [1][2].

Pregnancy is known to bring about profound changes in the body not only because it increases the demand for metabolic fuels for fetal growth and development of associated structures but also causes hormonal changes in the body that may lead to changes in the level of lipids in the blood during the three stages of Pregnancy [3]. The mother becomes almost a new person during Pregnancy, and changes occur in the physiology of expectant mothers and continue throughout the progression of Pregnancy by requiring additional energy. As the Pregnancy progresses, the metabolism transition is well integrated to ensure that the fetus is supplied with adequate nutrients. It has been observed that in the first trimester, a rise in fat occurs due to a rise in estrogen and progesterone levels, followed by hyperplasia of beta cells in the pancreas, which leads to an increase in insulin secretion [4].

Its overabundance leads to a decrease in the blood glucose level by increasing the peripheral utilization of glucose, followed by its storage in the tissues as glycogen [3][4].

The term "accelerated starvation," coined by Freinkel to characterize the metabolic alterations that occur in pregnant women when food is scarce, has now into common use. "induction of metabolism" when food intake is avoided (to the fetus) and increased plasma fatty acid concentrations [4]. [5] This was the first chemical investigation to show an increase in blood lipids during Pregnancy, and it was also the first to propose Cholesterol. With more recent development, different study techniques noted an increase in the different parts of the fat. However, the increase was inconsistent, and most authors believe that the increase in blood lipids is related to the increased requirements of the fetus. Thus, fat gain is normal during Pregnancy and before childbirth. Still, many questions in this field remained unanswered, such as those related to the exact relationship between changes in fat during Pregnancy. However, there have been preliminary studies on lipid levels and changes during Pregnancy on a large scale in large populations in developing countries, especially during the second and third trimesters of Pregnancy. Fat is a food insoluble in a range of solvents. Organic matter is mainly found in plasma; carbohydrates and fats are the necessary categories of nutrients that provide energy to increase the fetus's cellular proliferation and adapt the mother's multiple organs to perform their physiological functions. Fats are associated with certain proteins to form lipoproteins necessary for metabolism [4][5].

There are six main sub-compartments of lipoproteins: chylomicrons, very low-density lipoprotein (VLDL), medium-density lipoproteins (IDL), low-density lipoprotein (LDL) and high-density lipoprotein

(HDL). Chylomicrons are the least dense of all. Lipoproteins carry Cholesterol from the intestines to muscles and other tissues that use the fatty acids as an energy source or to produce fats. [5].

Abnormal lipid metabolism with increased blood fat creates an environment for atherosclerosis and is a medicine for coronary artery disease. Studies have shown that this abnormal metabolism leads to increased triglycerides, low- and high-density lipoproteins, and total Cholesterol during Pregnancy. This is essential due to the high energy required for increased cellular proliferation, enlargement of the maternal uterus, enlargement of blood volume, implantation of the fetus, and formation of blood vessels. Intrauterine placenta and placental development and growth However, high fat increases the risk of coronary artery disease (CHD). It can adversely affect the health of the pregnant woman and her fetus. [6].

It has also been found that the TC/HDL ratio is greater in PIH and preeclampsia than in a healthy pregnancy. [7] Hyperlipidemia refers to increased plasma concentrations of TGS or Cholesterol. Cholesterol is generated in the liver and other tissues, some from dietary sources.

Thyroid hormones, steroid hormones, and sex hormones contribute to the regulation of fat metabolism. It is known that estrogens and progesterone affect plasma volume. Because estrogen increases the production of LDL receptors and decreases the plasma amount of LDL, it may lower cholesterol levels. The expansion of plasma volume aids this effect. Heart disease and pregnancy metabolism accommodate both the growing needs of the baby and the mother's increased energy demands. [8].

An increase in hepatic triglyceride (T.G.) synthesis and subsequent fat deposition in the mother's adipose tissue is a hallmark of the tonic phase of Pregnancy. Late Pregnancy, on the other hand, is a catabolic state. Relative insulin resistance and the activation of hormone-sensitive lipase by placental hormones increase the release of all free fatty acids from adipocytes. [7][8]. As a consequence, the metabolism of fat in the mother is especially changed when she is carrying a child. Endothelial damage is considered to be more likely if LDL cholesterol builds up during Pregnancy. Despite this, HDL levels are high and growing in the third trimester. The mother's weight growth and her eating choices during Pregnancy affect her fat metabolism [9]. Studies in guinea pigs and mice show that cholesterol content and plasma cholesterol concentrations may be permanently altered by manipulating maternal food consumption during Pregnancy. [10].

## II. AIM OF THE STUDY

1- Study levels of total Cholesterol (T.C.), low-density lipoproteins (LDL), high-density lipoproteins (HDL),

very low-density lipoproteins (VLDL) and triglycerides (TGS) as Pregnancy progresses.

2- Knowing the stages of Pregnancy and their impact on lipid profiles Materials and methods of work.

### III. WORKING MODALITIES

#### Study Samples

This study was conducted in Tikrit Teaching Hospital in Tikrit from 2021 to 2022. It included 90 pregnant women (30) in the first stage of Pregnancy, (30) in the second stage of Pregnancy, and (30) in the last stage of Pregnancy. Their ages ranged between (15)-40 years of blood samples 90 samples were collected from pregnant women at different stages of Pregnancy, 5 ml of blood was drawn, and it was placed in EDTA-free wine test tubes. The blood was left at room temperature for 20 minutes; then, the blood serum was separated using a centrifuge at a speed of 3500 revolutions/min for 15 minutes; then, the serum was withdrawn with a micropipette and preserved until analyzes are performed.

Estimation of lipid profile concentration levels. The concentrations of lipid profiles were estimated using the number of measurements for each of them, as follows:

#### Cholesterol level measurement

The concentration of Cholesterol in the blood

serum was estimated based on the enzymatic method using the ready-made analysis kit from Biolabo, manufactured in France, bearing the number 02160 [11].

#### Triglyceride level measurement

The concentration of triglycerides in blood serum was estimated using the enzymatic method, which used the special analysis kit prepared by the French company Biolabs, which bears the number 02160 [11].

#### HDL level measurement

Serum HDL-C was determined using a ready-made HDL-C determination kit prepared by Biolabo, manufactured in France, bearing No. 02160 [12].

#### LDL level measurement

The concentration of low-density lipoproteins for Cholesterol was calculated according to the relationship followed by each of [13].

#### VLDL level measurement

VLDL concentrations were estimated according to the following relationship [13].

#### Statistical analysis

Statistical analysis was carried out using the SPSS program, and comparisons of averages were calculated using Dunkin's method, according to (14).

### IV. RESULTS AND DISCUSSION

**Table 1: The effect of pregnancy stages on the level of lipid profiles of pregnant women during the different stages of Pregnancy**

Mean ± Standard Deviation			The Details
3	2	1	
a 205.30±21.6	a 199.83±24.6	b 174.07±23.2	Cholesterol mg/dl
a 67.29±29.3	a 62.68±32.5	a 67.27±27.8	LDL mg/dl
a 43.18±4.2	a 44.30±4.5	a 45.21±4.8	HDL mg/dl
a 27.60±6.8	b 26.74±7.6	a 28.12±6.7	VLDL mg/dl
a 138.03±34.0	b 133.73±37.8	a 140.60±33.5	T.G mg/dl

It is clear from the above table that there was a significant superiority ( $P \leq 0.05$ ) during the second and third stages of Pregnancy compared to the first stage in its effect on cholesterol concentration. He also indicated [10] that Pregnancy is a stage that requires high levels of energy to complete the body's functions and that the increased demand for oxygen and its entry in large quantities increases the state of oxidative stress and causes an increase in fat oxidation. Both [9][10] stated

that the high concentrations of Cholesterol in the blood serum of pregnant women are considered a normal condition due to its contribution to the formation of cell membranes and digestive juices and to the manufacture of steroid hormones (progesterone and estrogen), in addition to its contribution to the construction and development of fetal tissues.

Pointed out that the high concentration of Cholesterol during Pregnancy, especially in the last two

stages, is evidence of women suffering from multiple diseases during Pregnancy, especially heart disease, diabetes, high blood pressure, and preeclampsia or preeclampsia, such as Cholesterol is a major factor in the incidence of these diseases. Since Pregnancy is a physiological stage that requires high energy expenditure to complete the functions of the body, so the demand for oxygen increases and its entry in large quantities increases the state of oxidative stress, so free radicals accumulate and derived fats such as Cholesterol are oxidized in the cell membranes, causing high malondialdehyde, which causes a functional disorder in the inner lining of blood vessels. The high concentration of Cholesterol in the blood serum of pregnant women is considered a normal condition because it is involved in forming cell membranes and digestive juices, such as bile acids, and synthesizing steroid hormones (progesterone and estrogen). It also builds the fetus's nerve tissues [15].

We believe that this is because these lipoproteins, when present naturally in the body, protect general health and that eating healthy foods during Pregnancy, like vegetables and fruits, helps to keep these levels up. The results also showed no significant differences in the concentration of high-density lipoproteins for HDL-C Cholesterol and low-density lipoproteins for LDL cholesterol during the three stages of Pregnancy. It's crucial to keep lipid levels steady throughout Pregnancy. These HDL lipoproteins do a great job of removing harmful Cholesterol from the blood and transporting it back to the liver, where it can be processed and discarded as waste. The current study's findings are consistent with those of [16], which confirmed that Pregnancy hurts HDL-C. That LDL levels remain stable during Pregnancy because their presence in the blood circulation can result in the accumulation of plaques in the walls of the arteries, making them more solid and narrow, which helps to gradually block the arteries, which can lead to a heart attack, a stroke, or even sudden death Both [14] and [15] showed that an increase in the concentration of triglycerides results in a reduction in HDL when the concentration of fatty acids does not rise proportionately. As the scientist explained [15][16], HDL-C carries Cholesterol from body fluids and tissues to the liver, and thus it reduces the risk of Cholesterol causing many diseases [17]

The results of the study also showed that there were no significant differences in the concentration of very low-density lipoproteins between the first and last stages of Pregnancy. In contrast, there was a significant decrease during the second stage of Pregnancy. We believe its decrease during the second stage of Pregnancy is due to the decrease in triglycerides during the second stage of Pregnancy. And the reason could be to increase blood pumping to the body due to the large size of the fetus, as these proteins are built in the liver, especially after eating a meal rich in fats. It participates

with LDL\_C, especially in causing coronary artery disease. It inhibits its secretion in the presence of insulin at a high concentration because it reduces the processing of proteins needed for its manufacture [18].

The above table also showed a decrease in triglycerides during the second stage of Pregnancy compared to the first and last stages of Pregnancy. The reason for this is attributed to the fact that Cholesterol and triglycerides increase at the end of Pregnancy and that the increase in hyperlipidemia is a result of the metabolic adaptation of the state of Pregnancy and the retention of glucose in the fetus [9]. The current study, along with the study done by [10], indicates that the increase in triglycerides during Pregnancy is accompanied by a decrease in the concentration of low-density lipoproteins in most cases and that these changes continue after childbirth.

The study also agreed with the study they did [18][19] that high Cholesterol and triglycerides are caused by fatty accumulation in adipose tissue. Hence, the pregnant woman's nutrition, age, and recurrence of Pregnancy are probably the reasons that call for the accumulation of fats and storing them in triglycerides. It is transported through the blood to the sites of its metabolism in the liver and muscles, and the liver has a limited capacity to store it. The surplus is secreted into the blood, and thus its concentration rises during Pregnancy, especially in the last stage of it. Total cholesterol levels grow during Pregnancy because the body consumes stored lipids for energy. Still, the body also uses some of the Cholesterol to produce steroid hormones, which are essential for the development of the fetus. This is according to the study's author [18].

This stage is like progesterone and estrogen, where at the end of Pregnancy, progesterone production consumes about 25% of the cholesterol stock compared to that of a non-pregnant woman. Whereas [19] the reason for the high level of triglycerides at the end of Pregnancy is that this stage represents a catabolic state to support rapid fetal growth, as lipolysis processes increase, releasing free fatty acids and glycerol from adipose tissue, and these basic substances will be metabolized in the liver into glycerides. Triglycerides and ketone bodies. Therefore, the level of triglycerides in the mother's serum rises at the end of Pregnancy as a result of the increase in free fatty acids during Pregnancy in the body, especially the liver, and the lack of amino acids led to the conversion of some of the fatty acids into phospholipids and Cholesterol, which are transmitted with the triglycerides formed in the liver to the blood. This results in an increase in the level of blood fats. Triglycerides rise during Pregnancy due to eating foods rich in fat. When they are decomposed in the intestine, fatty acids are liberated, which leads to increased quantities in the liver and the liberation of triglycerides at high concentrations. He also indicated [20] that oxidative stress has a major role in the increase in the percentage of triglycerides. Additionally, many disorders

that affect pregnant women, such as hypertension, gestational diabetes, and preeclampsia, may be traced back to the rise in oxidation factors indicated by the products of lipid peroxidation.

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