Pro Index | Journal of Science in Medicine and Life
Volume: 2 Issue: 3 Year: 2024
http://journals.proindex.uz

Evaluate the Liver, and Kidney Function in Pregnant Women with Gestational Hypertension

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Abstarct: The research sought to establish the connection between high blood pressure and some physiological and biochemical variables before and during pregnancy and to investigate the effect of this relationship on some body functions. The study was conducted from the beginning of July 2023 until the end of October 2023, and samples were collected from women visiting the Children, Obstetrics and Gynecology Hospital in Kirkuk City. Ninety-six blood samples were collected and divided into four groups. The groups consisted of 23 pregnant with gestational hypertension (GH), 23 non-pregnant with chronic hypertension (HT), 25 samples from healthy pregnant, and 25 samples from healthy non-pregnant females as a control group. The results showed a significant increase in serum albumin, urea, and ALT levels in pregnant with GH and pregnant with HT compared to the control group. As for creatinine and AST, their levels were high in pregnant with GH, with no significant differences between the infected non-pregnant group compared to the control group. The increase in all parameters studied was higher in women with GH than in the other groups. Current research indicates a significant link between high blood pressure and the development of pregnancy-related complications. Pregnant women face a greater risk of developing high blood pressure, which can lead to conditions such as preeclampsia and eclampsia, which can persist after pregnancy and turn into chronic hypertension.

Key points: Pregnancy, Gestational hypertension.

1. Introduction:

During pregnancy, natural changes occur in the woman's body to conform the growth of the embryo. They involve alterations in blood vessels, and heart, as well as in metabolic processes and functions of the lungs and kidneys. Cardiac output and respiratory rate increase and blood sugar levels rise. There is also a rise in estrogen and progesterone hormones, causing menstruation to stop during this period. These physiological changes are regulated by hormonal interactions, including progesterone, which affects the overall physical environment (Zachariah et al., 2019). These changes affect the body's natural biochemistry and cause some symptoms that may resemble the symptoms of the disease; hence, it becomes vital to differentiate between expected physiological effects and pathological symptoms. Pregnancy is divided into three stages and is a valuable way to distinguish developments that occur in the mother and fetus throughout pregnancy (Soma *et al.,* 2016).

Blood pressure is the force exerted by blood flowing over the walls of blood vessels, and typically, when we mention blood pressure, we are referring to the pressure within the arteries. (Khurana and Khurana, 2020). The World Health Organization report shows that about 80% of people with hypertension (HT) do not receive the necessary treatment. Nearly half of people with HT worldwide do not yet know their condition. In addition, more than 1,000 people die every hour from strokes and heart attacks, often linked to high blood pressure (WHO,2023).

Hypertensive disorders during pregnancy (HDP) is an umbrella term encompassing pre-existing hypertension that appears during pregnancy, and phrases such as preeclampsia and eclampsia occur in about 10% of pregnancies (ACOG, 2013). HDP is a leading cause of complications and deaths for mothers and fetuses worldwide and may pose a significant threat to maternal and child health (Garovic *et al.,* 2020). An important indicator in this study is serum albumin, a negatively charged and water-soluble spherical protein with an approximate molecular weight of about 65,000 Daltons. The presence of many long snails characterizes this protein; type α provides a certified three-dimensional structure that gives it rigidity. Serum albumin includes 11 distinct sites that provide it with hydrophobic binding capability, making it capable of carrying a variety of fatty acids simultaneously (Stillwell,2016).

2. Materials and methods:

Study Design:

The study was carried out from July 2023 to October 2023 at the (Children, Maternity and Gynecology) Hospital in Kirkuk City, where samples were collected from women. The study included 96 women divided into four groups: 23 pregnant women with gestational hypertension (third trimester), 25 healthy pregnant women (third trimester), 23 non-pregnant women with chronic hypertension, and 25 non-pregnant women as a control group.

Physiological and biochemical tests:

A set of physiological and biochemical parameters of the groups included in the study was measured by estimating serum albumin levels using a ready-made kit from the French manufacturer (Biolabo) based on an enzymatic and chromatic reaction (Doumas *et al.,*1972). Creatinine levels and urea levels in the serum were determined using a kit provided by a French company (Biolabo); the urea measurement method is based on an enzymatic and chromatic reaction (Phinney *et al.,*1998). Creatinine was measured by the chromatic reaction of creatinine with alkaline bicarbonates (Fabiny and Ertingshausen,1971). For AST and ALT tests, a Kit from the French company (Biolabo) was used to measure them, as the AST concentration was estimated using the method developed by Carmen and Al and was later improved by Henry and his group (Henry *et al.,*1960). Wrobleski and La Due developed the initial method for estimating ALT activity, later improved by Henry and the Bergmeyer team. The decrease in absorbency proportional to ALT activity in the sample (Henry *et al.,*1960; Bergmeyer *et al.,*1978).

Statistical Analysis:

A statistical analysis of the results of the current study was carried out using the ANOVA test to assess the variance between the totals and the Duncan multiple range test to test the significant differences between the arithmetic averages of the four groups. This was done at a significant level of (0.05) to determine the degree of significant differences between these totals.

3. Results and discussion:

Results:

Table (1) shows the levels of albumin, urea, and creatinine in the studied groups, where there was a significant increase ($P \leq 0.05$) in albumin concentration in pregnant women with GH (55.583 ± 1.055) and was the highest compared to the two groups of control (32.552 ± 2.648) and healthy pregnant group (40.904 ± 1.869), followed by the non-pregnant with chronic HT group (45.587 ± 3.862) as the second highest significant increase compared to the control group. When compared between the pregnant with GH, and non-pregnant with chronic HT, we find that the height was higher in the first group.

As for the concentration of urea in the blood serum of the pregnant group with GH (45.00 ± 2.876), it found that it recorded the highest significant increase compared to the two groups of control

(30.60 ± 4.975) and healthy pregnant women (29.40 ± 3.606), while the group of non-pregnant infected women (36.91 ± 5.854) comes in second place as the second highest significant increase compared to the control group. When compared the pregnant with GH, and non-pregnant with HT, we find that the height was higher in the first group. Regarding creatinine levels, the results show an significant increase in creatinine concentration in the pregnant with GH and the group was the highest increase at a rate of (0.960 ± 0.139) compared to the two groups of control (0.768 ± 0.124) and healthy pregnant women (0.801 ± 0.160), with no significant differences between the group of non-pregnant infected women (0.807 ± 0.132) compared to the control. When comparing the pregnant women's GH with the non-pregnant women's HT, we note recorded a significant increase in pregnant women's GH.

Table 1. Albumin, urea, and creatinine levels in the studied groups.

Group	Albumin (g/L)	Urea (mg/dL)	Creatinine (mg/dL)
Gestational hypertension	55.583 ± 1.055 a	45.00 ± 2.876 a	± 0.906 0.139 a
Chronic hypertension	45.587 ± 3.862 b	36.91 ± 5.854 b	0.807 ± 0.132 b
Uninfected pregnant	40.904 ± 1.869 c	29.40 ± 3.606 c	0.801± 0.160 b
Control	32.552 ± 2.648 d	30.60 ± 4.975 c	0.768 ± 0.124 b

* The values in the table indicate (Mean ± S.D).

*Different letters vertically indicate significant differences at ($P \leq 0.05$).

Table (2) displays the ALT and AST levels in the investigated groups. where there was a significant increase in ALT levels in the pregnant with GH group at a rate of (48.347 ± 3.926) as the highest increase compared to the two groups of control group (31.432 ± 9.138) and healthy pregnant women (22.12 ± 7.025), followed by the non-pregnant with HT (35.826 ± 3.961), recording the second highest increase compared to the control. When comparing between the pregnant with GH and those of non-pregnant with HT, we note that the pregnant with GH recorded a significant increase. As for the AST concentration, the results recorded a significant increase in the pregnant with GH (45.391 ± 3.499), which is significantly higher compared to the control group (29.40 ± 8.046) and the healthy pregnant group (20.68 ± 5.921), with no significant differences between the non-pregnant with HT (32.913 ± 6.423) compared to the control. When comparing the pregnant with GH with those of non-pregnant with HT, we note the greater increase in pregnant GH.

Table 2. ALT and AST levels in study participants.

Group	ALT (U/L)	AST (U/L)
Gestational hypertension	48.347 ± 3.926 a	45.391 ± 3.499 a
Chronic hypertension	35.826 ± 3.961 b	32.913 ± 6.423 b
Uninfected pregnant	22.12 ± 7.025 d	20.68 ± 5.921 c
Control	31.432 ± 9.138 c	29.04 ± 8.046 b

* The values in the table indicate (Mean ± S.D).

*Different letters vertically indicate significant differences at ($P \leq 0.05$).

Discussion:

Through the current study, it is found significant increase in the levels of serum albumin in pregnant with GH and non-pregnant with HT compared to the control group. This increase was higher in pregnant women with GH. These results are consistent with the study of Sale *et al* (2021), as it was found that it is possible to cause hypertensive disorders in pregnant women with high levels of albumin in the blood. In addition, the serum albumin level in gestational hypertension is an essential determinant of disease severity, as its increase was associated with the development of hypertensive disorders such as preeclampsia (Savanur *et al.,* 2022). The current study is also consistent with Høstmark *et al* (2005), where a positive association was found between serum albumin level and hypertension in different age groups, regardless of sex and age. Excess serum albumin causes high blood pressure and can have a combined effect on cardiovascular disease risk. The reason for this may be due to the function of albumin, as one of the essential functions of this protein is to maintain oncotic pressure (colloidal osmotic pressure), as it helps regulate the passage of fluids from plasma to interstitial fluid or vice versa through a semi-permeable membrane and prevents fluid leakage from blood vessels to surrounding tissues and that increasing albumin levels will cause an imbalance in osmotic balance, which in turn affects raising blood pressure (Darwish and Lui, 2023).

The results agreed with the study of Rajdev *et al* (2023), as there was an increase in urea levels in pre-eclampsia and eclampsia compared to average pregnant women. Serum urea levels showed significant positive associations with systolic and diastolic blood pressure as urea levels increased with increased blood pressure (Tesfa *et al.,* 2022). The results showed an increase in urea concentration in pregnant women with GH and non-pregnant women with HT compared to the control group, and this increase was greater in pregnant with GH than in non-pregnant with HT. During pregnancy, the glomerular filtration rate in the kidneys is 40-50% higher than before pregnancy, which leads to lower levels of urea and uric acid in the blood. Reduction in urea rates in the healthy pregnant group compared to the healthy control group, which is evidence of an increase in the glomerular filtration rate (Cheung and Lafayette, 2013). Thus, the increase in urea levels in pregnancy may be due to impaired or dysfunctional renal function and glomerular filtration efficiency. An increase in creatinine levels was found in the GH pregnant group, with no significant differences in the non-pregnant group compared to the proper control group. This study is consistent with what Rajdev *et al* (2023) found, showing creatinine as an independent risk factor for developing hypertensive disorders during pregnancy. In non-pregnant women with high blood pressure who show normal creatinine levels, creatinine clearance may decrease. However, clinical symptoms have not yet appeared, as high mortality has been observed in cardiovascular patients with renal dysfunction (Leoncini *et al.,* 2004). High creatinine in the blood can be attributed to a decrease glomerular filtration rate, low secretion, and high reabsorption in women with preeclampsia, which may explain why it increases in women with gestational hypertension (Weerasekera and Peiris, 2003).

For the liver enzymes AST and ALT, our current study recorded a significant increase in ALT levels in pregnant women with GH and non-pregnant women with HT compared to the control group. We observed that this increase was more significant in pregnant women with GH. The results of this study agreed with the study of Lee *et al* (2020), Patients with elevated ALT levels had a higher likelihood of developing hypertension during pregnancy and preeclampsia. Elevated liver enzyme prevalence was higher in individuals with hypertension, as increased serum ALT activity was positively associated with hypertension (Rahman *et al.,* 2020). This increase may be because increased blood will raise blood pressure, activating pro-inflammatory responses such as TNF-α, adiponectin, and leptin that contribute to increased hepatotoxicity (Musso *et al.,* 2008).

AST levels show an increase in the group of infected pregnant women with no significant differences for non-pregnant infected women compared to the control. These findings are consistent with the study of Lee *et al* (2020), An increase in AST levels was linked to a higher risk of developing pregnancy-related hypertension and associated conditions like preeclampsia. This increase may be due to tissue defect (damage to the plasma membrane with protein release or cell necrosis resulting from various harmful factors) or cell death (during physiological cell regeneration or inducing programmed cell death), which is one of the reasons leading to increased levels of aminotransferases, including AST, in the blood circulation. High blood AST activity is often due to acute myocardial ischemia or when there is a defect in the heart muscle cells (Pratt and Kaplan, 2000).

Conclusion:

In this study, found increase in the concentration of albumin, urea, creatinine, and liver enzymes in pregnant with gestational hypertension compared to non-pregnant with chronic hypertension, and this increase was larger than the control and pregnant with normal blood pressure. Based on this, it can be concluded that pregnant are exposed to more risks regarding the development of complications of hypertension compared to non-pregnant, and perhaps this increase could be an early sign indicating the possibility of developing problems associated with high blood pressure during pregnancy, such as preeclampsia and eclampsia, or may continue after pregnancy and become chronic hypertension.

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