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Evaluation of Lipid Profile and Hematological Changes Among Pregnant Women with Hypertension in Sebha City, Southern Libya

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gestational hypertention

ABSTRACT:

Disorders of pregnancy-induced hypertensive are a major health problem worldwide and they are one of the leading causes of maternal and perinatal morbidity and mortality. This study aimed to assess alterations in lipid profiles and hematological parameters among pregnant women with gestational hypertension. Conducted at Sebha Medical Center, 105 participants was divided into three groups: normotensive pregnant women, pregnant women with hypertension, and those with gestational hypertension. Complete blood count (CBC), low-density lipoprotein (LDL), high-density lipoprotein (HDL), total cholesterol (TC), and triglycerides (TG) were determined. Findings revealed that TG and LDL levels were elevated in the gestational hypertension group compared to the normotensive group. Moreover, HDL levels were significantly reduced in both the hypertensive and gestational hypertension groups. However, no significant changes in TC levels were observed among study groups. The results also showed changes in the values of mean cell volume (MCV), platelet count (Plt), and lymphocyte count (Lym) among all groups of study. Conversely, there were no significant differences in hemoglobin (Hb), red blood cells (RBC), mean cell hemoglobin (MCH), mean cell hemoglobin concentration (MCHC), white blood cells (WBC), packed cell volume (PCV), and neutrophil count (NEUT). In conclusion, these results suggest that both gestational hypertension and chronic hypertension during pregnancy are associated with dyslipidemia, which was remarkable by increased TG and LDL levels and decreased HDL. Additionally, some hematological alterations may accompanying with hypertensive disorders in pregnancy

تقييم صورة الدهون وبعض المعايير الدموية في النساء المصابات بضغط الحمل في مدينة سبها جنوب ليبيا

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الكلمات المفتاحية:
الحمل
ارتفاع ضغط الدم
اعتلالات الدهون
التغييرات الدموية
ارتفاع ضغط الدم الناتجة عن الحمل

الملخص

تُعتبر اضطرابات ارتفاع ضغط الدم المرتبطة بالحمل من أبرز المشكلات الصحية على مستوى العالم، حيث تُعد من الأسباب الرئيسية للامراضية ووفيات الأمهات وحديثي الولادة. هدفت هذه الدراسة إلى تقييم التغيرات في صورة الدهون وبعض المؤشرات الدموية لدى النساء الحوامل المصابات بضغط الدم الحملي. أُجريت الدراسة في مركز سبها الطبي، حيث تم جمع 105 عينة من النساء الحوامل وتقسيمها إلى ثلاث مجموعات، نساء حوامل طبيعيات (بدون ارتفاع الضغط)، نساء حوامل مصابات بارتفاع ضغط مزمن، نساء حوامل مصابات بضغط الحمل. تم قياس مستويات الدهون الثلاثية، الكوليسترول الكلي، البروتينات الدهنية منخفضة الكثافة والبروتينات الدهنية عالية الكثافة .كما شملت التحاليل المؤشرات الدموية التالية: تركيز الهيموغلوبين، عدد كريات الدم الحمراء، الهيماتوكريت، خلايا الدم البيضاء، الصفائح الدموية، متوسط حجم الكريات الحمراء، متوسط كمية الهيموغلوبين في الكرية، متوسط تركيز الهيموغلوبين في الكرية، اللمفاويات، وخلايا الدم البيضاء المتعادلة .

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أظهرت نتائج الدراسة وجود ارتفاع في مستويات كل من الدهون الثلاثية والبروتينات الدهنية منخفضة الكثافة لدى النساء المصابات بضغط الحمل مقارنةً بالنساء الطبيعيات. كما لوحظ انخفاض معنوي في مستويات البروتينات الدهنية عالية الكثافة لدى كل من النساء المصابات بضغط الدم المزمن والمصابات بضغط الحمل. من ناحية أخرى، لم تُسجّل فروق إحصائية في مستويات الكوليسترول الكلي بين المجموعات قيد الدراسة. كما أظهرت النتائج تغيرات في قيم كل من متوسط حجم الكريات الحمراء ، الصفائح الدموية ، وللمفاويات بين المجموعات الثلاثة، في حين لم تُسجل فروق معنوية في تركيز الهيموغلوبين ، عدد كريات الدم الحمراء ، متوسط كمية الهيموغلوبين في الكرية، متوسط تركيز الهيموغلوبين في الكرية ، الهيماتوكريت، خلايا الدم البيضاء المتعادلة.

تشير نتائج هذه الدراسة إلى أن ضغط الحمل وارتفاع ضغط الدم لدى الحوامل مرتبطان بوجود اضطرابات في الدهون ، كما يتضح من ارتفاع مستويات الدهون الثلاثية والبروتينات الدهنية منخفضة الكثافة وانخفاض مستويات البروتينات الدهنية عالية الكثافة كذلك وُجدت بعض التغيرات في المؤشرات الدموية المصاحبة لهذه الاضطرابات، مما يُبرز أهمية المتابعة الدورية للدهون والمؤشرات الدموية لدى النساء الحوامل لتفادي المضاعفات.

1. Introduction

Hypertensive disorders during pregnancy (HDP) continue to be among the leading contributors to maternal and fetal health complications and deaths globally. An increase in lipid profile abnormalities tends to correspond with the advancing gestational age of the mother [1]. Various studies have indicated that women with elevated levels of oxidized (LDL) and (TG), and reduced levels of high-density lipoprotein (HDL), are at greater risk of developing hypertensive disorders during pregnancy compared to those with normal blood pressure [2][3].Although several investigations have explored the link between maternal lipid profiles and hypertensive pregnancy, their findings are not entirely consistent. Some have observed significantly higher lipid levels in women with hypertensive pregnancies than in normotensive pregnant women [4][5][6]. On the other hand, a few studies reported no statistically significant difference in serum lipid levels between the two groups [7][8], while others have even noted lower lipid profiles in hypertensive pregnant women relative to normotensive controls [9]. Hematological profile is considered one of the factors affecting pregnancy and its outcome. The hematologic system undergoes a series of adaptive changes in preparation for fetal hematopoiesis and wellbeing while also serving as a cushion against expected blood loss at delivery. These changes range from the increased plasma volume and red blood cell mass, leukocytosis and adaptive immunological changes to the relative hypercoagulable state of pregnancy and tend to commence as early as the sixth week of gestation with resolution by the sixth week postpartum. .During pregnancy, many physiologic changes occur to accommodate the demands of the developing fetus, which affects the hematologic parameters directly or indirectly. These hematologic changes are considered to be the risk factors affecting maternal and pregnancy outcome[10][11][12][13], Identifying and understanding variations in hematological parameters throughout pregnancy is crucial, especially for distinguishing between normal physiological adaptations and underlying pathological conditions [14]. Therefore, this study aims to examine abnormalities in lipid profiles and hematological changes in women with pregnancy-induced hypertension.

2. MATERIALS AND METHODS

Study population:

This was a prospective cross-sectional study designed to assess the haematological and biochemical changes. A total of 105 subjects were divided into three groups, (35) normal pregnant women, (35) Pregnant with hypertension and (35) gestational hypertension women aged ranged from 20 to 42 years. The study population attended Sabha Medical Center; samples were collected between Septembers – December 2023. Women were excluded if typically had high-risk conditions such as renal dysfunction, Chronic obstructive pulmonary disease or cardiovascular disease are often grounds for exclusion.

Sample preparation:

Approximately 5 mL of venous blood was collected from each participant for both hematological and biochemical analyses. The samples were divided into two vacutainer tubes: 2 mL was placed in an ethylene diamine tetraacetic acid (EDTA) tube for complete blood count (CBC) analysis, and the remaining 3 mL was collected in a clot activator tube. Hematological assessments were performed at room temperature using a Sysmex hematology analyzer, which directly measured the complete blood count parameters. For biochemical analysis, serum was separated by centrifuging the whole blood using a Hettich XP-200 centrifuge. The resulting serum was transferred using a 1000 µL pipette into 1.5 mL Eppendorf tubes and stored at –40 °C until further analysis.

Methods

Hematological Analysis

1. Fresh venous blood samples were analyzed using a Sysmex hematology analyzer to perform a complete blood count (CBC). The hematological parameters assessed included total red blood cell (RBC) count, total white blood cell (WBC) count, hemoglobin (Hb) concentration, hematocrit (Hct), mean cell volume (MCV), mean cell hemoglobin (MCH), mean cell hemoglobin concentration (MCHC), and differential counts of lymphocytes, neutrophils, and platelets (Plt).

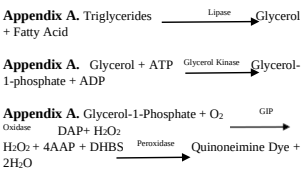
2. Lipid Profile Assessment in Serum Samples

High-Density Lipoprotein (HDL), Low-Density Lipoprotein (LDL), and Total Cholesterol (TC): Serum levels of TC, LDL-C, and HDL-C were quantified using enzymatic colorimetric methods with a commercial assay kit (Catalog No. XSY50041, Biomaghreb.

3.Triglyceride Measurement

Triglyceride concentrations were determined enzymatically using a hydrolysis-based method provided by Biomaghreb.

Appendix A: Triglyceride Measurement Reaction Pathway



Hydrolysis of TriglyceridesTriglycerides —(Lipase)→ Glycerol + Fatty Acids

Phosphorylation of Glycerol Glycerol + ATP —(Glycerol Kinase)→ Glycerol-1-Phosphate + ADP

Oxidation of Glycerol-1-Phosphate Glycerol-1-Phosphate + O_2 —(Glycerol-1-Phosphate Oxidase)→ Dihydroxyacetone Phosphate (DAP) + H_2O_2

Colorimetric Detection H_2O_2 + 4-Aminoantipyrine (4AAP) + DHBS —(Peroxidase)→ Quinoneimine Dye + $2H_2O$

Briefly, 10 µl of sample was mixed with 1 ml of triglyceride reagent, and was incubated at 37ºC for five minutes. The amount of the dye formed as determined spectrophotometrically at 520nm, is directly

proportional to the concentration of triglycerides in the samples.

Statistical analysis:

Data were summarized as mean ± SD in tables and mean ± SEM in graphs. Normality was assessed using the Shapiro-Wilk test. One-way ANOVA with LSD post hoc test was used for normally distributed data, while the Kruskal-Wallis test was applied to non-normal data. Statistical significance was set at $p < 0.05$.

3. Results:

Hematological Study.

Table 1 shows the results of complete blood count. There were significant changes in the platelets counts among pregnant women with hypertension when compared with normal pregnant women and pregnant hypertension p=0.001, P=0.01 respectively additionally, lymphocyte levels were elevated among gestational hypertension women compared to other groups. There were changes of MCV values among all study groups although these changes were not significantly different. On the other hand, the values of Hb, MCH, MCHC, RBC, WBC, PCV, Neut were none significantly different among all of study groups.

Table. 1 hematological parameters among normal pregnant women, pregnant hypertension and gestational hypertension

Hematological parameters	normal pregnant women	pregnant hypertension	gestational hypertension
HP	10.84±1.34	11.16±0.96	11.03±1.25
RBC	4.19±0.59	4.28±0.49	4.18±0.54
MCV	77.98±8.30	79.27±8.65	80.35±6.03
MCH	26.82±3.26	26.62±3.13	26.65±2.60
MCHC	33.64±3.37	34.60±3.33	33.84±2.75
PCV	31.21±4.01	33.16±3.47	32.76±3.85
WBC	8.99±2.80	8.49±2.77	8.22±2.09
PLT	262.6±86.4	239.8±64.6*	267.3±62.3*
LYM	22.82±7.10	29.41±9.10*	27.15±6.97*
NEUT	70.28±11.22	67.30±12.69	65.75±8.67

Note: Results are presented as mean ± standard error (S.E.M.). ***P<0.05 compared to normal group. Abbreviations:** RBC – red blood cells; WBC – white blood cells; Hb – hemoglobin concentration; Hct – hematocrit; MCH – mean cell hemoglobin; MCV – mean cell volume; MCHC – mean cell hemoglobin concentration; Plt – platelets.

Cholesterol concentration

The findings of the present study showed that the total cholesterol levels did not change significantly among all study groups

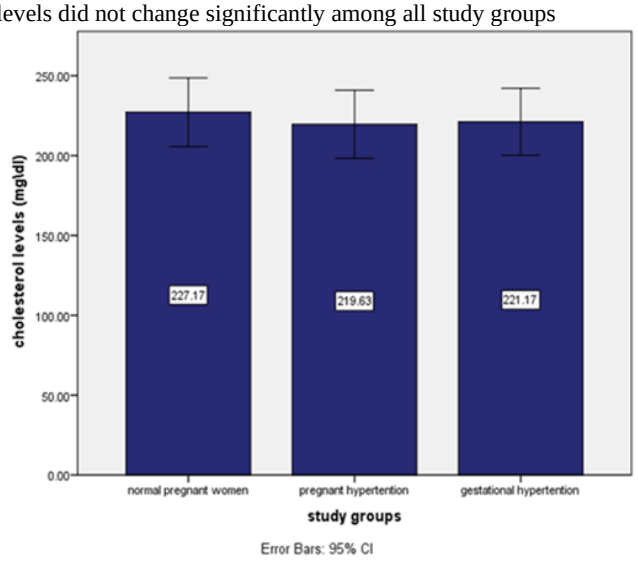


Fig. 1: cholesterol levels among normal pregnant women, pregnant hypertension and gestational hypertension. Results are expressed as means ± SEM.

Triglycerides concentration:

Pregnant with chronic and gestational hypertension women showed significantly increased levels of TG when compared with normal pregnant women p=0.0001.

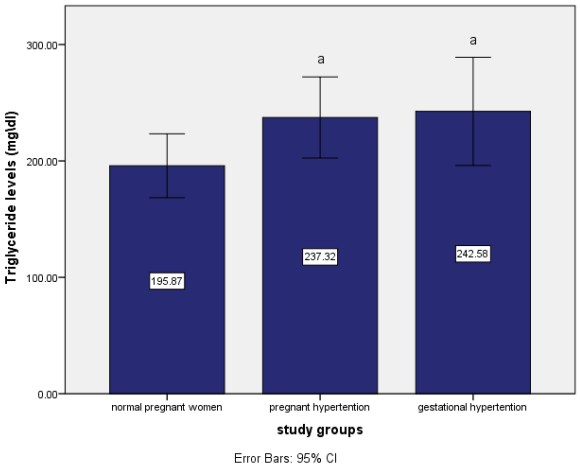


Fig. 2: Triglycerides levels among normal pregnant women, pregnant hypertension and gestational hypertension. Results are expressed as means ± SEM.

a -significantly different from the Normal group at p <0.05

Low-density lipoproteins levels:

The levels of LDL were increased among gestational hypertension when compared with pregnant hypertension p=0.03. In contrast, pregnant hypertension showed decreased levels of LDL among pregnant hypertension compared with normal pregnant women.

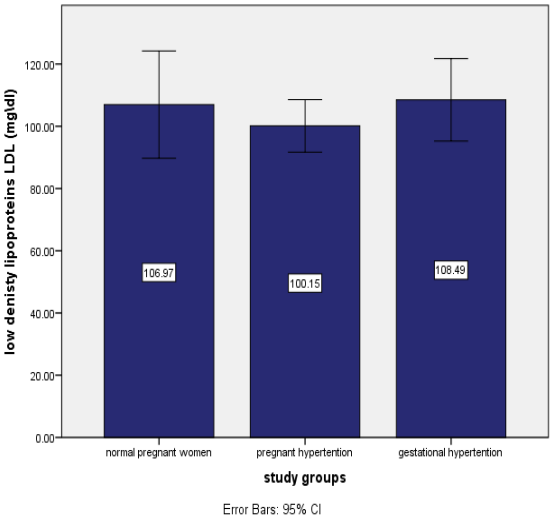


Fig. 3: Low-density lipoproteins levels among normal pregnant women, pregnant hypertension and gestational hypertension. Results are expressed as means ± SEM.

- High-density lipoproteins levels:

Both of pregnant hypertension and gestational hypertension women showed significantly decreased when compared with normal pregnant women P= 0.0001.

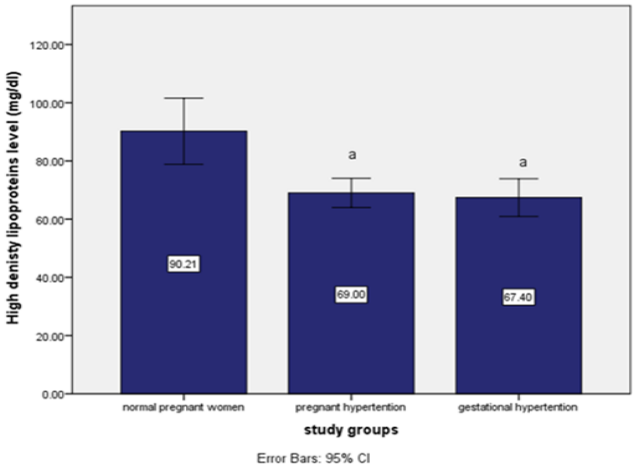


Fig.4: High-density lipoproteins levels among normal pregnant

women, pregnant hypertension and gestational hypertension. Results are expressed as means ± SEM.

a -significantly different from the Normal group at p <0.05

Discussion:

Pregnancy is associated with normal physiological changes that assist the nurturing and survival of the fetus. Biochemical and hematological parameters reflect these adaptive changes, which become very important in the event of complications [15]. This study aimed to investigate the status of lipid profile and haematological changes in pregnancy-induced hypertension (PIH).

These findings showed a statistically significant decraese in platelet count among women with PIH compared to normotensive pregnant women. This observation is consistent with earlier research. For instance, Ahmed (2015) in a study conducted in Sudan involving 120 hypertensive and 75 normotensive pregnant women, reported a significant decline in platelet count among the hypertensive group [16]. Similarly, Praveen et al. (2017) found that platelet counts were significantly lower in hypertensive pregnant women when compared to their normotensive counterparts [17]. These and other studies have consistently reported reduced platelet levels in PIH, suggesting a predisposition to thrombocytopenia among affected women [18][19][20][21][22].

In our current study, we also observed that platelet counts continued to decline with the progression of hypertensive pregnancy. This reduction may be explained by increased platelet consumption, reduced lifespan, and enhanced aggregation likely driven by elevated levels of thromboxane A2 in the placental circulation [23].

In addition to platelet count variations, our results indicated a significant rise in lymphocyte count among hypertensive pregnant women, which appeared to correlate with the severity of the condition. Although neutrophil levels were reduced in PIH cases, this change was not statistically significant compared to normotensive pregnancies. These findings are in line with the study by Amidu et al. (2020), who suggested that the elevated lymphocyte count could reflect an increased CD4+ T-cell population in circulation. Furthermore, the observed decrease in neutrophils and total WBC count in PIH cases might be a consequence of enhanced lymphocyte production, potentially influencing neutrophil generation and systemic distribution [24].

No statistically significant differences were observed among the study groups in other hematological parameters, including hemoglobin (Hb), hematocrit (HCT), mean corpuscular hemoglobin concentration (MCHC), mean corpuscular hemoglobin (MCH), red blood cell (RBC) count, and white blood cell (WBC) count.

When examining lipid profiles, our findings revealed elevated levels of total cholesterol (TC), low-density lipoprotein cholesterol (LDL-C), and triglycerides (TG), along with reduced high-density lipoprotein cholesterol (HDL-C) levels among women with PIH. These results align with prior studies that have reported a similar dyslipidemic pattern in hypertensive pregnancies [25][26][27][28]. The combination of increased TC and LDL-C with decreased HDL-C reinforces the presence of dyslipidemia in PIH, corroborating findings from other researchers [29].

Emerging research has increasingly pointed to the role of serum lipid profiles as potential early biomarkers for PIH. Several studies suggest that changes in lipid levels may precede the onset of hypertension in pregnancy [30]. For example, in cases of preeclampsia, higher triglyceride levels and lower HDL-C levels have been observed as early as the second trimester, suggesting that these lipid disturbances could be early indicators of impending hypertensive disorders [31].

Conclusion

The findings from this study highlight that elevated total cholesterol, LDL-C, and triglyceride levels, along with reduced HDL-C, are strongly associated with pregnancy-induced hypertension, reflecting a clear dyslipidemic profile. Early screening for lipid abnormalities could serve as a valuable tool for identifying high-risk pregnancies and implementing timely interventions. Additionally, the significantly lower platelet counts observed in hypertensive pregnant women point to a potential risk for thrombocytopenia, further emphasizing the need for close hematological monitoring in these patients.

4. Acknowledgement

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