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The Effect of Parity on Atherogenic Indices in Hypertensive Pregnant Women at 2nd Trimester

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Abstract

Dyslipidemia, or abnormal lipid metabolism, is a major triggering factor in atherosclerosis aggravated by hypertension. In this study, 100 female participants were chosen at random from Rivers State University and the Rivers State University Teaching Hospital. These women were divided into two groups: hypertensive pregnant women in their second trimester (50 individuals) and non-pregnant women (50 subjects). The hypertensive pregnant women were further sub grouped into 21 nulliparous women, 17 primiparous women, 10 multiparous women and 2 Grand multiparous women. Blood samples were analyzed for the atherogenic indices; Apo B/Apo A1, Castelli Risk Index I and II (CRI1, CRI-2), atherogenic coefficient (AC) and atherogenic index of plasma (AIP). The study found that parity showed no significant effect on all the atherogenic indices in an inter comparison between the hypertensive pregnant women and non-pregnant women. Also, there was no statistically significant difference in an intra-comparison amongst the varying parity states of the hypertensive pregnant women at 2nd trimester ($p<0.05$). Very few studies have focused on the relationship between parity and lipid levels in hypertensive women but the aforementioned association is still inconsistent. Hence, the expedient need for further researches.

Keywords: *Parity, Atherogenic indices, Hypertension, Pregnant women*

1.0 INTRODUCTION

Increased tissue lipolysis, maternal hyperlipidaemia, and fat storage are the main hallmarks of changes in lipid metabolism during pregnancy [1, 2], which are linked to foetal growth and development [3, 4]. These changes are necessary and correspond to clinical symptoms such as an increase in maternal lipid levels from conception through birth [5]. The typical endovascular invasion of cytotrophoblast into the spiral arteries does not occur beyond the decidua-myometrial junction in hypertension patients. As a result, the myometrial segment's musculoelastic media remains receptive to vasoconstrictor stimuli, resulting in reduced blood flow. Spiral artery atherosclerosis is severe, with lumen obliteration [6]. This causes placental under-perfusion, localized ischemia, and the start of oxidative stress due to increased reactive oxygen species generation. Lipid peroxidation products may result as a result of this. Both of these species are known to be important mediators of vascular dysfunction and inflammation in the body [7]. Both pre-eclampsia and atherosclerosis are linked to dyslipidaemia, endothelial dysfunction, and a rise in pro-inflammatory cytokine levels in the blood.

An aberrant lipid profile is linked to atherosclerosis and endothelial dysfunction [8]. Thus, one of the most prevalent obstetric problems is hypertension during pregnancy. It can lead to Pre-eclampsia if not recognized early enough [9]. Parity is defined in human medicine as the number of pregnancies carried by a woman for at least 20 weeks (length varies by area, 20–28 weeks depending on viability age). Even if a woman carries a foetus to viable age, even if the foetus is born dead, this count as an instance of parity since parity is determined by the time of gestation before to birth, not the status of the offspring after birth [10]. Nulliparous women, often known as nulliparas or para 0, have never carried a pregnancy beyond 20 weeks [14]. A primiparous woman, often known as a primipara or primip, is a woman who has only given birth once. A multipara is a multiparous woman who has given birth two, three, or four times. The condition of having given births five or more times is known as grand multipara [11].

Several attempts have been undertaken to find novel or emerging cardiovascular risk factors in order to enhance cardiovascular disease prediction. Several lipoprotein ratios or "atherogenic indices" have been created in an attempt to improve the predictive potential of the lipid profile [12]. ATHEROGENIC INDEX OF PLASMA (AIP), which is determined as log (TG/HDL-C), is one of them. Because it is elevated in persons at higher risk for coronary heart disease and is negatively linked with LDL particle size, it has lately been recommended as a marker of plasma atherogenecity. Both TGs and HDL-C are commonly measured and available, therefore this simple ratio potentially captures the balance between risk and protective lipoprotein factors. The ratio of non-HDL cholesterol to HDL cholesterol is used to calculate the ATHEROGENIC COEFFICIENT (AC). Non-HDL-c is a simple test that does not require the patient to fast beforehand. It's the cholesterol equivalent of an apo B level, with a stronger correlation coefficient than LDL cholesterol concentration [14]. CRI1 (TC/HDL-C), CRI-2 (LDL-C/HDL-C), and Apo A1 are some of the others.

In this region (Port Harcourt), research on the topic is sparse. In light of this, the current study was done in an attempt to use the data to understand the relationahip between parity, hypertensive pregnant women and CVD as well as to establish a new clinical

method for early detection and prevention of future cardiovascular illnesses in pregnant women with hypertension.

2.0 MATERIALS AND METHODS

2.1 Study Location

This research was carried out in collaboration with Rivers State University and the Rivers State University Teaching Hospital (previously known as Braithwaite Memorial Specialist Hospital) in Port Harcourt, Nigeria's capital city. Port Harcourt is an urban town of around two million people ans is the capital of Rivers State. it is a commercial and industrial hub in Nigeria. It has one of Nigeria's busiest seaports. As a result, in addition to the locals, Port Harcourt is home to a number of ethnic communities. The women were from the Rivers State University and the Rivers State University Teaching Hospital (Braithwaite), a specialist Hospital located in the old Government Reserved Area (GRA) axis Port Harcourt, where samples were collected from women who were pregnant after ascertaining their medical conditions based on the reports in their folders and physical observations during ward rounds.

2.1 Experimental Design

This was a cross-sectional study with 100 female participants recruited from Rivers State University Teaching Hospital and Rivers State University in Rivers State, Nigeria. The women were divided into two groups: 50 hypertensive pregnant women in their second trimester and 50 non-pregnant women. The hypertensive pregnant women were further classified into 21 nulliparous, 17 primiparous, 10 multiparous, and 2 Grand multiparous.

2.2 Characteristics of Subjects that Participated in the Study

Subjects were chosen at random from Rivers State University and the Rivers State University Teaching Hospital after verifying that they met the criteria for inclusion and exclusion on the questionnaire. The study enrolled 100 women, including hypertensive pregnant women who are nulliparous, primiparous, multiparous and grand multiparous as well as non-pregnant women.

2.3 Eligibility Criteria

2.3.1 Inclusion Criteria

This study included all seemingly hypertensive pregnant women, including those on medication and undergoing prenatal care. Other inclusion criteria include no history of surgery or blood transfusions, not being diagnosed with diabetes, and giving informed consent after counseling.

2.3.2 Exclusion Criteria

Those believed to be ill or with a known history of any of the infectious diseases, underlying chronic illness such as gastric and intestinal illness, history of prenatal bleeding, malignancy, tuberculosis, diagnosed diabetes, cardiovascular disease, a history of blood transfusion, surgery, or a difficulty to provide informed consent were included.

2.4 Ethical Consideration and Informed Consent

This study was approved by the Rivers State Ministry of Health’s Ethics committee in Port Harcourt, Nigeria. Informed consent for this study was obtained after counseling the women about the hospital's policy of screening every prenatal woman for HIV and the benefits of attendance for those who may be negative. All non-pregnant women were also informed about the study's goal. The non-pregnant women gave their assent verbally as well. Appropriate confidentiality

was maintained throughout the research. All of the women in this study provided all the necessary demographic information. The obstetrician in charge determined Parity and included other facts in their folders. Gestational age was derived by fundal height and the last menstrual period.

2.5 Blood Sample Collection

Using Venipuncture, fasting blood samples collected [15]. The blood was carefully dispensed into plain vacutainer tubes, left to clot and centrifuged at 1500rpm for 10 minutes. Serum was separated and stored at -4^{o}C until it was assayed for apoA1, apo B, total cholesterol, triglycerides and high density lipoprotein cholesterol, while the values of LDL and VLDL were calculated as TC-(TG/2)-HDL and TG/2.2 [21].

2.6 Biochemical Determinations

Biochemical tests for Apo A1 and B, TG, HDL-C, and total cholesterol were conducted using fasting blood samples. The serum was obtained by centrifuging blood samples in simple vials. The Department of Medical Laboratory Science at Rivers State University in Port Harcourt carried performed the biochemical analyses.

Determination of Apo Lipoprotein A1 in Human Serum

Apolipoprotein A1 was measured quantitatively by turbidimetric method [17] as described by Fortress Diagnostics Limited (United Kingdom).

Determination of Apolipoprotein B in Human Serum

Apolipoprotein B was measured quantitatively by turbidimetric method [17]

Determination of Total Cholesterol in Serum

Total cholesterol was measured quantitatively by enzymatic method **[**18]

Determination of High-Density Lipoprotein (HDL) Cholesterol in Serum

HDL-C was measured quantitatively by enzymatic method [19]

Determination of Triglycerides in Serum

Triglycerides are determined quantitatively by enzymatic method [20]

Determination of Low-Density Cholesterol (LDL-C)

LDL cholesterol was calculated from the Friedewald's equation [21]

Calculation

LDL cholesterol values in the serum sample were calculated as a difference in the results of the total cholesterol, triglycerides and HDL.
LDL – Cholesterol = Total Cholesterol – (TG/2.2) – HDL

2.7 Lipids, Atherogenic Index, and Lipid Ratio Evaluation

Lipid abnormality was defined as raised when TG level ≥1.7 mmol/L, reduced HDL-C - <1.03 mmol/L in males and <1.30 mmol/L in females, and TC level ≥5.2 mmol/L (200 mg/dl) [22]. The atherogenic index and lipid ratios were calculated using the following established formulas:

AIP = Log (TG/ HDL-C)
Reference Range = Low risk (-0.3 – 0.1), Moderate risk (0.1 – 0.24), High risk (>0.24) (WHO, 2014)

CRI-1 = TC/HDL-C
Reference Range = Low risk (< 1-3), Moderate risk (3-5), High risk (>5).

CRI-II = LDL-C /HDL-C
Reference Range =Low risk (< 1-3), Moderate risk (3- 5), High risk (> 5)

AC = TC – HDL-C/ HDL-C (Reference >3.0.

Apo B/ Apo A1

Reference range = (low risk 0.30, moderate risk 0.6 and high risk 0.8).

2.8 Statistical Analysis

The results of the study were analyzed using GraphPad Prism Version 8.0.2.263. The data were presented in the form of mean and standard deviation. The one-way analysis of variance was used to compare the means (ANOVA). To confirm significant differences between groups at P0.05, the Tukey comparison test was performed.

3.0 RESULTS

Tables 4.0 (a) and 4.0 (b) show the effect of parity on atherogenic indices (AIP, CRI1, CRI2, AC, Apo B/ApoA1) in hypertensive pregnant women at 2nd trimester. Parity showed no significant effect on all the atherogenic indices in hypertensive pregnant women at 2nd trimester ($p<0.05$).

Table 1.0 (a): Effect of Parity on Atherogenic Indices in Hypertensive 2nd Trimester

Parameters	**Hypertensive women**				**P-value**	**F-value**
	Nulliparous(0) n= 21	Primiparous(>1) n=17	Multiparous (≥ 5) n = 10	Grand Multiparous(≥5) n=2		
AIP	0.22 ± 0.05	0.22 ± 0.08	0.17 ± 0.02	0.22 ± 0.00	0.2179	1.5360
CRI 1	5.39 ± 0.98	5.64 ± 2.09	4.67 ± 0.42	4.17 ± 0.00	0.2348	1.4710
CRI 2	3.64 ± 0.95	3.83 ± 1.84	3.01 ± 0.53	2.42 ± 0.00	0.2372	1.4620
AC	4.39 ± 0.98	4.64 ± 2.09	3.67 ± 0.42	3.17 ± 0.00	0.2348	1.4710
APoB/APoA1	0.34 ± 0.03	0.33 ± 0.03	0.35 ± 0.03	0.35 ± 0.00	0.1427	1.9010

Table 1.0 (b): The ANOVA Post – Hoc Findings Using Turkey Multiple Comparison Test for Effect of Parity on Atherogenic Indices (Hypertensive 2nd Trimester)

Parameters	**Nulliparous vs. Primiparous**	**Nulliparous vs Multiparous**	**Nulliparous vs Grand Multiparous**	**Primiparous Vs Multiparous**	**Primiparous Vs Grand Multiparous**	**Multiparous Vs Grand Multiparous**
AIP	0.9983	0.2462	0.9987	0.2179	0.9998	0.7009
CRI 1	0.9 497	0.5384	0.6423	0.3164	0.5044	0.9675
CRI 2	0.9668	0.5644	0.5635	0.3686	0.4486	0.9313
AC	0.9497	0.5384	0.6423	0.3164	0.5044	0.9675
APoB/APoA1	0.6658	0.5550	0.8361	0.1363	0.5502	0.9989

DISCUSSION

Changes in maternal hormones affect the maternal metabolic environment during pregnancy, and a significant hyperlipidemia is considered natural [23]. Lipoproteins carry lipids such as cholesterol and triglycerides to tissues for energy use, lipid deposition, steroid hormone synthesis, and bile acid generation. Dyslipidemia, as well as abnormal lipid metabolism, is a major precipitating factor in atherosclerosis aggravated by hypertension [24, 25].

Two studies published in the early 1980s suggested a link between pregnancy and cholesterol levels [26, 27]. TG, TC, and LDL-C levels in the blood rise gradually during pregnancy. However, unlike serum TG, which drops fast after delivery, TC and LDL-C increases might continue longer before returning to baseline [28].

Parity had no significant influence on any atherogenic indices in hypertensive pregnant women in the second trimester ($p<0.05$) in the current investigation. Although several putative pathways have been hypothesized, the specific biologic mechanisms remain unknown. This might, however, be due to the specific sociocultural features of the research population. Because Port Harcourt is a cosmopolitan metropolis with two of Southern Nigeria's most prestigious teaching and medical institutions, the "no significant effect" found might be due to the subjects receiving effective pre-partum, partum, and post-partum maternal healthcare education and services in terms of educating people on the significance of diets, exercise, and other preventative measures to reduce the incidence of cardiovascular disease and its subsequent influence on parity. This result was in agreement with [29,30], however it was in conflict with [23].

Ever since, very few researches [31, 32] have focused on the relationship between parity and lipid levels in hypertensive pregnant women, however the aforementioned association remains inconsistent.

As a result, more research into the influence of parity on atherogenic indices in hypertensive pregnant women in the second trimester is needed.

CONCLUSION

Pregnancy causes significant biochemical, physiological, and anatomical changes in humans. Pregnancy is a physiological stress in which the body undergoes several changes. More emphasis is placed on biochemical changes in the blood that occur during a normal pregnancy and can become accentuated in pregnancy problems such as hypertension.

Lipid metabolism is an essential pathophysiology in pregnant hypertension. Because of the limited research conducted, the relationship between parity, hypertension in pregnancy, and risk factor for cardiovascular disease is incompletely recognized [33]. In hypertensive pregnant women in the second trimester, parity had no influence on all atherogenic indicators.

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