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Correlation between ABO blood group and gestational hypertensive disorder among pregnant women in Abuja, Nigeria

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Abstract

Gestational hypertensive disorder (GHD) is among the major health problems in pregnant women. In this study, we assessed the relationship between gestational hypertensive disorder and ABO blood groups among women who attended the antenatal clinic at the University of Abuja Teaching Hospital, Abuja, Nigeria. Correlational study design was used on a total of 138 patients with sociodemographic characteristics and clinical data such as blood group, gestational hypertensive disorder status, maternal age at pregnancy, and parity were extracted. Descriptive statistics was carried out on the collected data and chi-square test for the test of association or Fisher's exact where necessary. The maternal age of the women ranged from fifteen to fifty-one years old with a mean age of 30.7 ± 9.8. Clinical information revealed that 17 (12.3%) primigravida and 121 (87.7%) non-primigravida patients. The patients' distribution by blood group revealed that 33 (23.9%), 32 (23.2%), 47 (34.1%) and 26 (18.8%) belonged to blood group A, B, AB, and O respectively. Our results showed a relationship between blood pressure and the ABO blood group but not significant with $\chi^2 = 12.31$ and $p = 0.421$ with blood pressure of 150/100–154/104 mmHg ranked highest in frequency among all the blood groups. Also, we observed a non- significant relationship between maternal age and the occurrence of GHD at $\chi^2 = 19.81$ and $p = 0.229$ which implies that GHD is not associated with age but that blood pressure increases with gestational age. Interestingly, a significant relationship exists between gestational hypertension and parity at $\chi^2 = 26.71$ and $p = 0.045$. Blood group AB was more susceptible to gestational hypertensive disorder whereas blood groups O, A and B were less susceptible to it. We recommend increased awareness of GHD among pregnant women, all health workers, and the general public about its danger to pregnant mothers and fetuses.

Keywords: ABO; Gestational hypertensive disorder; Fetus; Abuja

1. Introduction

Gestational hypertensive disorder (GHD), previously known as pregnancy-induced hypertension (PIH), is the new onset of hypertension after 20 weeks of gestation or more in a pregnant woman who had normal blood pressure before pregnancy [1]. The diagnosis entails the patient's having elevated blood pressure (systolic ≥ 140 or diastolic ≥ 90 mm Hg, the latter measured using the fifth Korotkoff sound) with one or more of the following: chronic hypertension, gestational hypertension, preeclampsia/eclampsia, and chronic hypertension with superimposed preeclampsia. These disorders are among the leading causes of fetal and maternal morbidity and mortality. An accurate diagnosis in the emergency department is critical to initiating the appropriate treatment to reduce any potential injury to the mother and fetus [2]. GHD was not recognized for many years, and researchers have postulated that it caused various types of

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harm, including urine and placental local ischemia, and vascular injury. The cause of gestational hypertension is not known. Some conditions may increase the risk of developing it, such as pre-existing hypertension (high blood pressure) and kidney disease. However, susceptible factors include women with chronic hypertension (high blood pressure before becoming pregnant); women who developed high blood pressure or preeclampsia during a previous pregnancy, especially if these conditions occurred early in the pregnancy; women who were obese before pregnancy; pregnant women under the age of twenty or above the age of forty; women who are pregnant with more than one baby; and women with diabetes, kidney disease, rheumatoid arthritis, lupus erythematosus, or scleroderma (NICHD, 2022).

The global frequency of GHD between 1990 and 2019 increased from 16.3 million to 18.08 million with a cumulative increase of 10.92% [3]. Approximately 27,830 deaths resulting from GHD were reported in 2019, representing a 30.05% increase from 1990 [4]. Based on the incidence and prevalence, the number of deaths and the number of years lived with disability were highest in women aged twenty-five to twenty-nine followed by women aged thirty to thirty-four and twenty to twenty-four. There is a positive relationship between incidence rate and the genetic makeup of an individual, sociodemographic factors, and the human development index.

The ABO blood group was discovered more than ten decades ago. There had been an incorrect assumption that all blood was of the same type, and this led to numerous fatalities from blood transfusions. An increase in knowledge regarding the ABO blood group has simplified the work of scientists and medical practitioners. A great many research outcomes have generated numerous findings on different blood groups and how they are related to inherited characteristics. These findings are also relevant in forensic science and the settling of paternity disputes.

The ABO blood group is a highly stable genetic trait, and its method of transferring inherited traits is through the autosomal recessive or dominant mode. Evolution selection, environmental factors, and pathogens affect the ABO blood group. Recent studies have found that diseases such as GHD, tumors, hepatitis B, coronary artery disease, helicobacter pylori infection, and metabolic diseases are associated with the ABO blood group [5–7]. Studies have shown that certain ABO phenotypes are susceptible to certain diseases; for example, diseases such as ulcers and gastritis are associated with blood groups O and A, respectively. Another observation is that individuals with blood type O are likely to have lower levels of the von Willebrand factor (vWF), which is a protein involved in blood clotting.

About 5% to 10% of pregnancies in Nigeria are complicated by gestational hypertensive disorders and result in more antenatal admissions than any other pregnancy-related disorders. GHD is one of the leading causes of low birth weight, stillbirth, and prenatal and maternal mortality in secondary and tertiary hospitals in Nigeria [8]. The ABO blood group typing and Rhesus blood group have significant clinical importance in terms of newborn survival, blood transfusions, and risk factors for diseases such a metabolic disorders and tumors.

It is based on the above that this study is being undertaken to assess the relationship between ABO blood group types and GHD among the women who attended their antenatal clinic at the University of Abuja Teaching Hospital, Gwagwalada-Abuja, Nigeria.

2. Materials and Methods

2.1. Study Design

We adopted a correlational study design for this study of the relationship between ABO blood group types and gestational hypertensive disorder among women who attended the antenatal clinic at the University of Abuja Teaching Hospital, Gwagwalada.

The research design is an outline of the research scheme on which we are to work. It examines relative elements of the population with common attributes of representation of the entire population. Major advantages of this research design is that the data will be retrieved without intrusion into the private lives of the individuals who are the source of the data and the researchers will not have one-on-one contact with the subjects they are dealing with. Another advantage is that this is a fast method of data collection; there is no interference by the researcher, and the data may be of higher quality.

2.2. Study Population

The population of the study comprised all women who were at least twenty weeks pregnant who attended their antenatal clinic at the University of Abuja Teaching Hospital, Gwagwalada, Gwagwalada Area Council, Abuja. These women had done their blood work and were hypertensive from a gestational age of twenty weeks and above, between January 2021 and January 2022.

All pregnant women were included in the study who had attended antenatal care at the gestational age of twenty weeks and above, done their blood work, and had a blood pressure of 140/90 mmHg and above.

2.3. Exclusion criteria

All pregnant women were excluded whose blood pressure was less than 140/90 mmHg at twenty or more weeks of pregnancy. Also excluded were pregnant women who were more than twenty weeks pregnant and did not have their blood group identified in the course of their antenatal care.

2.4. Sample size and sampling technique

The sample size was determined using the formula for minimum sample size as follows:

$$N = Z^2P\,(1 - P)/d^2, \text{ where}$$

N = minimum sample size,
Z = standard normal deviation corresponding to 95% confidence interval (CI) (1.96),
P = prevalence from a previous study, which was 10%
d = degree of precision at 5% (0.05).

$$\text{Therefore, } N = (3.8416) \times (0.10) \times (0.90)/(0.0025) = 138$$

2.5. Data Analysis

We conducted statistical analysis using the statistical package for the social sciences (SPSS) version 20.0.0. We summarized demographic variables such as gender, educational status, age, and marital status using mean and standard deviation for continuous variables and proportions for categorical variables. We tested intergroup differences in demographic data for significance using the chi-square test or Fisher test for proportions.

3. Results

3.1. Sociodemographic Status of the Patients

The ages of the women in this study ranged from fifteen to fifty-one years old with a mean age of 30.7 ± 9.8. Of 138 patients, nineteen (13.8%) were less than twenty years old, twenty-five (18.1%) were between the ages of twenty and twenty-nine, fifty-two (37.7%) were from thirty to thirty-nine, thirty (21.7%) were from forty to forty-nine, and twelve (8.7%) were fifty years and above. Fifty-two (37.7%) were Muslims, and eighty-six (62.3%) were Christians. The table also indicates that six (4.3%) of the patients had a primary school certificate as their highest educational qualification, thirty-five (25.4%) had a secondary school certificate, and twenty-seven (19.6%) had no certificate. Seventy (54.8%) of the patients had more than a secondary school certificate. Forty-one (29.7%) of the patients were unemployed, nine (6.5%) were civil servants, three (2.2%) were public servants, twenty (14.5%) were teachers, fifty-nine (42.0%) were in trade or business, and six (4.3%) were in other professions.

Table 1 Sociodemographic characteristics of patients with gestational hypertension

Variable	Frequency	%
Age		
<20	19	13.8
20–29	25	18.1
30–39	52	37.7
40–49	30	21.7
≥50	12	8.7
TRIBE		
Hausa	29	21.1

Igbo	34	24.6
Yoruba	22	15.9
Others	53	38.4
Religion		
Islam	52	37.7
Christian	86	62.3
Level of education		
None	27	19.6
Primary	6	4.3
Secondary	35	25.4
Tertiary	70	50.7
Occupation		
Unemployed	41	29.0
Civil servant	9	6.5
Public servant	3	2.2
Teacher	20	14.5
Trade/business	59	42.8
Others	6	4.3

3.2. The Patients' Clinical Information

The patients' clinical information, shown in Table 2, revealed that ten (7.2%) were between twenty and twenty-four weeks pregnant, twenty-eight (20.3%) were between twenty-five and twenty-nine weeks, fifty-seven (41.3%) were between thirty and thirty-four weeks, thirty-four (24.6%) were between thirty-five and thirty-nine weeks, and nine (6.5%) were forty weeks or more. For parity, seventeen (12.3%) were primigravida, and the remaining 87.7% were non primigravida. Analysis of their blood pressure indicated that 14.5% were between140/90 and 144/94, 21.7% were between 145/95 and 149/99, 34.8% were between 150/100 and 154/104, and 19.6% were between 155/105 and 159/109. Only 9.4% had a blood pressure greater than 160/110.

Table 2 Clinical information of patients with gestational hypertension

Gestational Age	**Frequency (%)**
20–24	10 (7.2)
25–29	28 (20.3)
30–34	57 (41.3)
35–39	34 (24.6)
≥40	9 (6.5)
Parity	
1	17 (12.3)
2	19 (13.8)
3	45 (32)
4	33 (23.9)
≥5	24 (17.4)

Blood Pressure	
140/90–144/94	20 (14.5)
145/95–149/99	30 (21.7)
150/100–154/104	48 (34.8)
155/105–159/109	27 (19.6)
≥ 160/110	13 (9.4)

3.3. Distribution of Patients by Blood Group

A study of patients' distribution by blood group revealed that thirty-three (23.9%) belonged to blood group A, thirty-two (23.2%) belonged to blood group B, forty-seven (34.1%) belonged to blood group AB, and twenty-six (18.8%) belonged to blood group O. These results can be seen in Table 3.

Table 3 Distribution of patients with gestational diabetes into different blood groups

Blood Group	Frequency (%)
A	33(23.9)
B	32(23.2)
AB	47(34.1)
O	26(18.8)

3.4. Blood Group and Gestational Hypertension Disorder

The results obtained show the relation between blood pressure and the ABO blood groups (Table 4). A blood pressure of 150/100–154/104mmHg ranked highest in frequency among all the blood groups; also, the same blood pressure level was common in blood groups B and AB with 43.8% and 36.2%, respectively. Blood group O was more often associated with blood pressure of 145/95– 49/94mmHg. The chi-square was 12.31, and $P = 0.421$, which indicates no significance difference and implies that gestational hypertension is not associated with the ABO blood groups. We found no relationship between gestational hypertension and the ABO blood groups.

Table 4 Blood group and blood pressure of patients with gestational hypertension

	Blood Pressure (%)						
Blood Group	**140/90–144/94**	**145/95–149/99**	**150/100–154/104**	**155/105–159/109**	**≥160/110**	**Chi**	***P*-value**
A	6 (18.2)	4 (12.1)	13 (39.4)	5 (15.2)	5 (15.2)		
B	4 (12.5)	7 (21.9)	14 (43.8)	4 (12.5)	3 (9.4)		
AB	5 (10.6)	10 (21.3)	17 (36.2)	12 (25.5)	3 (6.4)	12.31	0.421
O	5 (19.2)	9 (34.6)	4 (15.4)	6 (23.1)	2 (7.7)		

3.5. Maternal Age and the Occurrence of Gestational Hypertensive Disorder

The relationship between maternal age and the occurrence of GHD is shown in Table 5. Among those younger than twenty years of age, the prevalence of GHD was 31.6% with blood pressure from 140/90 to 144/94. In the twenty to twenty-nine year old, the prevalence was 52% with blood pressure from 150/100 to 154/104. For thirty to thirty-nine year old. the prevalence was 25% with blood pressure from 145/95–149/99 and 150/100–154/104. In forty to forty-nine year old, the prevalence was 23.3% for both blood pressure ranges. Last, for those older than 50, the prevalence was 33.3% with blood pressure recorded at 155/105 to 159/109. The chi-square was 19.81, and $P = 0.229$, which indicated non-significance, implying that gestational hypertension is not associated with age. There is no relationship between gestational hypertension and maternal age.

Table 5 The maternal age and the occurrence of gestational hypertensive disorder in sampled patients

	Blood Pressure (%)						
Age	**140/90–144/94**	**145/95–149/99**	**150/100–154/104**	**155/105–159/109**	**≥ 160/110**	**Chi**	***P*-value**
≤2 0	6 (31.6)	5 (26.3)	5 (26.3)	2 (10.5)	1 (5.3)		
20–29	1 (4)	4 (16)	13 (52)	6 (24)	1 (4.0)		
30–39	5 (9.6)	13 (25)	13 (25)	10 (19.2)	6 (11.5)	19.81	0.229
40–49	6 (20)	7 (23.3)	7 (23.3)	5 (16.7)	2 (6.7)		
≥ 50	2 (16.7)	1 (8.3)	1 (8.3)	4 (33.3)	3 (25)		

3.6. Age of Pregnancy and the Occurrence of Gestational Hypertensive Disorder

The relationship between the age of the pregnancy and the occurrence of GHD is shown in Table 6. At a gestational age of twenty to twenty-four weeks, the prevalence of GHD was 50% with blood pressure from 140/90 to 144/94. At twenty-five to twenty-nine weeks gestational age, the prevalence was 42.9% with blood pressure from 145/95 to 149/99. At a gestational age of thirty to thirty-four weeks, the prevalence was 56.1% with blood pressure from 150/100 to 154/104. At thirty-five to thirty-nine weeks, the prevalence was 52.9 % with blood pressure from 155/105 to 159/109; and at more than forty weeks, the prevalence was 44.4% with blood pressure greater than 160/110. The chi-square was 91.08, and $P < 0.0001$, which is a significant indication that gestational hypertension is associated with age. An increase in gestational age increases blood pressure.

Table 6 Age of pregnancy and the occurrence of gestational hypertensive disorder

	Blood Pressure (%)						
Gestational Age	**140/90–144/94**	**145/95–149/99**	**150/100–154/104**	**155/105–159/109**	**≥ 160/110**	**Chi**	***P*-value**
20–24	5 (50)	2 (20)	3 (20)	0 (0)	0 (0)		
25–29	9 (32.1)	12 (42.9)	6 (21.4)	1 (3.6)	0 (0)		
30–34	5 (8.8)	12 (21.1)	32 (56.1)	5 (8.8)	3 (5.3)	91.08	< 0.0001
35–39	1 (2.9)	4 (11.8)	5 (14.7)	18 (52.9)	6 (17.6)		
≥ 40	0 (0)	0 (0)	2 (22.2)	3 (33.3)	4 (44.4)		

3.7. Parity of Women with Gestational Hypertensive Disorder

The relationship between gestational hypertension and parity (Table 7) suggested that blood pressure of 140/90–144/94 and 150/100–154/104 is common in a primigravida with a prevalence of 29.4%. For para 2, the prevalence is high at 145/95–149/99 and 150/100–154/100. For para 3, 35.6% were in the 150/100–154/104 range. The chi-square was 26.71, and $P = 0.045$, which indicates a significant relationship between gestational hypertension and parity.

Table 7 Parity of patients with Gestational Hypertensive Disorder

	Blood Pressure (%)						
Parity	**140/90–144/94**	**145/95–149/99**	**150/100–154/104**	**155/105–159/109**	**≥ 160/110**	**Chi**	***P*-value**
1	5 (29.4)	4 (23.5)	5 (29.4)	2 (11.8)	1 (5.9)		
2	4 (21.1)	5 (26.3)	5 (26.3)	4 (21.0)	1 (5.3)		
3	7 (15.6)	11 (24.4)	16 (35.6)	7 (15.6)	4 (8.9)	26.71	0.045
4	3 (9.1)	9 (27.3)	14 (42.4)	7 (21.2)	0 (0)		
≥ 5	1 (4.2)	1 (4.2)	8 (33.3)	7 (29.2)	7 (29.2)		

4. Discussion

This study assessed the prevalence of the ABO blood groups among 138 women who attended antenatal clinics. Their gestational age ranged from ≤ 20 weeks to ≥ 40 weeks. Findings from the study reveal that the relationship between blood group types and gestational hypertension was 12%, which indicates that gestational hypertension is associated with the ABO blood group.

The ages of the women who participated in this research ranged from fifteen to fifty-one with a mean age of 30.7 ± 9.8. The highest number of participants (37.7%) were between thirty and thirty-nine years old whereas those fifty and above were the smallest group (8.7%). Seventy (54.8%) of the women in this study were educated, 42.0% (fifty-nine) were in trade or business, about 30% (twenty-six) were working-class, and six (4.3%) of the patients were in another profession. Only forty-one (29.7%) of the patients were unemployed. Most of the women married between the ages of thirty and thirty-nine, which may be because most of them were educated up to the tertiary level and above. Similarly, they may be practicing child spacing due to their employment status.

The frequency of ABO phenotypes in women with, is similar to that of pregnant women with normal blood pressure. Women in the AB blood group had the highest risk of developing GHD, and women in the O blood group had the lowest risk which is consistent with other studies [9,10].

The risk of PIH in pregnant women with a non-O blood type is higher than in pregnant women with an O blood type [11]. Studies have shown that ABO blood types are associated with the risk of GHD [12].

The study of patients' distribution by blood group revealed that women with blood group type AB have the highest prevalence of GHD whereas women with blood group type O have the least. This is consistent with the conclusion of [9]; women in the AB blood group have the highest risks of GHD, pre-eclampsia, and severe pre-eclampsia whereas women in the O blood group have the lowest risks of developing these disorders. Although the magnitude of the increased risk is small, this finding may help improve our understanding of the etiology of pre-eclampsia.

The results of this study indicated that gestational hypertension may be associated with age. This confirms the results of [13] which indicates that primigravida with AB blood group have the highest risk of developing PIH disorders compared with other blood groups [13]. This finding is consistent with other findings [9,14–16]. Maternal age is also associated with chronic PIH [17]. Gestational hypertension risk was reported to be 1.22 times greater in women thirty-five to 39.9 years old. In addition, GH is 1.63 times more prevalent in women aged forty to forty-four than in their counterparts between the ages of twenty-five and twenty-nine [9].

[18,19] explains that reduced nitric oxide NO and high levels of reactive oxygen species are a sign of aging, and this has an adverse effect on endothelium relaxation. The resultant effect of these factors can lead to gestational hypertension in older mothers due to an increase in cardiac output during pregnancy.

The results of this study show that GH may not be associated with age. There was no relationship between gestational hypertension and maternal age. However, [19] show that the risk of hypertensive disorders in pregnancy increases gradually with age in pregnant women who are over 35 years. The risks of preeclampsia and eclampsia increase in teenage pregnancy. Better management helps to reduce the incidence of eclampsia and improve the outcomes of pregnancy in pregnant women with advanced maternal age and teenagers.

However, although multiple gestations have been reported to be an important risk factor for Hypertensive disorders of pregnancy HDP, this study found no statistically significant influence of multiple gestations on HDP, which is similar to the result of [20]. This study also found parity, advanced maternal age, and gestational age to be risk factors for HDP. Parity is an important risk factor for pre-eclampsia among pregnant women in Lagos, Nigeria. However, although multiple gestations have been reported to be an important risk factor for HDP, this study found that there is no statistically significant influence of multiple gestations on HDP [20]. Gupte and Wagh [21] also emphasized the need to increase awareness among medical and paramedical personnel regarding the need for early referral of women with a previous history of preeclampsia, multiple gestations, gestational diabetes, and obesity for specialist care because they have a higher risk of developing HDP [13,14].

5. Conclusion

GHD is one the most important diseases pregnant women suffer from, and it has grievous consequences for both the pregnant woman and her fetus. ABO blood groups are also very important to both pregnant women and their fetuses. The relationship between the two was assessed but showed no significant relationship. However, the data assessed showed that blood group AB has the highest association with gestational hypertensive disorder whereas O has the least association.

Compliance with ethical standards

Disclosure of conflict of interest

The authors show no conflict of interest.

Statement of ethical approval

The head of the Department of Public Health, National Open University of Nigeria, sent a letter of permission with an ethics clearance to the chairman of the ethics committee at Gwagwalada University of Abuja Teaching Hospital, Gwagwalada Abuja. The letter permitted us to conduct the study in the Gwagwalada University of Abuja Teaching Hospital. This research did not contain studies on human. We explained the study in detail to the ethics committee and the head of records in the hospital. We adhered to the principles of autonomy, justice, beneficence, and no malfeasance and ensured the privacy of the people whose records were used.

Statement of informed consent

No individual was interviewed in this work, we only examined the records in the hospital.

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