

## Original Article

# ABO Blood Group as a Biomarker of Preeclampsia among Antenatal Clinic Attendees in Nigeria

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## INTRODUCTION

Antigens of the ABO blood group are oligosaccharides found on endothelial cells, epithelial cells, and red cells.<sup>[1]</sup> The A and B alleles encode unique glycosyltransferases that add N-acetylgalactosamine and D-galactose to the H substance, this H substance is then converted into A- or B-antigens, respectively.

The clinical application of the ABO blood group is not limited to transfusion medicine but extends to other aspects of medicine. It has been found to be associated with several disease conditions like cardiovascular diseases, cancer, infections, dental

**ABSTRACT** **Background:** The clinical application of the ABO blood group is not limited to transfusion medicine but extends to other aspects of medicine. Its impact on preeclampsia is controversial. **Aim:** To determine the association of ABO blood group type with preeclampsia. **Subjects and Methods:** This was a cross-sectional analytical study of 66 women with preeclampsia and 81 apparently healthy women controls carried out in a tertiary health institution. The case and control groups were consecutively recruited during antenatal clinic visits and matched for age, parity, and gestational age. Data on demographics and the ABO blood group of the two groups of individuals were obtained. The analysis was both descriptive and inferential using the statistical package for social sciences (SPSS) version 21 (Chicago IL, USA). A *P* value of <0.05 was considered statistically significant. **Results:** The mean age of the participants was 30.6 (4.9), 95% CI: 27.76–33.95. The majority of the women were ≤40 years (98.5%) and multigravidae constituted 81.8%. Forty-six (69.7%) women with preeclampsia had blood group O and 20 (30.3%) had a non-O blood group. Forty-nine (60.5%) of the controls had blood group O and 32 (39.5%) had a non-O blood group. The observed difference was not statistically significant (OR 1.50; 95% CI: 0.75–3.0; *P* = 0.26). The odds ratio for developing preeclampsia was 0.83 (95% CI: 0.37–1.91; *P* = 0.67) for the primigravidae. The non-O blood groups were more likely to present with symptoms than the O group (*P* < 0.01). Twenty-six (39.4%) women with preeclampsia had a mild disease while 40 (60.6%) had severe disease. **Conclusion:** Women with non-O blood groups are not at increased risk of developing preeclampsia but are more likely to be symptomatic than the O group.

**KEYWORDS:** ABO blood group, preeclampsia, severe hypertension, symptomatic

malocclusion, and hematological disorders like venous thromboembolism.<sup>[2-5]</sup>

Despite several studies on preeclampsia, the etiology is still not clear. Some risk factors thought to predispose to preeclampsia include preexisting hypertension, previous personal history of early-onset preeclampsia, and hypertension as well as a family history of

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preeclampsia. Preeclampsia is associated with symptoms like headaches, edema, weight gain, visual changes, abdominal pain, dyspnea, nausea, and vomiting. They can present with seizures when severe. The severity of preeclampsia is graded into mild and severe. Mild preeclampsia was taken as blood pressure (BP) of 140–160 mmHg systolic, 90–110 mmHg diastolic, absence of symptoms such as epigastric pain and headaches. Severe preeclampsia has BPs greater than 160 mmHg systolic, diastolic of more than 110 mmHg, thrombocytopenia ( $<100,000/\mu\text{L}$ ), proteinuria of  $\geq 3+$  on two random urine samples.<sup>[6,7]</sup>

Over time, several researchers have studied the association of ABO group type with poor pregnancy outcomes like preeclampsia and HELLP syndrome, intrauterine fetal growth restriction (IUGR), venous thromboembolism (VTE), post-partum hemorrhage, and gestational diabetes and there exist some controversies.<sup>[8,9]</sup> Several studies have shown a relationship between ABO blood group and preeclampsia with blood group AB women being at higher risk of developing preeclampsia<sup>[10-12]</sup> whereas this is disproved by other studies.<sup>[13,14]</sup>

There are conflicting findings on the association between preeclampsia and ABO blood groups. Our aim is, therefore, to determine the association between ABO blood group and preeclampsia in our environment. This study will also serve to highlight the need for early follow-up of pregnant women whose blood groups put them at high risk of developing preeclampsia.

## PATIENTS AND METHODS

This was a cross-sectional analytical study carried out at our institution from May to October 2015. A total of 147 consenting pregnant women who attended the antenatal clinic of the hospital were consecutively recruited. They were made up of 66 cases and 81 controls. The cases were women who were diagnosed of preeclampsia defined as a BP of  $\geq 140/90$  mmHg, with proteinuria  $>300$  mg/24 h period or  $\geq 2+$  dipstick occurring in a pregnant women at a gestational age of 20 weeks or more,<sup>[15]</sup> whereas, the control group was made up of apparently healthy pregnant women matched for age, parity, and gestational age. Participants were considered to have severe preeclampsia if the systolic BP was  $>160$  mmHg and/or diastolic was  $>110$  mmHg or proteinuria  $\geq 3+$  on a dipstick urine sample.

The minimum sample size (n) for this study was calculated using the formula for comparison of proportions according to Kirkwood.<sup>[16]</sup> Assuming a 30% increase in the incidence of preeclampsia among blood group O women compared to the general population;<sup>[17]</sup>

with an attrition rate of 10% for possible dropouts or losses to follow-up, the minimum sample size for each group was 63 corresponding to 80% statistical power and 5% level of significance.

Prior to recruitment and inclusion into the study, written informed consent was obtained from the women. 3 mL of venous blood was collected from the women for blood group typing. Other parameters such as biodata, the BP at diagnosis (or at the point of recruitment for the controls), degree of proteinuria (using a dipstick) were retrieved from the case notes. With the aid of a pro forma associated symptoms and previous history of hypertension or preeclampsia were equally obtained. Women with incomplete data from case notes and those who had diabetes mellitus, vascular or chronic renal diseases were excluded. Ethical clearance was obtained from the institutional review board of our institution. The procedures followed were in accordance with the ethical standards of the ethical committee on human experimentation and with the Helsinki Declaration of 1975, as revised in 2000 (available at [http://www.wma.net/e/policy/17-c\\_e.html](http://www.wma.net/e/policy/17-c_e.html)).

Statistical analysis was done using the statistical package for social sciences (SPSS) version 21 (Chicago IL, USA). Categorical variables were presented in simple proportion and continuous variables as mean and standard deviation. The results were presented as tables. Chi-square and student t-test were used for comparison of the categorical and continuous variables between groups. Relationships were expressed using the odds ratio and confidence interval. Significance was set at 0.05.

## RESULTS

The study flow chart is as shown in Figure 1. The demographic characteristics of the two groups including age, gravidity, and parity were similar as shown in Table 1. Twenty-six (39.4%) women with preeclampsia had a mild disease while 40 (60.6%) had severe disease.

**Table 1: Demographics of study participants**

	Preeclampsia n=66	Control n=81	P
Age (years)	30.7 $\pm$ 4.7	30.4 $\pm$ 5.1	0.70
Gravidity	3.3 $\pm$ 1.9	3.0 $\pm$ 1.7	0.33
Parity	1.2 $\pm$ 1.5	1.3 $\pm$ 1.4	0.62
Age (years)			
$\leq 40$	65 (98.5)	80 (98.8)	$> 0.99$
$> 40$	1 (1.5)	1 (1.2)	
Gravidity			
Primigravida	12 (18.2)	17 (21.0)	0.67
Multigravida	54 (81.8)	64 (79.0)	
Parity			
Nulliparous	36 (54.5)	50 (61.7)	0.38
Multiparous	30 (55.5)	31 (38.3)	

**Table 2: Blood group and severity of preeclampsia<sup>a</sup>**

	Mild n=26	Severe n=40	P
ABO blood group			
O	18 (69.2)	28 (70)	0.67
A	6 (23.1)	6 (15.0)	
B	2 (7.7)	5 (12.5)	
AB	0 (0.0)	1 (2.5)	
ABO blood group			
O	18 (69.2)	28 (70.0)	0.95
Non-O	8 (30.8)	12 (30.0)	

a=Fisher's exact test

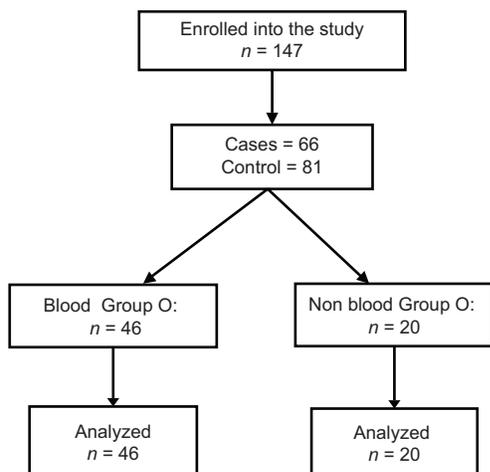
**Table 3: Blood group of the women and the associated symptoms at presentation<sup>a</sup>**

	O	Non-O	P
Symptomatic	29 (63.0)	19 (95.0)	<0.01
Headache	14 (30.4)	7 (35.0)	0.71
Edema	17 (37.0)	12 (60.0)	0.08
Seizures	6 (13.0)	2 (12.1)	>0.99
Breathlessness	2 (4.3)	1 (5.0)	>0.99
Epigastric pain	2 (4.3)	2 (10.0)	0.58
Blurred vision	1 (2.2)	1 (5.0)	0.52
Vomiting	1 (2.2)	0 (0.0)	>0.99

a=Fisher's exact test

**Table 4: Median values of blood pressure and proteinuria of study participants**

ABO Blood Group	Median blood pressure		Median proteinuria (dipstick)
	Systolic	Diastolic	
O	160	100	2
A	160	95	2
B	170	100	1
AB	160	100	2
O	160	100	2
Non-O	160	100	2



**Figure 1: Study flowchart**

As shown in Table 2, 46 (69.7%) of women with preeclampsia had blood group O and 20 (30.3%) had

a non-O blood group. Conversely, 49 (60.5%) of the controls had blood group O and 32 (39.5%) have a non-O blood group. The observed difference was not statistically significant ( $P = 0.639$ ; OR: 1.5; 95% CI: 0.75–3.00).

Out of the 66 women with preeclampsia, 48 presented with headaches, edema, epigastric pain, blurred vision, breathlessness, vomiting, or seizures. These symptoms were analyzed against the different blood groups. Table 3 shows that while individual symptoms did not differ significantly between the groups, overall, the non-O blood group was significantly more symptomatic than the O blood group ( $P < 0.01$ ).

Table 4 shows the distribution of the median values of blood pressure and proteinuria of study participants.

## DISCUSSION

The relationship between the ABO blood group system and several disease entities has been researched by several groups in the past. Previous works have studied the effect of ABO blood group on diseases such as cardiovascular diseases, colorectal cancers, and proneness to bacterial and viral illnesses.<sup>[15,18]</sup> Similar studies that compared the relationship between preeclampsia and ABO blood group gave results that are conflicting and controversial.<sup>[14]</sup>

The incidence of preeclampsia in the developing world such as Nigeria varies widely. It ranges from 1.2% to 6% from the previous works done in Calabar and Sokoto.<sup>[14,19]</sup> This underscores the need to find out the risk factors for preeclampsia which leads to maternal and infant morbidity and mortality. The ages of women with preeclampsia are commonly below 40 years and we know that preeclampsia is seen mostly among women who are 35 years and below. Our study showed that the primigravidae have a higher risk of developing preeclampsia and this finding is in keeping with the findings of Jido and Yakasai 2013, who found a higher incidence among nulliparous women than multiparous women.<sup>[20,21]</sup> Among those women who had preeclampsia in their previous pregnancies, the risk of having preeclampsia increases from 4.1% in the first pregnancy, to 14.7% in the second pregnancy and then to 31.9% in the third.<sup>[20]</sup> This may explain why we have a higher incidence of preeclampsia among the multiparous women when compared to the primigravidae. There was no association found between blood groups and preeclampsia from our study as was also reported by a local study in south-west Nigeria.<sup>[22]</sup> Even though it was not significant, our study showed that women with blood group O were even more at risk of developing preeclampsia. This is similar to the

work reported by Elmugabil *et al.* which was carried out on an African population.<sup>[23]</sup> On the contrary, a work carried out by Phaloprakarn and Tangjitgamol in Iran showed an association between the ABO blood group and the development of preeclampsia.<sup>[24]</sup> Likewise, other researchers found a high risk of developing preeclampsia among women with blood group AB,<sup>[25-27]</sup> where they proposed careful grouping of antenatal women with great attention given to those women with AB blood group because they have been found to have higher thrombotic events than O blood group. It is worthy to note that all these referenced studies reporting an association between ABO blood group and preeclampsia were carried out on the non-Nigerian population. In our study, only one patient (1.51%) is of the AB blood group as against 750 (7.74%) reported in the Indian study. Even though the frequency may be affected by the limited sample size, the prevalence of AB blood group is known to be lower among Nigerians (3.7%),<sup>[28]</sup> when compared to the Indians and Scandinavians where the prevalence of AB blood group is reportedly 5–7%.<sup>[29]</sup> These suggest a possible contributory ethnic/environmental factors to the prevalence of preeclampsia among women with AB blood group.

Although making a diagnosis of preeclampsia requires only blood pressure and proteinuria,<sup>[15]</sup> some clinical features/symptoms such as headache, blurring of vision, etc., are used to determine severity.<sup>[21]</sup> The findings from this study show that there is a relationship between the blood group and the development of symptoms associated with preeclampsia. Whereas the non-O blood group was found to be more likely to be symptomatic than the O blood group, the individual symptoms were not significantly associated with any blood group type. The import of this finding will need to be elucidated by further studies. Nevertheless, these associated symptoms may aid early diagnosis and prompt intervention thereby curbing morbidity and mortality resulting from preeclampsia.

Limitations of the study include the fact that the study was conducted in only one center which limits the generalization of the findings to the entire population. Furthermore, the study did not follow up with the women to ascertain the pregnancy outcome. The major strength of this study was in its prospective design with increased accuracy in data collection.

## CONCLUSION

Women with non-O blood groups are not at increased risk of developing preeclampsia. They are however more likely to be symptomatic than the O counterparts which may aid early identification and intervention.

## Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient (s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Nil.

## Conflicts of interest

There are no conflicts of interest.

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