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FREQUENCY DISTRIBUTION OF HEMOGLOBIN VARIANTS AND RHESUS BLOOD GROUPS AMONG PREGNANT WOMEN

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ABSTRACT

Hemoglobin variants, ABO and Rhesus blood groups vary from one population to another. The study was designed to sample pregnant women population from Ayetoro community of Ogun state, Nigeria, for the purpose of updating information on the prevalence of abnormal hemoglobin variants, ABO and Rh blood groups and compare the results with previously published data. Hospital records of recruited pregnant women were sorted out for the determination of the prevalence of hemoglobin variants, ABO and Rh blood groups. Blood group O were the most prevalent (59.1%) followed by groups A (19.1%), B (17.1%) and AB (4.8%). Rhesus D antigen was positive in 97.1% and negative in 2.9% of the study population. Four genotypes; HbAA (70.5%), HbAS (18.1%), HbAC (10.5%) and HbCC (1.0%) were reported in this study. The occurrence of the hemoglobin variants and the different ABO blood groups varied significantly ($p<0.05$). The frequency of ABO and Rhesus blood groups from this study is consistent with reports from previous studies in Nigeria. The study helps in the formulation of genetic counseling policies to help prospective mothers make informed decisions before and after giving birth.

Keywords: Pregnant Women, Hemoglobin Genotypes, ABO Blood Groups, Rhesus

1. INTRODUCTION

The ABO and Rh blood groups are among the most important blood groups (Seeley *et al*., 2008). ABO blood groups are carbohydrate histo-blood antigens that are also expressed in many tissues and which have important roles in modulating protein activities both in infection and in some types of cancer (Greenwell, 1997). These antigens are formed by terminal glycosylation of glycoproteins and glycolipid chains present on cell surfaces.

Cell surface glycans have an essential role in reproductive biology and the adhesion and implantation of the blastocyst is partly mediated by carbohydrates with blood group specificity (Burrows *et al*., 1994). Each mammalian species has its own glycotype at the feto-maternal interface and this variation depends on both evolution and the environment (Jones *et al*., 2004). ABO histo-blood groups and related antigens are expressed in the endometrium and are modulated by the hormonal environment (Skovlund, 1997), but are not expressed in the placenta and fetal endothelium where only other related blood groups can be detected in the interstitial trophoblast directly opposed to the maternal deciduas (Ravn and Dabelsteen, 2000). In contrast, examination of the glycan expression at the fetomaternal interface using lectins, some with ABO determinant specificity have shown binding with placental structures (Thrower *et al*., 1990; Jones *et al*., 1997).

Rhesus system emerged as second most important blood group system due to Hemolytic Disease of Newborn (HDN) and its importance in Rh D negative individuals in subsequent transfusions once they develop Rh antibodies (Dennis *et al*., 1998). People are positive if they have a certain Rh antigen (the D antigen) on the surface of their erythrocytes and people are Rh-negative if they do not have

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this Rh antigen. Rhesus incompatibility can pose a major problem in some pregnancies when the mother is Rh-negative and the fetus is Rh-positive (Avent, 1998) where it can lead to HDN, or erythroblastosis foetalis and it may be fatal to the fetus (Dennis *et al*., 1998).

Sickle cell Hemoglobin (HbS) differs from normal Hemoglobin (HbA) because it has a valine in place of a glutamic acid in position number six of the beta chain of the globin molecule. When the availability of oxygen is reduced, the erythrocytes containing sickle cell hemoglobin change from round to sickle-shaped cells. The sickle cell Homozygote (HbSHbS) almost always dies of anemia. The sickle cell Heterozygote (HbAHbS) is only slightly anemic and has resistance to malaria (Tamarin, 2002). The normal Homozygote (HbAHbA) is not anemic and has no resistance to malaria. Thus, in areas where malaria is common, the fit genotype of the three appears to be the sickle cell heterozygote, which has resistance to malaria and only a minor anemia.

This study presents the frequency distribution of ABO and Rh blood groups and the frequency distribution of blood genotypes in this pregnant women population.

2. MATERIALS AND METHODS

The study was conducted in Ayetoro, the head quarter of Yewa North Local Government Area, Ogun State. It is a peri-urban community with three secondary schools and numerous private and government owned primary schools. The predominant occupations are civil service, farming and petty trading. The community has three primary health centers with one government owned hospital (General Hospital, Ayetoro). It is a heterogeneous community comprising people of different ethnic groups such as Yorubas, Fulanis, Ogoris and people from the Republic of Benin.

The medical records of a total of 105 pregnant women attending antenatal consultation at the Ayetoro General Hospital between July, 2011 and January, 2012 were retrieved having obtained an oral informed consent from the subjects. Only the pregnant women willing to participate in the study and those that have resided in the area for at least a period of one year were recruited while visitors were excluded from the study. Information on each pregnant woman blood group and hemoglobin genotype was recorded against their name.

2.1. Statistical Analysis

Data was analyzed using computer database software from the Statistical Package for Social Sciences (version 17; SPSS Inc., Chicago, IL). Frequency distribution and prevalence of the various parameters were determined. Differences in proportions were determined by chi-square tests. A P-value of <0.05 was considered statistically significant in all clinical comparisons.

3. RESULTS

The overall frequencies of the ABO and Rh blood groups in the pregnant women population (n = 105) are shown on **Table 1**. The most and the least prevalent blood groups were blood group O and AB with 59.1 and 4.8% respectively. Rhesus D^+ and Rh D^- accounted for 97.1 and 2.9% respectively. The frequencies of Rh D groups among the four ABO groups are shown in **Table 2**. No Rh D^- was recorded in the blood groups A and AB. The most predominant hemoglobin genotype was HbAA (70.5%) (**Table 3**). The hemoglobin variants HbSC and HbCC did not occur in this study population. There were significant differences in the occurrence of ABO blood groups and hemoglobin genotypes in the pregnant women population ($p<0.05$).

Table 1. Frequencies of ABO Rh blood groups among pregnant women participants (n = 105)

Variables		Number observed	Prevalence (%)
Blood groups			
	A	20	19.10
	B	18	17.10
	AB	5	4.80
	O	62	59.10
			p<0.05
Rhesus (Rh)			
	D^+	102	97.10
	D^-	3	2.90
			p<0.05

Table 2. Rhesus (Rh) D distribution among pregnant women in ABO blood groups

Blood group	Rh D Positive (%)	Rh D Negative (%)
A	20 (19.1)	-
B	17 (16.2)	1(1.0)
AB	5 (4.8)	-
O	60 (57.1)	2(1.9)
Total	102(97.1)	3(2.9)

Table 3. Frequencies of hemoglobin genotypes among pregnant women

Hb genotypes	Number observed	Prevalence (%)
AA	74	70.50
AS	19	18.10
AC	11	10.50
CC	1	1.00
SS	0	0.00
SC	0	0.00
		p<0.05
Total	105	100.00

4. DISCUSSION

This study was designed to evaluate the frequency of the most clinically relevant and routinely tested blood groups and hemoglobin genotypes in pregnant women population in South- western Nigeria. The prevalence of ABO blood groups reported in our study is similar to other studies from other part of the country (Jeremiah, 2005; Bakare *et al*., 2006; Uneke *et al*., 2007; Erhabor *et al*., 2010). A frequency of 26.7% for group A, 18.3% for B, 2.2% for AB and 52.8% for group O from the South-southern Nigeria was reported by Jeremiah (2005) while Uneke *et al*. (2007) from South-eastern Nigeria reported a frequency of 25.0% for group A, 16.4% for B, 1.9% for AB and 56.7% for group O. These all showed a consistent highest frequency of group O individuals with group AB having the least frequency in their respective study population.

The high prevalence of group O individuals in nature is of great advantage because of their status as 'universal donors' as this implies availability of blood in cases of emergency. However, caution should be taken in doing this as some group O blood is known to contain potent immune hemolytic antibodies (hemolysins) (Jeremiah, 2006). Routine hemolysin test on every group O blood will help reduce the risk of transfusion reaction. More so, the O phenotype has been reported to show parity-specific association with protective malaria immunity in pregnancy leading to improved birth anthropometry (Loscertales and Brabin, 2006).

The frequency of Rh D positive was 97.1% while that of Rh D negative was 2.9%. This is in consonance with other reports on Nigerian pregnant women and students' populations (Jeremiah and Buseri, 2003; Jeremiah, 2005; Akigbe *et al*., 2009). The 2.9% Rh D negative women in this study stand the risk of developing anti-D which can cause both moderate and severe form of hemolytic disease of the newborn. However inclusion of this test in antenatal programs especially for the primigravid mothers, followed by appropriate health education will reduce the risk of the disease.

Previous studies from Nigeria have reported the presence of 2-6 hemoglobin genotypes (Jeremiah, 2006; Adeyemo and Soboyejo, 2006; Akigbe *et al*., 2009; Pennap *et al*., 2011). It is of specific interest to note that HbSS was not found in this pregnant women population. This is in line with the report of Uneke *et al*. (2007) who reported the absence of HbSS in pregnant women population in Abakaliki, Nigeria and in malaria-endemic areas of Kenyan population (Moormann *et al*., 2003). The decline in prevalence of HbSS in our study and other studies in Nigerian population (Jeremiah, 2005; Pennap *et al*., 2011) compared to those reported earlier (Nwafor and Banigo, 2001; Bakare *et al*., 2006) implies that the sickling gene pool is gradually shrinking thus lowering the occurrence of hemoglobinopathies in the Nigerian populations. This could be attributed to increased awareness of the disease, improved socio-economic conditions and other environmental and genetic factor which have an overall effect on the sickling gene pool (Jeremiah, 2006).

5. CONCLUSION

This study forms the basis for genetic counseling in the study population and will help prospective mothers make informed decisions before and after giving birth.

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