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ORIGINAL ARTICLE

ABO, Rh, and Kell Blood Group Antigen Frequencies among Pregnant Women in Sokoto, Nigeria.

[1]Buhari, H.A., [2]Sagir, A., [4]Akuyam, S.A., [1]Erhabor, O., [4]Panti, A.A, [5]Garba, N.

[1]Buhari, H.A., 2Sagir, A., 4Akuyam, S.A., 1Erhabor, O., 4Panti, A.A, 5Garba, N.

[1]Haematology Department, School of Medical Laboratory Science, Usmanu Danfodiyo University Sokoto

[2]Haematology Department, Aminu Kano Teaching Hospital Kano.

[3]Department of Medical Laboratory Science, Faculty of Allied Health Sciences, Ahmadu Bello University, Zaria

[4]Obstetric and Gynaecology Department, Usmanu Danfodiyo University Teaching Hospital Sokoto

[5]Department of Medical Laboratory Science, Faculty of Allied Health Sciences, Bayero University Kano.

Corresponding Author's E-mail: hawwaubuhari@

Abstract

Background: Blood group antigens have been used to evaluate ethnic diversity of human populations and they also play most important roles in pregnancy and blood transfusion. Knowledge of antigen frequencies is important to assess the risk of alloimmunization and to guide the probability of finding antigen-negative donor blood. This study was aimed at determining the frequencies of ABO, Rh and Kell blood group antigens phenotype among pregnant women.

Materials and Methods: The study was cross sectional in nature conducted among 1,250 consecutively recruited pregnant women in the department of Obstetrics and Gynaecology, antenatal clinic in Sokoto from January 2020 to September 2020. The blood grouping were determined using standard tube techniques for ABO while column agglutination card was used for Rh C, E, c, e and Kell blood groups. The data were collected, and calculations were done to determine the frequencies of ABO, Rh, and Kell blood group antigens and chi square was used to determine statistical significance .

Results: The distribution of the ABO blood group revealed that 48.5% were group O, 27.3% were group B, 19.4% were group A and 4.8% were group AB. Out the subjects investigated, 93.1%, 30.2%, 24.6% , 90.2% and 97.6%were RhD, RhC, RhE, Rhc and Rhe positive respectively while 2.4% were Kell positive while 97.6% were Kell negative. ABO antigens has statistically significant correlation with Kell antigens.

Conclusion: There is phenotypic variability of ABO and Rh blood group antigens with low prevalence of Kell antigen that has statistical relationship with ABO antigen. Incorporation of blood group phenotyping as premarital screening may reduce the prevalence of alloantibody formation.

yahoo.com.
Telephone number:
08068087711

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Introduction

The Discovery of blood group antigen is usually beginning with the discovery of antibodies in the serum of multiply transfused blood recipients or the serum of a multiparous woman with a unique pattern of reactivity. The discovered antibody can then be used to study the basic biochemical properties of the corresponding antigen to enable the recognition of the pattern of the antigen in the family and population, to identify RBC that lacks the antigen and to search for antithetical antigen, and the identified characteristics are compared to existing systems and collections [1]. Blood group antigens have been used to evaluate ethnic diversity of human populations with similar frequencies in people ranges from 0 to 90 years and had been related to predisposing individuals to some diseases like cancer, diabetes, infectious diseases, and heart illnesses or may protect individuals against some diseases such as malaria and diabetes. The ABO and Rh blood groups are the most important antigens because their incompatibility causes transfusion reaction in recipient and haemolytic disease of the foetus and newborn Furthermore, blood antigens play an important role in the success of transfusions and organ transplants [2, 3].

The Human Genome Organisation (HUGO) Gene Nomenclature Committee (HGNC) currently recognizes 43 blood group systems, which represent approximately 349 red cell antigens [4]. The difference between red cell antigens that represent the products of alleles is small, usually, just one monosaccharide or one amino acid, and most blood group systems have a null phenotype in which the whole blood group protein is absent from the red cells or any other cells. These usually result from homozygosity for gene deletions or inactivating mutations within the genes [5]. The genes of these blood group systems are autosomal except for XG and XK, which are X-linked. The antigens can be integral proteins where polymorphisms lie in the variation of amino acid sequence (Rhesus and Kell), glycoproteins or glycolipids (ABO) [6].

Most blood groups are encoded by one allele but variant usually arises from single nucleotide change, for example, A and B alleles differ by amino acid substitutions in their respective transferases while some allele is silent and does not produce any recognizable antigens, for example, AA and AO. Some blood group genes are complexes of several closely linked genes that evolve through duplications of an ancestral gene for example; the Rh system with genes RHD and RHCE and the MNS system with genes GYPA, GYPB and GYPE [7].

Materials and Methods

Study Location

The selected area for this study is Sokoto State and the area covered included Usmanu Danfodiyo University Teaching Hospital (UDUTH), Specialist Hospital Sokoto, Maryam Abacha Women and Children Hospital, Women and Children Welfare Clinic, General Hospital Yabo and General Hospital Bodinga. Sokoto State is located in the extreme Northwest of Nigeria, near the confluence of

the Sokoto River and Rima River. With an annual average temperature of 28.30c (82.9 0F). Sokoto is, on the whole, a very hot area. However, maximum day time temperatures are for most of the year generally under 40 0C (104.0 0F). The warmest months are February to April when daytime temperatures can exceed 45 0C (113.0 0F). The rainy season is from May to October during which showers are a daily occurrence. There are two major seasons, wet and dry which are distinct and are characterized by high and low malarial transmission respectively. Report from the 2007 National Population Commission indicated that the State had a population of 3.6 million [8].

Study Setting

The study was conducted among the pregnant women that visited various hospitals in Sokoto for their first ante-natal visit. The research laboratory analysis was done in School of Medical Laboratory Science of Usmanu Danfodiyo University in collaboration with Haematology Department of Usmanu Danfodiyo University Teaching Hospital Sokoto.

Sample Collection and Methods

Blood samples were collected by venepuncture into ethylene diamine tetracetic acid (EDTA) anticoagulated tubes and used for the determination of ABO, Rh, MSs, Kell, Kidd and Duffy blood 1250 consecutively recruited subjects. Red cell phenotyping was carried out using standard tube techniques and column agglutination technology. The test is based on haemagglutination principle.

For ABO and Rh D blood grouping, a drop of Biorad Seraclone anti-A, anti-B, and anti-D (Bio Rad Medical Diagnostics, Germany) each was placed in clean test tubes labelled 1, 2, and 3. To each tube was added a drop of 5% red blood cell suspension in saline, the contents were gently mixed together and centrifuged for 30 seconds at 1000g. The cell buttons were re-suspended and observed for agglutination.

For Rh and Kell blood group, Combined Column agglutination card consisting of antisera to C, c, E, e and K was used. A drop of washed 5% red cells was added into each column containing respected antiserum. The cards were centrifuged in Column card centrifuge for 2 min at 1500g. Each card was then read by checking whether the red cell sink to the bottom of the column or was suspended on top of the gel.

Eligibility Criteria

All consenting, consecutively recruited pregnant women willing to offer a written or oral informed consent to participate in the study after counselling;

Exclusion Criteria

The pregnant women who do not meet the inclusion criteria were excluded from participating in the study that is the Non-pregnant women; Non-consented pregnant women and pregnant women attending hospitals outside the Sokoto metropolis.

Ethical consideration

Written and oral informed consent was obtained from all participants using a standard protocol while the ethical clearance was obtained from the Ethical Committee of Ministry of Health, Sokoto as well as the study site in accordance with Helsinki declaration (No: SMH/1580/V.IV on 08/10/2019; NHREC/30/012/2019; SHS/SUB/133/VOL 1).

Data Analysis

The data collected was recorded on an Excel spreadsheet and later subjected to statistical

analysis using a statistical software SPSS version 23.0. Statistical analysis included descriptive statistics of mean and percentage and p-value of <0.05 was considered clinically significant.

Results

Among the 1250 apparently healthy pregnant women studied, the prevalence of ABO blood group antigens among the pregnant women were 48.5%, 27.3%, 19.4% and 4.8% for O, B, A and AB respectively. The Rh antigens D, c and e were common in most participants (93.1%, 90.2% and 97.9%, respectively), while E was least prevalent (24.6%). The Prevalence of The K of Kell blood group system was 97.6% and 2.4% for negative and positive respectively (table 1).

The prevalence of 93.1%, 30.2%, 24.6%, 90.2% and 97.9% were positive for RhD, RhC, RhE, Rhc and Rhe respectively and the most frequently occurring Rh phenotype was Dce. While the Prevalence of The K of Kell blood group system was 97% and 3% for negative and positive respectively (table 1). The Rh profile Dce/dce (47.3%) was most common, followed by Dce/dce (19.7%) while CDE/dCe, DCE/dcE, and dCe/dCe (0.3%) was the least common (Tables 2).

The comparison of the distribution of Rh and Kell Antigens by ABO Blood Groups Blood Group shows Kell antigens are statistically significant with ABO antigens (Tables 3).

Table 1: The distribution of ABO, Rh and Kell antigens among pregnant women

Table 1: The distribution of ABO, Rh and Kell antigens among pregnant women

Antigen	Number (%) of positive	Number (%) of negative
A	240 (19.2)	
B	345 (27.6)	
AB	60 (4.8)	
O	605 (48.4)	
RhD	1,165 (93.2)	85 (6.8)
RhC	380 (30.4)	870 (69.6)
RhE	310 (24.8)	940 (75.2)
Rhc	1,125 (90.0)	125 (10)
Rhe	1,220 (97.6)	30 (2.4)
Kell	30 (2.4)	1,220 (97.6)

Table 2: Rh phenotypes and genotype frequencies of Rhesus positive and Rhesus negative pregnant women

Blood group	Pheotype	Genotype	N	%
Rh Positive	DCCee	DCe/dCe	7	0.6
	DccEE	DcE/dcE	221	17.7
	DCcee	DCe/dce	240	19.2
	Dccee	Dce/dce	591	47.3
	DCCEe	DCE/dCe	3	0.3
	DccEE	DCE/dcE	3	0.3
	DCcEe	DCE/dce	52	4.2
Rh Negative	ddCcee	dCe/dce	33	2.7
	ddccEe	dcE/dce	7	0.6
	Ddccee	dce/dce	80	6.0
	ddCcEE	dCe/dcE	10	0.8
	ddCCEe	dCe/dCe	3	0.3

Table 3: Distribution of Rh and Kell Antigens by ABO Blood Groups Blood Group

ABO Anti-gens	Rh Antigens [n (%)]										Kell Antigens [n (%)]	
	D		C		E		C		e		Neg	Pos
	Neg	Pos	Neg	Pos	Neg	Pos	Neg	Pos	Neg	Pos	n=1220	n=30
	n=85	n=1165	n=870	n=380	n=940	n=310	n=125	n=1,125	n=30	n=1220		
A	35(5.8)	570(94.2)	404(66.8)	201(33.2)	471(77.9)	134(22.1)	64(10.6)	541(89.4)	15(2.5)	59(97.5)	592(97.9)	13(2.1)
B	11(4.6)	229(95.4)	168(70)	72(30)	167(69.6)	73(30.4)	27(11.3)	213(88.7)	12(5)	228(95)	2(0.8)	238(99.2)
AB	36(10.4)	309(89.6)	276(77.4)	78(22.6)	253(73.3)	92(26.7)	12(3.5)	333(96.5)	2(5.9)	343(94.1)	11(3.2)	334(96.8)
O	3(5)	57(95)	31(51.7)	29(48.3)	49(81.7)	11(18.3)	22(36.7)	38(63.3)	1(6)	59(94)	4(6.7)	56(93.3)
Chi-square	0.11		0.170		0.064		0.233		0.11		0.032	

Discussion

This study screened one thousand, two hundred and fifty (1250) pregnant subjects for alloantibody among the women attending antenatal clinic in different hospitals in Sokoto state (Usmanu Danfodiyo University Teaching Hospital, Specialist Hospital Sokoto, Women and Children Welfare Clinic, Maryam Abacha Women and Children Hospital, General Hospital Bodinga and General Hospital Yabo) at their first booking.

In this study, a prevalence of 48.5%, 27.3%, 19.4% and 4.8% was observed for blood group O, B, A and AB respectively for ABO antigens. The prevalence of 93.1% was positive for RhD while 6.9% was negative for RhD. This is in agreement with the previous reports of Northern Nigeria reported that Group O was found in 46.6% followed by 25.95% of Group B, 23.05% of Group A while the frequency of

3.64% of Rhesus negative was reported [9] and in Delta reported that blood group O was most common followed by A, B and AB respectively and Rhesus positive was more common than Rhesus negative in the rhesus system [10]. Another study also reported that 94.5% of the subjects were Rh(D) positive while 5.5% were Rh(D) negative while 46.7%, 26.4%, 22.8% and 4.1% as prevalence of O, B, A and AB blood group antigens respectively and also the prevalence of RhD antigen as (92.7%) in a multi-ethnic group in Nigeria. [11].

The prevalence of RhC, RhE, Rhc and Rhe was observed as follows: 30.2%, 24.6%, 90.2% and 97.9% were positive for RhC, RhE, Rhc and Rhe respectively while 69.8% 75.4% 9.8% and 2.1% were negative for RhC, RhE, Rhc and Rhe respectively. This is in line with the report [12] in the multi-ethnic group in Nigeria who reported the prevalence of Rh antigens as follow: C (20.5%), c (97.7%), E (19.5%), and e (97.4%) and another study that reported prevalence of c (99.8%), followed by e (98.7%), then D (95.0%), E (20.5%), and finally C (17.7%) [13].

The Rh phenotype distribution observed in this study among the pregnant women shows the order of commonest phenotypes to be cDe/cDe, CDe/cDe and then cDe/cDE. These similar findings have been observed in various studies in Port Harcourt [14] These findings are however in disagreement with the a report in Uganda [15] who observed the order of prevalence to be ccDee (cDe/cDe), CcDee (cDe/CDe), ccDEe (cDe/cDE), ccdee (cde/cde), CcDEe (cDe/CDE), Ccdee (Cde/cde), CCDee (CDe/CDe) and ccDEE (cDE/cDE) as the least (0.1%). This is possibly due to the ethnic differences in the populations in these areas.

On the comparison of ABO with Rh and Kell antigens, the prevalence of Kell with ABO antigens is statistically significant (p=0.032) although there is paucity of data to compare with our findings. The reason for our fin ding may have to relationship with ethnic and geographical difference because there is low prevalence of Kell antigens in the study area.

Disclosure

The authors declare having no competing conflicts of interest relevant to the work presented in this article.

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