

RED CELL ANTIGENS IN THE GA ETHNIC GROUP OF GHANA

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SUMMARY

The frequencies of some red cell antigens were determined in 230 blood donors all belonging to the Ga tribe. Commercial blood grouping sera were used following the manufacturers instructions. The frequencies for A.B.O. were 0.1165, 0.1567 and 0.7268. Out of the total number of donors 3.9% were rhesus (D) negative. The commonest rhesus gene complexes were cDe, cde, CDe and cDE with $R_0 R_0$, $R_0 R_1$ and $R_0 R_1$ being the commonest combinations. The MNSs findings were similar to reports in Ewes.

The Kell/Cellano and the Duffy systems were similar to findings in some other negro populations.

Key words: Red Cell antigens, A.B.O., Rhesus MNSs, Kell, Kidd, Ghanaians.

INTRODUCTION

Determination of probable rhesus genotype of an individual in blood bank work depends on the knowledge of the frequencies of the various rhesus gene complexes in that population. This know-

ledge is also required in medico legal cases. Together with the gene frequencies of the red cell antigens, these have been a source of material for anthropological studies. Variations in the prevalences of various red cell antigenic groups have been encountered in various populations.^{1,2} For instance the prevalence of the rhesus (D) in Europeans is higher than in Negroes who in turn have a higher prevalence than in Japanese.³⁻⁶ In Nigeria Worlledge and others⁶ found significant differences in some of these red cell groups in different tribes. Study of red cell antigens in ethnic Ghanaians have been scanty and narrow in scope.^{7,8,9} There is, therefore the need to determine the frequencies of as many red cell antigens as possible in the various Ghanaian ethnic groups. Of the various major Ghanaian ethnic groups the Gas are the least studied with regard to these antigens though they form the majority of blood donors in Korle Bu. This study among Ga blood donors is therefore undertaken to calculate the gene frequencies of different red cell antigens to form the basis of immunohaematological studies in the Korle Bu Blood Bank and also as a source of anthropological data.

Subjects and Methods

The subjects under study were blood donors who had come to donate blood at the Korle Bu Blood Bank. Each gave his tribe and home town and the tribe and home town of the mother and father. The home town served as a cross check on the tribe. A donor is accepted for the study if both parents belong to the same tribe which in this particular study is Ga. The sample collected is clotted blood and tests are carried out within four days of collection. The ABO and rhesus blood groups were done on 230 donors. The MNS_s, Kell-Cellano, Duffy and Kidd blood groups were performed on 158 of this number. The ABO blood group was by the tube method doing both cell and serum grouping using commercial anti A, anti B and group O serum. The rhesus grouping was done by the tube method using commercial anti C, anti c, anti D, anti E, and anti e, following the manufacturers' instruction. In the case of anti D, the negative ones were subjected to indirect

anti globulin test to exclude D^u. The M and N grouping was incubated at room temperature using commercial antisera. The Duffy, Kidd and Kell blood groups were by the indirect anti globulin method using commercial anti Fya, Fyb, Jka, Jkb, and Kell. Cellano grouping by antiglobulin method was done on every ninth and tenth samples and any case which is positive for Kell.

Calculations for phenotype, genotype and gene frequencies were based on methods by Mourant et al.¹⁰

RESULTS

Table 1 shows the frequencies in the ABO system. The genes A,B and O are represented by p, q, and r respectively and their frequencies are shown in the table. Table 2 shows the reactions with the five rhesus antisera, the observed frequencies and the probable genotype calculated from the gene frequencies in Table 3. Donors reacting positively

BLOOD GROUP	NUMBER	OBSERVED PHENOTYPE FREQUENCY (%)	EXPECTED FREQUENCY (%)	Chi ²	GENE FREQUENCIES
A (p)	45	19.6	18.28	.095	0.1165
B (q)	61	26.5	25.23	.064	0.1567
O (r)	119	51.7	52.82	.024	0.7268
TOTAL	230	100.0	99.98		1.0

TABLE 1

Frequencies of phenotypes of the ABO system and the corresponding gene frequencies.

Reactions with anti	Number	Observed Frequency	Probable Genotypes
C c D E e			
- + + - +	136	59.1	R_0R_0 R_0r (42.5) (16.4)
+ + + - +	57	24.8	R_0R_1 R_0r' $R r$ (13.8) (5.0) (3.1)
- + + + +	22	9.5	R_0R_2 R_2r (7.6) (1.7)
- + - - +	7	3.0	rr (2.1)
+ + + + +	3	1.3	R_1R_2 R_2r' R_1r'' (1.3) (0.4) (0)
+ + - - +	2	0.9	$r'r$ (1.1)
+ - + - +	2	0.9	R_1R_1 R_1r' (1.1) (0.8)
- + + + -	1	0.4	R_2R_2 R_2r'' (0.3) (0)
TOTAL	230	99.9	(97.1)

*Expected genotype frequencies in bracket. Calculated from Gene Frequencies in Table 3.

TABLE 2

Reactions with anti C,c,D,E,e, the observed Rhesus phenotype frequencies and the Probable genotypes with the expected frequencies.

<u>Rhesus Gene</u>	<u>Frequency</u>
cDe (R_0)	.652
cde (r)	.146
CDe (R_1)	.106
cDE (R_2)	.058
Cde (r')	.038
cdE (r'')	0
CDE (R_2)	0
TOTAL	1

TABLE 3

Rhesus Gene Frequencies. Shorthand notation in Bracket.

Phenotype	Number	Frequency %
MM	34	21.5
MN	114	72.2 TOTAL 158 (100%)
NN	10	6.3
SS	4	2.5
Ss	20	12.7 TOTAL 158 (99.9%)
ss	133	84.1
S-s-	1	0.6

M = 0.576 N = 0.424; S = 0.089 s = 0.899

TABLE 4

Genotype and Gene Frequencies of MN and Ss

with only anti c, anti D and anti e form the highest group. The cDe (R₀) gene complex is, therefore, the commonest gene complex followed by cde (r). The least observed gene complex is Cde (r¹). The complexes cdE (r¹) and cDE(R₂) were not observed. No D^u was also encountered. From the calculations the rhesus genotypes encountered in the Ga tribe in descending order of frequency using shorthand notations are : R₀R₀, R₀r, R₀R₁, R₀R₂, R₀r¹R₁r, rr, R₂r, R₁R₂, R₁R₁, r¹r, R₁r¹, R₂r¹, R₂R₂. The prevalence of rhesus negative is 3.9%.

Table IV shows results with antisera against M, N, S, and s. The frequencies for MN and Ss are calculated separately for the 158 donors. One individual lacked both S and s. Table V takes the MNS_s as one complex and shows the genotype frequen-

cies of eight complexes. The commonest complex MNss is present in 58.6% of the subjects. Regarding the Duffy system only one was Fy (a + b-), the remainder were all negative with anti Fya and anti Fyb making them Fy (a-b-). Reactions with anti Kell and anti Cellano show only two reacting with both antisera i.e. Kk and the remaining 156 were all negative for anti Kell. The frequencies for Kk and kk are 1.3% and 98.7% giving gene frequencies for Kell as 0.9935 and Cellano as 0.0065. Tests with anti JK_a and anti Jk_b gave the following reactions JK (a-b-) 60 (38%), a + b +, 24 (15.2%), a-b + 24, (15.2%) a + b-, 50 (31.6%).

Genotype	MNss	MMss	MNSs	NNss	MNSS	NNSs	MMSs	MN--
Number	93	32	16	8	4	2	2	1
Frequency %	58.6	20.6	10.1	5.1	2.5	1.3	1.3	0.6

TABLE 5

Genotype frequencies of the MNSs Complex.

DISCUSSION

The observed phenotype frequencies obtained in the ABO system are not different from those observed in Ewes and non Ashanti Akans in 1980.¹¹ The calculated gene frequencies for A, B and O of 0.1165, 0.1567 and 0.7268 are also not different from the figures for non Ashanti Akans of 0.117, 0.138 and 0.745 in the same study. A low frequency of the rhesus negative (rr and r'r) as usually obtains in the negro,^{6,12} is again encountered. The total rhesus negative in this study is 3.9% which is similar to the 3.2% seen in non Ashanti Akans but contrasts with the 1.4% seen in Ashantis¹¹. The absence of D^u is due to the commercial antisera used. The commonest rhesus gene complexes in the Gas are Ro,r and R₁ which are the same as seen in the Ashantis and Ewes⁹ though the frequencies are different. For routine blood bank work and medicolegal practice the frequencies of the rhesus genotypes appear in Table 2.

The frequencies of the M and N genes of 0.576 and 0.424 seen are similar to those obtained by Armatoe and others for the Ewes⁹, the corresponding figures being 0.5404 and 0.4596 but different from the Ashantis in whom M was 0.4341 and N, 0.5619. The low frequency of the S gene observed by Worledge and colleagues in Nigerians⁶ is present in the Gas with a frequency of

0.089. The presence of the S-s- gene is also significant being 2.6% in the Nigerian study.⁶ It is noteworthy that the commonest MNSs gene complex in the Gas is MNss which is the same as observed in American negroes though the frequency in the Gas is higher.^{13,14} The low frequency of Kell is expected as it had been previously observed in Negroes.¹⁵ The high prevalence of Fy (a-b-) is also a typical Negro finding.¹⁶ The unexpectedly high prevalence of JK (a-b-) needs to be reinvestigated using double or triple antisera in view of the difficulty in working with anti JK^a. However, JK (a-b-) had been reported in non negro populations.¹⁷

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