ABO, RHESUS AND KELL BLOOD GROUPS IN THE AKANS OF GHANA

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SUMMARY

Racial and ethnic variation in frequencies of various blood groups prompted this study in four Akan groups with regards to the ABO, Rhesus and Kell blood groups. The subjects were 1533 Akan blood donors who were Fantis, Asantes, Kwahus or Akwapims. Both parents of a subject belonged to the same ethnic group. ABO, Rhesus and Kell blood groups were determined and the frequencies of the phenotypes and genes calculated. Blood groups A, B, AB and O varied between 19.1 to 22.6, 19 to 26.5, 1.3 to 2.5 and 50 to 57 per cent respectively. Rhesus negative was between 2.9 and 9.9 per cent. Kell ranged between 0 and 2.2 percent, Cellano between 71 and 100 percent and heterozygous Kell/Cellano between 1 and 4.1percent. Commonest rhesus genes were Dce and dce. There were no significant differences in the blood groups of the various Akan tribes. The frequencies were similar to those seen in other Negro population.

Keywords: Akans, Blood groups, ABO, Rhesus, Kell.

INTRODUCTION

Red cell antigens provide a useful tool in anthropology, forensic medicine and in immunohaematology. Racial variation in the distribution of various red cell antigens have been known for a long time[1,2]. The variation of the frequency of Rhesus d or the absence of D is a typical example, being almost absent in Mongoloids[3], and 15% in Europeans[4]. In addition to the racial variations, ethnic differences are also known to exist as in the ABO group in North and South England[2] and in Igbos and Urhobos of Nigeria[5]. In the blood bank laboratory different antibodies are encountered. A knowledge of ethnicity is at times useful in the identification of some of these antibodies to these antigens. In Rhesus (D) haemolytic disease of the newborn the paternal rhesus genotype is required. This is calculated from the gene frequencies in the population.

Of late the study of red cell antigens has focused on the biochemical structure and molecular genetics[6]. The biochemistry of the rhesus complex protein is now known[4,7]. The genetic structure of the rhesus had shown that Rh(D) negative in Caucasians is mainly due to gene deletion as opposed to at least three different mechanisms in Negroes and other racial groups[7]. The serological variations form the basis for the interpretation of the genetic polymorphisms.

This study was undertaken as a continuation of earlier ones in the Ga and Ewe[8,9] ethnic groups to provide new information on the ABO, rhesus and Kell blood groups of various Akan groups in Ghana.

SUBJECTS AND METHODS

The subjects were blood donors who came to the National Blood Transfusion Service, Korle Bu, to donate blood. The study was spread over a two year period. After informed consent each blood donor gave his tribe and hometown and home towns of both parents. The hometown was used to crosscheck the tribe. A donor was accepted for the study if both parents belonged to the same ethnic group, these being Asante, Fanti, Kwahu and Akwapim. Clotted blood samples were collected at the end of the blood donation and the tests were performed within three days.

ABO grouping and Rhesus typing were performed on all the samples. Cell and serum grouping for ABO were done by standard tube methods[10], Rhesus phenotypes were determined using commercial anti D, anti C, and c, anti E and anti e following the manufacturer's instructions. The antisera were obtained from Biotec Laboratories. The anti D used was monoclonal. In the case of Rhesus D, Coomb's test was done on all the negative cases. With the Kell/Cellano system the anti globulin test was used. The calculations for phenotype and gene frequencies were based on methods by Mourant[1]. Chi square was calculated for the ABO and Rhesus phenotypes from the observed and expected frequencies by the method of Mourant[1].

RESULTS

There were 1533 subjects comprising 397 Fantis, 480 Asantes, 234 Kwahus and 422 Akwapims. Other Akan groups were excluded on account of inadequate representation. The ABO and Rhesus types were done on all of these with the exception of one Fanti who had only the ABO done because of technical mishap. The Kell/Cellano was done on 20 Fantis, 94 Asantes. 78 Kwahus and 78 Akwapims.

The results of the ABO blood grouping are shown in Table 1.

ethnic groups. No Rhesus D^u was encountered. Rhesus D negative was 6.1%, 2.9%, 4.8%and 9.9% in the Fantis, Asantes, Kwahus and Akwapims respectively. The calculated Rhesus gene frequencies are shown in Table 3. The two commonest genes in all four ethnic groups were Dce and dce followed by Dce for Fantis and Kwahus and DcE for the Asantes and Akwapims. The highest frequencies of genes containing E were seen in the Asantes (DcE 0.88 and dcE 0.016) and the Akwapims (DcE 0.92). Frequencies of genes containing C or E were about equal in the Akwapims, whereas genes with C were higher than those with E in the Fantis and Kwahus and the

Table 1 ABO phenotype and gene frequencies of the ABO system; p, q , r represent the A,B,O genes.

Tribe	n	Group A	Group B	Group O	Group AB	p	q	r	Chi^2
Fanti	397	76(19.1)	85(21.4)	226(56.9)	10(2.5)	.115	.128	.757	.216
Asante	480	107(22.3)	91(19.0)	272(57.7)	10(2.0)	.131	.112	.757	.15
Kwahu	234	53(22.6)	50(21.4)	128(54.7)	3(1.3)	.128	.121	.755	.112
Akwapim	422	90(21.3)	112(26.5)	211(50)	9(2.1)	.125	.156	.719	.116

The phenotype frequencies are in brackets. The phenotype frequencies in the various tribes are not significant: P>0.05.

The frequency of group O is between 50 and 57.7 percent for the four ethnic groups. Blood group AB also varied between 1.3 and 2.5 percent. There are no significant differences between group A and group B in all the tribes with group A ranging between 19.1 and 22.6 percent and group B between 19.0 and 26.5%. The gene frequencies are also represented in Table 1. In all of them the differences between the observed and the expected frequencies were not significant.

Table 2 represents the Rhesus phenotyping. The phenotype Dccee exceeded 55 percent in all the reverse in the Asantes. The differences in the frequencies of each particular gene in the various ethnic groups were however not significant.

The results with anti Kell (K) and anti Cellano (k) are represented in Table 4. There were two Fantis homozygous for Kell. Heterozygosity for K and k was seen in about three percent of Akans. The frequencies for the K and k genes respectively in the four ethnic groups were Fantis 0.039 and 0.961, Asantes 0.016 and 0.983, Kwahus 0 and 1, Akwapims 0.02 and 0.979.

Table 2 Rhesus phenotype frequencies in the ethnic groups.

Phenotype	Fanti	Asante	Kwahu	Akwapim
Dccee	245(61.7)	299(62.3)	154(65.8)	243(57.6)
DCcee	73(18.4)	67(13.9)	47(20.1)	59(14.0)
DccEe	49(12.1)	88(18.3)	20(8.6)	62(14.7)
DCcEe	5(1.3	10(2.1)	2(.85)	16(3.8)
DccEE	0	0	0	0
DCCee	1(0.25)	2(0.4)	0	0
ddccee	22(5.55)	8(1.7)	9(3.8)	36(8.5)
ddccEe	1(0.25)	2(0.4)	1(0.43)	0
ddCCee	0	0	0	0
ddCcee	1(0.25)	4(0.8)	1(0.43)	6(1.4)
Total (n)	**396**	**480**	**234**	**422**

The percentages appear in brackets. The differences in the ethnic groups are not significant. P>0.05

Table 3 Calculated rhesus gene frequencies.

Gene	Fanti	Asante	Kwahu	Akwapim	Ga	Ewe	Nigerians
Dce	0.588	0.677	0.646	0.52	0.652	0.567	0.591
DCe	0.091	0.049	0.097	0.051	0.106	0.046	0.06
DcE	0.064	0.088	0.039	0.092	0.053	0.05	0.115
DCE	0	0	0	0	0	0	0
dce	0.237	0.13	0.198	0.291	0.146	0.199	0.203
dCe	0.011	0.04	0.01	0.045	0.038	0.083	0.031
dcE	0.005	0.016	0.01	0	0	0.052	0
Total	**0.996**	1	1	**0.999**	1	1	0.995

The differences between the Akan tribes are not significant P>0.05. The results in the shaded area are attached for comparison

Table 4 Kell/Cellano phenotype frequencies.

Tribe	n	Group KK	Group Kk	Group kk
Fanti	90	2(2.2)	3(3.3)	85(94.4)
Asante	94	0(0)	3(3.2)	91(96.8)
Kwahu	78	0(0)	0(0)	78(100)
Akwapim	74	0(0)	3(4.1)	71(95.9)

Percentage in brackets. Differences in the tribes are not significant P>0.05

DISCUSSION

Earlier studies of the ABO blood group system in Ghanaians and other West Africans have given the prevalence of blood group O as 50%, AB about three percent, and the remainder being groups A and B in about equal proportions with B being slightly more than A in the majority of tribes[5,9,10,11]. The same observation is made in this study. There was no significant difference in the four Akan groups under consideration. However in the Asantes the prevalence of group A was higher than group B as earlier observed whereas it is opposite in the Gas, Ewes, Gonjas and the Dagombas[8,12]. Armattoe and colleagues had A and B gene frequencies of 0.1506 and 0.1690 for the Ewes and 0.1480 and 0.1377 for the Asantes respectively[11]. This compares with group A of 0.131 and group B of 0.112 seen in the Asantes in this study. These minor differences in the A and B frequencies were reported in various tribes in Nigeria[5]. Its significance if any has not been determined.

The general results of the rhesus typing was typically Negroid with rhesus D negative averaging about 5%. Statistically the differences between the tribes were insignificant but a few areas need emphasis. The 9.9 rhesus D negative in the Akwapim is high and unusual for an African population. The Urhobos and Ijaws of Nigeria have rhesus D negative of 6.6%, the highest in Nigeria[5]. The lowest rhesus D negative reported in Ghana and Nigeria apart from the Asantes is 2.9%[5,12]. The Fulanis of Nigeria have a frequency of 3.2%, same as was found in non Asante Akans in 1980[5,12]. A study in 1953 recorded rhesus negative of 5.3% in Asantes but this was at a time when incomplete anti D was in use, this being less sensitive than present day monoclonal anti D[11]. Rhesus D negative in the Ga and Ewe ethnic groups are 3.9 and 6.6 percent respectively[8,9]. The commonest rhesus gene complexes in all the Akan ethnic groups, the Ga and the Ewe are Dce and dce, the same as reported in other Negro populations[1,4,8,9]. Dce is 0.52, 0.677, 0.567, 0.591 respectively in Akwapims, Asantes, Ewes and Nigerians compared to 0.26% in the Englighs[4,9] (Table 3). The figures for cde in the same groups are 0.291, 0.13, 0.199, 0.203 and 0.389 respectively. Beyond these two divergence occurs in the Ghanaian population as seen in table 3 where results of earlier studies in the Ga, the Ewe and Nigerians are added to the Akan groups. These differences become significant only when deducing probable and possible genotypes in cases of disputed paternity.

The rhesus (RH) locus on chromosome one comprise two highly homologous very closely linked genes. It is one of the most complex systems in humans comprising 50 different antigenic characters coded for by the genes RHD and RHCE. The alternative allele to RHD is an amorph RhD-. This had been shown to be due mainly to gene deletion[13]. However there are other rare polymorphisms[14,15] to explain the RhD-phenotype. There is a wide variation in the frequencies of RhD- from 2.9% to 9.9%. Besides this Armattoe[11] had a high frequency of D^u in the Ewes. These will now group as Rhesus positive. Gene analysis of the RHD locus and especially of the RhD- in various West African populations will help elucidate these variations.

The Kell system is also complex and comprises many groups including Kell/Cellano, Penny and

Rautenberg, Sutter and Matthews, etc. with 23 antigens[16] in all. The most important of these is Kell/Cellano because of the high antigenicity of Kell. Nine percent of Caucasians are Kell positive compared to 1.5% in American Blacks, 0.02% in Japanese, 1.3% in the Ga ethnic group[7,4,8,9], 3.2% in Asantes, 4.1% in Akwapims, and nil in the Kwahus. Thus the lower frequency in Blacks is also evident in the Akans of Ghana.

The frequencies of the various phenotypes and genes observed in this study are not significantly different from those observed in other Black populations. There are also no differences in the various Akan groups of anthropological significance. The minor differences in rhesus gene frequencies in various Ghanaian ethnic groups must be taken cognizance of in paternity disputes. Gene analysis of the RHD locus may help unravel the D^{u} phenomenon and the differences in the frequencies of the RhD- in West African populations.

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