

# Distribution of ABO, Rh, MN and Kell blood groups in Central Cuba

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## ABSTRACT

Villa Clara province is located in the central region of Cuba. Phenotype and allele frequencies of blood groups ABO, Rh, MN and Kell among the three racial groups present in our population - Whites, Mulattoes and Negroes were determined. Statistically significant differences were observed among racial groups in two blood group systems (ABO, Rh).

## INTRODUCTION

Information on the distribution of the various blood group, red cell and serum systems in the Cuban population are limited to the Havana city population (González *et al.*, 1975; González *et al.*, 1976; Garcia *et al.*, 1982).

Villa Clara is the largest and most populous province in the central region of Cuba. Its surface covers 7,944 square kilometers, with a population of 765,823 (1981, Census). Santa Clara (22.4°N; 79.9°W) is the capital (Figure 1).

The population is basically the product of an admixture of White colonists of Spanish ancestry and Black slaves, chiefly from Africa's West Coast (Franco, 1975; Guancho, 1983). Racial admixture in the Cuban population is revealed by the variation of morphological characteristics (Rivero de la Calle, 1984). In General, Cuban anthropologists consider the Mulattoes as a group distinct from the Negroes as well as from the Whites (Jordan, 1979; Rivero de la Calle, 1984).

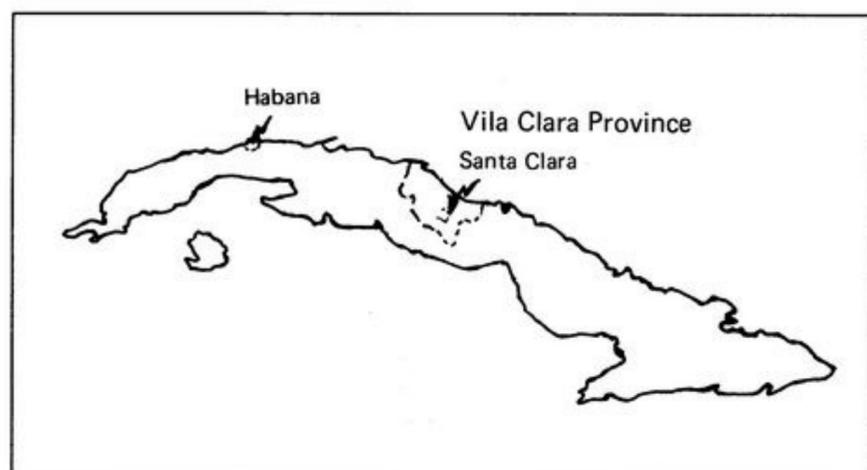
According to the 1981 census, 82.6% of the persons living in the Villa Clara province were classified as White, 10.5% Mulatto, and 6.9% Negro. Individuals of Asiatic ancestry (mainly Chinese) did not reach 0.1% (Comite Estatal de Estadísticas, 1983).

## MATERIAL AND METHODS

Blood samples from healthy blood donors were collected by vein puncture in tubes containing acid-citrate-dextrose solution at the Provincial Blood Bank of the Villa Clara province in Santa Clara. The blood samples were carried immediately to the laboratory and were kept in a refrigerator at 5°C. Each subject received a subjective racial classification based on morphological characteristics such as skin color, lip thickness, nose, eyes, hair color and form. This classification was based on a three-group scheme (White, Mulatto and Negro) proposed by González *et al.* (1976) and Jordán (1979). The samples comprise unrelated blood donors of both sexes, and their ages varied from 18 to 55 years. In all cases the individuals were born in Villa Clara province.

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**Figure 1** - Map of Cuba. Location of Villa Clara Province.

Each batch of samples was tested the day following collection, using either commercial test reagents (Hyland), or routine reagents prepared and tested by the Provincial Blood Bank of Villa Clara. All reagents were tested in advance for their suitability. Blood group testing was carried out according to the methods recommended by Race and Sanger (1975). The samples were tested with the following antisera: anti-A, -B, -C, -c, -D, -E, -M, -N, and -K.

The gene frequencies of ABO were calculated by Bernstein's method according to Mourant *et al.* (1976). The gene frequencies of MN, Rh and Kell were calculated using Mourant *et al.* (1976) improved formulas. The departure from Hardy-Weinberg (H.W.) equilibrium was calculated for each blood system and each racial group using a standard chi-squared goodness-of-fit test (Cavalli-Sforza and Bodmer, 1971).

## RESULTS AND DISCUSSION

Phenotype and gene frequencies for ABO blood group are given in Table I. A allele frequency was higher than B while O had the highest, value. Negroes had the highest B frequency and Whites the lowest. A allele frequency was higher in Whites than in Mulattoes and Negroes. There was an evident cline in allele frequencies related to the individual Negro admixture phenotype. The B allele increased and A decreased from Whites to Negroes, the Mulattoes' frequencies being intermediate. The lower frequency of B allele in Whites is in the direction of the frequencies in the Spanish population (Valls, 1975).

Tables II and III summarize the results obtained in the Rh system among the racial groups, in CDE the Mulattoes' frequencies being intermediate. In general the White group showed a close resemblance to those of the Canary Islands (Planas *et al.*, 1969) and Southern Spain (Valls, 1975) with a low frequency of cDe haplotype and a high frequency of cde. Negroes had

**Table I** - Phenotypes and gene frequencies of the ABO system.

Racial groups	Phenotypes	No.	Gene frequencies
Whites	A	1766	A = 0.2307
	B	432	B = 0.0616
	AB	119	O = 0.7077
	O	2305	
Total		4622	
H.-W. equilibrium: $\chi^2 = 1.58$ (1 df)			
Mulattoes	A	174	A = 0.1834
	B	78	B = 0.0857
	AB	15	O = 0.7309
	O	301	
Total		568	
H.-W. equilibrium: $\chi^2 = 0.61$ (1 df)			
Negroes	A	241	A = 0.1809
	B	120	B = 0.0942
	AB	26	O = 0.7254
	O	427	
Total		814	
H.W. equilibrium: $\chi^2 = 0.13$ (1 df)			

**Table II** - Frequency of Rh phenotypes.

Phenotypes	Whites		Mulattoes		Negroes	
	Obs.	Exp.	Obs.	Exp.	Obs.	Exp.
CCDE	0	0.0	1	0.6	3	2.3
CCDee	18	20.3	10	5.6	6	1.9
CCddee	0	0.0	0	0.1	1	0.6
CcDE	15	16.6	5	8.9	6	12.9
Ccddee	58	51.7	21	27.0	30	28.7
CcddE	0	0.0	0	0.0	0	0.0
Ccddee	0	0.0	2	1.5	4	3.6
ccDE	26	24.5	24	20.5	24	17.8
ccDee	11	12.5	28	27.1	42	45.2
ccddee	18	20.4	9	8.7	6	6.4
Total	146		100		122	
H.-W equilibrium						
$\chi^2$ (5 df)	1.73		6.59		2.65	

Obs.: observed; Exp.: expected.

the CDE haplotype, with a moderately low frequency of cDe and a high CDe frequency, different from the majority of African samples (Mourant *et al.*, 1976).

Table IV shows the distribution of the MN blood group among the three racial groups. The *M* allele frequency was greater in Whites than that reported for the Canary Islands (Mourant *et al.*, 1976), but similar to that found by Colino and Campillo (1977) in the Spanish population. In our study the *M* allele frequency in Negroes was a little lower than that found in some African samples (Mourant *et al.*, 1976). In the Cuban population Negroes showed a higher *M* allele frequency than Whites. In the Mulattoes group the frequency was intermediate.

Table V shows the Kell blood group in the three racial groups from our population. The Negroes, with a low *K* allele frequency conform more to the African pattern and are markedly different from Whites. The *K* allele frequency value for Whites agree very closely with the values given for the Spanish population by Valls (1975). In Mulattoes the *K* allele frequency was intermediate.

In all the three racial groups the observed and expected phenotype numbers are in good agreement and no significant deviation from the Hardy-Weinberg equilibrium was found.

Pairwise heterogeneity chi-square analysis on phenotypes of the blood groups (Table VI) show that Whites differ from Negroes and Mulattoes in more than one blood group system (ABO, Rh). Mulattoes and Negroes were homogeneous for the blood groups studied.

In conclusion, there is a consistent effect of racial group on allele frequencies. Whites conformed more to the Spanish pattern and differed from Negroes. The separation between Mulattoes and Negroes can be preserved as the only choice to avoid excessive heterogeneity in the results.

**Table VI** - Pairwise heterogeneity chi-square among the racial groups.

Racial groups	ABO (df)	$\chi^2$	Rh (df)	$\chi^2$	MN (df)	$\chi^2$	Kell (df)	$\chi^2$
Whites x Mulattoes	3	18.65*	4	25.94*	2	0.21	1	0.34
Whites x Negroes	3	35.63*	4	37.16	2	3.03	1	2.35
Mulattoes x Negroes	3	0.72	4	2.91	2	1.67	1	0.00

\* $P < 0.01$ .

## RESUMO

A província de Vila Clara está localizada na região Central de Cuba. Foram determinadas frequências fenotípica e alélica dos grupos sanguíneos ABO, Rh, MN e Kell entre os três grupos raciais presentes em nossa população - Brancos, Mulatos e Negros. Foram observadas diferenças estatisticamente significantes entre grupos raciais em dois sistemas de grupos sanguíneos (ABO, Rh).

**Table III** - Rh system haplotype frequencies.

Haplotype	Whites	Mulattoes	Negroes
CDE	0.0	0.0115	0.0423
Cde	0.3730	0.2135	0.1387
cDE	0.1520	0.1518	0.1039
cDe	0.1010	0.3031	0.4206
Cde	0.0	0.0250	0.0650
cde	0.3740	0.2951	0.2295

**Table IV** - MN blood group distribution, gene frequencies and tests for Hardy-Weinberg equilibrium.

Racial groups	No.	MM	MN	NN	<i>M</i> frequency	$\chi^2$ (1 df)
Whites	152	42	76	34	0.5263	0.01
Mulattoes	148	43	75	30	0.5439	0.07
Negroes	138	44	74	20	0.5870	1.55

**Table V** - Kell blood group and gene frequencies.

Racial groups	No.	Kell+	Kell-	<i>K</i> frequency
Whites	849	50	799	0.0299
Mulattoes	125	4	121	0.0161
Negroes	109	2	107	0.0092

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