

DISTRIBUTION OF THE LEWIS AND SECRETOR TRAITS IN RIO DE JANEIRO, BRAZIL

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ABSTRACT

Lewis/Secretor phenotypes and gene frequencies were determined among urban Caucasoids and Blacks of Rio de Janeiro, Brazil. The Black pattern of high prevalence of the Le(a-b-) type was observed in both skin color groups. Both samples fit the equilibrium estimated for two independent loci, and there are no significant differences between their gene frequencies.

INTRODUCTION

The Lewis system is a tissue group that produces antigens in secretions which are subsequently adsorbed onto the red cells. The *Le* gene is thought to be located on the chromosome 19 linked to the C3 complement locus. The product of the *Le* gene adds the $\alpha(1-4)$ fucose to the subterminal G1cNAc unit to produce the *Le*^a epitope. The double action of the Lewis enzyme plus the β DGal α -2-L-fucosyltransferase coded by the *Se* gene (secretor locus) produces the *Le*^b epitope (François *et al.*, 1986).

In secretors, Le and H fucosyltransferases compete for the type 1 chain precursor. H glycosyltransferase catalyzes H synthesis on Type 1 chain precursor structures. The respective amounts of *Le*^a and type 1 H substances formed in secretions are determined by the ratio of these two fucosyltransferases. In nonsecretors

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(*se se*), only Le^a antigens are found in secretions since no H enzyme is present in secretory cells even though the *H* gene is inherited. As a result, all type 1 chain precursor glycoproteins are available for the Le enzyme, α -4-L-fucosyltransferase (Pittiglio, 1986).

The present study describes the distribution of the Lewis/Secretor phenotypes and gene frequencies in Brazilian Caucasoids and Blacks.

MATERIAL AND METHODS

Sample collection and antisera

Blood specimens were collected from consecutive group O blood donors over a five month period. Saliva samples from about 60% of this population sample were also obtained and preserved in the frozen state until use. A pair of anti-Le^a sera and one anti-Le^b serum were used. The anti-Le^a serum donors were of group A and O, Le(a-b-), and their salivas were devoid of either Le^a or Le^b antigens. The anti-Le^b donor was of blood group Aint, Le(a-b-), without salivary Lewis substances. The titers of anti-Le^a sera were in the range of 24-96 against ficinized Le(a+) red cells; those of anti-Le^b, in the range of 6-8 against ficinized Le(b+) cells. Neither Le^b nor Le^x activities were detected in the anti-Le^a sera and neither Le^a nor Le^x activities could be found in the anti-Le^b serum. Furthermore, 25 samples of group O cord red cells, as expected, reacted negatively with both testing sera, confirming their specificity. No anti-H reactivity was found.

Red cell typing

Two volumes of serum and one volume of untreated red cell suspension were incubated for one hour at room temperature and the results were read with the naked eye after centrifugation. The erythrocytes were tested within 24 hours of collection.

Salivary tests

The Lewis antisera and anti-H (*U. europaeus*) reagent were used in dilutions giving 4-8 agglutinating units against ficinized Le(a+b-), Le(a-b+) or untreated group O cells, respectively. All test red cells were donated by members of our staff and used fresh.

One volume of twofold serial dilutions of inactivated saliva plus two volumes of Lewis antisera or one volume of anti-H lectin were incubated for 15 minutes; then, one volume of ficinized Le(a+) or Le(b+) or untreated O cells was added to each titration series and incubated for one hour at room temperature. The results were read

after centrifugation and the dilution of saliva that completely inhibited the respective reagent was considered the endpoint titer. A full account of the statistical analyses of the titration results will be published elsewhere.

The Lewis and H studies were performed by independent technicians and when possible discrepancies between red cell and salivary tests appeared, confirmatory studies were done through blind tests and also with fresh specimens of blood and saliva from a significant number of donors who agreed to participate in the project.

RESULTS AND DISCUSSION

A high frequency of the Le(a-b-) type, already described in Black populations, was observed in both racial stocks (Table I) and the distribution of the various Lewis phenotypes between the two skin color groups was statistically similar, probably due to intense miscegenation.

Table I - The Lewis blood groups in a random population sample of blood group O individuals.

Red cell phenotype	Caucasoids	Blacks	Total
Le (a-b+)	175	224	399
Le (a+b-)	57	73	130
Le (a-b-)	71	110	181
Total	303	407	710

The relationship between Lewis and Secretor phenotypes does not strictly follow the Europoid patterns because some Le(a-b+) persons are nonsecretors of H substance and some Black Le(a+b-) are secretors of H (Table II). The proportions of Le(a-b-) secretors and nonsecretors were not significantly different from those of the other Lewis phenotypes, Le(a-b+) plus Le(a+b-).

The distribution of the Lewis and Secretor phenotypes among the Blacks was statistically similar to that for Blacks from Charleston, USA described by Ceppellini *et al.* (1959).

Caucasoid and Black samples fit the equilibrium estimated for two independent loci, with no significant differences between their gene frequencies (Table III).

While the Secretor character has already been reported for Caucasoids and Blacks from Porto Alegre (Palatnik *et al.*, 1969) and São Paulo (Guinsburg Saldanha, 1982), this is the first report on Lewis types in urban Brazilian populations.

The relative frequencies of Secretors and nonsecretors of H substance among the Black samples of Porto Alegre, São Paulo and Rio de Janeiro are similar. However,

Table II - The Secretor phenotypes among the various Lewis blood groups.

Red cell phenotype	Caucasoids		Blacks		No. of persons
	H salivary substance				
	Secretor	Nonsecretor	Secretor	Nonsecretor	
Le (a-b+)	95	1	141	4	241
Le (a+b-)	0	28	5	42	75
Le (a-b-)	28	13	62	11	114
Total	123	42	208	57	430

Table III - The Lewis and Secretor salivary phenotypes and gene frequencies.

Population sample	No. of people	Salivary phenotypes				Gene frequencies			
		Sec		Non-sec					
		Les	Les	nL	nL	<i>Le</i>	<i>le</i>	<i>Se</i>	<i>se</i>
Black	265	174	51	34	6	.6115	.3885	.5362	.4638
Caucasoid	165	111	34	12	8	.6518	.3482	.4955	.5045
Total	430	285	85	46	14	.6265	.3735	.5202	.4798

Sec = secretor of H substance; Non-sec = nonsecretor of H; Les = Lewis substances present; nL = Lewis substances absent.

Caucasoids from the three cities differ significantly ($d.f. = 3, P < 0.01$). This difference is due to the Porto Alegre x Rio de Janeiro ($P < 0.01$) and São Paulo x Rio de Janeiro ($P < 0.02$) comparisons, while the samples from Porto Alegre and São Paulo do not differ from one another.

Concerning the Le(a-b+) blood samples, about 14% Caucasoids and 21% Blacks produced some reaction with the anti-Le^a sera. Most of these reactions were weak, but a few strong ones were also found. The weak reactions could not be consistently reproduced with further blood samples from the same individuals or with the same sera, but 5 Caucasoid and 13 Black samples were retested and the strong reactions confirmed. These exceptional Le(a+b+) bloods will be discussed in a forthcoming publication.

It was already pointed out by Sturgeon and Arcilla (1970) that red cells from

adults belonging to type O and A2 which are strongly agglutinated by anti-Le^b may also occasionally be weakly agglutinated by some anti-Le^a sera. These adults are postulated to have quantitative *Se* gene variants which, although fully activated, are capable of inducing only partial conversion of Le^a to Le^b substance. An opposite view, however, is offered by Salmon *et al.* (1984), who suggest that such a phenotype might be explained through the effect of an *Se* allele: with an incorrectly activated H gene, and only a partial conversion of type 1 disaccharide into H, the competitive Le enzyme would produce more Le^b than usual.

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RESUMO

Descreve-se a distribuição dos fenótipos e frequências gênicas dos sistemas Lewis e Secretor em Caucasoídes e Negróides do Rio de Janeiro. Observa-se em ambos grupos de cor o padrão de elevada prevalência do tipo Le (a-b-) geralmente presente em Negros. Ambas amostras ajustam-se ao equilíbrio estimado para dois locos independentes e não há diferença significativa na suas frequências gênicas.

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