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Placental Alkaline Phosphatase Types in Calcutta, India

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Introduction

Six common phenotypes of alkaline phosphatase can readily be demonstrated by starch gel electrophoresis of extracts of placental tissue and these phenotypes are controlled by three codominant alleles, Pl^{S1}, Pl^{11}, and Pl^{F1} (Robson and Harris, 1965; Beckman *et al*, 1966). In addition rarer phenotypes have been observed in the majority of populations studied so far. These rarer phenotypes in many cases appear to be heterozygotes for alleles such as Pl^{S2}, Pl^{S3} etc., in combination with one of the three common alleles, or they represent completely novel combinations (Robson and Harris, 1967; Beckman *et al*, 1967; Blake *et al*, 1968, 1969a, b, and c).

The distribution of placental alkaline phosphatase types in Indian populations so far has been inadequately studied. Robson and Harris (1967) studied 51 cases collected in England, and Blake *et al* (1969a) studied 210 cases in Kuala Lumpur, Malaysia. In both series the Pl^{F1} frequency was lower and the Pl^{S1} frequency higher than among Europeans: further, in the series sampled in Malaysia there was a relatively high frequency of the rare allel Pl^{S2}. We have now been able to study a very much larger series of placentas collected in Calcutta, and the results are presented below.

Material and Methods

Placental tissue was obtained from births in the Baranagar Municipality Maternity Hospital, Ramkrishna Mission Seva Pratishthan and R. G. Kar Medical College and Hospitals, all situated in Calcutta.

Small portions of tissue free from membranes were dissected from the placenta immediately after delivery and stored at −20°C. Procedures for the preparation of the extracts, electrophoresis and visualisation of the alkaline phosphatase patterns were identical with those described by Blake *et al* (1969b). Approximately one half

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Table 1. Distribution of Placental Alkaline Phosphatase Types in Calcutta

Population	No. Tested	Common Phenotypes							Rare Phenotypes			
		S_1S_1	S_1I_1	S_1F_1	I_1I_1	I_1F_1	F_1F_1	S_1S_2	S_2S_2	I_1S_2	F_1S_2	F_2S_2	Others
Bengali: Brahmin, Kayastha and Vaidya	247	127	20	69	3	9	7	2	3	0	1	1	5
Bengali: Other Castes	594	337	57	148	6	16	13	3	2	2	2	0	8
Non-Bengali Hindu	84	48	7	19	3	2	4	0	1	0	0	0	0
Total All Groups	925	512	84	236	12	27	24	5	6	2	3	1	13

of the series were typed in Calcutta, the remainder being typed in Canberra: in the latter case small portions of placental tissue were flown to Canberra at wet ice temperature.

A total of 925 placentas were available for study. Of these 247 resulted from deliveries to mothers who were classified as Bengalis belonging to the Brahmin, Kayastha and Vaidya castes: 594 were from deliveries to Bengali mothers belonging to other Hindu castes and 84 were from non-Bengali Hindus of various castes.

The distribution of phenotypes and gene frequencies in these three series and for all series combined is given in Tables 1 and 2. Thirteen phenotypes could not be assigned to any of the previously recognised types. These have been listed separately in Table 1 and omitted from the gene frequency calculations. In 10 samples an S_2 and in 7 samples an S_3 component was recognised: these have been combined to give the Pl^{S2} & Pl^{S3} gene frequency shown in Table 2.

There are slight differences in gene frequencies for the Pl^{S1} and Pl^{F1} alleles between the higher caste group, comprising Brahmin, Kayastha and Vaidya and the remaining Bengali other castes. The majority of the latter have lower caste status though a few upper caste persons may have been included in those cases where caste status could not be ascertained. However, the differences in Pl^{S1} and Pl^{F1} frequencies are non-significant at the P=0.05 level ($\chi^2_{(1)}$=2.12 and 2.10 respectively).

For the combined totals the Pl^{S1}, Pl^{F1} and Pl^{I1} frequencies are almost identical with those reported previously by Blake *et al* (1969a) for Indians sampled in Malaysia. The Pl^{S2} frequency among Indians in Malaysia, however, had a frequency of 0.029, whereas in the present series the combined Pl^{S2} and Pl^{S3} frequency was only 0.009. It is possible that some Pl^{S2} and Pl^{S3} alleles were combined with other rare alleles in the Calcutta series but their inclusion would not affect the general

Table 2. Placental Alkaline Phosphatase Gene Frequencies in Calcutta (Non-identified phenotypes have been omitted from the totals)

Population	*Pl*			
	S_1	F_1	I_1	S_2 & S_3
Bengali: Brahmin, Kayastha and Vaidya	0.7190 ±.0204	0.1942 ±.0180	0.0723 ±.0118	0.0145 ±.0054
Bengali: Other Castes	0.7543 ±.0126	0.1638 ±.0108	0.0742 ±.0077	0.0077 ±.0025
Non-Bengali Hindu	0.7321 ±.0342	0.1726 +.0292	0.0893 ±.0220	0.0060 ±.0059
Total All Groups	0.7429 ±.0102	0.1727 ±.0089	0.0751 ±.0062	0.0093 −.0022

gene frequency pattern in any significant manner.

The present results add support to the evidence for the stability of the placental alkaline phosphatase polymorphism in human populations as well as to their usefulness in anthropological studies. Indians sampled in Malaysia and in Calcutta have closely similar frequencies for the universally distributed alleles Pl^{S1}, Pl^{F1} and Pl^{I1}. Moreover, we have not been able to detect significant differences in the frequency of these alleles between upper and lower caste groups in Calcutta. Compared with other ethnic groups however, there are marked differences (see Blake *et al*, 1969b for detailed figures). The Pl^{S1} frequency in Indians is higher and the Pl^{F1} frequency lower than in Caucasians, whilst the Pl^{I1} frequency is similar in these two ethnic groups. Mongoloid groups in general (Japanese, Chinese, Malays, Thais) have Pl^{S1} frequencies similar to Indians but have markedly increased Pl^{I1} and decreased Pl^{F1} frequencies. Negroes on the other hand, have even higher Pl^{S1} frequencies than Indian and Mongoloid groups, but lower Pl^{I1} and Pl^{F1} frequencies. Finally, Papuans have frequencies for all three alleles similar to those for Negroes (Blake *et al*, 1969c).

Further studies are needed, not only for populations in different parts of India but also for ethnic groups in other parts of the world. So far the results suggest, however, that the placental alkaline phosphatase alleles are not subject to rapid or highly localised variation in frequency and therefore they may be of value in estimating the extent of race mixture in hybrid populations.

Summary

A series of 925 placentas from births in Calcutta maternity hospital have been used to determine placental alkaline phosphatase gene frequencies: 13 placentas could not be assigned to previously reported types. For the remainder the frequencies were $Pl^{S1}=0.7429$, $Pl^{F1}=0.1727$, $Pl^{I1}=0.0751$ and Pl^{S2} and Pl^{S3} combined $=0.0093$. These

frequencies are similar to those found previously for Indians in Malaysia. No significant differences were found in gene frequencies between upper and lower caste groups.

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