

Table 4. Prediction results of discriminant analysis in Whites. Newborn infants with a negative score (standardized value assumed by discriminant function) are considered at 'low risk'

Cases classified as	Number of cases which actually developed hyperbilirubinaemia ≥ 10 mg/dl	Number of cases which actually did not develop hyperbilirubinaemia ≥ 10 mg/dl
Low risk: females	1	89
males	3	88
High risk: females	17	44
males	13	47
Total: females	18	133
males	16	135

10 mg/dl could be of questionable relevance to clinicians. As a first approach to the problem, however, the subdivision is reasonably justified on the basis of the general indications for phototherapy. It is very likely that the discriminating power could sensibly increase by adding other variables such as cord bilirubin level⁹, hematocrit, hemoglobin, reticulocyte count and clinical conditions at birth, and informations on drugs given during pregnancy and on anesthesia during labor. Unfortunately, these data were not available for the present analysis. The results indicate that the multivariate approach is feasible. The main advantage of the procedure consists in the optimal, rational and simultaneous utilization of clinical and laboratory parameters available for the care of ABO incompatible infants. These data can be obtained within 12 h after birth. Even at the present preliminary stage, the analysis might allow, few hours after delivery, a useful classification of low and high risk infants regarding the level of serum bilirubin in the neonatal period. Overall, in fact, babies with a negative score, representing in our sample more than 50% of all ABO incompatible infants, show a risk of hyperbilirubinaemia lower than 3%. However, since the aim of the study is to select ABO incompatible infants which would be discharged very early, the inclusion of false negative may have deleterious consequences. Therefore, to have practical utilization, the discriminant function should be improved in order to further reduce the probabilities of false negative to negligible values.

Table 5. Prediction results of discriminant analysis in Blacks. Newborn infants with a negative score (standardized value assumed by discriminant function) are considered at 'low risk'

Cases classified as	Number of cases which actually developed hyperbilirubinaemia ≥ 10 mg/dl	Number of cases which actually did not develop hyperbilirubinaemia ≥ 10 mg/dl
Low risk: females	0	21
males	1	22
High risk: females	6	8
males	8	10
Total: females	6	29
males	9	32

The differences observed between Caucasians and Blacks concerning the pattern of factors predisposing to clinical jaundice and those between sexes may be of major theoretical and practical importance and deserves further investigations to be elucidated.

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Studies on the Dd antigen-antibody system. II. Antigen Dd reactivity in some North Indian populations

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Summary. The frequency of antigen Dd-reactors has been recorded in Muslims and Buddhists from Ladakh, in Rana Tharus from Uttar Pradesh and in two samples of largely Jat Sikh origin from Punjab, all in India. The results show a wide range of variation, from 0% in the Rana Tharus to 25% in the Punjabi blood donors, of incidence of antigen Dd-reactivity in these populations.

Antigen Dd is a component of certain specimens of human dandruff and precipitates some but not all human sera³. The nature of this antigen is not precisely known and it cannot as yet be definitely said that it is not of extra-human origin. The antibodies reacting with antigen Dd have not been detected in human cord serum but they appear to be present permanently in the sera of adult antigen Dd-reactors.

Shrivastava³ found 3.97% Polish blood donors from Warsaw to have antibodies against antigen Dd. In contrast, the frequency of antigen Dd-reactors in Punjab, in North India, was estimated to be 24.17% in one sample⁴ and 19.28% in

another⁵. In yet another sample, this time drawn from the Gaddi tribals of Himachal Pradesh in India, we did not come across a single antigen Dd-reactor in 87 sera examined⁶.

Here we present results of our further studies on the distribution of antigen Dd-reactors in some more populations from North India.

Materials and methods. Antigen Dd was prepared as described earlier³. About 5 ml blood was drawn i.v., under aseptic conditions, from each individual and the sera extracted were stored at -20°C until they were used. Immunoelectroosmophoresis was performed on agarose gels at

pH 8.2, using the buffer system of Rose and Bigazzi⁷. The material analyzed included 82 Muslims and 59 Buddhists from Ladakh in the State of Jammu and Kashmir, 120 Rana Tharus from Uttar Pradesh, 318 Punjabis of largely Jat Sikh origin from Punjab and 300 undifferentiated Punjabi blood donors, also from Punjab.

Ladakh is the largest district in the State of Jammu and Kashmir, lying between 32° 15' and 36° latitude and between 75° 15' and 80° 15' longitude. The territory of Ladakh, with an area of 97,872 km², is one of the world's most elevated regions at a mean altitude of about 3500 m. It is very thinly populated with a density of about 2 persons/km², which may well be among the lowest anywhere. The Buddhists and Muslims, numbering 54,565 and 49,131 respectively, form the bulk of the chiefly Mongoloid population of Ladakh. The data were collected from the 2 principal towns of Ladakh: Kargil and Leh, which are situated at a distance of 204 km, and 434 km respectively, from the capital of the state, Srinagar. Leh is mainly inhabited by Buddhists and Kargil is predominantly Muslim. Marriages between Muslims and Buddhists were a common feature until as late as the beginning of this century and even now occasional marriages do occur.

The Tharus are a semi-Hinduised tribe inhabiting the Terai area of Uttar Pradesh, between the Himalayan foothills and the Northern Indian plains. They are primarily agriculturists but live also by fishing and hunting. The Rana Tharus, one of the 3 main groups of the tribe, are mainly confined to the districts of Nainital and Kheri. They are divided into higher and lower categories and each category is further subdivided into endogamous units called Kuries. Cross-cousin marriages are common but parallel cousin marriages are avoided. The Tharus are probably a tribal people of the Himalayan region with Mongolian affiliations but with slight recent admixture with non-Mongoloid populations from the plains.

Punjab is a flat alluvial plain with altitude less than 300 m. The State is thickly populated with a density of about 269 persons per km². The people of Punjab, on the whole, are physically well-built and are of medium to fair complexion. Ethnically, they appear to be a mixture of diverse strains of

which Nordic, Mediterranean and Scythian are believed to be the major components.

Results and discussion. Table 1 shows the distribution of antigen Dd-reactors in the populations we have just described. The range of variation in the frequency of reactors is from 0% in the Rana Tharus to as high as 25% in the Punjabi blood donors, the latter frequency comparing favorably with that observed earlier in a Punjabi sample by Kaur and Shrivastava⁴. We have made inter-population comparisons and have noted very significant differences between some. Table 2 shows population sets in which we have recorded χ^2 values that exceed the 5% level of significance.

Thus, while the samples from Punjab are more or less alike in the distribution of this trait, they are significantly different from all other populations. Of the 2 groups of Ladakhis, only the Buddhists come anywhere closer to them. The tribal community of Rana Tharus forms a separate category, widely separated from the rest of the populations studied. It may be relevant to note here that besides Rana Tharus, the only other tribal group to have been examined for this trait, that of the Gaddis, also had a 0% incidence of antigen Dd-reactivity⁶.

Antigen Dd-reactivity is equally distributed between the 2 sexes so that the observed population differences cannot be attributed to sexual isolation. The possibility of genetic involvement has been considered in another paper in this series and here we will confine ourselves to a discussion of the possible environmental correlates of antigen Dd-reactivity.

The Rana Tharus and Gaddis, the 2 tribal communities totally lacking in antigen Dd-reactivity, both inhabit areas with an abundance of rainfall. In contrast, the only moisture Ladakh gets is via melted snow in the summer. In Punjab, too, the climate is much drier than in the Terai area of Uttar Pradesh, home of the Tharus, or in Himachal Pradesh where the Gaddis live. It is tempting to speculate, therefore, that environmental factors may be implicated in the Dd antigen-antibody system. We have observed that at least in North India, dandruff is seen to be in its most aggravated form in the dry winter months. Other factors causing its enhanced production may be diseases of several kinds, ingestion of alcohol and use of certain articles of toilet, etc. It is not unlikely that factors as these might cause dehydration of the skin to the extent of denaturing its otherwise normal surface protein(s) and which, as a consequence of it, might become sufficiently antigenic to be able to evoke immune response in man. This hypothesis can be easily tested in populations whose members are not localized at one place but, instead, are spread over in different climatic areas and are having different environmental experiences.

Table 1. Distribution of antigen Dd-reactors in populations studied

Population	n	Dd-reactor		Dd-nonreactor	
		Number	%	Number	%
Jammu and Kashmir					
Ladakhi Muslims	82	4	4.88	78	95.12
Ladakhi Buddhists	59	7	11.86	52	88.14
Uttar Pradesh					
Rana Tharus	120	0	0	120	100.00
Punjab					
Punjabis	318	63	19.81	255	80.19
Punjabi blood donors	300	75	25.00	225	75.00

Table 2. Antigen Dd-reactivity: Results of homogeneity tests (χ^2) between different population sets

Populations compared	χ^2	Probability
Punjabi blood donors and Ladakhi Muslims	15.898	$p < 0.001$
Punjabi blood donors and Ladakhi Buddhists	4.831	$0.02 < p < 0.05$
Punjabi blood donors and Rana Tharus	36.526	$p < 0.001$
Ladakhi Muslims and Rana Tharus	5.994	$0.01 < p < 0.02$
Ladakhi Buddhists and Rana Tharus	14.818	$p < 0.001$

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