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A Study of Genetic Diversity Among Punjabi Khatris and Aroras of Delhi and Shimla

Robin Saluja, M.P. Sachdeva and A.K. Kalla

Department of Anthropology, University of Delhi, Delhi 110 007, India

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ABSTRACT The present investigation aims at finding out the genetic diversity as evaluated on the basis of family data on ABO, Rh_0 (D), Hp and GLO 1 genetic parameters among the two Punjabi (Khatri and Arora) population groups of Delhi and Shimla hills. With respect to ABO phenotypes the difference between parents and offsprings is not found to be statistically significant both for the population of Delhi and that of Shimla though, as a group, both the parental and offspring populations of Delhi differ significantly from those of Shimla. In case of Rh_0 (D), data seems to indicate that while the 'Punjabis' of Shimla retained the generational similarity, those of Delhi did not. Data on haptoglobin phenotypes reveals that both among the 'Punjabis' of Delhi and Shimla the genetic equilibrium is significantly disturbed and more so in the parental populations of the two groups. As regards the GLO 1 phenotypes it may be stated that the Punjabi Arora and Khatri population of delhi is in a state of genetic equilibrium while for the population of Shimla the same is disturbed.

INTRODUCTION

The Khatris and Aroras were essentially trading castes and were distributed through out different regions of the Punjab in the late 19th century. The Khatris were most numerous in the central districts; the Aroras were to be found mostly in the south-western sections of the Punjab. In the 19th century, the Khatris were still mainly Hindus and were spread out for trading activities. Some were land holders as well, and cultivated or followed various avocations. They extended from Delhi to Agra to Lucknow to Patna and to Calcutta (Marenco, 1976). However, they were most numerous in Jalandhar, Amritsar, Lahore and Rawalpindi divisions. (Baker, 1990). Within the Punjab, the distribution of the Khatri element was well marked. The Khatri hardly appeared east of Ludhiana nor did they penetrated into the eastern hills, They were strongest in the central districts, in the Rawalpindi Division and Hazara and in the western hill states (Ibbeston, 1881). The divisions of the Khatri Hindus were many, with a system of social gradation, in accordance with which certain Khatri exogamous groups would refuse to inter marry with any but a specified number of their fellow 'tribes' or exogamous groups. (Marenco, 1976). "As a class, they are much superior in point of civilization and refinement to most other 'tribes' of the Punjab" (Baker, 1990).

The Arora group had the Multan and Derajat divisions and Bahawalpur almost to themselves, extending also into Peshawar and Kohat and crossing the Satluj in Sirsa to meet the Banya group of the east (baker, 1990).

"The Arora or Rora as he is often called, is the trader par excelence. He is commonly known as Kirar, a word almost synonymous with coward. The Aroras claim to be of Khatri origin and it will presently be seen that they follow some of the Khatri sub-divisions. The Khatris however reject the claim. Sir George Campbell is of the opinion that the two belong to the same ethnic stock" (Ibbetson, 1881).

The partition of India, which simultaneously resulted in the division of Punjab into West Punjab in Pakistan and East Punjab in present India, led to the migration of almost the entire Hindu community from areas now in Pakistan in to India. The Aroras and Khatris, among others, moved into Delhi, the then East Punjab and Uttar Pradesh. Many Khatris and Aroras of Shimla are also a part of that diaspora, though some of the families were living there even before the partition of India.

It was reported by Kalla (1985) that Kashmiri Pandit populations of Srinagar and Delhi, who had once belonged to the same core population, showed distinct genetic diversity. Punjabi (Khatri & Arora) of Shimla Hills and Delhi respectively present quite similar

condition to those of the Kashmiri Pandits. It is, therefore, presently attempted to see whether any genetic differentiation has set in among the Punjabi (Khatri & Arora) of Shimla hills and Delhi respectively.

MATERIAL AND METHODS

The blood samples for the present study were collected from 198 Punjabi (Khatri and Arora) families of Shimla and 178 Punjabi (Khatri and Arora) families of Delhi. The blood specimens were tested for ABO and Rh_0 (D) blood group by the methods advocated by Boorman et al. (1988).

Haptoglobin phenotyping was done by disc electrophoresis in vertical tubes of 5 per cent acrylamide gel using the discontinuous buffer system as described by Davis (1964) and Ornstein (1964). GLO 1 typing was achieved using horizontal starch agarose gel electrophoresis as described by Scott and Fowler (1982). Gene frequency calculations were carried out by the methods advocated by Mourant et al. (1976). The χ^2 values were obtained by using the log likelihood method (G table) of Woolf (1957).

RESULTS AND DISCUSSION

ABO Blood Groups

The distributions of ABO blood group phenotypes among the parent and offspring populations for the Punjabis (Khatri and Arora) of Delhi and Shimla respectively are set out in table 1.

Table 1 : ABO Blood group phenotypic distribution among the Punjabis (Khatri and Arora) of Delhi and Shimla

Area/	*Parents*		*Offspring*	
Phenotype	*N*	*%*	*N*	*%*
Delhi				
O	108	30.34	54	30.34
A	59	16.57	34	19.10
B	144	40.45	70	39.32
AB	45	12.65	20	11.23
Shimla				
O	150	37.88	62	31.31
A	94	23.74	61	30.80
B	90	22.73	51	25.76
AB	62	15.66	24	12.12

The difference between parents and offsprings in the above distribution is not statistically significant both for the population of Delhi $\chi^2 = 0.6617$, df 3, (.90 >P> .80) and that of Shimla : $\chi^2 = 5.7709$, df 3 (.20 >P> .10).

However, both the parental and the offspring populations of the 'Punjabis' of Delhi and Shimla are found to differ significantly with respect to their ABO blood group distribution : $\chi_2 = 28.1037$, df 3, (P<.001) for parental population and $\chi^2 = 10.6283$, df 3, (.02>P>.01) for offspring population with the frequency of blood group B being much higher among the population of Delhi than the respective population from Shimla; but the frequency of blood group A and O respectively were higher among the repective population of Shimla.

Thus, the differences in the ABO blood group frequencies observed between parental populations have continued between the respective offspring population of Delhi and Shimla. The corrected *A, B, O* allele frequencies along with the values of D/σ for the Punjabi population of Delhi and Shimla are set out in table 2, which clearly indicate that the 'Punjabis' of Delhi have higher frequency of allele '*B*' than that of allele '*A*' while the 'Punjabis' of Shimla have higher frequency of allele '*A*' that of allele '*B*'. However, the Pregnency of allele '*O*' is some what higher in both the generations of 'Punjabis' of Shimla than that in the respective generation of 'Punjabis' of Delhi.

Table 2 : Corrected A,B,O allele frequency And D/σ of the 'Punjabi' (Khatri and Arora) of Delhi and Shimla

Area/Group	*A*	*B*	*O*	*D/σ*
Delhi				
Parents	.1357	.2941	.5702	2.550
Offsprings	.1537	.2857	.5606	0.888
Shimla				
Parents	.1740	.1672	.6588	7.320
Offsprings	.2304	.1975	.5721	1.185

From the D/σ values it is evident that each of the parental populations was in a state of genetic disequilibrium with respect to '*A*', '*B*' and '*O*' alleles while each of the offspring populations had reached a state of genetic equilibrium in this regard. This is quite in accordance with the expectations from the Hardy-Weinberg Law.

Table 3: Distribution of Rh_o (D) among the 'Punjabis' (Khatri and Arora) of Delhi and Shimla

Area/	*Parents*				*Offspring*			
Phenotype/gene	*Number*		*Percentage*		*Number*		*Percentage*	
	Obs.	*Exp.*	*Obs.*	*Exp.*	*Obs.*	*Exp.*	*Obs.*	*Exp.*
Delhi								
Rh_o (D+)	336	336.01	94.38	94.38	176	175.96	98.88	98.85
Rh_o (D-)	20	19.99	5.62	5.61	2	2.04	1.12	1.15
d	.237				.107			
D	.763				.893			
Shimla								
Rh_o (D+)	355	354.94	89.65	89.63	176	176.96	88.88	88.91
Rh_o (D-)	41	41.06	10.35	10.36	22	21.95	11.11	11.08
d	.322				.333			
D	.678				.667			

Rh_o (D) Blood Groups

χ^2 values between the observed and the expected Rh_o (D) and Rh_o (D) -ve blood group frequencies were not found to be statistically significant among both the groups of the 'Punjabis' in each of their respective generations : χ^2 = .000005, df 1, (P>.99) for Delhi parents; χ^2 = .000793, df 1, (.93 > P > .95) for Delhi offsprings; χ^2 = .000978, df, 1, (P > .99) for Shimla parents ; χ^2 = .000128, df 1, (P > .99) for Shimla offsprings indicating that both the generations of the two groups of 'Punjabis' are in a state of genetic equilibrium *vis-à-vis* Rh(D) locus.

The difference between the parents and the offsprings in the above observed distribution was not found to be statistically significant for the population of Shimla : χ^2 = 0.0789, df 1, (.80 > P > .70) whereas, it was found to be statistically significant (at 5% probability level) for the population of Delhi : χ^2 = 7.4581, df 1, (.01 > P > .001). This seems of indicate that while the 'Punjabis' of Shimla retained the generatrional similarity with respect to Rh_o (D) factor, those of Delhi did not. However, it is presently difficult to attribute this generational difference among the 'Punjabis' of Delhi to any specific cause or causes.

Further, both the parental and the offspring populations of the 'Punjabis' of Delhi and Shimla respectively were found to differ significantly with respect to their Rh_o (D) distribution : χ^2 = 57734, df 1, (P < .001) for the parent population and χ^2 = 18.4388, df 1, (P < .001) for the offspring population with the frequency of '*d*' being much higher among the parent and offspring respectively from Shimla.

Haptoglobins

Observed and expected frequencies of haptoglobin (Hp) phenotypes among the parent and offspring populations of Delhi and Shimla are presented in table 4.

Table 4: Distribution of Hp types among the 'Punjabis' (Khatri and Arora) of Delhi and Shimla

Area/	*Parents*				*Offspring*			
Phenotype	*Number*		*Percentage*		*Number*		*Percentage*	
	Obs.	*Exp.*	*Obs.*	*Exp.*	*Obs.*	*Exp.*	*Obs.*	*Exp.*
Delhi								
Hp 1-1	14	82.02	3.93	23.04	6	41.01	3.37	23.04
Hp 2-1	317	177.72	89.04	49.92	159	88.86	89.33	49.92
Hp 2-2	25	96.26	7.02	27.04	13	48.13	7.30	27.04
Shimla								
Hp 1-1	30	87.48	7.57	22.09	25	47.54	12.63	24.01
Hp 2-1	311	197.28	78.53	49.82	146	98.96	73.74	49.98
Hp 2-2	55	111.24	13.88	28.09	27	51.50	13.64	26.01

Chi-square values revealed that there existed statistically significant differences between the observed and the expected frequencies of Hp phenotypes in both the 'Punjabi' groups and in each of the two generations respectively : χ^2 = 218.31, df 2, (P <001) for parental population of Delhi and χ^2 = 110.89, df 2, (P<.001) for offsprings of Delhi ; χ^2 = 131.85, df 2, (P<.001) for parental population of Shimla and χ^2 = 44.69, df 2, (P<.001) for offsprings of Shimla.

This indicates that both among the 'Punjabis' of Delhi and Shimla the genetic equilibrium with resepct of Hp alleles is significantly disturbed and more so in the parental population of the two groups.

Presently it is difficult to explain the above observation though it appears that there may be certain genetic forces operating in both the population groups and in both the generations to cause the unstability of genetic equilibrium at the Hp locus not withstanding that such an unstability is at decline in the offspring population.

However, the frequency of Hp 2-1 is found to be much higher among the parents as well as offsprings in the respective population of Delhi and Shimla. The difference between parents and offsprings in the above distribution was not found to be statistically significant both for the population of Delhi : χ^2 = 0.1158, df 2, (.95 > P > .90) and that of Shimla χ^2 = 3.8714, df 2, (.20 > P > .20).

But both the parental and the offspring populations respectively of Delhi and Shimla were found to differ respectively from each other : χ^2 = 15.41, df 2, (P < . 001) between parental populations of Delhi and Shimla and χ^2 = 17.0008, df 2, (P < .001) between offspring populations of Delhi and Shimla.

Glyoxalase 1

Observed and expected frequencies of Glyoxalase 1 (GLO 1) phenotypes among the parent and offspring populations of Delhi and Shimla respectively are set out in table 5.

Chi-square values between the observed and the expected frequencies of GLO 1 phenotypes revealed that the difference between the two is not statistically significant for parental population : χ^2 = .883, df 2 (.70 > P > .50) as well as for the offspring population : χ^2 = .013, df 2 (P > .99) whereas, there existed a statistically significant difference between observed and the expected frequencies, both among the parental and the offspring 'Punjabi' population of Shimla : χ^2 = 187.09, df 2 (P < .001) for parental population and χ^2 = 69.81, df 2 (P < .001) for offspring population.

From the above resperctive χ^2 values for the two population groups, it may be stated that the population of Delhi is in a state equilibrium while in the population of Shimla, the genetic equilibrium with respect to GLO 1 locus is disturbed. However, presently is is difficult to attribute these differences among the 'Punjabis' of Delhi and Shimla to any specific cause/causes.

Nevertheless, both the parental and the offspring generations of the 'Punjabis' of Shimla are found to be in a state of genetic disequilibrium, the causality of which is yet to be ascertained. However, the frequency of GLO 2-1 is found to be much higher among the parents as well the offsprings in the respective popu- lations of Delhi and Shimla.

The difference between parents and offsprings in the above distribution was not found to be statistically significant for the population of Delhi : χ^2 = 1.0853, df 2 (.70 > P > .50) and that

Table 5 : Distribution of GLO 1 types among the 'Punjabis' (Khatri and Arora) of Delhi and Shimla

Area/	*Parents*				*Offspring*			
Phenotype	*Number*		*Percentage*		*Number*		*Percentage*	
	Obs.	*Exp.*	*Obs.*	*Exp.*	*Obs.*	*Exp.*	*Obs.*	*Exp.*
Delhi								
GLO 1-1	61	65.82	17.13	18.49	29	28.48	16.29	16.00
GLO 2-1	183	174.50	51.40	49.02	85	85.44	47.75	48.00
GLO 2-2	112	115.66	31.46	32.49	64	64.08	35.95	36.00
Shimla								
GLO 1-1	14	73.22	3.53	18.49	7	34.93	3.53	17.64
GLO 2-1	316	194.12	79.79	49.02	154	9646	77.77	48.72
GLO 2-2	66	128.66	16.66	32.49	37	66.61	18.68	33.64

of Shimla : $\chi^2 = 0.3751$, df 2 (.90 >P > .80). Both the parental and the offspring populations respectively of the Punjabis of Delhi and Shimla were found to differ significantly from each other : χ^2 = 77.5449, df 2 (P < .001) between parental populations of Delhi and Shimla and $\chi^2 = 49.888$, df 2 (P < . 001 between offspring populations of Delhi and Shimla)

From the above observations on the distributions of ABO, Rh_o (D) blood groups, Hp and GLO 1 types, it is amply evident that :

(i) The genetic equilibrium is disturbed *vis-à-vis* Hp alleles in each of the two generations of both the 'Punjabi' groups, and *vis-à-vis* GLO 1 alleles in both the generations of 'Punjabis' of Shimla.

(ii) The 'Punjabis (Khatri and Arora) of Delhi form a genetically distinctly distinguishable population from the 'Punjabis' (Khatri and Arora) of shimla vis-à-vis the above four genetic loci.

However, presently it is difficult to identify any of the specific factor/factors that could have lead to the above observed genetic diversification of the two 'Punjabi' populations, which can historically be traced to have belonged to one stock population, other than the possible influence of process of differential isolation and climatic adaptation.

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REFERENCES

Baker, S. : *Caste, At Home in Hindu India*. Jonathan cape, London (1990).

Boorman, K.E., Dodd, B.E. and Lincoln, P.J. : *Blood Group Serology*. 6th Edition, Churchill Livingstone, New York (1988).

Davis, B.J. : Disc electrophoresis II. Methods and application to human serum proteins. *Ann. N.Y. Acad. Sci.*, **121** : 404 (1964).

Ibbetson, D.C.J. : *Report on the Census of the Punjab, 1881*. Vol. I, Text, Calcutta (1883).

Kalla, A.K. : *Kashmiri Pandits and their Diversity*. B.R. Publishing Co., Delhi (1985).

Marenco, E.K. : *The Transformation of Sikh Society*. Heritage Publishers, New Delhi (1976).

Mourant, A.E., Kopec, A.C. and Sobezak, K.D. *:The Distribution of Human Blood Groups*. 2nd Edition Oxford Univesity Press, London (1976).

Ornstein, L. : Disc electrophoresis 1. Background and Theory. *Ann. N.Y. Acad. Sci.*, **121** : 321 (1964).

Scott, A.C. and Fowler, J.C.S. : Electrophoretic typing of Glyoxalase 1 (GLO 1) isozymes using a mixed startch/ agarose gel. *Forensic Science International*, **20** : 287 (1982).

Woolf, B. : The log likelihood ratio test (the G test). Methods and tables for test of heterogeneity in contingency tables. *Ann. Hum. Genet.*, **21** : 397 (1957)