

## Distribution of Red Cell Enzymes Among Two Kashmiri Population Groups of Srinagar District, Jammu and Kashmir, India

M.K. Bhasin, Asha Khanna and S.M.S. Chahal<sup>1</sup>

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

*1. Department of Human Biology, Punjabi University, Patiala 147 002, India*

**KEY WORDS** Kashmiri. Red Cell Enzymes. Polymorphism.

**ABSTRACT** Blood samples collected from two Kashmiri population groups - Muslims and Pandits inhabiting Srinagar district, Jammu and Kashmir were analysed for seven red cell enzyme systems - AP, ADA, AK, EsD, GPI, GLO I and PGM<sub>1</sub>. The distribution of these enzyme polymorphisms is discussed in relation to other North Indian populations.

Human populations are polymorphic for a large number of genetic loci. Gene frequency data for such genetic markers are very useful for studying the genetic relationship and evolution among them. Since early 1960s, with the development of electrophoretic techniques, human geneticists have devoted an increasing amount of attention to the study of naturally occurring genetic variation in enzymes and proteins. Several red cell enzymes have been found to be highly polymorphic offer opportunities to test various theoretical models of population genetics and to study the genetic structure.

The genetic data available on various polymorphic enzymes from Jammu and Kashmir are still very meagre. In fact, only one study is available on the distribution of red cell enzyme polymorphisms from the state, among Sunni Muslims (Chahal et al., 1989). The present study reports data on seven different enzyme systems, namely AP, ADA, AK, EsD, GPI, GLO I and PGM<sub>1</sub>, among two Kashmiri population groups - Muslims and Pandits of Srinagar district, Jammu and Kashmir.

### MATERIAL AND METHODS

Blood samples of 122 Kashmiri Muslims and 33 Kashmiri Pandits collected from Srinagar district of Jammu and Kashmir in 1988 were analysed for seven polymorphic red cell enzyme systems. Enzyme typing was carried out using horizontal electrophoresis following the methods of Harris and Hopkinson (1976) for acid phosphatase (AP) and glucose phosphate isomerase (GPI) systems; Scott and Fowler (1982) for glyoxalase I (GLO I) system; Murch et al. (1986) for adenosine deaminase (ADA) and adenylate kinase (AK) systems; and Wraxall and Stolorow (1986) for phosphoglucomutase locus 1 (PGM<sub>1</sub>) and esterase D (EsD) systems. The gene frequency calculations were carried out after Mourant et al. (1976.)

### RESULTS AND DISCUSSION

The distributions of enzyme phenotypes and gene frequencies in the present material from Jammu and Kashmir are shown in tables 1 and 2, respectively.

**Acid phosphatase (AP) system**

The frequency of  $P^a$  gene is 24.59 per cent in Kashmiri Muslims and 33.33 per cent in Kashmiri Pandits;  $P^c$  is absent among Kashmiri Pandits, whereas among Kashmiri Muslims it is present with a frequency of 0.41 per cent. Both the Kashmiri population groups are showing similarities in the distribution of AP gene frequencies with Sunni Muslims of Jammu and Kashmir (Chahal et al., 1989) and Brahmins of Himachal Pradesh (Chahal et al., 1982).

**Adenosine deaminase (ADA) system**

The ADA<sup>2</sup> frequency has been observed over 10 per cent among both Kashmiri population groups - Muslims (12.81 per cent) and Pandits (10.61 per cent), which depicts a distribution pattern similar to that observed among Sunni Muslims of Jammu and Kashmir, Gaddi-Rajput (Chahal et al., 1982); Chamar (Papiha et al., 1982) and Kanet of Nachar (Papiha et al., 1984) of Himachal Pradesh.

**Adenylate kinase (AK) system**

The frequency of AK<sup>2</sup> gene recorded among Kashmiri Muslims and Kashmiri Pandits is low. The former are showing a frequency of AK<sup>2</sup> gene (6.25 per cent) close to that found among the Sunni Muslims of Jammu and Kashmir (Chahal et al., 1989). Furthermore, the present populations are exhibiting similarities with various caste groups and communities of North India like Brahmins (Papiha et al., 1982); Rajputs (Bhasin et al., 1983); Kanets (Papiha et al., 1984); Paliwal Brahmin, Rajputs and Meghwals of Rajasthan (Papiha et al., 1982); Arora and Brahmin of Delhi (Blake et al., 1971).

**Esterase D (EsD) system**

Both among the Kashmiri Pandits and Kashmiri Muslims, the EsD<sup>2</sup> frequency is low (18.18 and 24.38 per cent, respectively). Kashmiri Muslims are falling closer to the Sunni Muslims

(Chahal et al., 1989) and Gaddi-Rajputs (Chahal et al., 1982) while Kashmiri Pandits are showing similarities with various caste groups like Jat Sikh (Woolley et al., 1983; Chahal et al., 1986), Jat (Papiha and Nahar, 1977; Kushwaha et al., 1990); Arora and Khatri (Ghosh, 1977); Paliwal Brahmin (Papiha et al., 1982) in the distribution of EsD gene frequencies.

**Glucose phosphate isomerase (GPI) system**

Among both Kashmiri population groups, no rare GPI gene has been encountered; albeit rare gene GPI<sup>3</sup> has been detected among the Sunni Muslims of Jammu and Kashmir (Chahal et al., 1989).

**Glyoxalase I (GLO I) system**

It has been observed that among both Kashmiri Muslims and Kashmiri Pandits the frequency of gene GLO<sup>1</sup> is above 20 per cent and it is similar to that observed among various other groups of Western Himalayas [Sunni Muslims (Chahal et al., 1989); Gaddi-Rajputs (Chahal, 1981); Rajputs (Chahal, 1981; Chahal et al., 1991) of Himachal Pradesh.

**Phosphoglucosmutase locus 1 (PGM<sub>1</sub>) system**

The PGM<sub>1</sub><sup>2</sup> frequency has been found rather low among Kashmiri Pandits (17.19 per cent), but in Kashmiri Muslims of the same region, the frequency recorded was comparatively high (27.46 per cent). Sunni Muslims of Jammu and Kashmir showed high frequency of PGM<sub>1</sub><sup>2</sup> gene (36.3) (Chahal et al., 1989) as compared to that observed in the present study. However, Kashmiri Muslims of present study are showing similarities with Muslims of Uttar Pradesh (Chahal, 1981); while Kashmiri Pandits exhibit a distribution similar to that observed among Paliwal Brahmin, Rajputs and Meghwal of Rajasthan (Papiha et al., 1982).

Table 1: Distribution of red cell enzymes among Kashmiri Muslims and Kashmiri Pandits

Enzyme/Phenotype	Number Observed	
	Kashmiri Muslims	Kashmiri Pandits
AP		
A	9	6
BA	41	10
B	71	17
CA	1	0
<b>Total</b>	<b>122</b>	<b>33</b>
ADA		
1-1	92	26
2-1	27	7
2-2	2	0
<b>Total</b>	<b>121</b>	<b>33</b>
AK		
1-1	105	30
2-1	15	3
2-2	0	0
<b>Total</b>	<b>120</b>	<b>33</b>
ESD		
1-1	68	22
2-1	47	10
2-2	6	1
<b>Total</b>	<b>121</b>	<b>33</b>
GPI		
1-1	122	33
3-1	0	0
<b>Total</b>	<b>122</b>	<b>33</b>
GLO I		
1-1	6	4
2-1	38	9
2-2	78	20
<b>Total</b>	<b>122</b>	<b>33</b>
PGM <sub>1</sub>		
1-1	61	22
2-1	51	9
2-2	8	1
7-1	2	0
<b>Total</b>	<b>122</b>	<b>32</b>

Table 2: Gene frequencies of red cell enzymes among Kashmiri Muslims and Kashmiri Pandits

Enzyme/Gene	Gene Frequency	
	Kashmiri Muslims	Kashmiri Pandits
AP		
<i>P<sup>a</sup></i>	24.59	33.33
<i>P<sup>b</sup></i>	75.00	66.67
<i>P<sup>c</sup></i>	0.41	0.00
<b>Total</b>	<b>100.00</b>	<b>100.00</b>
ADA		
<i>ADA<sup>1</sup></i>	87.19	89.39
<i>ADA<sup>2</sup></i>	12.81	10.61
<b>Total</b>	<b>100.00</b>	<b>100.00</b>
AK		
<i>AK<sup>1</sup></i>	93.75	95.45
<i>AK<sup>2</sup></i>	6.25	4.55
<b>Total</b>	<b>100.00</b>	<b>100.00</b>
ESD		
<i>EsD<sup>1</sup></i>	75.62	81.82
<i>EsD<sup>2</sup></i>	24.38	18.18
<b>Total</b>	<b>100.00</b>	<b>100.00</b>
GPI		
<i>GPI<sup>1</sup></i>	100.0	100.0
<i>GPI<sup>3</sup></i>	0.0	0.0
<b>Total</b>	<b>100.0</b>	<b>100.0</b>
GLO I		
<i>GLO<sup>1</sup></i>	20.49	25.76
<i>GLO<sup>2</sup></i>	79.51	74.24
<b>Total</b>	<b>100.00</b>	<b>100.00</b>
PGM <sub>1</sub>		
<i>PGM<sub>1</sub><sup>1</sup></i>	71.72	82.81
<i>PGM<sub>1</sub><sup>2</sup></i>	27.46	17.19
<i>PGM<sub>1</sub><sup>7</sup></i>	0.82	0.00
<b>Total</b>	<b>100.00</b>	<b>100.00</b>

## ACKNOWLEDGEMENT

The financial assistance provided by the Ministry of Environment and Forests, Government of India for the project entitled "Environment, Human Settlement and Human Activities in Jammu and Kashmir with Special Reference to Ladakh" under MAB Programme

of UNESCO (Ref. No. 14/122/84 RE-MAB) to Dr. M.K. Bhasin (Principal Investigator), Department of Anthropology, University of Delhi, Delhi-110 007, is gratefully acknowledged.

### REFERENCES

- Bhasin, M.K., Singh, I.P., Walter, H. and Bhardwaj, V. : Genetic study of five population groups of Lahaul-Spiti and Kulu districts, Himachal Pradesh. *Z. Morph. Anthropol.*, 74 : 13-38 (1983).
- Blake, N.M., Kirk, R.L., McDermid, E.M., Omoto, K. and Ahuja, Y. R. : The distribution of serum protein and enzyme group systems among north Indians. *Hum. Hered.*, 21 : 440-457 (1971).
- Chahal, S.M.S. : *Genetic Variation and Structure in Selected Populations of India*. Ph.D. thesis, University of Newcastle upon Tyne, England (1981).
- Chahal, S.M.S., Papiha, S.S., Roberts, D.F. and Singh, I.P. : Serological and biochemical variation in the Gaddi tribe of Himachal Pradesh, India. *Z. Morph. Anthropol.*, 73 : 197-208 (1982).
- Chahal, S.M.S., Sehgal, I.K., Bansal, I.J.S. and Singh, P. : Genetic variation of esterase D (EsD) polymorphism in Indian populations. *Anthrop. Anz.*, 44 : 341-353 (1986).
- Chahal, S.M.S., Sidhu, B.K. and Mahajan, A. : Biochemical variation in the Sunni Muslims of Pulwama district, Jammu and Kashmir. *Hum. Hered.*, 39 : 113-115 (1989).
- Chahal, S.M.S., Mahajan, A. and Singh, P. : Erythrocyte enzyme variation in some caste populations of Chamba, Himachal Pradesh. *J. Hum. Ecol.*, 2 : 73-76 (1991).
- Ghosh, A.K. : The distribution of genetic variation of glyoxalase I, esterase D and carbonic anhydrase I and II in Indian populations. *Ind. J. Phys. Anthropol. Hum. Genet.*, 3 : 73-83 (1977).
- Harris, H. and Hopkinson, D.A. : *Handbook of Enzyme Electrophoresis in Human Genetics*. North-Holland Publishing Co., Amsterdam (1976).
- Kushwaha, K.P.S., Chahal, S.M.S., Bansal, I.J.S., Chugh, O.P. and Sarojani: Serogenetic variation in four caste populations of Haryana, India. *Hum. Hered.*, 40 : 262-266 (1990).
- Mourant, A.E., Kopec, A.C. and Domaniewska-Sobczak, K. : *The Distribution of the Human Blood Groups and Other Polymorphisms*. Oxford University Press, Oxford, 2nd Edition (1976).
- Murch, R.S., Gambel, A.M. and Kearney, J.J. : A double origin electrophoretic method for the simultaneous separation of adenosine deaminase, adenylate kinase and carbonic anhydrase II. *J. Forens. Sci.*, 31 : 1349-1356 (1986).
- Papiha, S.S. and Nahar, A. : The world distribution of the electrophoretic variants of the red cell enzyme esterase D. *Hum. Hered.*, 27 : 424-432 (1977).
- Papiha, S.S., Mukherjee, B.N., Chahal, S.M.S., Malhotra, K. C. and Roberts, D.F. : Genetic heterogeneity and population structure in North-West India. *Ann. Hum. Biol.*, 9 : 235-251 (1982).
- Papiha, S.S., Chahal, S.M.S., Roberts, D.F., Murty, K.J.R., Gupta, R.L. and Sidhu, L.S. : Genetic differentiation and population structure in Kinnaur district, Himachal Pradesh, India. *Hum. Biol.*, 56 : 231-257 (1984).
- Scott, A.C. and Fowler, J.C.S. : Electrophoretic typing of glyoxalase I (GLO I) isozymes using a mixed starch/agarose gel. *Forens. Sci. Internat.*, 20 : 287-294 (1982).
- Woolley, V., Gill, P.S. and Sunderland, E. : Blood groups, haptoglobins and red cell isoenzymes of the Jat Sikhs of Ludhiana district, Punjab, India. *Hum. Hered.*, 33 : 44-51 (1983).
- Wraxall, B.G.D. and Stolorow, M.D. : The simultaneous separation of the enzymes glyoxalase I, esterase D, and phosphoglucomutase. *J. Forens. Sci.*, 31 : 1439-1449 (1986).