

Finger and Palmar Dermatoglyphic Study among the Dhimals of North Bengal, India

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ABSTRACT The study intends to explore finger and palmar dermatoglyphic pattern of Dhimals, a little known community of sub-Himalayan West Bengal, India. Bilateral finger and palm prints of 202 individuals of both sexes (in equal proportions) were studied for dermatoglyphic traits. The finger type exhibits more whorls (52.65%) followed by loops (45.25) with little sex differences. The values of different indices are: Pattern Intensity Index 15.05, Furuata's Index 116.49, Dankmeijer's Index 4.1 and Poll's Index 4.78. Total Finger Ridge Count is 162.18. The IV interdigital area is characterized by more pattern (88.73%) followed by others. Main line formula 7.5.5 is more frequent (52.94%) with 7.38 as Main Line Index. The mean value of *atd* angle was calculated 42.29°.

INTRODUCTION

Dermatoglyphics, the study of dermal ridges on finger balls, palms and soles, with its qualitative and quantitative traits which are not adaptive and free from paratypic influences, provide a pertinent area of research to human population, geneticists interested in studying variation within and between populations (Reddy and Reddy 2006). Dermatoglyphics have been used extensively to characterize and differentiate human populations, hence, are highly suitable for studying population variation. Dermatoglyphic features due to its permanency, genetic influence as well as number of easily observable and measurable characters may be considered one of the most suitable parameters for population variability. In India, several studies were done covering tribal as well as other populations from different parts of India to understand ethnic and regional differences in respect of dermatoglyphics traits. A wide range of studies and their findings may be scanned from the work of Bhasin et al. (1994), Bhasin and Walter (2001). However, such a study on Dhimal is literally absent. The present study intends to identify dermatoglyphic traits of Indian Dhimal exclusively residing in Naxalbari region of Darjeeling district, West Bengal, India.

MATERIAL AND METHODS

In India, Dhimals are confined to Naxalbari region of Darjeeling district, the terai portion of sub-Himalayan West Bengal. Altogether, 202

adult Dhimals of both sexes from Naxalbari block of Darjeeling district, West Bengal, India (in equal proportions-101 male, 101 female) were identified by random sampling and examined for dermatoglyphic traits. Rolled prints of the fingers and bilateral palmar prints were taken following standard method of Cummins and Middledo (1961). Finger and palm dermatoglyphics variables were analyzed after Cummins and Middledo (1961), finger ridge count after Holt (1968), the *a-b* ridge count after Fang (1950).

RESULTS

Finger Patterns

Overall they are characterized by highest frequency of Whorls (55.1% for male and 50.2% for female) followed by Loops (42.16% and 48.24% respectively) and Arches (2.75% and 1.57% respectively) (Table 1).

Indices

The Pattern Intensity Index (PII) is somewhat higher (15.24 for male and 14.86 for female) because of high proportion of whorls as well as loops compared to arches. For Furuata's Index, the sex difference is greater having 130.7 for male and 104.07 for female because of higher proportions of whorls than loops. The Dankmeijer's Index again exhibit sex differences having more value for male (4.98) than their female counterpart (3.13) because of comparatively higher proportion of arches for male than

Table 1: Digit wise percentage frequency of papillary patterns among the Dhimals of North Bengal

	<i>Digit</i>	<i>Side</i>	<i>Arch</i>		<i>Loop</i>		<i>Whorl</i>		
			<i>Plain</i>	<i>Tented</i>	<i>Ulnar</i>	<i>Radial</i>	<i>True</i>	<i>TL</i>	<i>CPL</i>
Male	All digits	R	1.57	0.39	41.96	0.39	33.33	4.71	17.65
		L	2.35	1.18	40.78	1.18	31.76	7.06	15.69
		R+L	1.96	0.78	41.37	0.78	32.55	5.88	16.67
	All digits, Galton type	R		1.96		42.65		55.69	
		L		3.53		41.96		54.51	
		R+L		2.75		42.16		55.1	
Female	All digits	R	0	0.78	48.24	1.18	28.24	5.88	15.69
		L	0	2.35	43.92	3.14	27.45	6.27	16.86
		R+L	0	1.57	46.08	2.16	27.84	6.08	16.27
	All digits, Galton type	R		0.78		49.41		49.8	
		L		2.35		47.06		50.59	
		R+L		1.57		48.24		50.2	
Pooled	All digits	R	0.78	0.59	42.16	0.78	30.78	5.29	16.67
		L	1.18	1.76	42.35	2.16	29.61	6.67	16.27
		R+L	0.98	1.18	43.73	1.47	30.2	5.98	16.47
	All digits, Galton type	R		1.37		45.88		52.75	
		L		2.94		44.51		52.55	
		R+L		2.16		45.2		52.65	

female. The Poll's Index again shows greater sex differences (for male 6.51 and for female 3.25) resulting from comparatively high proportion of arches as well as slightly lower proportion of loops among male than their female counterpart (Table 2).

Table 2: Value of different indice among the Dhimals of North Bengal

<i>Pattern type</i>	<i>Male</i>	<i>Female</i>	<i>Pooled data</i>
Pattern Intensity Index	15.24	14.86	15.05
Furuhata's Index	130.7	104.07	116.49
Dankmeijer's Index	4.98	3.13	4.1
Poll's Index	6.51	3.25	4.78

Total Finger Ridge Counts

The mean total finger ridge count of the population is 162.18 ± 3.38 with a wide range of 16 to 267. Males exhibit greater TFRC (168.63 ± 5.03) with much wider range (16 to 267) in comparison with their female counterparts having 155.73 ± 4.45 as mean ($\pm$ SE) and 59 to 257 as range (Table 3).

Palmer Pattern Areas

Both sexes exhibit high proportion of pattern on IV interdigital areas (88.24% for male and 89.22% for female), followed by III interdigital areas (27.45% for male and 24.51% for female) and hypothenar areas (10.78% for male and

32.35% for female). In II interdigital areas the patterns occur with lowest frequencies (1.96% for each category) (Table 4).

Main Line Formula

The 7.5.5- is predominant (49.02% for male and 56.86% for female) followed by 9.7.5- (30.39% and 20.59% respectively) and 11.9.7- (15.69% and 11.76% respectively). Other formulae (11.0.7-, 9.0.5-, 9.X.5-, 7.9.5- and 7.0.5-) are found with lesser or zero (11.X.7) percentile. Sex differences are greater having as many as 9.8 point differences for both 9.7.5- and 7.5.5- formulae of the population (Table 5).

Main Line Index

The male- female differences or bilateral differences of the population in respect of Main line index exhibit greater similarities than other traits. Overall, MLI of the population is 7.38 ± 0.1 ; for male it is 7.46 ± 0.15 and for female 7.29 ± 0.14 (Table 6).

Position of Axial Triradii

In all samples, whether it is male or female, right or left, the majority of the palms are characterized by highest frequency of single triradius *t*, at the base of the palm (77.45% for male and 56.86% for female) followed by *t'* (17.65% and 23.53% respectively) (Table 7).

Table 3: Total finger ridge count and their statistical constants among the Dhimals of North Bengal

	Range	Mean	$\pm$ S.E.	S.D.	$\pm$ S.E.	C.V.	$\pm$ S.E.
Male	16-267	168.63	5.03	50.78	3.56	30.11	2.11
Female	59-257	155.73	4.45	44.91	3.14	28.84	2.02
Total	16-267	162.18	3.38	48.25	2.39	29.75	1.47

Table 4: Percentage frequency of palmer pattern areas among the Dhimals of North Bengal

Hand		Palmer areas				
		Hypothenar	Thenar & I interdigital	II interdigital	III interdigital	IV interdigital
Male	Right	11.76	7.84	1.96	33.33	86.27
	Left	9.8	19.6	1.96	21.57	90.2
	R+L	10.78	13.73	1.96	27.45	88.24
Female	Right	33.33	3.92	1.96	27.45	90.2
	Left	31.37	5.88	1.96	21.57	88.24
	R+L	32.35	4.9	1.96	24.51	89.22
Pooled	Right	22.55	5.88	1.96	30.39	88.24
	Left	20.59	12.75	1.96	24.51	89.22
	R+L	21.57	9.31	1.96	27.45	88.73

Table 5: Percentile frequency of Main Line Formulae_ among the Dhimals of North Bengal

Hand		A			b			c		
		11.9.7	11.X.7	11.0.7	9.7.5	9.X.5	9.0.5	7.5.5	7.9.5	7.0.5
Male	Right	13.73	0	0	35.29	1.96	0	47.06	1.96	0
	Left	17.65	0	0	25.49	0	0	50.98	3.92	1.96
	R+L	15.69	0	0	30.39	0.98	0	49.02	2.94	0.98
Female	Right	9.8	0	5.88	23.53	0	1.96	54.9	1.96	1.96
	Left	13.73	0	3.92	17.65	0	5.88	58.82	0	0
	R+L	11.76	0	4.9	20.59	0	3.92	56.86	0.98	0.98
Pooled	Right	11.76	0	2.94	29.41	0.98	0.98	50.98	1.96	0.98
	Left	15.69	0	1.96	21.57	0	2.94	54.9	1.96	0.98
	R+L	13.73	0	2.45	25.49	0.49	1.96	52.94	1.96	0.98

Table 6: Main Line Index among the Dhimals of North Bengal

		Range	Mean	$\pm$ S.E.
Male	Right	5-11	7.75	0.2
	Left	5-11	7.18	0.21
	R+L	5-11	7.46	0.15
Female	Right	5-11	7.47	0.2
	Left	5-11	7.12	0.2
	R+L	5-11	7.29	0.14
Pooled	Right	5-11	7.61	0.14
	Left	5-11	7.15	0.14
	R+L	5-11	7.38	0.1

atd Angle

However, if *atd* angle is considered as a parameter, the sex or bilateral differences are minimal. The *atd* angle for pooled data is 42.29° with 42.24° for male and 42.34° for female (Table 8).

DISCUSSION

The affinity of Dhimal has not been assessed by any genetical parameters. However, literature suggests a close affinity with Mongoloid population as a part of Tibeto-Burman linguistic family. The study also finds close affinity with Mongoloid population in respect of dermatoglyphic traits. The study by Bhasin et al. (1994) suggests that among Mongoloid population from East Asia, the frequency of whorls is high (about 46%) and frequency of arches is quite low, which is also evident from present population. The frequency of whorls is as high as 52.65%, whereas for arch, it is as low as 2.16%, which in turn is exhibited by high Pattern Intensity and Furuhashi's Index as well as low Dankmeijer's and Poll's Index. Again, according to Bhasin et al. (1994), the mean value of TFRC is highest

Table 7: Percentage frequency of axial triradii t among the Dhimals of North Bengal

	Hand	t	t'	t''	tt'	tt''
Male	Right	74.51	19.61	1.96	0	3.92
	Left	80.39	15.69	1.96	0	1.96
	R+L	77.45	17.65	1.96	0	2.94
Female	Right	54.9	23.53	0	13.73	7.84
	Left	58.82	23.53	1.96	3.92	11.76
	R+L	56.86	23.53	0.98	8.82	9.8
Pooled	Right	64.71	21.57	0.98	6.86	5.88
	Left	69.61	19.61	1.96	1.96	6.86
	R+L	67.16	20.59	1.47	4.41	6.37

Table 8: atd angle among the Dhimals of North Bengal

		Range	Mean	$\pm S.E.$	S.D.	$\pm S.E.$	C.V.	$\pm S.E.$
Male	Right	33°-56°	43.04°	0.48°	4.82°	0.34	11.2	0.78
	Left	32°-55°	41.43°	0.45°	4.57°	0.32	11.03	0.77
	R+L	32°-56°	42.24°	0.33°	4.76°	0.24	11.27	0.56
Female	Right	35°-58°	42.61°	0.46°	4.62°	0.32	10.84	0.76
	Left	33°-60°	42.08°	0.47°	4.79°	0.34	11.38	0.8
	R+L	33°-60°	42.34°	0.33°	4.71°	0.23	11.12	0.55
Pooled	Right	33°-58°	42.82°	0.33°	4.72°	0.23	11.02	0.55
	Left	32°-60°	41.75°	0.33°	4.68°	0.23	11.21	0.55
	R+L	32°-60°	42.29°	0.23°	4.73°	0.17	11.18	0.39

among Mongoloid populations (Bhutanese 155.35, Tibetans 156.23), which is also evident from the present study as they have much higher TFRC (162.18), even higher than Bhutanese or Tibetans. The preponderance of 7.5.5- main line formulae over other types also suggests close affinity with Mongoloid populations. However, to make a conclusion on the topic, it needs incorporation of other morphological, genetic parameters, oral history as well as comparison of social-cultural aspects including linguistics.

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REFERENCES

- Bhasin MK, Walter H 2001. *Genetics of Castes and Tribes*. Delhi: Kamla-Raj Enterprises.
- Bhasin MK, Walter H, Danker-Hopfe H 1994. *People of India: An Investigation of Biological Variability in Ecological, Ethno-economic and Linguistic Groups*. Delhi: Kamla-Raj Enterprises.
- Cummins H, Midlo C 1961. *Finger Prints, Palms and Soles: An Introduction to Dermatoglyphics*. New York: Dover Publications.
- Fang TC 1950. A Note on the a-b Ridge Count and Intelligence. *Journal of Mental Science*, 97: 394-96.
- Holt SB 1968. *The Genetics of Dermal Ridges*. Springfield: C.C. Thomas.
- Reddy BKC, Reddy KSN 2006. A Study of Palmar Dermatoglyphics among Sugalis, a Tribal Population of Andhra Pradesh. *Anthropologist*, 8(1): 21-24.