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## PALMAR DERMATOGLYPHICS OF THE BHILS OF RAJASTHAN

*ABSTRACT — Palmar dermatoglyphics of 100 male and 100 female Bhils of Udaipur district of Rajasthan were examined. It is revealed from the present study that bilateral and sexual variations are significant for the distribution of modal types of line—D, line—A and axial triradii. Further an attempt has been made to compare and discuss the results of the present study with other available male Austroloid tribal populations.*

*KEY WORDS: Palmar dermatoglyphics — Bhils — Rajasthan.*

The importance of dermatoglyphic traits in the study of population variation and personal identification have been pointed by numerous scholars because of the fact that the configurations and details of individual ridges appear for the first time on the human fingers, palms and soles from the twelfth to sixteenth week of embryonic development and their formation completes by the twenty fourth week. The ridges, thus formed remained unchanged throughout the life of the individual. In the present study an attempt has been made to investigate the palmar dermatoglyphics of the Bhils of Rajasthan. The finger dermatoglyphics of the Bhils have already been reported by the present author elsewhere (1984).

### MATERIAL AND METHODS

A total of two hundred bilateral palmar prints on Bhils (100 males and 100 females) were collected from various schools and surrounding areas of Kherwara Tehsil of Udaipur district of Rajasthan. All care was taken to avoid related individual. The prints were collected by ink-pad method. The analysis of data was done according to Cummins and Midlo (1961).

### RESULTS AND DISCUSSION

Table 1 displays the occurrence of Wilder's three principal main line formulae. It is evident from table that the formula 11.9.7.—occurs more frequently on the right palms compared to its occurrence on left palms in both the sexes of Bhils 60.0 per cent and 49.0 per cent, whereas the formula 7.5.5.—occurs more frequently on left palms in both the sexes of Bhils 21.0 per cent and 23.0 per cent respectively. The bilateral variation for the distribution of Wilder's three principal main line formulae are statistically significant for Bhil males and non-significant for Bhil females, whereas the sexual variations are noticed as statistically non-significant.

It is observed from Table 2, that for modal types of line-D, MT-11 occurs most frequently on right palms in both the sexes. MT-9 and MT-7 occurs more frequently on the left palms than the right in the two sexes of Bhils. Bilateral variation for the occurrence of different modal types of line-D is observed to be significant both for Bhil males and Bhil females, where the sexual variation also show significant values for the distribution of three modal types of line-D. Similarly for modal types of line-A, MT-5 occurs more frequently on the right palms in both the sexes,

TABLE 1. Percentage distribution of Wilder's three principal main line formulae among 100 Bhil males and 100 Bhil females

Wilder's three principal main line formulae	Bhil males			Bhil females		
	R	L	R+L	R	L	R+L
a) 11.9.7.—	60.0	37.0	48.5	49.0	35.0	42.0
b) 9.7.5.—	12.0	26.0	19.0	19.0	17.0	18.0
c) 7.5.5.—	18.0	21.0	19.5	14.0	23.0	18.5
d) Rest	10.0	16.0	13.0	18.0	25.0	21.5
Total	100.0	100.0	100.0	100.0	100.0	100.0

N.B. a) = 11.9.5., 11.×.7., 11.0.7.—  
b) = 9.7.5., 9.×.5., 9.0.5.—  
c) = 7.5.5., 7.×.5., 7.0.5.—

Chi-square for bilateral differences:

Bhil males = 10.8114 df = 2  
.01 >  $\phi$  > .001; significant

Bhil females = 0.3346 df = 2  
.90 >  $\phi$  > .80; non-significant

Chi-square for sexual differences:  
= 0.1737 df = 2  
.95 >  $\phi$  > .90: non-significant

TABLE 2. Percentage distribution of three model types formulae of line-D among 100 Bhil males and 100 Bhil females

Three model types	Bhil males			Bhil females		
	R	L	R+L	R	L	R+L
a) MT-11	68.0	48.0	58.0	53.0	38.0	45.5
b) MT- 9	14.0	31.0	22.5	33.0	39.0	36.0
c) MT- 7	18.0	21.0	19.5	14.0	23.0	23.5
Total	100.0	100.0	100.0	100.0	100.0	100.0

N.B. a) = includes position = 11, 12, 13  
b) = includes position = 9 and 10  
c) = includes position = 7, 8, × and 5

Chi-square for bilateral differences:

Bhil males = 10.1820 df = 2  
.01 >  $\phi$  > .001; significant

Bhil females = 5.1977 df = 2  
.10 >  $\phi$  > .05; significant

Chi-square for sexual differences:  
= 19.3665 df = 2  
 $\phi$  > .001; significant

whereas MT-3 occurs more frequently on the left palms than the right in the two sexes of Bhils. Bilateral variations are observed as non-significant for this trait, whereas the sexual variation is observed to be statistically significant (Table 3).

Table 4 shows the ridge alignment of four palmar main lines. It is evident that in both the sexes line-D terminates more often at position 11 on right palms than on the left. The gradation order of the

TABLE 3. Percentage distribution of three modal types formulae of line-A among 100 Bhil males and 100 Bhil females

Three model types	Bhil males			Bhil females		
	R	L	R+L	R	L	R+L
a) MT-5	43.0	38.0	40.5	51.0	45.0	48.0
b) MT-3	56.0	61.0	58.5	49.0	55.0	52.0
c) MT-1	1.0	1.0	1.0	0.0	0.0	0.0
Total	100.0	100.0	100.0	100.0	100.0	100.0

N.B. a) includes position = 5, 6, 5" and 5'  
b) includes position = 4 and 3  
c) includes position = 2 and 1

Chi-square for bilateral differences:

Bhil males = 0.5244 df = 2  
.80 >  $\phi$  > .70: non-significant

Bhil females = 0.7416 df = 2  
.50 >  $\phi$  > .30: non-significant

Chi-square for sexual differences:  
= 4.4863 df = 2  
.05 >  $\phi$  > .02: significant

TABLE 4. Percentage distribution of termination of individual main lines among 100 Bhil males and 100 Bhil females

Main lines and their terminations	Bhil males			Bhil females		
	R	L	R+L	R	L	R+L
Line-D						
11	68.0	48.0	58.0	53.0	38.0	45.5
9	14.0	31.0	22.5	33.0	39.0	36.0
7	18.0	21.0	19.0	14.0	23.0	18.5
Total	100.0	100.0	100.0	100.0	100.0	100.0
Line-C						
11	3.0	0.0	1.5	0.0	0.0	0.0
9	60.0	36.0	48.0	54.0	49.0	51.5
7	17.0	38.0	27.5	25.0	21.0	23.0
5"	17.0	21.0	19.0	15.0	21.0	18.0
0	3.0	5.0	4.0	6.0	9.0	7.5
Total	100.0	100.0	100.0	100.0	100.0	100.0
Line-B						
9	3.0	1.0	2.0	0.0	0.0	0.0
7	65.0	47.0	56.0	52.0	41.0	46.0
5"	30.0	46.0	48.0	39.0	57.0	48.0
5'	2.0	6.0	4.0	8.0	2.0	5.0
3	0.0	0.0	0.0	1.0	0.0	0.5
Total	100.0	100.0	100.0	100.0	100.0	100.0
Line-A						
5"	8.0	2.0	5.0	5.0	1.0	3.0
5'	35.0	36.0	35.5	46.0	44.0	45.0
3	56.0	61.0	58.5	49.0	55.0	52.0
1	1.0	1.0	1.0	0.0	0.0	0.0
Total	100.0	100.0	100.0	100.0	100.0	100.0

termination of line-C for right and left palms among the Bhil males is 9 > 7 > 5" and 7 > 9 > 5" respectively, whereas among the female Bhils, it is 9 > 7 > 5" and 9 > 7 > 5" for right and left palms respectively. The line-B, terminates at position 7 more often on right palms than on the left in both the sexes. Line-A, terminates more frequently at position 3 in both the sexes of the Bhils.

Table 5 lists the distribution of main line index values among the Bhils. It is observed that the bilateral

TABLE 5. Frequency distribution of main line index among 100 Bhil males and 100 Bhil females

Main line index	Bhil males			Bhil females		
	R	L	R+L	R	L	R+L
5	14	18	32	12	15	27
7	13	25	38	24	31	55
8	1	0	1	0	1	1
9	36	32	68	26	26	52
10	1	0	1	0	1	1
11	27	23	50	33	26	59
12	8	2	10	5	0	5
Total	100	100	200	100	100	200

Right = mean  $\pm$  S.E = 8.95  $\pm$  0.20  
Left = mean  $\pm$  S.E = 8.39  $\pm$  0.22  
Left + Right = mean  $\pm$  S.E = 8.63  $\pm$  0.14  
Right = mean  $\pm$  S.E = 8.85  $\pm$  0.21  
Left = mean  $\pm$  S.E = 8.30  $\pm$  0.21  
Left + Right = mean  $\pm$  S.E = 8.57  $\pm$  0.15

t = values for bilateral differences:

Bhil male = 1.94 : significant  
Bhil female = 1.55 : non-significant

t = values for sexual differences

TABLE 6. Percentage distribution of types and combinations of axial triradii among 100 Bhil males and 100 Bhil females

Types	Bhil males			Bhil females		
	R	L	R+L	R	L	R+L
t	80.0	78.0	79.0	80.0	69.0	74.5
t'	1.0	4.0	2.5	10.0	13.0	11.5
t"	5.0	4.0	4.5	3.0	4.0	3.5
tt	0.0	0.0	0.0	0.0	1.0	0.5
tt'	13.0	11.0	12.0	2.0	9.0	5.5
tt"	1.0	3.0	2.0	5.0	4.0	4.5
Total	100.0	100.0	100.0	100.0	100.0	100.0

Chi-square for (t) and (t') and (t'') for bilateral differences:

Bhil males = 7.9256 df = 2  
.05 >  $\phi$  > .02: significant

Bhil females = 1.0750 df = 2  
.70 >  $\phi$  > .50: non-significant

Chi-square for (t), (t') and (t'') for sexual differences:

= 12.9147 df = 2  
.01 >  $\phi$  > .001: significant

variations are statistically significant for Bhil males and non-significant for Bhil females. The values of main line index are observed more in the right palms than the left palms in both the sexes of Bhils.

From Table 6 it is observed that axial triradius t preponderates both in male and female Bhils. The incidence of t is invariably more on the right palms 80.00 per cent in each sex of the Bhils. The next in order of preponderance is tt' among the male Bhils 11.00 per cent and t' among the female Bhils 11.50 per cent. Bilateral variations for the occurrence of axial triradii are statistically significant among the male Bhils and non-significant among the female Bhils, whereas the sexual variation is observed to be significant for this trait.

TABLE 7. Percentage distribution of patterns on five palmar configurational areas among the 100 Bhil males and 100 Bhil females

Area	Presence (+) or absence (-) of patterns	Bhil males			Bhil females		
		R	L	R+L	R	L	R+L
Hypothenar	+	28.0	27.0	27.5	30.0	32.0	31.0
	—	72.0	73.0	72.5	70.0	68.0	69.0
then-I int.	+	9.0	20.0	14.5	13.0	15.0	14.0
	—	91.0	80.0	85.5	87.0	85.0	84.0
II int.	+	8.0	3.0	5.5	4.0	2.0	3.0
	—	92.0	93.0	94.0	96.0	98.0	97.0
III int.	+	64.0	36.0	50.0	55.0	49.0	52.0
	—	36.0	64.0	50.0	45.0	51.0	48.0
IV int.	+	44.0	76.0	60.0	63.0	67.0	65.0
	—	56.0	24.0	40.0	37.0	33.0	35.0

Table 7 shows the high frequency of patterns in IVth interdigital area of Palm, 60.00 per cent in male Bhils and 65.00 per cent in female Bhils, followed by IIIrd interdigital area 50.00 per cent and 52.00 per cent, hypothenar area 27.5 per cent and 31.0 per cent, and then (Ist interdigital area 5.50 per cent and 3.50 per cent in male Bhils and female Bhils respectively). The bilateral variation for the occurrence of patterns in the five palmar configurational areas are found to be statistically significant except IInd interdigital area in male Bhils, whereas in female Bhils bilateral variations are observed to be non-significant for all the five palmar configurational areas. The sexual variation is observed to be non-significant except IIIrd interdigital area, (Table 8).

Comparison of Bhil males with other available Austroloid male tribal populations with respect of the distribution of Wilder's three principal main line formulae (Table 9) shows resemblance with the Munda (Mahapatra 1970), the Raj Gond, the Murias, the Halbas, the Batras (Sharma, 1970), whereas they differ from the Santal (Chakravartti 1960), the Sabara (Chakravartti 1963), the Paniya, the Kurumba,

TABLE 8. Chi-square test of significance for bilateral and sexual differences among 100 Bhil males and 100 Bhil females for various palmar configurational areas. *df* = 1

Area	Chi-square values for bilateral differences among Bhil males	Chi-square values for bilateral differences among Bhil females	Chi-square values for sexual differences (Bhil males and Bhil females)
Hypothenar then-I int.	0.0191: .90 > $\phi$ > .80 N.S	0.0934 .80 .70 N.S	0.5929 .50 > $\phi$ > .30 N.S
II int.	4.9808: .05 > $\phi$ > .02 N.S	0.1662 .50 .30 N.S	0.0206 .90 > $\phi$ > .80 N.S
III int.	2.4906: .20 > $\phi$ > .10 N.S	0.7003 .50 .30 N.S	1.6578 .20 > $\phi$ > .10 N.S
IV int.	15.8917: $\phi$ < .001 N.S	0.6912 .50 .30 N.S	10.0511 .01 > $\phi$ > .001 N.S
	22.8028: $\phi$ < .001 N.S	1.6482 .20 .10 N.S	1.0673: .50 > $\phi$ > .30 N.S

TABLE 9. Distribution of palmar main line formulae among the various Austroloids

Tribal Male Populations						
Tribes	Number studied	Palmar Main Line Formulae			Investigator	Chi-square values
		11.9.7.—	9.7.5.—	7.5.5.—		
Santal	62	24.4	11.4	33.3	Chakravartti (1960)	18.1971
Munda	65	26.2	17.4	15.4	Mahapatra (1970)	3.1673*
Sabara	54	22.1	16.4	27.9	Chakravartti (1963)	12.5427
Raj Gond	50	18.0	15.0	18.0	Sharma (1970)	7.0639
Muria	20	25.0	7.5	17.5	Sharma (1970)	1.6667*
Halbas	18	30.5	16.6	19.4	Sharma (1970)	0.9585*
Batras	20	27.5	12.5	22.5	Sharma (1970)	2.2586*
Paniya	138	39.1	17.0	22.5	Chakravartti (1961)	3.3871*
Kurumba	134	36.0	18.4	28.7	Chakravartti (1961)	9.2985
Kota	124	54.9	9.7	5.6	Chakravartti (1961)	39.1143
Irula	170	34.1	14.0	24.8	Chakravartti (1961)	7.2102
Kadar	80	13.2	19.5	40.3	Chakravartti (1959)	49.1610
Uralis	60	26.0	21.0	40.0	Chatterjee (1960)	108.6805
Bhils	100	48.5	19.0	19.0	Present study	—

\* Non-significant at 5% level.

the Kota, the Irula (Chakravartti 1961), the Kadar (Chakravartti 1959) and the Urali (Chatterjee 1960). However it is not possible, on the basis of single trait, to conclude the association of the Bhils with other ethnic groups (tab. 9). An elaborate investigation of other genetic traits may help to understand the exact affiliation of the Bhils with other Austroloid populations.

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