

The Symmetry of the Plantar Main Line Formula in an Indian Population

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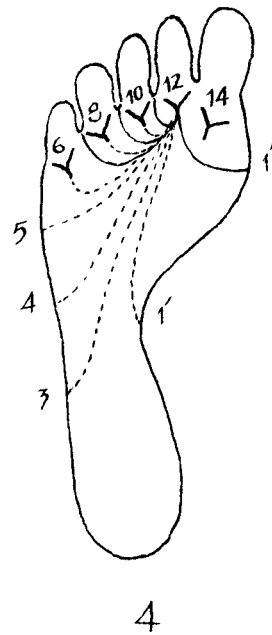
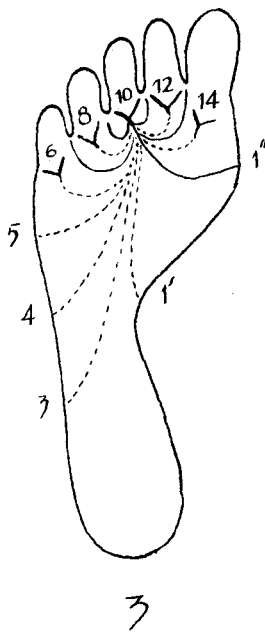
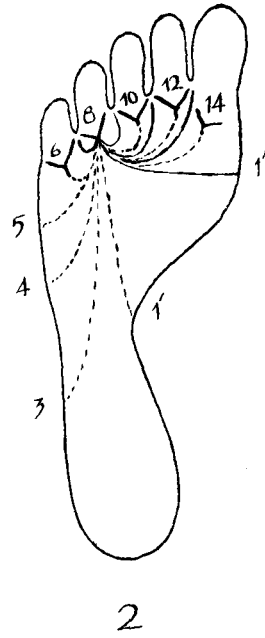
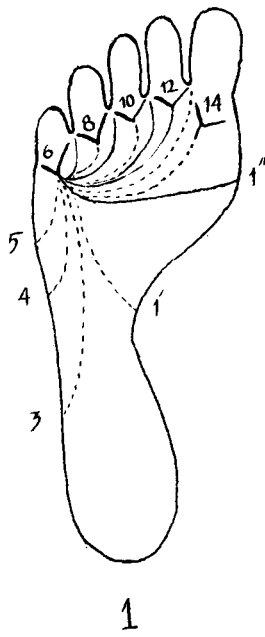
Symmetry of various traits, as based upon the right/left combination in the same individual, has been studied by numerous investigators in the field of anthropology. To denote the symmetry and asymmetry of dermatoglyphics, as of other features, these authors tend to use widely different terminologies. Kirchmair (1935) employed the terms relative and absolute symmetry in his investigation of finger-ball patterns. Cummins and Midlo (1927) and Oetting (1949) attempted a similar method for their finger dermatoglyphic data. Geipel (1952), while conducting studies on the plantar prints of twins has used the term *Konkordanz* for describing the symmetry of pattern types.

The studies on symmetry in various populations and in both sexes have revealed interesting results. Henckel (1933) has studied the symmetry of homologous finger prints of Chilean males and females and has compared the results with Germans investigated by Gruneberg. In both samples, females tend to show a higher incidence of symmetry than males. Meyer-Cording's (1955) data on the modal types of palmar main lines of German males and females also show similar results, as well as those of Sharma (1960) on the Burman males and females.

In the present investigation, the right/left symmetry of the plantar main line formula has been studied in order to determine whether the symmetry exhibited by Panjabi males and females is statistically significant.

Material and method

The data consist of bilateral plantar prints of 125 male and 125 female individuals from Panjab (India) collected at random. The technique followed in the printing of subjects and the analysis of data is generally consistent with Cummins and Midlo (1961), except slight modifications found necessary by the author (1961) in recording the prints. For studying the symmetry of plantar main line formula, all 14 terminations of the main lines, from 1 to 14, have been directly compared (Figs. 1 to 4). Chi-



Figs. 1-4. Possible courses of the plantar main lines D, C, B and A. Dark lines indicate more common terminations, while dotted lines indicate terminations of rare occurrence

square values have been obtained from Woolf's G-tables (1956-57), and probability levels ascertained from Fisher and Yates (1953). Errors have been calculated after Bernoulli's formula ($E = \sqrt{p \frac{1-p}{n}}$). Use has been made of nomenclatural symbols S and A (Sharma, 1960).

Results

The incidence of symmetry and asymmetry of the plantar main line formula, in terms of right/left combination of the same individual, has been shown in Table 1.

Tab. 1. Frequency distribution of symmetry and asymmetry of plantar main line formula in Panjabi Indians

S. no.	Category	Combination of S and A in the order D.C.B.A.	Frequency	
			♂ (125)	♀ (125)
1	4S + 0A	S S S S	53 (42.4% ± 4.41)	66 (52.8% ± 4.46)
2	3S + 1A	S S S A	5	2
		S S A S	9	8
		S A S S	3	5
		A S S S	—	—
3	2S + 2A	S S A A	6	7
		A A S S	3	2
		S A A S	11	12
		A S S A	1	3
		S A S A	1	2
		A S A S	1	2
4	1S + 3A	S A A A	16	12
		A S A A	3	2
		A A S A	2	—
		A A A S	3	1
5	0S + 4A	A A A A	8 (6.4% ± 2.18)	1 (0.8% ± 0.79)
1 to 5	Total		125	125

The various combinations of symmetry (S) and asymmetry (A), five in all, ranging from SSSS to AAAA have been displayed separately for males and females. The five combinations are as shown here at right:

- 1) 4S + 0A
- 2) 3S + 1A
- 3) 2S + 2A
- 4) 1S + 3A
- 5) 0S + 4A

The expression 4S + 0A (four S plus zero A) means that all four main lines in the order DCBA show symmetric occurrence and as such there is absolutely no asymmetry. On the other hand, 0S + 4A implies the asymmetry of all four plantar main lines. The incidence of complete symmetry in the main line formula is more common in females (52.8%). Conversely, the absolute asymmetry is more preponderant in Panjabi males (6.4%) than in females (0.8%). It is interesting to note that the differences displayed by males and females in total symmetry and asymmetry (Tab. 1a) are statistically significant ($\chi^2 = 7.339$; DF = 1 : 0.01 > P > 0.001).

Tab. 1a

Group	♂	♀	Total
Total symmetry	53	66	119
Total asymmetry	8	1	9
Total	61	67	128
$\chi^2 = 7.339$	DF = 1	0.01 > P > 0.001	

In the rest of males (51.2%) and females (46.4%), both symmetry and asymmetry as expressed in terms of 3S + 1A, 2S + 2A and 1S + 3A, are noticed in varying degrees. Tab. 1b shows that the statistical differences between males and females,

Tab. 1b

Combination	♂	♀	Total
S S S S	53	66	119
Rest	72	59	131
Total	125	125	250
$\chi^2 = 2.715$	DF = 1	0.10 > P > 0.05	

taking on the one hand total symmetry and, on the other, rest of the combinations, are of doubtful significance ($\chi^2 = 2.715$: DF = 1 : $0.10 > P > 0.05$).

These five categories of combinations can further be simplified into three groups in order to assess the relative preponderance of symmetry and asymmetry in the plantar main line formula. These three groups are:

- 1) S greater than A
- 2) S equal to A
- 3) S less than A

From a study of Tab. 2, it is indicated that the frequency of S greater than A (1) far exceeds the incidence of S less than A (3) in both males and females, whereas the condition S equal to A (2) is presented by a small fraction of individuals. Com-

Tab. 2. Frequency distribution of plantar symmetry and asymmetry according to three groups in Panjabi Indians

S. no.	Group	♂	♀
1	S > A 4S + 0A	53	66
	3S + 1A	17	15
Total		70 (56.0% ± 4.44)	81 (64.8% ± 4.27)
2	S = A 2S + 2A	23 (18.4% ± 3.46)	28 (22.4% ± 3.72)
3	S < A 1S + 3A	24	15
	0S + 4A	8	1
Total		32 (25.6% ± 3.79)	16 (12.8% ± 3.00)
Grand total		125 (100.0%)	125 (100.0%)

paring the figures sex-wise, there appears a preponderance of symmetry over asymmetry in females (64.8%) as compared to males (56.2%). Conversely, the frequency of asymmetry over symmetry is twice as common in males (25.6%) than in females (12.8%). The condition S equal to A, in which the two main lines show symmetry and the other two asymmetry, exhibits a greater frequency in females (22.4%) than in males (18.4%). On the whole, taking into account all three conditions simulta-

neously, it is evident that the occurrence of symmetry in the plantar main line formula far exceeds that of asymmetry, and that females show a higher incidence than males.

Tab. 2a appears to corroborate statistically the findings reached by a study of Tab. 2. From this table it is observed that the differences between males and females

Tab. 2a

S. no.	Group	♂	♀	Total
1	S>A	70	81	151
2	S = A	23	28	51
3	S>A	32	16	48
Total		125	125	250
$\chi^2 = 6.729$		DF = 2	0.05 > P > 0.02	

in the symmetry and asymmetry of plantar main lines, as shown by the three groups S>A, S = A and S<A are statistically significant ($\chi^2 = 6.729$: DF = 2 : 0.05 > P > 0.02).

Summary

The plantar dermatoglyphic prints of 125 male and 125 female Panjabi Indians have been studied in order to determine the relative incidence of symmetry and asymmetry.

Females tend to possess a higher degree of symmetry than males. On the contrary, asymmetry shows a preponderance in males.

The differences between males and females are statistically significant when total symmetry is compared to total asymmetry, or when a comparison is made between the three groups of S and A. However, when the total symmetry and the rest of the combinations taken together are studied statistically, the differences appear to be of doubtful significance.

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RIASSUNTO

Sono state studiate le impronte plantari degli Indiani Panjabi (125 maschi e 125 femmine) al fine di determinare l'incidenza relativa di simmetria ed asimmetria. Le donne tendono a presentare un più alto grado di simmetria degli uomini, mentre in questi ultimi risulta predominante l'asimmetria. Le differenze fra uomini e donne sono statisticamente significative quando la simmetria totale venga raffrontata all'asimmetria totale, o quando venga fatto un raffronto fra i tre gruppi di S ed A, ma appaiono di dubbia significatività quando si studino statisticamente la simmetria totale ed il resto delle combinazioni nel loro insieme.

RÉSUMÉ

Les empreintes plantaires des Indiens Panjabi (125 mâles et 125 femelles) ont été étudiées dans le but de déterminer l'incidence relative de la symétrie et de l'asymétrie. Les femelles tendent à présenter un degré de symétrie plus élevé que les mâles, tandis que ces derniers présentent une prépondérance d'asymétrie. Les différences entre mâles et femelles sont statistiquement significatives, si comparées à la symétrie totale, ou si l'on compare les trois groupes de S et A, mais sont assez douteuses si l'on étudie statistiquement la symétrie totale avec le reste des combinaisons dans leur ensemble.

ZUSAMMENFASSUNG

Es wurden die Fußsohlenabdrücke der Panjabi-Inder (125 männliche und 125 weibliche Probanden) untersucht, um die relative Häufigkeit von Symmetrie und Asymmetrie festzustellen. Die Frauen neigen zu einer höheren Symmetrie als die Männer, bei welchen hingegen die Asymmetrien vorwiegen. Die Unterschiede zwischen Männern und Frauen sind statistisch be-

deutend, wenn man der gesamten Symmetrie die gesamte Asymmetrie, oder auch die drei Gruppen S A untereinander gegenüberstellt. Sie erscheinen aber von zweifelhafter Bedeutung, wenn man die gesamte Symmetrie und die übrigen Kombinationen zusammengenommen statistisch untersucht.