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SEXUAL VARIATION IN THE FINGERPRINTS OF AUSTRALIAN ABORIGINES *

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SUMMARY

Sexual variation in fingerprint types and pattern size, as measured by total ridge counts, has been examined in a sample of 84 Australian aborigines and compared with other populations. As it generally happens in a population, total ridge counts have been found to be higher in males than females on account of (1) the males' higher frequency of whorls and lower frequency of loops, and (2) the males' larger whorl counts. The higher incidence of arches in females than males has also been found to play a role.

INTRODUCTION

Among the various metrical characters that are found in humans, fingerprint pattern size, as measured by total ridge count, is unique because of its high heritability. The total ridge count varies from individual to individual, and also, to some extent, from one ethnic group to another. Both family and twin studies clearly indicate that the variations are almost exclusively determined genetically, the environmental component being very little; they may be accounted for by perhaps a comparatively small number of additive autosomal genes (Holt 1961). One aspect of total ridge count that merits further investigation is concerned with its sexual variation.

The material for the present study was taken from the author's earlier study of finger and palm prints of the Australian aborigines reported elsewhere (Rao 1964) and concerning 44 male and 40 female adults. Conventional methods, as prescribed by Cummins and Midlo (1943), were used for the analysis of fingerprints and the ridge counts were computed as suggested by Holt (1968).

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RESULTS AND DISCUSSION

Table I shows the sexual differences in percentage frequencies of the four main pattern types and the mean total ridge counts for the Australian aborigines and three other ethnic groups for comparison. Table II shows the mean ridge count of a whorl and a loop by sex and digit among the Australian aborigines. Table III gives a summary of the results comparing the overall mean ridge counts in the two sexes according to pattern type among the Australian aborigines and two other ethnic groups for comparison.

TABLE I

PATTERN TYPES AND MEAN TOTAL RIDGE COUNTS IN DIFFERENT POPULATIONS

Population	Sex	No.	Pattern types in % [a]				Mean total ridge count	Author
			A	R	U	W		
Australian aborigines	M	44	0.45	1.13	35.08	64.82	160.40	Present study
	F	40	2.00	1.25	33.00	64.75	148.00	
Japanese	M	200	1.70	3.30	45.60	49.50	150.80	Matsunga et al. 1968
	F	200	1.90	2.60	53.20	42.40	139.20	
French	M	82	7.20	5.10	55.20	32.40	129.40	Matsunga et al. 1968
	F	73	7.40	2.20	58.60	31.10	124.20	
British	M	500	4.30	5.90	61.50	28.30	145.00	Holt 1955, 1964
	F	500	5.70	4.80	65.40	23.90	127.20	

[a] A = arch, R = radial loop, U = ulnar loop, W = whorl.

TABLE II

MEAN RIDGE COUNT OF A WHORL AND A LOOP AMONG THE AUSTRALIAN ABORIGINES

Pattern type	Sex	Digits					
		I	II	III	IV	V	All
Whorl	M	20.26	16.28	17.17	17.38	16.66	17.55
	F	16.90	15.53	17.28	17.42	14.76	16.37
Ulnar loop	M	16.13	9.97	13.64	14.27	13.56	13.51
	F	15.52	10.31	11.53	16.58	11.70	13.13
Radial loop	M	—	12.00	10.00	—	—	11.00
	F	—	—	10.00	8.00	8.00	8.66

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TABLE III

MEAN RIDGE COUNT PER DIGIT ACCORDING TO PATTERN TYPES IN DIFFERENT POPULATIONS

Population	Sex	No.	Mean ridge count per digit			Author
			R	U	W	
Australian aborigines	M	44	11.00	13.51	17.55	Present study
	F	40	8.66	13.13	16.37	
Japanese	M	200	9.80	12.10	18.60	Matsunga et al. 1968
	F	200	9.50	11.90	17.40	
French	M	82	9.70	12.30	17.40	Matsunga et al. 1968
	F	73	10.10	10.10	16.20	

It is seen from Table I that in all three or four groups whorls are more common in males than females, while ulnar loops are more common in females than males. As regards arches and radial loops there also are some sexual variations in their respective frequencies but their extent is comparatively small. Females having slightly more arches than males, and arches having by definition no ridge count, this causes a larger total ridge count in males than females, which especially applies to the Australian aborigines. It is clear from Table I that the mean difference between males and females in the total ridge count varies from group to group: it is about 18 for the British, 11 for the Japanese, and only about 5 for the French. In the case of the Australian aborigines it is about 12. As pointed out by Holt (1961) the sexual variation in fingerprints may be regarded not as a direct genetic effect, but rather as due to some physiological effect acting during early embryonic development, although the precise nature of its underlying mechanism is not clear.

Since whorls have generally higher ridge counts than loops, higher incidence of whorls and lower incidence of loops in males than in females should make a significant contribution towards higher total ridge count in males than in females. However, in order to see the sexual variation in total ridge count within a particular pattern, whorls and loops have been examined on each digit in the two sexes (Table II). Among the Australian aborigines it is clear that whorls of males have on the average a larger ridge count than those of females, while no such difference was found for loops. The situation remains essentially the same even if the whorls are divided into typical true whorls and composites. Therefore it may be said that taking a particular pattern on any digit, the higher ridge count in males than females is only related with whorls and not with loops. In populations such as the French and the Japanese, the tendency was quite the same as found among the Australian aborigines with regard to the mean ridge count per digit according to pattern type (see Table III).

There are thus two major factors contributing to the larger ridge count of males than females in a given population, i.e., (1) the higher frequency of whorls and lower frequency of ulnar loops in males on an average, and (2) the larger ridge count of

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whorls in males than females. Sometimes the high incidence of arches in females may contribute to the males' larger total ridge count, as is true in the present series of Australian aborigines.

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Riassunto

La variabilità sessuale delle impronte digitali è stata esaminata in un campione di 84 aborigeni australiani raffrontato con altre popolazioni. Come si verifica in genere in una popolazione, il numero totale delle creste è risultato più elevato nei maschi che nelle femmine a causa (1) della maggiore frequenza di vortici e minore frequenza di anse nei maschi e (2) dei più elevati conteggi nei vortici dei maschi. È stata anche riscontrata una maggiore frequenza di archi nelle femmine che nei maschi.

Résumé

La variabilité sexuelle des empreintes digitales a été examinée dans un échantillon de 84 aborigènes australiens comparé avec d'autres populations. Comme il se vérifie généralement dans une population, le nombre total des crêtes a été trouvé plus élevé chez les hommes par rapport aux femmes à cause (1) d'une fréquence plus élevée de tourbillons et moins élevée de boucles chez les hommes et (2) d'un plus élevé nombre de crêtes dans les tourbillons des hommes. Un rôle est aussi joué par une fréquence d'arcs plus élevée chez les femmes.

Zusammenfassung

An einem Muster von 84 australianischen Eingeborenen wurden bei beiden Geschlechtern die Fingerabdrücke untersucht und die Ergebnisse mit anderen Bevölkerungen verglichen. Wie allgemein bei einer Bevölkerung war die Gesamtzahl der Hautleisten bei den männl. Individuen höher als bei den weibl. und zwar weil (1) Männer mehr Wirbel und weniger Schleifen aufweisen, (2) die Wirbel bei Männern zahlreichere Leisten haben. Ein Rolle spielt dabei auch, dass Bögen bei Frauen häufiger vorkommen als bei Männern.

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