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Finger Dermatoglyphics of Australian Aborigines in the Northern Territory of Australia

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Fingerprints of 114 Australian Aboriginal males and 90 females have been analyzed. Whorls are more frequent in males (56.7%) than in females (51.2%) and loops are less frequent in males (42.6%) than in females (47.0%). The index of pattern intensity displays a higher value in males (15.60) than in females (14.94). The bimanual differences both in males and females are not statistically significant for the occurrence of patterns on the digits of the right and left hands. Also the difference between both sexes for the occurrence of patterns is not statistically significant. Incidences of actual symmetry on homologous digits represented 74.0% in males and 77.3% in females. The mean total ridge counts showed 156.65±43.32 (M±SD) in males and 148.69±43.64 (M±SD) in females, respectively. Conclusively, this study represents that the Australian Aborigines conform closely to the Polynesians in finger dermatoglyphics.

Australian Aboriginal dermatoglyphics has been examined according to different populations. Studies have been made of the Australian Aborigines at West Arnhem Land (Macintosh, 1952), Kalumburu Mission in Western Australia (Rao, 1964) and Yuendumu Settlement in Central Australia (Rao, 1965). From the articles above, we see that the Australian Aborigines have the highest whorl frequencies and relatively low frequencies of loops and arches.

Dermatoglyphics of the Australian Aborigines has been neglected for decades since Rao (1965). In this paper, the various characteristics of finger dermatoglyphics of the Australian Aborigines are qualitatively and quantitatively described. The everlasting increases of admixed blood have affected dermatoglyphics of the living Maoris in New Zealand. In view of human migration and blood, the degree of racial mixture of the living Aborigines would be confirmed as an example of Maori (Cho, 1998a).

Materials and Methods

The samples consist of 204 Australian Aborigines in the Northern Territory of Australia, 114 males and 90 females, respectively, supplied by the Northern Territory Central Police Station, Darwin, Australia. The fingerprints were impressed in ink and personal records except sex were not provided. The methods used in analysing, formulating and interpreting the fingerprint patterns were those described by Cummins and Midlo (1961). The classification of the fingerprint pattern types is modified from the Henry system (Henry, 1900). Lateral pocket loops, twin loops, central pockets and accidentals were counted as whorls. Radial and ulnar loops were counted separately. Together with plain and tented arches, other forms which simulate diminutive loops were classified as arches. The frequencies of pattern types, the pattern indices and the total ridge count (TRC) have been examined for males and females. Computed chance symmetry and actual symmetry of finger pattern types are compared in the percentages for males and females.

Results

Percentages of the fingerprint pattern types on different digits separately, as well as on both hands, are listed in Table 1 for males and Table 2 for females, respectively.

It has been observed that whorls (56.7%) are more abundant than loops (42.6%) in males (Tables 1 and 3). Females exhibit a bit higher frequency of whorls (51.2%) and lower frequency of loops (47.0%) (Tables 2 and 3). The frequency of ulnar loops (41.6%) and arches (0.8%) are lower in males than in females, who show them as 45.3% and 1.7%, respectively. Radial loops are absent in the third, fourth and fifth digits of both hands for males and females. Simple whorls are nearly eighteen times as lateral pockets, central pockets, twin loops and accidentals combined in males and eleven times in females (Tables 1 and 2). Distribution of the finger pattern types exhibits statistically insignificant variations ($P>0.05$) between both sexes (Table 3).

The mean values of Dankmeijer's index, pattern

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Table 1. Frequencies (%) of the fingerprint pattern types in the Australian male Aborigines (N=114)

Digit	Side	Arches		Loops		Whorls			
		Plain	Tented	Ulnar	Radial	Simple	Lateral pocket + Twin loop	Central pocket	Accidental
I	R	0.9	-	56.1	-	38.6	4.4	-	-
	L	1.8	-	63.2	0.9	28.9	5.3	-	-
	R+L	1.3	-	59.7	0.5	33.8	4.8	-	-
II	R	0.9	-	23.7	7.0	63.2	4.4	0.9	-
	L	2.6	0.9	29.8	1.8	62.3	2.6	-	-
	R+L	1.8	0.5	26.8	4.4	62.7	3.5	0.4	-
III	R	-	-	36.0	-	62.3	1.8	-	-
	L	-	-	32.5	-	66.7	0.4	-	-
	R+L	-	-	34.2	-	64.5	1.3	-	-
IV	R	-	-	14.0	-	85.1	0.9	-	-
	L	-	-	26.3	-	67.5	6.1	-	-
	R+L	-	-	20.2	-	76.3	3.5	-	-
V	R	-	-	60.5	-	38.6	0.9	-	-
	L	0.9	-	73.7	-	23.7	1.8	-	-
	R+L	0.4	-	67.1	-	31.1	1.3	-	-
All digits	R	0.4	-	38.1	1.4	57.5	2.5	0.2	-
	L	1.1	0.2	45.1	0.5	49.8	3.3	-	-
	R+L	0.7	0.1	41.6	1.0	53.7	2.9	0.1	-

intensity index (PII) and Furuhata's index exhibit 2.37, 15.28 and 120.54 in the total samples in order, respectively (Table 3). Incidences of chance and actual symmetry represent 55.6% and 75.7% in the total samples in order, respectively (Table 4).

The variation of the TRC for males ranged from 91 to 250 ridges but for females from 78 to 230 ridges. Mean ridge count for each individual displays 15.2 in males 12.5 in females for loops, and 17.0 in males and 16.0 in females for whorls. The highest means are those for digits I of right hands in males and digits IV of right hands in females. The lowest ridge count occurs on digits V of right hands in males and digits V of left hands in females, respectively (Table 5).

Discussion

No one knows how long the Australian Aborigines have lived in Australia, nor whence they originally came. Their origin is shrouded in antiquity. There is agreement that they are members of the species Homo sapiens, to which all living races belong (Ronald and Berndt, 1988). The pattern frequencies vary to some degree with race, sex and side. Asians have a higher frequency of whorls than Europeans and Americans. In most ethnic groups with some exceptions, whorl frequency is greater in males than in females. The general rule agrees with the present samples whose males exceed females in whorl frequency (Tables 1, 2 and 3). As for the relative frequencies of whorls and loops in males, whorls are more frequent in right hands than in left hands; accordingly, loops are less frequent in right than in left hands. In females, whorls are less frequent in right than in left hands; loops are more frequent in right than in left hands, which is an exception to the ordinary rules (Tables 1 and 2). Generally, whorl frequencies of both sexes are commonly predominant in right hands (Cummins and Midlo, 1961).

As expected from the general reduction in the frequencies of loops, radial loops are rare (1.4%) and they make 3.1% of the total loops. However the

Table 2. Frequencies (%) of the fingerprint pattern types in the Australian female Aborigines (N=90)

Digit	Side	Arches		Loops		Whorls			
		Plain	Tented	Ulnar	Radial	Simple	Lateral pocket + Twin loop	Central pocket	Accidental
I	R	4.4	-	70.0	-	21.1	4.4	-	-
	L	5.6	-	65.6	1.1	22.2	5.6	-	-
	R+L	5.0	-	67.8	0.6	21.7	5.0	-	-
II	R	2.2	2.2	25.6	5.6	62.2	1.1	1.1	-
	L	2.2	-	20.0	10.0	56.7	7.8	3.3	-
	R+L	2.2	1.1	22.8	7.8	59.4	4.4	2.2	-
III	R	-	-	42.2	-	53.3	3,3	1.1	-
	L	-	1.1	40.0	-	52.2	5.6	1.1	-
	R+L	-	0.6	41.1	-	52.8	4.4	1.1	-
IV	R	-	-	24.4	-	73.3	1.1	1.1	-
	L	-	-	30.0	-	67.8	2.2	-	-
	R+L	-	-	27.2	-	70.6	1.7	0.6	-
V	R	-	-	67.8	-	31.1	1.1	-	-
	L	-	-	67.8	-	28.9	1.1	2.2	-
	R+L	-	-	67.8	-	30.0	1.1	1.1	-
All digits	R	1.3	0.4	46.0	1.1	48.2	2.2	0.7	-
	L	1.6	0.2	44.7	2.2	45.6	4.4	1.3	-
	R+L	1.4	0.3	45.3	1.7	46.9	3.3	1.0	-

Table 3. Frequencies (%) and indices of the fingerprint pattern types in Australian Aborigines

Sex	N	Frequency of pattern types			Index of pattern intensity[1]	Dankmeijer's index[2]	Furuhata's index[3]
		Arches	Loops	Whorls			
M	114	0.8*	42.6**	56.7***	15.60	1.41	133.10
F	90	1.7*	47.0**	51.2***	14.94	3.32	108.94
M+F	204	1.3	44.8	54.0	15.28	2.37	120.54

*, **, *** P > 0.05, [1](2×% whorls+1×% loops)÷10, [2](% arches÷% whorls)×100, [3](% whorls÷% loops)×100

frequency of the radial loops (89.5%) of the total loops conform to the general rule that radial loops predominate on the second digits in both sexes. The percentages of radial loops were found to be slightly lower in males (1.0%) than in females (1.7%) as shown in Tables 1 and 2. The values corresponded with the ordinary rules (Srivastava, 1963; Tiwari and Chattopadhyay, 1967; Jantz et al., 1969; Cho, 1990; Cho, 1998a and b). The whole percentages of the present samples are similar with those of Suzuki (1961) and Shima (1963) for the Samoans, which are higher than Caucasoids (Cummins and Midlo, 1961), American Indians (Jantz et al., 1969) and African Negroids (Cummins, 1955; Barnicot et al., 1972). The whole Australian samples, too, were not significant among them. Arches preponderate on the second digits in males and on the first digits in females from the present samples. Abundant samples are of necessity for the stable percentages, especially in arches. The percentage of arches (1.3%) is higher than that (0.9%) of West Arnhem Land Aborigines (Macintosh, 1952).

Generation gap in whorl frequency was counted between samples of Macintosh (1952) and the present study. Because of such a small gap (4.2%), the present samples are supposed to bear their original blood.

The PII, arch/whorl index of Dankmeijer and whorl/loop index of Furuhata are used for an affinity of races. The values of three indices belong to the Mongoloid range: the standard values are 14 or more for the PII, 10 or less for the Dankmeijer's index and 70 or more for the Furuhata's index. Among three indices, the PII might be considered to be very useful for racial distinction. The samples are within Mongoloid range (Dankmeijer, 1938: Hisakichi, 1939; Bhasin, 1968; Cho, 1990). The distributions of the PII present a tendency with higher values of males in the examinations by sex separately (Tables 3).

The bimanual symmetry in the fingerprint pattern types is examined from the chance symmetry which has been calculated by multiplying the percentages of incidence, and the actual symmetry. The percentages of the symmetry actually examined (74.4-82.1%) are found to be greater than that of computed chance symmetry in a number of different races (Cummins and Midlo, 1961). The percentages obtained from the present samples are, as Ellice Islander (Veale and Adams, 1968), Maoris (Veale and Adams, 1965; Cho,

Table 4. Incidences (%) of bimanual symmetry in the fingerprint pattern types in the Australian Aborigines

Sex	N	Symmetry	Homologous Digits					
			I	II	III	IV	V	Total (%)
M	114	Chance	50.7	54.2	54.7	67.0	54.7	56.3
		Actual	67.5	71.1	76.3	77.2	78.1	74.0
F	90	Chance	54.0	53.1	50.9	60.2	56.3	54.9
		Actual	71.1	73.3	83.3	77.8	81.1	77.3
M+F	204	Chance	52.4	53.7	52.8	63.6	55.5	55.6*
		Actual	69.3	72.2	79.8	77.5	79.6	75.7*

* P<0.05

Table 5. Mean ridge counts on individual fingers in the Australian Aborigines

Digit	Males (N=114, Mean±SD)		Females (N=90, Mean±SD)	
	Right	Left	Right	Left
I	18.40± 5.35	16.02± 5.73	16.21± 5.92	15.33± 5.99
II	14.97± 4.19	14.86± 4.64	13.77± 4.74	13.92± 4.71
III	15.75± 4.21	16.75± 3.98	14.81± 3.66	15.39± 3.54
IV	17.47± 4.16	17.28± 3.90	16.68± 4.22	16.61± 4.40
V	10.95± 3.47	14.16± 3.69	13.10± 3.24	12.87± 3.22
I-V	77.54±21.38	79.12±21.94	74.57±21.78	74.12±21.86
TRC (R+L)	156.65*±43.32		48.69*±43.64	

P > 0.05

1998a) and Samoans (Cho, 1998b), significantly greater than expected by chance (Table 4).

The influence of symmetry on the incidence of the finger patterns is a general morphological phenomenon which is not affected by sex or race (Dankmeijer and Renes, 1938). Frequency of obligatory symmetry on 10 digits from the present samples are 9.7% in all whorl combinations and 2.6% in all loop combinations for males, and 8.9% and 7.8% for females in order, respectively. It is noted that all arch combinations is not at all observed in both sexes. The mean actual percentage (7.3%) of obligatory symmetry from 10 digits of the total samples is considerably lower than those (20.2%) of the Maori and those (23.3%) of New Zealand-Samoans (Cho, 1998a and b). All loop combinations might be most frequent in Caucasians due largely to high loop occurrences (Cummins and Midlo, 1961).

For the mean ridge count on different digits from the present samples, males display higher values in left hands and lower values in right hands, but females show nearly equal values in both hands. In general, the mean ridge count is higher in the right hand than in the left hand, and the TRC of the separate sex is higher in males than in females (Glanville, 1969; Jantz et al., 1969; Mi and Rashad, 1977; Hwang, 1985). The present samples demonstrated one of many populations which showed the greatest ridge counts (Srivastava, 1965; Basu and Namboodiri, 1971).

The mean ridge count has been calculated for 125 fingers in the sex separately. In males, the value for arches is zero, for loops, 15.17 and for whorls, 16.95: in females zero, 12.46 and 16.02 in order, respectively. The values of the present Aborigines are totally lower than those of Caucasians (Preus and Fraser, 1972).

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