

# A Finger Dermatoglyphic Study of Maori

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Fingerprints of 104 New Zealand Maori males and 98 females have been analyzed. Whorls are more abundant in females (55.0%) than in males (47.3%). The index of pattern intensity reveals a higher value in females (15.39) than in males (14.52). The bimanual differences both in males and females are not statistically significant for the occurrence of pattern on the digits of the right and left hands. The difference between the sexes in occurrence of patterns is not statistically significant. Incidences of actual symmetry on the homologous digits represented a mean of 78.8% in all subjects. The mean total ridge counts showed 161.7 in females and 159.6 in males, respectively. Thus, the Maori show greater affinities with the Mongoloids in quantitative dermatoglyphics.

The Maoris are aborigines in New Zealand. A study on New Zealand Maori fingerprints was first worked out by Veale and Adams (1965) who have also studied the Polynesian Ellice Islanders' fingerprints (Veale and Adams, 1968). From their studies, the Maori and Ellice Islanders were known to have exceptionally high percentages of whorls, and relatively low percentages of loops and arches.

Thereafter, the study on this topic has been neglected for decades. The everlasting increases of European admixed blood might have affected dermatoglyphics of the living Maoris. The aim of this study was to analyze the configurations on fingerprint patterns of the present Maoris.

## Materials and Methods

I analyzed fingerprint samples of 202 Maoris, 104

males and 98 females, supplied by Fingerprint Section, Auckland Central Police Station, New Zealand. The fingerprints were impressed in ink and personal records except sex were not provided.

The methods used in analyzing, formulating and interpreting the fingerprint patterns were those described by Cummins and Midlo (1961). The frequencies of pattern types, pattern indices and total ridge count (TRC) were examined. Chance symmetry and actual symmetry of pattern types were compared in percentages for males and females.

## Results

Incidences of the finger patterns on the different digits separately as well as on both hands are listed in Table 1 for males and in Table 2 for females, respectively.

Table 1. Frequencies of the fingerprint pattern types of the Maori males (N=104)

Digit	Side	Arches		Loops		Whorls			Accidental
		Plain	Tented	Ulnar	Radial	Simple	Lateral pocket twin loop	Central pocket	
I	R	2.9	-	45.2	-	29.8	22.1	-	-
	L	2.9	-	60.6	-	9.6	26.0	1.0	-
	R+L	2.9	-	52.9	-	19.7	24.1	0.5	-
II	R	4.8	-	37.5	7.7	36.5	9.6	3.8	-
	L	2.9	-	41.3	9.6	34.6	9.6	1.0	1.0
	R+L	3.9	-	39.4	8.7	35.6	9.6	2.4	0.5
III	R	1.9	-	56.7	-	28.8	7.7	4.8	-
	L	1.9	-	55.8	-	30.8	9.6	1.9	-
	R+L	1.9	-	56.3	-	29.8	8.7	3.4	-
IV	R	1.0	-	26.9	-	62.5	6.7	1.9	1.0
	L	1.0	-	42.3	-	39.4	11.5	5.8	-
	R+L	1.0	-	34.6	-	51.0	9.1	3.9	0.5
V	R	1.0	-	52.9	1.0	35.6	6.7	2.9	-
	L	1.0	-	69.2	-	19.2	10.6	-	-
	R+L	1.0	-	61.1	0.5	27.4	8.7	1.5	-
All digits	R	2.3	-	43.8	1.7	38.6	10.6	2.7	0.2
	L	1.9	-	53.8	1.9	26.7	13.5	1.9	0.2
	R+L	2.1	-	48.8	1.8	32.7	12.1	2.3	0.2

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Table 2. Frequencies of the fingerprint pattern types of the Maori females (N=98)

Digit	Side	Arches		Loops		Whorls			Accidental
		Plain	Tented	Ulnar	Radial	Simple	Lateral pocket twin loop	Central pocket	
I	R	1.0	-	36.7	-	22.5	38.8	-	1.0
	L	2.0	-	46.9	-	15.3	35.7	-	-
	R+L	1.5	-	41.8	-	18.9	37.3	-	0.5
II	R	1.0	-	28.6	5.1	40.8	20.4	3.1	1.0
	L	2.0	-	31.6	2.0	40.8	22.5	1.0	-
	R+L	1.5	-	30.1	3.6	40.8	21.5	2.1	0.5
III	R	2.0	-	50.0	1.0	35.7	9.2	2.0	-
	L	1.0	-	51.0	-	36.7	9.2	2.0	-
	R+L	1.5	-	50.5	0.5	36.2	9.2	2.0	-
IV	R	-	1.0	24.5	-	66.3	6.1	2.0	-
	L	-	-	33.7	-	53.1	8.2	5.1	-
	R+L	-	0.5	29.1	-	59.7	7.2	3.6	-
V	R	1.0	-	59.2	-	30.6	7.1	2.0	-
	L	-	-	68.4	-	23.5	6.1	2.0	-
	R+L	0.5	-	63.8	-	27.1	6.6	2.0	-
All digits	R	1.0	0.2	39.8	1.2	39.2	16.3	1.8	0.4
	L	1.0	-	46.3	0.4	33.9	16.3	2.0	-
	R+L	1.0	0.1	43.1	0.8	36.6	16.3	1.9	0.2

Whorls (47.3%) were less abundant than loops (50.6%) in males. Females exhibited a much higher frequency of whorls (55.0%) and lower frequency of loops (43.9%). The frequency of ulnar loops (48.8%) and arches (2.1%) were higher in males than in females ulnar loops, 43.1% and arches, 1.1%. Radial loops were absent in the first and fourth digits of both hands in both males and females. Simple whorls were nearly twice as common as lateral pockets, central pockets, twin loops and accidentals combined and their frequencies in males and females were 32.7% and 36.6%, respectively. Distributions of the finger pattern types exhibited statistically insignificant variations ( $P>0.05$ ) between the sexes (Table 3).

The mean values of Dankmeijer index, pattern intensity index (PII), and Furuhashi index exhibited 3.22, 14.96 and 109.38 in the total samples, respectively (Table 4). The PIIs were within the Mongoloid range (Table 5). Incidences of chance and actual symmetry were 49.7% and 78.8% in the total samples, respectively (Table 6). The same patterns shown the greatest frequency occurred in ten digits of males (26.0%) and

eight digits of females (22.5%) (Table 7). Sex difference displayed a little bit in TRC (Table 8).

### Discussion

Characteristic features of the Polynesian fingerprints are the predominance of whorls and great diminution of arches. Shima (1963) reported that the whorl frequencies are 80.5% (M+F) in pure blood-line Polynesians and 70.4% (M+F) in Polynesian-European hybrids from Maupiti Island, Central Polynesia. Veale and Adams (1965) reported relative frequencies of the different fingerprint patterns in three samples of the Maoris. The whorl percentage was known to be very high, 77.08% in 65 Maori males and 68.60% in 86 Maori females. The whorl percentages were somewhat lower in two groups of criminals who contained a greater admixture of European ancestry (Burridge, 1983). However, it is evident that Polynesian-European hybrids possess a low whorl percentage as compared with the pure Polynesians. The whorl percentages of the Maoris are close to the Mongoloid values (Table 5).

In most ethnic groups whorl frequency is greater in males than in females (Veale and Adams, 1965). I report, however, that the Maori females exceeded the males in whorl frequency. As for the relative frequencies of whorls and loops of the Maori, whorls are more frequent in the right than in the left hands; loops are less frequent in the right than in the left hands (see also Veale and Adams, 1965).

As might be expected from the general reduction in the frequencies of loops, radial loops are rare (1.3%): the value is highly biased, since, in the samples, radial loops compose 2.7% of the total loops. But then, the samples conform to the general rule that radial loops predominate on the index digits in both sexes. And also the percentages of radial loops are slightly higher in males than in females as shown in Tables 1 and 2.

Table 3. Significance test for comparisons of the fingerprint pattern types of the Maori

No	Comparison	Value of "t"	Result
1	Rs <sup>1</sup> and Ls <sup>2</sup> of males in arches	0.20	insignificant
2	Rs and Ls of males in loops	-1.48	insignificant
3	Rs and Ls of males in whorls	1.42	insignificant
4	Rs and Ls of females in arches	0.10	insignificant
5	Rs and Ls of females in loops	-0.80	insignificant
6	Rs and Ls of females in whorls	0.78	insignificant
7	Rs and Ls combined of males and females in arches	0.57	insignificant
8	Rs and Ls combined of males and females in loops	0.96	insignificant
9	Rs and Ls combined of males and females in whorls	-0.83	insignificant

<sup>1</sup>Right hands, <sup>2</sup>Left hands.

**Table 4.** Frequencies and indices of the fingerprint pattern types of the Maori

Sex	N	Frequency of pattern types			Index of pattern intensity <sup>1</sup>	Dankmeijer's index <sup>2</sup>	Furuhata's index <sup>3</sup>
		Arches	Loops	Whorls			
M	104	2.1	50.6	47.3	14.52	4.44	93.48
F	98	1.1	43.9	55.0	15.39	2.00	125.28
M+F	202	1.7	47.3	51.2	14.96	3.22	109.38

<sup>1</sup>(2 × % whorls + 1 × % loops) ÷ 10

<sup>2</sup>(% arches ÷ % whorls) × 100

<sup>3</sup>(% whorls ÷ % loops) × 100

The values correspond with the ordinary rules (Srivastava, 1963; Tiwari and Chattopadhyay, 1967; Jantz et al., 1969; Barnicot et al., 1972; Cho, 1990).

The whorl percentages of the present samples are lower than those of the previous study of the Maori (Veale and Adams, 1965). The present samples consisted of a small number of full Maori and a great number of half or three-quarter Maori. The distributions of the PII present a contrast to those of most populations examined thus far.

The percentage of the symmetry was found to be

greater than that of computed chance symmetry. The values obtained from the present samples are in accordance with general rules and no obvious anthropological difference was found. The total frequency of homologous finger patterns is within the range of 74.4%~82.1% in a number of different races (Cummins and Midlo, 1961). The present samples exists within the range. 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). The frequency of obligatory

**Table 5.** Fingerprint pattern frequencies in the Mongoloids and other high-whorl populations

Population	Sex	N	Frequency of pattern types			Pattern intensity index	Authors
			Arches	Loops	Whorls		
Maori (New Zealand)	M	65	0.3	22.6	77.1	17.68	Veale and Adams (1965)
	F	86	0.5	30.9	68.6	16.81	
	M	104	2.1	50.6	47.3	14.52	Present study
Samoans (New Zealand)	F	98	1.1	43.9	55.0	15.39	Cho (Unpublished)
	M	100	0.8	43.6	55.6	15.48	
Ellice Islanders (Polynesia)	F	93	0.7	33.7	65.6	16.49	Veale and Adams (1968)
	M	45	0.5	27.5	72.0	17.15	
	F	67	2.0	33.2	64.9	16.30	
West Arnhem Land Aborigines (Australia)	M	82	0.9	38.0	60.9	15.98	Macintosh (1952)
Kalumburu Mission Aborigines (Australia)	M	44	0.5	35.1	64.3	16.37	Rao (1964)
	F	40	2.0	33.0	64.8	16.26	
Yuendumu Settlement Aborigines (Australia)	M	61	1.3	48.0	50.7	14.94	Rao (1965)
	F	44	2.0	55.0	43.4	14.18	
Newars (Nepal)	M	336	2.8	54.5	42.8	14.01	Bhasin (1968)
	F	192	6.9	53.7	39.4	13.25	
Tibetans (Refugees in India)	M	156	0.8	39.0	60.2	16.00	Tiwari and Chattopadhyay (1967)
	F	150	2.2	49.1	48.7	14.70	
Tharus (India)	M	90	4.4	54.0	41.6	13.70	Srivastava (1963)
	F	91	3.6	56.2	40.2	13.65	
West Nakanai of New Britain (Melanesia)	M	257	1.7	46.8	51.5	14.98	Mavalwala et al. (1963)
	F	64	4.1	50.5	46.0	14.24	
Chinese (China)	M+F	300	1.4	47.7	50.7	14.91	Dankmeijer (1938)
Koreans (S. Korea)	M	250	2.7	42.8	54.5	14.70	Cho (1990)
	F	250	4.6	49.3	46.1	14.01	

**Table 6.** Frequencies of bimanual symmetry in the fingerprint pattern types of the Maori

Sex	N	Symmetry	Digits (R+L)					Average(%)
			I	II	III	IV	V	
M	104	Chance	46.4	46.2	49.1	52.3	50.1	48.8
		Actual	77.9	84.6	87.5	79.8	76.8	81.3
F	98	Chance	49.0	53.3	49.4	57.6	53.0	50.5
		Actual	76.5	73.5	79.6	79.6	71.6	76.2

Table 7. Frequencies of the same patterns on four fingers or more in of the Maori

Sex	N	Number of digit with same patterns in individuals							Total (%)
		4	5	6	7	8	9	10	
M	104	1.0	5.8	15.4	18.3	18.3	15.4	26.0	100
F	98	0.0	12.2	21.4	16.3	22.5	13.3	14.3	100

symmetry (all whorl, all loop and all arch combinations) was greatly different between the sexes.

The males and females together displayed lower ridge counts in the right and higher ridge counts in the left hands. In general, the mean ridge count is higher in the right than in the left hands and the TRC is higher in males than in females (Glanville, 1969; Jantz et al., 1969; Mi and Rashad, 1977; Hwang, 1985). The present Maori demonstrates one of the greatest ridge counts (Srivastava, 1965; Basu and Namboodiri, 1971).

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.

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Table 8. Mean ridge counts between fingers of the right and left hands in the Maori

Side	Digit	Male (mean ± SD, N=104)	Female (mean ± SD, N=98)
R	I	19.8 ± 6.6	18.5 ± 4.8
	II	13.8 ± 6.9	14.7 ± 6.0
	III	14.7 ± 5.2	14.8 ± 6.0
	IV	17.0 ± 5.7	18.0 ± 5.6
	V	13.9 ± 5.4	13.9 ± 4.7
	Total	78.7 ± 28.7	79.9 ± 27.0
L	I	18.4 ± 6.5	17.5 ± 5.8
	II	13.7 ± 6.5	14.6 ± 5.4
	III	15.9 ± 5.6	16.9 ± 5.5
	IV	17.6 ± 5.4	18.1 ± 5.7
	V	15.3 ± 5.3	14.8 ± 4.7
	Total	80.9 ± 29.2	81.8 ± 27.0
TRC (R+L)		159.6 ± 57.9*	161.7 ± 54.1*

\* P<0.05

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