

# Finger Ridge Counts in the Micronesians of Yap

E. E. HUNT, Jr.\* and J. D. MAVALWALA\*\*

*\*Forsyth Dental Center, Harvard School of Dental Medicine, Boston, Mass.*

*\*\*Department of Anthropology, University of Manitoba, Winnipeg*

## Introduction

The present paper is a comparative and familial analysis of finger ridge counts of the right hand only. The data come from finger prints of a sample of Micronesian males from Yap, in the Western Caroline Islands. As shown previously, the palm and finger prints of the Yapese resemble most closely those of other Pacific islanders and mainlanders from Southeast Asia (Mavalwala and Hunt, 1964; Swindler, Mavalwala and Hunt, 1963). The dermatoglyphic affinities of the Yapese agree well with their position as deduced from anthropometry (Hunt, 1950a, 1950b). Within Yap itself, the population is divided into three largely endogamous castes which are slightly differentiated in size, physique, and dermatoglyphic features.

The finger prints of the Yapese are typical of the Pacific area in their high frequency of whorls and scarcity of arches. In general, the peoples of Oceania show a complexity of pattern.

In the present study, this complexity in the Yapese is evaluated further by the method of ridge counting (Bonnievie, 1924). A sample of 250 men was chosen for clarity of their prints, and with no more than one member of any sibship present. An additional 46 brothers were later included, so that the larger sample of 296 males contained 40 sibships, with 91 brothers in all.

In the samples of 250 and 296 men, means and standard deviations of ridge counts were calculated for all fingers of the right hand, and correlations between them. The data in the two series were so closely similar throughout that the tables here deal only with the larger sample. This lack of appreciable bias in including related persons in studies of ridge counts was also noted by Holt (1949, 1951, 1955, 1956-7), whose earlier, small series of British subjects excluded related persons, but whose later and much larger sample contained a goodly proportion of families.

## Findings

For the sample of 296 Yapese, Table 1 gives means and standard deviations of the ridge counts of each finger, and of the whole right hand. The table also contains comparative data on the large British sample of Holt (1955), a smaller group from Portugal (da Cunha and Abreu, 1954), a series of French twins (Lamy et al., 1956), and Parsis from India (Mavalwala, 1962). The British and Parsis

Table 1. Ridge counts of the right hand in Yapese, British, Parsi, Portuguese and French males

Digit	296 Yapese			825 British			200 Parsis			100 Portuguese	351 French twins		
	$\bar{x}$	$s\bar{x}$	$s$	$\bar{x}$	$s\bar{x}$	$s$	$\bar{x}$	$s\bar{x}$	$s$	$\bar{x}$	$\bar{x}$	$s\bar{x}$	$s$
R I	20.70±.25	4.25		19.76±.21	6.25		18.08±.39	5.49		19.45	—	—	—
R II	15.31±.32	5.47		11.78±.26	7.41		11.67±.49	6.97		10.98	—	—	—
R III	16.48±.30	5.13		12.02±.23	6.48		11.38±.46	6.44		11.47	—	—	—
R IV	18.91±.27	4.69		16.52±.23	6.51		15.09±.43	6.05		15.91	—	—	—
R V	15.22±.23	4.03		14.10±.19	5.38		13.83±.34	4.87		13.53	—	—	—
Total	85.62±1.05	18.09		74.18±.89	25.60		70.03±1.65	23.34		71.33	68.37±1.08	20.25	

Table 2. Correlations between ridge counts in the fingers of the right hand in 296 Yapese males

Digit	R V	R IV	R III	R II	R I
R V	1.0000	0.5561*	0.4855	0.4747	0.3673
R IV	0.5561*	1.0000	0.6494	0.5402	0.3480
R III	0.4855	0.6494	1.0000	0.5491	0.3725
R II	0.4747	0.5402	0.5491	1.0000	0.3789
R I	0.3673	0.3480	0.3725	0.3789	1.0000

\* r differs significantly from Parsi and from British male coefficients,  $p \approx .05$ .

samples included correlations of the counts between fingers, so that means and standard deviations of the counts for the entire right hand were calculated. The latter coefficients were obtained by the usual formula for the variance of a sum of correlated variables.

The Yapese ridge counts are consistently higher than those of the other series, particularly in digits II and III. In all digits, the Yapese are less variable as well. Perhaps simpler polygenic systems regulate Yapese ridge counts than in the other groups in the table, but the genes themselves seem to be relatively hypermorphic, especially in the second and third digits.

Table 2 shows the correlations between fingers in the larger Yapese sample. These coefficients are all lower than in the 825 British males published by Holt (1955), and also lower than in the 200 male Parsis described by Mavalwala (1962). This peculiarity of the Yapese is significant, however, for only one cell: between digits IV and V between Yapese and British, and the same between Yapese and Parsis. Differences between the Parsis and British have been discussed elsewhere (Mavalwala, 1962).

As in both other samples, the Yapese correlations are higher between adjacent fingers than in more separated fingers. The maximal correlation is between digits III and IV: whereas in the British and Parsis, the highest coefficients are between II and III.

Table 3. *Analysis of variance and intraclass correlation of total ridge count of right hand in 40 Yapese fraternal sibships*

Source of variance	Sum of Squares	df	Mean square	Intraclass correlation
Total	39,080	90		
Between sibships	25,628	39	657.13	.397
Within sibships	13,452	51	263.77	

F=2.49; p<.001

Table 3 presents evidence on the reduced variance within Yapese fraternal sibships. The data include an analysis of variance within and between sibships, and an intraclass coefficient of correlation, calculated by the method of Haggard (1959), correcting for differing sizes of sibships.

The value of 0.397 for the intraclass correlation is slightly lower than Holt (1957a, 1957b, 1961) has noted for parent-child, sib-sib, and dizygotic twin correlations. Her findings for these combinations conform closely to 0.50. The data from monozygotic twins, however, are as high as 0.98 (Newman, 1930; Holt, 1961).

In a sample as small as the fraternal group of Yapese, the slightly lower correlation is not a significant departure from a theoretical expectation of 0.50. The Yapese evidence therefore does not lead us to question Holt's suggestion that the ridge count may be a polygenic character with simple additivity of loci, no dominance, and high heritability.

### Summary

The finger prints of the Yapese males in the present study show a relative complexity of pattern, so that their ridge counts are high, with reduced variability. Most correlations between fingers do not differ significantly from those found in British and Parsi males, but all are lower in the Yapese.

Intraclass correlations between brothers in the total ridge count of the right hand are lower than those in sib pairs, dizygotic twins, and parents and progeny (Newman, 1930; Holt, 1957a, 1957b, 1961). The Yapese data do not contradict Holt's conclusion that the ridge count may be a polygenic character with simple additivity of loci, no dominance, and high heritability.

### References

- BONNEVIE, K. 1924. "Studies on papillary patterns of human fingers." *J. Genet.*, **15**, 1-111.
- DA CUNHA, A. X. & M. D. A. ABREU. 1954. "Impressões digitais de Portugueses. *Contr. antrop. portug.*, **5**, 315-347.
- HAGGARD, E. E. 1958. *Intraclass correlation and the analysis of variance*. New York: Dryden Press.
- HOLT, S. B. 1949. "A quantitative survey of the finger-prints of a small sample of the British population." *Ann. Eugen. Lond.*, **14**, 329-338.
- HOLT, S. B. 1951. "The correlations between ridge-counts on different fingers." *Ann. Eugen.*

- Lond.*, **16**, 287-297.
- 1953. "Genetics of dermal ridges: maximization of intraclass correlation for ridge counts." *Ann. Eugen. Lond.*, **17**, 293-301.
- 1955. "Genetics of dermal ridges: frequency distributions of total finger ridge-count." *Ann. Hum. Genet. Lond.*, **20**, 159-170.
- 1957a. "Genetics of dermal ridges: sib pair correlations for total finger ridge count." *Ann. Hum. Genet. Lond.*, **21**, 352-362.
- 1957b. "Quantitative genetics of dermal ridge-patterns on fingers." *Acta Genetica*, **6**, 473-476.
- 1959. "The correlation between ridge-counts on different fingers estimated from a population sample." *Ann. Hum. Genet. Lond.*, **23**, 459-460.
- 1961. "Quantitative genetics of finger-print patterns." *Brit. Med. J.*, **17**, 247-250.
- HUNT, E. E.** 1950a. "A view of somatology and serology in Micronesia." *Am. J. Phys. Anthropol.*, **8**, 157-184.
- HUNT, E. E.** 1950b. *Studies of physical anthropology in Micronesia*. Ph. D. Thesis, Department of Anthropology, Harvard University.
- LAMY, M., J. FRÉZAL, J. DE GROUCHY, & J. KELLEY.** 1957. "Le nombre de dermatoglyphes dans un échantillon de jumeaux." *Ann. Hum. Genet. Lond.*, **21**, 374-385.
- MAVALWALA, J.** 1962. "Corellations between ridge-counts on all digits of the Parsis of India." *Ann. Hum. Genet. Lond.*, **26**, 137-138.
- MAVALWALA, J. & E. E. HUNT.** 1963. "Finger and palm prints of the Micronesians of Yap." *Zschr. f. Morphol. u. Anthropol.*, (in press).
- MAVALWALA, J., D. SWINDLER, & E. E. HUNT.** 1963. "The dermatoglyphics of the West Nakanai of the Britain." *Am. J. Phys. Anthropol.*, (in press).
- NEWMAN, H. H.** 1930. "The finger prints of twins." *J. Genet.*, **23**, 415-446.