CORRELATIONS BETWEEN HEIGHT AND FINGER-PRINTS (PORTUGAL)

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ABSTRACT:

Height and finger-prints of two homogenous samples (720 males and 589 females), ages comprised between 25 and 50, collected in Coimbra and Figueira da Foz cities are analised. The aim of this paper is to study the behaviour of R and U genes and the correlations between height and quantitative values of the digital dermatogliphics. The statistic analysis shows that is linear the correlation between radial and ulnar differences — the cushioned factors are partly conditioned by maxium value of ridge. The correlation height/quantitative values is linear, but very small; this fact suggest that the height does not influence R and U.

Key words: Height, finger-prints Portugal.

The study of finger-prints has been carried on more under the morphological point of view than that of genetic. Many authors correlate the different digital systems (Becker, 1954-55; Pons, 1956 and 1956-57; Wichmann, 1952 and 1956).

In other works values of correlation were determined between dermatoglyphies and different ilnesses (Holt, 1950-51; Bragança, 1985; Olivier, 1968; Weninger, 1987) or with blood groups (Geipel, 1935; Hesch, 1932).

According to Bonnevie (1931) the quantitative values are conditioned by three independent pairs of genes, V, R e U; the quantitative values are however correlated between each other (r=0.64±0.022). It would be logical to expect that the radial and ulnar differences were also correlated, but the author states that R and U genes are independent.

Piebenga (1938) in his study found r=0.35±0.043 and η_{RU}=0.46 and η_{RU}=0.42, despite radial and ulnar differences are not very different. The correlation ratio (η) show an even stronger linkage. However Piebenga's study using material of Urk island (1942) accurately did not confirmed this link.

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When Fleischhacker (1951) investigated the frequence and distribution of the hereditary forms of Bonnevie, he came to the conclusion that from 27 possibilities of R, U and V combinations not all of them do not present the same frequences. There are 8 or 9 of them which are more frequent and always represented in racial different groups with a considerable frequence. This fact is partly conditioned by the frequence of each pair of factors, however this seems to make one believe that it may exist a partial link between factors, chiefly those that determine the cushioned factors (R, U). And the author goes on: if both factors where inherited separately, the different combinations (rr, Rr, RR and uu, Uu, UU) would match according to random laws. This does not occur since Fleischhacker (1951) arrives at the conclusion that certain pairs occur more frequently while others occur more slowly than it would be expected. Studies carried on with families-relationship parents-children, grandparents-grandchildren and twins allowed to conclude that the quantitative values have a polygenic inheritance and may even be influenced by intra-uterine factors (Lamy, 1956-57; Hreczko and Ray, 1985).

The aim of this paper is to study the behaviour of R and U genes and to correlate the height with the quantitative values among an homogeneous population from the district of Coimbra.

MATERIAL AND METHODS

The dermatoglyphies, the heigth, the birth place and profession of 725 men and 590 women — ages between 25 and 50 — are collected in Coimbra and Figueira da Foz, in 1969. The classification of the digital patterns is those described by Geipel (1935); different categories of arches, loops and whorls were considered and ridge counting were carried out according Geipel (1935). The percentage of digital patterns, the distribution by fingers and hands, the quantitative values (average and maximal), the radial and ulnar differences, and the empirical frequences were determined.

This paper does not present all the results but only those concerning the present study. The sequence of the statistical analysis was as follows:

1 — *Correlations between radial and ulnar differences*: coefficient of correlation (r) and respective regression lines; correlation ratio (η); coefficients of partial correlation that keep the maximum value of the papillars in case we keep constant the maximum value; the «spurious correlation» based on the variability coefficient.

2 — *Correlations between height and quantitive values*: correlation coefficients (r); correlation ratio (η); the variance analysis was also used to verify non-linearity of regression lines (Q^2).

RESULTS AND DISCUSSION

Table 1 presents the number and percentages of arches, loops and whorls of two studies (Cunha and Abreu, 1954; and the present one).

		Indiv.	F-prints	Arches		Loops		Whorls	
		N	N	N	%	N	%	N	%
a	♂	100	1000	—	3.6	—	69.5	—	26.9
	♀	100	1000	—	8.6	—	67	—	24.4
b	♂	725	7250	309	4.3	4774	65.9	2167	29.9
	♀	590	5900	373	6.3	4048	68.6	1479	25.1
♂ + ♀		1315	13150	682	5.2	8822	67.1	3646	27.7

TABLE 1 — Distribuition in number and percentages for arches, total loops and whorls in two portuguese samples.
a) Cunha and Abreu (1954)
b) Neto and Rocha (1989)

The differences may be imput to the samples while the first one concerns only 100 individuals for each sex (all ages comprised) and a large geographic distribution, our data is larger ♂=725, ♀=590 (only ages groups between 25-50) and with restrict geographic distribution.

After this comparasion we are going to analyse the proposed research.

Table 2 we have the mean, the standard deviation and respective errors of variables that we intend to study. The number of individuals is little (♂=720, ♀=589) due to the impossibility of counting some papillars.

Ridges Values	♂ (n=720)		♀ (n=589)		♂+♀ (n=1309)	
	$\bar{x}$	s	$\bar{x}$	s	$\bar{x}$	s
HEIGTH	167.62±2.274	69.92±1.605	155.28±2.246	54.52±2.246	—	—
AVERAGE VALUE	15.06±0.184	4.95±0.130	13.68±0.212	5.14±0.150	14.44±0.140	5.08±0.101
MAXIMAL VALUE	22.95±0.186	4.99±0.131	20.93±0.213	5.18±0.151	22.04±0.143	5.17±0.103
RADIAL DIF.	13.67±0.208	5.58±0.147	12.70±0.206	5.01±0.146	13.23±0.148	5.35±0.135
ULNAR DIF.	9.81±0.170	4.56±0.120	9.12±0.178	4.32±0.178	9.50±0.123	4.47±0.087

TABLE 2 — Means, standard error of mean (x)/($\bar{x}$) and standard deviation (s) for height and ridges values in both sexes.

We find that the means of height are higher than those found before for Portuguese adult population. Tamagnini (1932) obtained in 11.657 recruits (x=164.50cm) and Themido (1933) 0=164.80 cm (n=200), 0=152.35cm (n=150).

1 — **Correlations between radial/ulnar differences.**

The correlation coefficients between two cushioned R and U factors as well as the respective correlation ratio are in the *Table 3*.

Rad. dif:	Uln. dif	r	ηyx	ηxy
Men	(n=720)	0.47>0.06	0.49	0.50
Women	(n=589)	0.42>0.07	0.43	0.43
Total	(n=1309)	0.45>0.04	0.46	0.54

TABLE 3 — Correlation coefficient (r) and correlation ratio (η) between radial and ulnar differences.

The correlation coefficients exceed in the three cases the limits of security and the higer than those determined by Piebenga (1931), r=0.35±0.15. In the relation to the Wichmann (1963) values our correlation coefficient for males is lower but in females is higher (Wichmann ♂ r=0.52>0.15; ♀ r=0.32>0.19 and ♂+♀ r=0.48>0.12). This author attributes the differences between the both sexes to the non-lineriaty of regression lines, chiefly in the ulnar (female difference as the correlation ratio shows — ηyx=0.44).

Our two samples may be considered homogeneous, since there are no significant statistical differences between the two correlation coefficient. The correlation ratio are significatively different from zero in all cases.

For men the correlation is not significatively different from the ulnar correlation ratio, which results that the respective regression line is linear and deviations must be attributed to fluctuations imputable to the random of data. However the regression radial line is non-linear, once the correlation is significatively different from the radial correlation ratio.

In the female sex the correlation is not significatively distinct from the two correlation ratio, wich results that the two regression lines may be considered to be linear, and the deviations imputed to the random of the sample.

In the case the two sexes together the correlation between the radial and ulnar difference is significatively distinct from the two correlation ratio, the regression lines being therefore considered to be non-linear.

In a next step we rickon the *partial coefficients of correlation* between the values of cushioned factors, R and U, and we maintain constant the maximum value of pappilar ridges. We found for men $r_{RU,V}$=0.42>0.06, for women $r_{RU,V}$=0.37>0.07 and for both sexes $r_{RU,V}$=0.40>0.05. The values of r got lower, but they do not seem to present any satisfactory conclusion, since the dependence of these values with the maximum value of the figures is not taken in consideration, according to the definition of Bonnevie.

An attempt to find out an apparent correlation consists in calculating a «*spurious correlation*» as Pearson, that uses the variability coefficient. The correlation values got very lower (r_{RU}=0.20>0.07 for men, r_{RU}=0.26>0.08 for women and r_{RU}=0.22>0.05 for two sexes), but they are still out the minimum of randow, since they are all significative.

2 — Correlations between height/papillars values.

In our sample the male right thumb has an $\bar{x}$ =19.45 ridges and the female an $\bar{x}$ =17.85 ridges, both sexes presenting $\bar{x}$ =18.52; ulnar side of the hand has fewer ridges (♂=13.52; ♀=12.33; ♂+♀=12.93); whorls are richer in ridges than loops (6 ridges more than the mean) and the ridges exist larger number in men (♂=26%; ♀=24%); there is sexual differentiation in the ridge distribution, see *Table 1*.

After these variations had been found out we calculated, just as Wichmann (1963) and Tillner (1967), the correlation coefficients between height and the quantitative values in each of the sexes.

Ridges Values	r	ηyx	Q²	ηxy	Q²
Average value	0.03<0.08	0.08	1.08<2.79	0.13	1.08<2.30
Maximal value	0.06<0.08	0.17	1.78<1.80	0.20	2.12>1.76
Radial dif.	0.08=0.08	0.16	1.29<1.80	0.16	1.72<1.76
Ulnar dif.	0.002<0.08	0.15	1.55<1.80	0.13	1.02<1.80

TABLE 4 — Correlation coefficient (r), correlation ratio (η) and variance analysis (Q^2) between height and ridges values for males (N=720).

Ridges Values	r	ηyx	Q²	ηxy	Q²
Average value	0.09>0.08	0.16	1.06<1.95	0.20	1.62<1.78
Maximal value	0.09>0.08	0.13	1.65<2.72	0.17	1.02<1.78
Radial dif.	0.04<0.08	0.13	1.02<1.90	0.11	1.66<2.40
Ulnar dif.	0.05<0.08	0.12	1.30<2.71	0.14	1.01<1.85

TABLE 5 — Correlation coefficient (r), correlation ratio (η) and variance analysis (Q^2) between height and ridges values for females (N=589).

Our values are even lower than those of Wichmann, and the random limits were not reached, either (except in females for the height/maximum value and heigth/average value correlation, where the coefficients values of correlation are signifacative, but only at the level of 5%).

In spite of these results we cannot conclude that there is absence of relationship between height and quantitative values. Only the linearity of the regression lines cannot lead to any conclusions. In case these hypothesis is not verified then the calculated values get nearer to zero.

Next we calculate *correlation ratio*, which, in spite of being higer than the respective values of (r) and exceeding the security level of the correlation coefficients, are small that they do not convince of the non-linearity of the regression lines. Almost these correlation ratio are not significatively different from zero except those of maximum value ♂ and one of them of the average value ♀ (level 5%). As to the correlation coefficients there are not significatively distinct from their correlation ratio values either (except for the correlation height/maximum value ♂) which is significatively distinct from the correlation ratio (η/xy).

We keep on trying to prove the non linearity of the regression lines by calculating the *analysis of variance* since by means of Q^2 (*relation of variance*) we can reach the Known levels of security. Only once (maximum value and correlation ratio ηxy) F value was significative ($p<0.05$), so the regression line is not linear; for all the other cases the regression lines are linear so the deviation to the straight line can be imputed at random fluctuation of the sample.

In our sample as correlation ratio are according to their respective coefficients of correlation and accordingly they show that there are no non-linear relationship but only linear between height and the quantitative values.

CONCLUSION

We can conclude that in one sample there was also, a correlation between the cushioned factors which are partly conditioned by its dependance on the maximum value of ridges, according to the Bonnevie definition.

Through the calculation of *partial correlation* (in case we keep constant the maximum value) there still remains a correlation that leads us to suppose that there are still other causes that influence the quantitatives values.

Wichmann (1963) came to the conclusion that the height was one of there, since the found non-linear correlation between it and the quantitative values.

In our case the correlation between heigth the quantitative values are linear but to small that we can conclude for the non-existence of any influence of the height on the relationship of R and U genes.

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