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Palmar Intertriradial Ridge Counts in Sardinians

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Abstract

Palmar intertriradial ridge counts (a-b, b-c, c-d, a-d) in 260 males and 260 females of Sardinian origin were considered. Bilateral and sex differences, correlation coefficients, skewness and kurtosis of the four distributions and an index of asymmetry were calculated. There are no sex differences, ridge counts show positive and almost always significant correlations. The a-d ridge count shows a normal distribution in both sexes.

Keywords

a-b, b-c, c-d, a-d Ridge Counts, Sardinians

1. Introduction

While there are many data about a-b ridge count (Floris and Sanna, 1982; Jantz and Webb, 1982; Pons, 1982), other palmar intertriradial ridge counts are relatively few (Jaeger, 1971; Knussmann, 1971; Hitzeroth and Brehme, 1974; Maté, 1975; Brehme et al., 1977; Dennis, 1977; Reichmann, 1978; Brehme and Hitzeroth, 1979, 1980; Galaktionov et al., 1981; Gill et al., 1982; Babu, 1983; Gyenis, 1984; Karmakar and Malhotra, 1985; Hitzeroth et al., 1986; Jantz et al., 1988-1992; Brehme and Jantz, 1990; Arrieta et al., 1992; Demarchi and Marcellino, 1994-1995; Milicic and Rudan, 1991; Milicic and Vidovic, 2005; Reichmann, 1978; Deep Kumar and Ramachandraiah, 1991; Kamali, 1982; Reddy et al., 2004; Karmakar et al., 1996). The a-d ridge count in particular has been examined only in Asiatic populations (Basu, 1971; Chattopadhyay and Kushwaka, 1978; Balgir and Sharma, 1986; Narahari et al., 2008; Bhasin, 1970; Bansal et al., 1984; Chai, 1971), and in Sardinians (Floris, 1993; Floris and Sanciu, 1989), while data on persons from Bologna (Gualdi-Russo, 1987) from Galicia (Lodeiro Ainsua et al., 1985) and from Bulgaria (Tornjava-Randelova et al., 2008) were given by the sum of a-b, b-c and c-d counts and not directly by calculating the ridges crossing, or which in any case touching, the line joining triradii a and d (Cummins and Midlo, 1961). Ahuja et al., 1977, measured the distance a-d in centimetres. Hauser and Abraham (1985) only measured the b-c and c-d ridge counts. One of the difficulties met with in calculating intertriradial ridge counts is the not infrequent absence of triradius c (triradius d, which is also sometimes absent, is so with a frequency of only 0.06% of Sardinians of both sexes, Floris and Sanna, 1983), which for example shows up in 2.94% of Sardinian males (Floris and Sanna, 1987). To make up for this absence, it is possible either not to consider prints without triradius c (Rosa, 1983) or estimate its presumed position (Braitsch and Scwarzfischer, 1959). In this note, we adopt the first method because having examined a small sample of individuals belonging to the same group of prints in which the intertriradial counts were calculated where triradius c was absent in one (or both) palms and made up of 12 males and 12 females (Floris and Sanciu, 1989) significantly differing average values (in the two sexes as well as in the two sides) were obtained, with the exception of the a-b ridge count, with respect to values obtained in the sample with triradius c always present. For this reason, it was decided to examine only, at least in this note, the prints with triradius c present and not estimated. One can not neglect at last the critical remarks of Weninger (1978) about b-c and c-d ridge counts and the probability that some results are incorrect, because the ridges cross the b-c or c-d line can be more or less obliques and not at nearly right angles (as for the a-b ridge count or for the determination of the finger ridge count).

For all the reasons mentioned above, it can therefore be considered useful to increase our knowledge concerning palmar intertriradial ridge counts in a sample belonging to the Europoid population.

2. Materials and Methods

The data reported concern the four palmar intertriradial ridge counts (a-b, b-c, c-d, a-d) in 260 Sardinian males and 260 Sardinian females, chosen from the different palm prints on file at our Department, taking into account possible sex and side differences, correlations, the normality of the distributions (skewness and kurtosis) and the asymmetry. Among the various indices that have been advanced to examine bilateral asymmetry, we have chosen for his simplicity and for the reasons brought by the Author, the asymmetry index proposed by Jantz (1975) for digital ridge counts, adapted for four characters:

$$A.I. = \sqrt{\sum_1^4 \left(R_i - L_i\right)^2}.$$

3. Results and Discussion

Table 1 gives the means and standard deviations and the result of the analysis of differences of sex (Student's

Table 1. The intertriradial palmar ridge counts (mean and standard deviation of the mean).

		R	SD	L	SD	R + L	SD	$\overline{D}/\sigma_{\overline{D}}$	t (R × L)
a-b									
	M	40.54	5.64	41.40	5.58	81.93	10.36	3.22**	1.75
	F	40.42	5.60	41.94	6.40	82.37	11.26	5.79**	2.88**
	t(M × F)	0.23		1.04		0.45			
b-c									
	M	27.22	5.79	26.79	5.55	54.01	10.78	1.98*	0.86
	F	28.01	5.61	27.15	6.01	55.17	11.08	3.97**	1.69
	t(M × F)	1.58		0.71		1.20			
c-d									
	M	36.39	5.27	35.46	5.66	71.85	10.00	3.38**	1.94
	F	36.13	6.01	35.81	6.17	71.94	11.36	1.16	0.60
	t(M × F)	0.54		0.67		0.09			
a-d									
	M	82.15	15.85	83.60	16.54	165.75	31.29	2.80**	1.02
	F	84.27	16.40	84.93	16.24	169.19	31.60	1.31	0.46
	t(M × F)	1.50		0.92		1.25			
A.I.									
	M					10.06	4.79		
	F					9.94	4.50		
	t(M × F)					0.29			

*$p \le 0.05$, **$p \le 0.01$.

test) and side (in this case, since the variables under examination are not independent, the paired data test was used, Barbensi, 1952).

As can be seen from **Table 1**, the values on the right are larger than those on the left in both sexes for counts b-c and c-d, while they are higher on the left for counts a-b and a-d. Values are higher in males than in females only for counts a-b and c-d on the right and higher in females in all other cases.

Side differences are significant for all the counts in males (but they are not if we do not use the test t for paired data!) and for a-b and b-c counts in females (only for a-b count with t test for non paired data). These differences show that the directional asymmetry (if the bilateral differences are not significant the asymmetry is fluctuating, if they are statistically significant the asymmetry is said directional) is small (about one ridge in favor of the left hand for a-b and a-d ridge counts and in favor of the right hand for b-c and c-d ridge counts) but statistically almost always significant, as seen for a-b ridge count by Jantz and Webb (1982).

Sex differences are in any case never significant.

The correlation coefficients for palmar intertriradial ridge counts are given in **Table 2**. All correlations are

Table 2. Correlations among the intertriradial palmar ridge counts.

	Ra-b	Rb-c	Rc-d	Ra-d	La-b	Lb-c	Lc-d	La-d	RLa-b	RLb-c	RLc-d	RLa-d
						Males						
Ra-b	1.00											
Rb-c	0.30	1.00										
Rc-d	0.11	0.18	1.00									
Ra-d	0.37	0.51	0.35	1.00								
La-b	0.71	0.28	0.20	0.36	1.00							
Lb-c	0.33	0,81	0.23	0.53	0.26	1.00						
Lc-d	0.23	0.36	0.67	0.51	0.25	0.29	1.00					
La-d	0.39	0.48	0.33	0.87	0.37	0.56	0.47	1.00				
RLa-b	0.92	0.32	0.16	0.40	0.92	0.32	0.26	0.41	1.00			
RLb-c	0.33	0.95	0.21	0.55	0.28	0.95	0.35	0.55	0.33	1.00		
RLc-d	0.19	0.30	0.91	0.47	0.24	0.29	0.92	0.44	0.23	0.31	1.00	
RLa-d	0.39	0.51	0.35	0.96	0.38	0.56	0.51	0.97	0.42	0.57	0.47	1.00
						Females						
Ra-b	1.00											
Rb-c	0,29	1.00										
Rc-d	0.29	0.07	1.00									
Ra-d	0.43	0.67	0.37	1.00								
La-b	0.76	0.34	0.32	0.42	1.00							
Lb-c	0.35	0.82	0.11	0.63	0.34	1.00						
Lc-d	0.31	0.27	0.74	0.46	0.33	0.19	1.00					
La-d	0.40	0.65	0.29	0.87	0.41	0.65	0.41	1.00				
RLa-b	0.93	0.34	0.33	0.46	0.95	0.37	0.34	0.43	1.00			
RLb-c	0.34	0.95	0.09	0.68	0.36	0.96	0.24	0.68	0.37	1.00		
RLc-d	0.32	0.18	0.93	0.45	0.35	0.16	0.93	0.38	0.36	0.18	1.00	
RLa-d	0.43	0.68	0.34	0.97	0.43	0.66	0.45	0.97	0.46	0.70	0.43	1.00

Critical value ($p \le 0.05$) = 0.12.

positive and in most cases significantly different from zero. The sole exceptions found concern those between a-b and c-d (males on right), between b-c and c-d (females on right) and between c-d (females on right) and b-c (females on left). On the whole correlations are greater in females in the 68% of the cases, in males in the 27% and equals in the 5% of the cases. The existence of sex differences in the correlations may suggest that the sex chromosomes may be involved in the control of dermal ridge development (just as suggested for the fingers by Jantz, 1977).

For homologous counts the greatest correlation is found between a-d counts in both sexes, for non homologous counts between b-c and a-d, in both sexes and sides. Because, for homologous counts, high correlations signifly low fluctuating asymmetry (Jantz and Webb, 1982), we can say that the fluctuating asymmetry increases from a-d count to b-c, a-b, c-d counts.

Parameters concerning skewness and kurtosis are given in **Table 3**. On the basis of these two parameters (and of X^2 for d.f. = 5) it can be said that distributions are normal only for count a-d in both sexes while in all other cases either for parameter g_1 (skewness) or g_2 (kurtosis), either on one side or the other, there is a significant difference from zero. On not considering side, only count a-b is found to have significant g_1 and g_2 values. It is therefore possible to say that the a-d ridge count is due to a large number of additive genes, whose action brings to a nearly normal distribution (e.g. = stature).

The asymmetry index is higher in males than in females, but the difference is not significant, as seen in an English sample by Jantz (1975) for the total ridge count.

Finally, on comparing our results with those of subjects from Bologna (Gualdi-Russo, 1987), it is seen that Sardinians present higher values for count b-c and lower values for counts a-b and c-d, but in any case, on the average, differences go from 0.2 to 1.7 ridges.

In conclusion, from what has been reported thus far, it can be said that there are no sex differences (in agreement with Garg and Chattopadhyay, 1983), while there are side differences (with t test for paired data); the variables considered are significantly and positively correlated (except for few exceptions) and tend to be no

Table 3. Skewness, kurtosis and X^2.

			a-b			b-c	
		g_1	g_2	X^2	g_1	g_2	X^2
	R	0.63**	0.99**	15.81**	−0.16	−0.47	9.35
M	L	0.47**	1.31**	16.74**	−0.30*	−0.16	13.48*
	R + L	0.41**	0.57	2.28	−0.29	−0.32	5.17
	R	0.45**	0.90**	19.01**	−0.17	−0.11	8.18
F	L	1.19*+	2.74**	19.69**	−0.33*	0.24	13.23*
	R + L	0.91**	1.87**	9.78	−0.27	−0.09	6.09
			c-d			a−d	
	R	−0.28	0.99**	12.18*	−0.01	−0.57	6.71
M	L	−0.24	0.91**	11.26*	−0.19	−0.53	7.32
	R + L	−0.14	0.58	5.35	−0.13	−0.58	5.17
	R	−0.38*	o.42	4.55	−0.25	−0.22	3.75
F	L	−0.48**	0.34	8.68	−0.03	−0.14	6.46
	R + L	−0.39**	0.18	10.15	−0.15	−0.15	2.40

$sg_1 = 0.15$, $sg_2 = 0.30$, N = 260, $t = g_1/sg_1$ and $t = g_2/sg_2$. X^2 with d.f. = 5. $^{*}p \le 0.05$ $^{**}p \le 0.01$.

normally distributed with the exceptions of the a-d ridge count in both the sexes and the sides and in the two sides together.

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