

DERMATOGLYPHIC PATTERNS AMONG LEBANESE MEDICAL STUDENTS OF BAU

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ABSTRACT

Introduction: Dermatoglyphics has a potential contribution to biological anthropology and population genetics. The present study aims to detect the percentages of dermal ridge patterns' distribution among both sexes of medical students of Beirut Arab University with the intent to provide data that can serve as a control group in the future dermatoglyphic studies.

Materials and Methods: 50 males and 50 females of Lebanese medical students were taken randomly from all students of faculty of medicine of Beirut Arab University.

Results: The total distributions of fingertip patterns for both hands were 9.4 % for arches, 44.4 % for ulnar loops, 6.2 % for radial loops and 40.0 % for whorls for male students, 8.6 % for arches, 46.4 % for ulnar loops, 6.6 % for radial loops 38.4 % for whorls for females. Radial loops had the least distribution among both hands of males with nearly equal distribution between the ten fingers. Same results were found in both hands of females, with more inclination to the left index. For the palmar dermatoglyphic, the mean atd angle in males was 44.6 ± 5.795847 for the right hand and 45 ± 6.586938 for the left hand with no significant difference. In females it was 44.94 ± 4.528414 for the right hand and 46.14 ± 7.056651 for the left hand with no significant difference. The results for the Pattern intensity index was 13.02 for both sexes, for the Dankmeijer's index was 22.959 for both sexes and for the Furuhashi's index was 75.676 for both sexes. More than 3 fingers' were concordant in the present work in both sexes 80 %.

Conclusion: For finger tips, loops had the highest ratios, arches were the least, and whorls were in between with no significant differences between both hands and in both sexes. In the palm, the mean atd angle was around 45° for both hands and in both sexes.

KEY WORDS: Arch, Radial loop, Ulnar loop, whorl, atd angle, Various dermatoglyphic indices.

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INTRODUCTION

Dermatoglyphics is the study of patterns of fingers, toes, palms and soles. Fingerprints will not change so long as there is no serious injury. Both hands differ and also identical twins show differences. All primates have ridges [1].

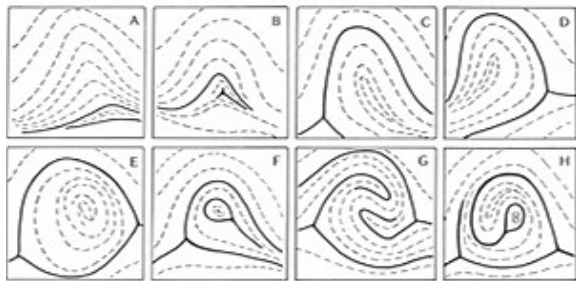
Each individual exhibits unique finger and palm print configurations determined by the genetic

profile of their parents [2].

There are 3 basic patterns in the prints; arches, loops and whorls. Arches are either simple or tented. Loops include radial and ulnar loops. Whorls have many subtypes including simple whorl (concentric or spiral), double loops, central pocket whorl and accidental whorl which represents two or more patterns such as a loop

and a whorl or triple loops (fig. 1). 60-65 % of the population has loops, 5 % has arches and 30-35 % has whorls [1,3-5].

Fig. 1: Schematic drawings of fingertip patterns with boldly traced type lines. A, simple arch; B, tented arch; C and D, loop (ulnar or radial); E, simple whorl; F, central pocket whorl; G, double loop whorl; H, accidental whorl [5].



A study on 400 healthy Nigerian students reveals that: Ulnar loops polarized preferentially to digits III, IV and V and radial loops to digit II. Female subjects had higher counts of radial loops ($p < 0.001$) than the males. Male subjects had a higher whorl count than the females ($p < 0.05$) [6].

Frequency distribution of finger pattern types among major Mongoloid tribal populations in India showed that whorls were the most prevalent patterns among both males (52.19%) and females (55.69%), followed by loops (47.70% in males and 2.81% in females) for both left and right sides combined [7].

The general distribution of finger print patterns among the students of medical school of Ajmer, India, showed high frequency (51.87%) of loops whereas whorls were moderate (35.83%) and arches were least (12.30%) in frequency [8].

Studying of 200 medical students (100 male & 100 female) belonging to the age group 18- 25 of Kasturba Medical College, Mangalore, India, showed that each finger print is unique; loops are the most commonly occurring fingerprint pattern while arches are the least common. Males have a higher incidence of whorls and females have a higher incidence of loops [9].

The dermal ridges on the fingertips, i.e., fingerprints, are arranged in patterns and classified based on the number of tri-radii present [10].

Pattern intensity refers to the complexity of ridge configurations. It can be expressed by counting the number of triradii present. According to the number of triradii, a digit can have

a pattern intensity 0–3. The simple arch, which lacks a triradius, is assigned the number 0, the tented arch and loop are both assigned 1, as each has one triradius, and typically, the whorl and its subtypes are assigned 2, as they have two triradii [10, 11]. The most widely used palmar character is the measurement of atd angle [3]. Concordance is the presence of similar patterns on homologous fingers of right and left hands, and it is an example of fluctuating asymmetry caused by environmental disturbance [12]. Greater concordance in fingerprint patterns is present among control group than among cases [13].

Previous studies have reported the proportional variation in fingerprint pattern types among Thai populations [14] and other ethnicities [15 - 18]. For example, the arch pattern type is present at a high frequency in African (17.5%) [15] compared to Indian (5.6%) [16], Thai (3.2%) [17], and New Zealand (0.8%) [18] Populations.

The present study aims to detect the percentages of dermal ridge patterns' distribution among the medical students of Beirut Arab University of both sexes with the intent to provide data that can serve as a control group in the future dermatoglyphic studies.

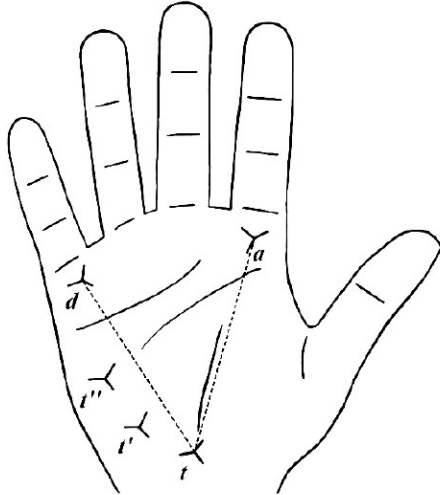
MATERIALS AND METHODS

100 Lebanese medical students, 50 males and 50 females were taken randomly from all students of faculty of medicine of Beirut Arab University. Personnel data and consent were recorded for each student [appendix-1]. Non Lebanese parental nationality, congenital malformations, like congenital heart diseases and musculo-skeletal abnormalities were excluded.

Both palms were scanned using Adobe Photoshop CS6 at a resolution of 600 dots per in (DPI). Finger patterns were also read by magnifying lens and recorded in each sheet. Palmar triradii were studied. The Triradius present below medial four fingers are named a,b,c and d starts from index finger to little finger, the Triradius present between thenar and hypothenar eminence were named as (t). When two (a) or two (d) triradii were encountered, the more radial and more ulnar triradius, respectively, was used to determine the atd angle. When more than one t triradius was encountered in a single

print, only the more proximal triradius was used (t instead of t' and t' instead of t'') in accordance with the method proposed by David (1981a) (fig. 2) [19]. The atd angle was drawn by photoshop.

Fig. 2: The corrected atd angle [19].



The Various dermatoglyphic pattern indices calculated from the obtained results are as follows:

Pattern intensity index = $[(2 \times \% \text{ whorl} + \% \text{ loop}) \div 10]$ [20, 21, 22, 23].

Dankmeijer's index = $[(\% \text{ arches} \div \% \text{ whorl}) \times 100]$ [20, 21, 24].

Furuhata's index = $[(\% \text{ whorl} \div \% \text{ loop}) \times 100]$ [20, 21, 25].

Data were statistically analyzed using chi squared test with Yate's correction and Unpaired Student "t" test. Differences were considered significant if p values were less than 0.05 [26, 27].

RESULTS

Table 1: Distribution of fingertip patterns for both hands of male students.

	Right		Left		Total	
	N	%	N	%	N	%
Arches	21	8.4	26	10.4	47	9.4
Ulnar loop	111	43.6	111	44.4	222	44.4
Radial loop	17	6.8	14	5.6	31	6.2
Whorls	101	41.2	99	39.6	200	40
Total	250	100	250	100	500	100

The differences were insignificant for the chi-square (X²) with Yates' p-value = 0.9234802 at 3 degree of freedom.

A total of 100 medical students participated in the present study, out of which 50 were males

and 50 were females. The following results were encountered:

For the percentage of distribution of fingertip patterns among the ten fingers, nearly equal percentages were found for both right and left hands of male students (table 1), and female students (table 2). The differences were not significant.

Table 2: Distribution of fingertip patterns for both hands of female students.

	Right		Left		Total	
	N	%	N	%	N	%
Arches	19	7.6	24	9.6	43	8.6
Ulnar loop	114	45.6	118	47.2	232	46.4
Radial loop	25	10	8	3.2	33	6.6
Whorls	92	36.8	100	40	192	38.4
Total	250	100	250	100	500	100

The differences were insignificant for the chi-square (X²) with Yates' p-value = 0.03801539 at 3 degree of freedom.

Also nearly equal ratios for fingertip patterns distribution in both sexes were present (tab. 3). The differences were not significant.

Table 3: Distribution of fingertip patterns in both sexes.

	Males		Females		Total	
	N	%	N	%	N	%
Arches	47	9.4	43	8.6	90	9
Ulnar loop	222	44.4	232	46.4	454	45.4
Radial loop	31	6.2	33	6.6	64	6.4
Whorls	200	40	192	38.4	392	39.2
Total	500	100	500	100	1000	100

The differences were insignificant for the chi-square (X²) with Yates' p-value = 0.93629017 at 3 degree of freedom.

From the previous tables the radial loops had lower percentages when compared with ulnar loops. 8 Radial loops were found on the left hands in females; mainly on the index finger (5), two on the left middle and one on the left little finger. Whereas 25 radial loops were recorded on the right hands of female students with about equal distributions between the five fingers. In males, about equal numbers were recorded for both right (17) and left (14) with nearly equal distributions between the five fingers.

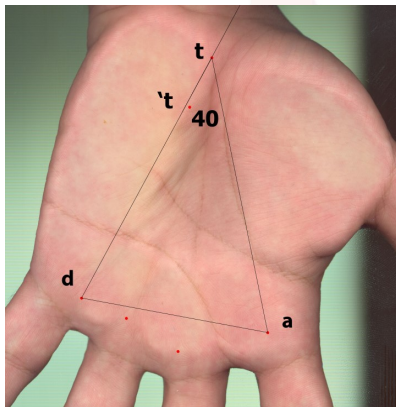
The results of the present study for both sexes revealed that arches had the lower percentage 9 %, followed by the whorls 39.2 %, whereas loops had the higher ratios 51.8 %.

For the palmar dermatoglyphic, the mean for the atd angle of the right hands in males was 44.6 ± 5.795847 and that for the left hand was 45 ± 6.586938 , the difference was not significant at 98 degrees of freedom table 4.

Table 4: Differences between atd angles of both right and left hands of male students.

	Males	
	Rt hand (N = 50)	Lt hand (N = 50)
Mean	44.6	45.6
Standard deviation	5.795847	6.586938
t-test	0.00000023	
p-value	Not significant	

Fig. 3: Photoshop of the palm of the left hand showing (a & d) triradii at the roots of the index and little fingers. Note that two proximal (t & t') triradii were present in this condition and that the most proximal (t) triradius was included in the measurement of atd angle.



For the palmar dermatoglyphic, the mean for the atd angle of the right hands in females was 44.94 ± 4.528414 and that for the left hand was 46.14 ± 7.056651 , the difference was not significant at 98 degrees of freedom table 5.

Table 5: Difference between atd angles of both hands of female students.

	Females	
	Rt hand (N = 50)	Lt hand (N = 50)
Mean	44.94	46.14
Standard deviation	4.528414	7.056651
t-test	0.20239972	
p-value	Not significant	

The various dermatoglyphic indices table 6:

- o The pattern intensity index was 13.06 for males and 12.98 for females.
- o Dankmeijer's index was 23.5 for males and 22.396 for females.
- o Furuhashi's index was 79.051 for males and 72.453 for females.

Table 6: The various dermatoglyphic indices for both males and females

Study data	Gender	Pattern intensity index	Dankmeijer's index	Furuhashi's index
Medical students of BAU	Males	13.06	23.5	79.051
	Females	12.98	22.396	72.453
	Males + Females	13.02	22.959	75.676

Table 7: Distribution frequency of fingertip patterns among the five fingers of both right and left hands in male students.

	I			II			III			IV			V		
	Right	Left	Both	Right	Left	Both	Right	Left	Both	Right	Left	Both	Right	Left	Both
	50	50	100	50	50	100	50	50	100	50	50	100	50	50	100
A	4	4	4	16	22	19	14	18	16	6	6	6	2	2	2
UL	38	38	38	36	26	31	50	46	48	38	38	38	60	74	67
RL	4	4	4	8	8	8	12	6	9	2	4	3	8	6	7
W	54	54	54	40	44	42	24	30	27	24	52	53	30	18	24

1 = thumb, II = index, III = middle, IV = ring, V = little finger.

A = Arch, UL = Ulnar loop, RL = Radial loop, W = Whorl.

Table 8: Distribution frequency of fingertip patterns among the five fingers of both right and left hands in female students.

	I			II			III			IV			V		
	Right	Left	Both	Right	Left	Both	Right	Left	Both	Right	Left	Both	Right	Left	Both
	50	50	100	50	50	100	50	50	100	50	50	100	50	50	100
A	2	2	2	12	14	13	16	18	17	4	6	5	4	6	5
UL	42	46	44	36	28	32	48	52	50	32	40	36	64	70	67
RL	10	0	5	10	8	9	12	4	8	6	0	3	12	2	7
W	46	52	49	42	50	46	24	26	25	58	54	56	20	22	21

1=thumb, II=index, III=middle, IV = ring, V = little finger.

A = Arch, UL = Ulnar loop, RL = Radial loop, W = Whorl.

The highest concordant percentages were recorded for 4 fingers, followed by 5 and 3 fingers. The lowest concordant rates were recorded for 2 fingers, whereas none or one finger concordance were almost none for both sexes table 9.

Table 9: Finger patterns' concordance for both sexes in the present study.

Concordant fingers	Males		Females		Total	
	N	%	N	%	N	%
5 Fingers	10	20	10	20	20	20
4 Fingers	20	40	23	46	43	43
3 Fingers	13	26	7	14	20	20
2 Fingers	7	14	9	18	16	16
None	0	0	1	2	1	1
Total	50	100	50	100	100	100

The chi-square distribution was non-significant at 4 degrees of freedom (Yates' *p*-value: 0.83440588).

DISCUSSION

The dermatoglyphic patterns of the present study

were done sex wise and side wise. The four fingerprint patterns highlighted in the present study were arches, ulnar loops, radial loops and whorls. Pattern indices were recorded and the means of palmar atd angle were tabulated. Higher frequencies of ulnar loops were recorded in the present study for the right hand 43.6 and 44.4 for the left hand in male students with 44.4 % for both hands as the difference was insignificant (table 1). Also the same results were recorded for female students which were 45.6, 47.2 and 46.4 % for the right hand, left hand and both hands respectively, as the difference was insignificant (table 2). When the percentages of both sexes were compared, the difference also was insignificant, so the ratios for both sexes summed were 9.0, 45.4, 6.4 and 39.2 % for arches, ulnar loops, radial loops and whorls respectively (table 3). These insignificant type, sex and side wise distribution in the present study was consistent with the study done on medical students 2006[28].

The previous results were in accordance with five Indian studies [8, 9, 28, 29, 30], two Nigrean studies [15, 31], two Sri Lanka studies [21, 32], Bengal [33], Tunisia [34], Black Americans (USA) [35], Vietnamese [36], and Caucasian [37] where loops were more prevalent than whorls. On the other hand, the present results were in contrast to the studies conducted by some authors in Australia [38], New Zealand [18], and India [7, 39] where the whorls predominate over the ulnar loops in both hands of males and females.

Higher percentages of arch pattern were found on the index and middle fingers of both hands for male and female students in the present work (table 6-7), more in the left index in males and in the left middle finger in females. These results were in accordance with two studies on Indian people in 2015 [28, 40], on Sri Lanka people 2013 [21] and on Thailand people 2013 [14].

Radial loop was the least frequent pattern recorded in the present study 6.4 % (table 3). It was seen on all the ten digits with a slight higher inclination to the index and middle fingers of right and left hands in both sexes. These results were in accordance with the records for the index finger [28, 21, 14, 6] whereas the radial loops

were either absent or with low records on the remaining digits.

Ulnar loop was the highest frequent pattern in the present study. It showed highest record for the little finger of both the right and left hands in both sexes, followed by the middle and then the thumb in female students, with equal records on both the thumb and ring fingers in males. These results of ulnar loop for the little, middle and thumb fingers in the present study were consistent with the studies on Muslim population from India in 2015 [29], Nigerian students' 2011 [6], Indian people 2009 [7], and among Sinhalese people in Sri Lanka 2013 [21].

Whorls were the 2nd frequent pattern in the present study. Higher frequencies were recorded on the thumb, ring and index fingers. A result which was in accordance with an Indian study 2009 [7], a Sri Lanka study 2013 [21] with higher records on the ring finger, an Indian people 2015 [28,40] with also higher records on the ring finger. A 3rd Indian study in 2015 [41] recoded high frequencies for the whorls on the index and thumb, with nearly equal ratios on the middle and ring fingers. Also the present results for whorls were consistent with a Thailand study 2013 [14], an Indian study 2006 [28] for the ring, thumb and index fingers.

The three indices of the present study for both males and females were slightly higher than those recorded in the Indian study in 2015 [29], but the Pattern intensity index for both males and females in the present study were nearly equal to the study in 2013 [21] whereas the other two indices were also higher.

The results for fingertip patterns' concordance in the present study showed that three and more finger concordance represents more than 80 %. A result that agreed with a previous one among Thai Adolescents [14].

ABBREVIATIONS

A - arch.
RL - radial loop.
UL - ulnar loop.
W - whorl.

CONCLUSION

The distribution of fingertip patterns where loops predominate over whorls and arches, concordance rate over three fingers and mean atd

angles of 45 in both hands and for both sexes makes the present sample of BAU students as a control group for future studies.

Conflicts of Interests: None

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