A study of morphological patterns of dermatoglyphics among mother and fetus in different ABO, RH blood groups

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Abstract

Background: Dermatoglyphics, the study of fingerprints are unceasing and characteristic. It has been found useful in forensic medicine and documentation purpose. It is beneficial in medical diagnosis of genetically inherited diseases and in detection of crimes.

Objective: To associate between digital dermatoglyphics patterns in ABO, Rh blood groups in the mother and fetus and to assess their significance.

Patients and Methods: The pregnant mother and her baby of the 2016 in Al-Batool teaching hospital, designed the study populace. The present study has been carried out on 90 fit individuals (mothers her baby) undergoing medical screening. Fingerprints were attained by Ink method. Parameters studied were arches, whorls, loops.

Results: Common of the subjects (42%) in the study were of blood group A followed by blood group O, B and AB of whom (30%) were Rh-positive. The common distribution of pattern of finger print showed high frequency (30%) of loops followed by whorls and arches. Almost similar order was detected in both Rh-positive and Rh negative individuals or A, B, AB and O blood groups, except blood group O- ve which showed more whorls.

Conclusion: There is an association between distribution of finger print pattern and blood groups.

Key words: Dermatoglyphics, Loops, Whorls, Arches.

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Introduction

A fingerprint in its fine sense is an imprint left by the friction ridges of a human finger.The word “dermatoglyphics“is derived from the Greek word “Derma“meaning skin and “glyphae meaning carve. A friction ridge is a elevated portion of the epidermis on the digits (fingers and toes), the palm of the hand or the sole of the foot, consisting of one or additional connected ridge of friction ridge skin.[1] These are known as "epidermal ridges" which are caused by the underlying border between the dermal papillae of the dermis and the interpapillary (rete) pegs of the epidermis. The term dermatoglyphics was presented by Harold Cummins (1926).

The classic pattern of epidermal ridges was determined since their development in the first foetal life which is permanent. The ridges are distinguished in their definitive form during third and fourth month of foetal life and once formed remain permanent and not ever change during the life (Cummins H and Midlo, 1943).

The ridge pattern depends upon cornfield layer of epidermis. Dermatoglyphics, the study of fingerprints are endless and personal. In the Henry system of classification, there are three basic fingerprint patterns: loop, whorl, and arch. The dermatoglyphics and blood groups together show national and genetic differences, a correlative study between dermatoglyphics and blood groups may expose the genetic interdependence. There are uncommon studies on correlation between dermatoglyphics and blood groups. (Otto and Bozoti, 19803; Nayak and Patel, 19734). Therefore the study was reserved to find correlation between ABO blood group system and various dermatoglyphic patterns. Clinically, merely 'ABO' and 'Rhesus' groups are of major importance. 'ABO' system is additional classified as A, B, AB, O blood group kinds according to presence of corresponding antigen in plasma. 'Rhesus' system is classified into 'Rh +ve' and 'Rh –ve' according to the presence or absence of 'D' antigen.

Thus, it is considered to be an important instrument in assessing the genetic characteristic, evaluation of children with supposed genetic disorders and also in forensics. It is prominent that subjects with chromosomal abnormalities had rare ridge developments. The ridges are influenced by blood vessel-nerve pairs at the margin between the dermis and epidermis during prenatal development and factors, such as insufficient oxygen supply, uncommon distribution of sweat glands, and modifications of epithelial growths could influence the ridge patterns [2, 3].

Patients and Methods

The descriptive survey method of the quantitative design was used. The newly admitted pregnant mother and her baby of the 2016 in Al-Batool teaching hospital, formed the study population. The present study has been carried out on 90 healthy individuals (mothers her baby) undergoing medical screening. All the subjects were fit with identified blood groups. The ABO and Rhesus blood groups of all subject (mother and her baby) were attained from the records in the medical laboratory register. Other statistics recorded were sex and age of the subject.

Two types of blood grouping were used.

1. ABO blood group system – Subjects grouping into four blood groups → A, B, AB and O.
2. Rh blood group system – Subjects grouping into two blood groups → Rh positive and Rh negative.

Mother and her fetus age between (18 – 22 years) were haphazardly chosen, the fingerprints of each subject were attained using endorsing ink and plain white paper. The stamp pad was homogeneously saturated with endorsing ink. Each finger was positioned on the stamp pad and then moved to the plain paper and rolled gently from side to side to obtain clear complete print. The three primary ridge patterns were identified and recorded in a data sheet The ABO blood groups was selected for the study and individuals were grouped into four blood groups : A, B, AB and O. The print paper following points were noted.

Name –
Age-
Sex –
Date of the print –
Right or left Indices –

Dermatoglyphic prints were worked by the "INK METHOD "as described by CUMMINS (1936) and CUMMINS and MIDLO (1961). To improve the excellence of dermatoglyphics prints, it was essential to eliminate sweat, oil & dust from the skin surface. This was ended by cleaning the hands with soap & water & wiping with ethyl alcohol. The materials used were printers, duplicating ink from Kores, cardboard, roller, gauze pads and sheets of paper. Subjects

were asked to wash and dry their hands. A quantity of ink was applied over the indices with a gauze piece and smeared carefully and homogeneously. A sheet of paper was kept at the table. The printed papers were coded with name, age, sex, blood group. Prints were evaluated with the help of magnifying hand glass. The parameters detected were loops, whorls, arches. Magnifying lens, Pencil Pen the prints were analyzed for the following parameter.

Fingertip patterns

I) Arches
II) Loops
III) Whorls

Ethical Issues

Prior to data collection, the subjects were informed of the nature and purpose of the study and only those who gave voluntary consent participated in the study.

Accordingly, the Research and Ethics Committee of the College of Health Sciences, Diyala University, approved the research protocol.

Statistical Analysis

The statistics were subjected to statistical analysis using frequency distribution and chi square, with the assistance of the Statistical Package of Social Sciences (SPSS) version 16. A P value < 0.05 was considered statistically significant.

Results

In this study, of the 90 subjects that participated, 53% were female while 47% were male fetuses. Results showed the dominant ABO blood group in the population was group O+ (26%),O- (10%), followed by group A+ (20%),A- (4%), group B+ (26%), B+ (4%), group AB+ (4%) and then group AB- (6%). Results also showed that Rh+ was the dominant Rhesus factor (76%) and ABO-Rh blood group (24%). The distribution of finger ridge patterns of the mother showed that the dominant finger ridge pattern was loop (30%), followed by whorl (40%) and then arch (30%). The distribution of finger ridge patterns of the fetus showed that the dominant finger ridge pattern was loop (46%), followed by whorl (20%) and then arch (34%).Table 1 shows cross tabulation of the chi square test between gender and ABO blood group. Female had higher percentage of blood group O and B while male had higher percentage of blood group A. There was no significant association between gender and blood group (P > 0.05). Table 2 shows cross tabulation of the chi square test between gender and Rhesus blood group. Within the respective blood groups, females had higher percentages compared to males. There was no significant association between gender and Rhesus blood group (P > 0.05).Table 3 shows cross tabulation of the chi square test between gender and ABO-Rh blood group. Within the respective blood groups, females had higher percentages compared to males. There was no significant association between gender and ABO-Rh blood group (P > 0.05). Table 4 shows cross tabulation of the chi square test between gender and fingerprint patterns. Within each fingerprint pattern, female had higher percentage of arch and whorl while male had higher percentage of loop. There was no significant association between gender and fingerprint patterns (P > 0.05). Table 5 shows cross tabulation of the chi square test between fingerprint patterns and ABO blood group. Within the respective blood groups, whorl had higher percentages compared to arch and loop. There was no significant association between fingerprint patterns and ABO blood group (P > 0.05). Table 6 shows cross tabulation of the chi square test between fingerprint patterns and Rhesus blood group. Within the respective Rhesus blood groups, arch had higher percentages compared to loop and whorl. There was a significant association between fingerprint patterns and Rhesus blood group (P < 0.05). Table 7 shows cross tabulation of

the chi square test between fingerprint patterns and ABO-Rhesus blood group. Within the respective ABO-Rhesus blood groups, whorl had higher percentages compared to arch and loop. There was a significant association between fingerprint patterns and ABO-Rhesus blood group (P < 0.05). Table 8 shows cross tabulation of the chi square test between fingerprint patterns of mother and fetus. Loop had higher percentages compared to arch and whorl in fetus compare to the mother. There was a significant association between fingerprint patterns of the mother and fetus (P < 0.05).

Table (1): Distribution of ABO blood group with regards to gender ABO blood group Gender (%) Total (%) Female and Male.

ABO blood group	Gender (%)		Total (%)
	Female	Male	
B	(51.0)	(49.0)	(100.0)
O	(55.1)	(44.9)	(100.0)
AB	(50.0)	(50.0)	(100.0
A	(44.5)	(55.5)	(100.0)
Total	(51.8)	(48.2)	(100.0)

*$\chi 2$= 3.55, df =3, P=0.314

Table (2): Distribution of Rhesus blood group with regards to gender Rhesus factor Gender (%) Total (%) Female Male.

Rhesus factor	Gender (%)		Total (%)
	Female	Male	
RH-	60	40	100
RH+	51.6	48.4	100
Total	51.8	48.2	100

*$\chi 2$= 0.628, df =1, P=0.428

Table (3): Distribution of Rhesus blood group with regards to gender Blood group Gender (%) Total (%) Female Male.

Blood group	**Gender (%)**		**Total (%)**
	female	**male**	
A+	12%	8%	20 %
A-	3%	1%	4%
B+	18%	8%	26%
B-	3%	1%	4%
AB+	1%	3%	4%
AB-	2%	4%	6%
O+	19%	7%	26%
O-	4%	6%	10%
Total	62%	38%	100%

*$\chi 2$=8.47, df =6, P=0.21

Table (4): Distribution of finger ridge patterns (fetus) with regards to gender Fingerprint Gender (%) Total (%) Female Male.

finger ridge	Gender (%)		Total (%)
	female	male	
Arch	20%	14%	34%
Loop	14%	32%	46%
whorls	12%	8%	20%
Total	46%	54%	100%

*$\chi 2$=4.71, df =2, P=0.10

Table (5): Distribution of finger ridge patterns (mother) within ABO blood groups ABO blood group Fingerprint (%) Total (%) Arch Loop Whorl.

Blood group	arch	loop	whorl	Total
A	11%	9%	13%	33%
B	12%	9%	3%	24%
AB	0%	9%	25%	34%
O	3%	0%	6%	9%
Total	26%	27%	47%	100%

*$\chi 2$=7.36, df= 6, P=0.28

Table (6): Distribution of finger ridge patterns within Rhesus blood groups Rhesus factor Fingerprint (%) Total (%) Arch Loop Whorl.

Blood group	arch	loop	whorls	Total
RH+	21%	15%	27%	63%
RH-	26%	2%	9%	37%
Total	47%	17%	36%	100%

*$\chi 2$=8.75, df= 2, P=0.013

Table (7): Distribution of finger ridge patterns within ABO-Rhesus blood groups Blood group Fingerprint (%) Total (%) Arch Loop Whorl.

Blood group	**Arch**	**Loop**	**Whorl**	**Total**
A+	**6%**	**10%**	**3%**	**19%**
A-	**6%**	**0%**	**0%**	**6%**
B+	**10%**	**10%**	**3%**	**23%**
B-	**5%**	**0%**	**0%**	**5%**
O+	**0%**	**6%**	**20%**	**26%**
O-	**0%**	**6%**	**6%**	**12%**
AB+	**0%**	**0%**	**3%**	**3%**
AB-	**3%**	**0%**	**3%**	**6%**
Total	**30%**	**32%**	**38%**	**100%**

*$\chi 2$=23.17, df =12, P=0.026

Table (8): Distribution of finger ridge patterns between mother and fetus Fingerprint between mother and fetus (%) Total (%) Arch Loop Whorl.

	Arch	Loop	Whorl
Mother	26	27	47
Fetus	34	46	20

*$\chi 2$=3.11, df =3, P=0.01

Discussion

The present study tells that there is link between distribution of fingerprint design and blood groups of the mother and fetus. In the present study blood group O is found to be the commonest (36%) and AB the least common (10%). Similar findings has been reported by Agte, A.V. (1973). However Dapson (1946) found higher incidence of blood group O and A in British population.

A significant decrease of arches in blood group AB as compared with rest of the blood groups in both male and female individuals is observed in the present study. Nayak and Patel (1973) reported that no. of arches were significantly little in blood group O than rest of the blood groups.

Studies (Mehta and Mehta 2011, Bharadwaja et al. 2004, Herch 1932, Gowda and Rao 1996, Kshirsagar et al. 2001, Mahajan et al. 1986) have shown that the distribution of the fingerprint designs is the similar for the different ABO blood groups (A, B, AB and O):loop had the highest percentage, followed by whorl and the least was arch. Studies have also described a significant association between fingerprint patterns and blood groups (Bharadwaja et al. 2004; Mehta and Mehta 2011). In contrast, Odokuma et al. (2008) described that there was no significant association between thumb print patterns and ABO blood groups.

The occurrence of the loops in different blood groups (except O blood group) in males and females did not tell any significant difference. It indicates unchanging distribution of loops in the population.

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In the present study the male populace shows 32% loop frequency, but the incidence of loop is lesser in blood group O (0%). In females blood group (14%) has lesser frequency of loops than blood group O (0%). This variation between the blood groups is also significant.

In the present study the male population shows 14% arch frequency, but the incidence of arch is lesser in blood group AB (0%). In females blood group (20%) has lesser frequency of loops than blood group AB (0%). This variation between the blood groups is also significant.

Conclusion and Recommendation:

Present study revealed the correlation between ABO blood group system and dermatoglyphics of the mother and fetus. Within each fingerprint pattern, female had higher percentage of arch and whorl while male had higher percentage of loop. There was no significant association between gender and fingerprint patterns ($P > 0.05$). Within the respective Rhesus blood groups, arch had higher percentages compared to loop and whorl. There was a significant association between fingerprint patterns and Rhesus blood group ($P< 0.05$). There was a significant association between fingerprint patterns of the mother and fetus ($P < 0.05$).

Research works have been carried out on digital dermatoglyphics and blood groups independently. However, studies focusing on association between fingerprints and gender as well as blood groups have not been undertaken to this extent in this population. The purpose of this study was to determine fingerprint patterns in relation to gender and blood group among the mother and fetus in diyala city - Iraq. This will serve as an important assistance in sex and blood group determination and vice versa, thus, increasing the authenticity of fingerprints in investigation of crimes and criminals.

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