

## Gender specific correlation among fingerprint patterns and blood group in Pakistani population

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### Abstract

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*Finger print patterns are extensively used for the study of individuality as most legitimate evidence against criminals. Due to the massive potential of fingerprints as a definite method of identification they can be useful to analyze their correlation with gender. In present study, total 166 Pakistani subjects with (70.83%) of males and (29.1%) of females were selected for this study. Whorls were the most frequent fingerprint pattern (48.21%), while arches were the least common (10.11%). There high frequency of whorls (35.4%) and females have higher incidence of loops (14.2%). The ridge density can also predict the gender as the female had higher ridge density (13±1) than males (12±1). Whorls were predominant in blood group O, A, B and AB in both Rh negative and Rh positive individuals.*

**Keywords:** Blood group, Finger print, Gender, Arches, whorls

### Introduction

Throughout the world finger print pattern are (Champod *et al.*, 2001; Gutiérrez *et al.*, 2008) used by forensic scientists for the investigation of criminals (Martín., *et al* 1998). During the course of crime investigation finger prints along with other forensic techniques can million chances for two persons for sharing the similar pattern of fingerprints (Arrieta *et al.* 1990). Even the identical twins being born from same zygote are indistinguishable during DNA profiling but can be identified through individuality of their fingerprint pattern (Floris *et al.* 1975).

Presently most appropriate and extensively used Gattton system of identification. Impression of error (Dittmar *et al* 1998). Henry–Gatton system is based on eight classes of finger print patternnamely, Plain Arch, Tented Arch, Left-Loop, Right-Loop, Plain Whorl, Central-Pocket Whorl, Double-Loop Whorl and Accidental

whorl (Esteban *et al.*, 1993; Nithin *et al.*, 2009). Many studies have explored the gender differentiation using finger print impressions (Bharadwaja *et al.*, 2004). Recently, forensic chemists have also studied the secretions on the finger prints contain residue with variable chemicals that can also be utilized for the criminal investigations (Jones *et al.*, 2001).

Worldwide number of research groups has significantly contributed to analyze the correlation between fingerprints pattern and ABO blood group sin different geographical areas (Mehta *et al.*, 2011). Present study evaluates the relationship among finger prints, blood groups and gender in Pakistani population.

### MATERIALS AND METHOD

The prospective study was carried out at Nova plus Molecular Diagnostic Lab and Research center on 166 subjects from Lahore, Pakistani aged between 18 and 55 years. Purpose of the study was explained and verbal informed consent was taken from all the subjects individually.

### Finger print analysis

The subjects were asked to wash their hands and dried with tissue papers. All of them were then

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asked to press finger bulb on the stamp pad and then to the paper to transfer the fingerprint impression. The same method was repeated for all the fingers of both hands. The fingerprint patterns were studied according to Henry's system of classification with the help of a magnifying lens and were classified Loops, Whorls and Arches based on the manifestation of ridge lines (Keogh *et al.*, 2013). This value represents the number of ridges and will be referred to as the ridge density value as shown in Figure 1.

**NOTE:** People with any hand deformities due to injury, birth defect or disease, were excluded from the study.



**Figure 1:** Epidermal ridges of fingerprint, counted by 5mm x 5mm square drawn on transparent film.

### Blood group screening

All the subjects were screened for blood grouping. 2.0 ml sample of blood was drawn from the antecubital vein of each subject in a disposable syringe, and transferred immediately to a tube containing ethylene diamine tetra acetic acid (EDTA) anti clotting agent. Blood grouping and Rhesus factor evaluation was performed by the antigen antibody agglutination test. The antisera and plasmatic anti serum D were obtained from Plasmatic (Kent, UK).

### RESULTS

A fingerprint is an impression of the friction ridges found on the inner surface of a finger or a thumb. Fingerprinting is considered to be the only

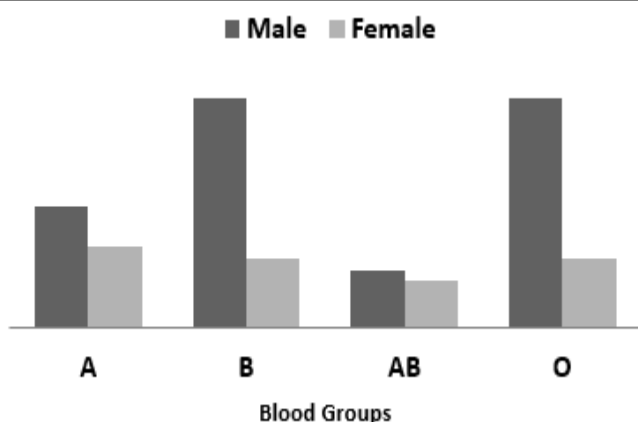
science which leads to unique means of identification. In this study the males were with frequency of (70.8%) and females with frequency of (29.1%). The most frequent type of fingerprint pattern is whorl (48.2%) and its distribution with respect to gender is males (35.5%) and females (12.2%). Loops were the second most common type of fingerprint pattern with slight differences in frequency (41.6%), in which (27.3%) were male and (14.2%) females. The Arches were least common type with frequency of (10.1%) in which (5.9%) males and (4.1%) females. The sub- types of fingerprints patterns were also observed. Three types of whorl patterns were observed namely Plain whorls, Accidental whorl and Central pocket whorl. The Plain whorls were found with the frequency of (36.9%), Accidental whorls (7.14%) and Central pocket whorls (4.16%). The Loops were found as the second most common type of fingerprint patterns and the subtypes Radial Loop persists with frequency of (22.0%) and Ulnar Loop (20.2%). The rare type of fingerprint pattern was Arches with subtypes Plain Arch (6.54%) and Tented arch (3.57%) (Table 1). The ridge count studies showed that females had greater ridge count as compared to males which can be of great significance and an important evidence in gender studies associated with fingerprint impressions.

The average ridge count in this study was found between 12 -13 in males and 13-14 in females. The association between ridge count of fingerprint impression and gender as illustrated (Figure 2).

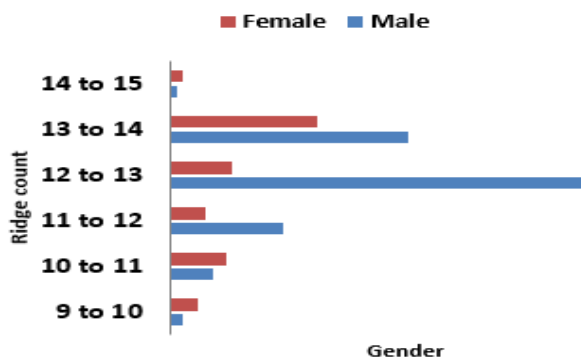
In this study the majority of the subjects belonged to the blood group O; followed by the blood group B, A and AB. Males have frequency of 13.6%, 24.1%, 25.5% and 6.49% whereas females have frequency of 14.54%, 7.68%, 8.24% and 4.76% for blood groups A, B, AB and O respectively (Figure 3).

**Table 2:** The ridge density with respect to sub-types of fingerprints

Whorls			Loops		Arches	
Plain whorl	Accidental Whorl	Central pocket whorl	Radial loop	Ulnar loop	Plain arch	Tented arch
1.7%	1.1%	0.54%	3.57%	3.57%	1.1%	0.2%
2.38%	1.1%	0.54%	2.38%	2.38%	0.54%	0.54%
4.1%	1.7%	1.7%	6.54%	5.95%	2.97%	1.1%
16.07%	2.97%	1.1%	8.33%	7.7%	0.54%	0.54%
11.0%	0.54%	0.1%	0.54%	0.54%	0.54%	1.1%
0.54%	0.1%	0.2%	0.54%	0.1%	0.54%	0.1%
36.9%	7.14%	4.16%	22.0%	20.2%	6.54%	3.57%



**Figure 2:** Blood groups types with respect to gender



**Figure 3:** Ridge count with respect to gender

For Rh factor in males, the blood group O the most prevalent in which the Rh +ve subjects were more as compared to Rh -ve subjects with the frequency of 23.80% and 1.7% respectively. The second most frequent blood group B showed Rh +ve 23.80% and Rh-ve 1.1%. The third most common type of blood group was blood group A with frequency of 12.5% and 1.1% for Rh+ve and Rh -ve respectively. The least frequent blood group was blood group AB with frequency of 5.95% and 0.54% (Table 2). Majority of the subjects were Rh positive (93.3%) while only (6.7%) were Rh negative including all the male and female subjects. The male were (66.05%) Rh positive and (4.67%) Rh negative. The females were (27.38%) and (1.78%) respectively. However, in contract to male subjects where blood group B was the second most common the females subjects possess second most common blood group A. This shows a unique variation on the part of blood group types in Pakistan.

**Table 2:** Table representing Finger print pattern and Blood group (For left and right thumb impressions)

Finger Print pattern	Total	Rh+ve				Rh-ve			
		O	A	B	AB	O	A	B	AB
Arches	10.10%	4.10%	0.54%	3.51%	1.10%	-	0.54%	0.54%	-
Loops	41.60%	11.90%	11.30%	13.60%	4.10%	1.10%	-	0.54%	-
Whorls	48.20%	14.80%	8.90%	13.60%	6.54%	1.70%	0.54%	0.34%	0.54%
<b>Total</b>	<b>100.00%</b>	<b>30.90%</b>	<b>20.80%</b>	<b>30.90%</b>	<b>10.70%</b>	<b>2.97%</b>	<b>1.10%</b>	<b>1.70%</b>	<b>0.54%</b>

The arches have blood group O common in them and then blood group B, A and AB respectively. Likely, the loops had blood groups B as the most common one and then blood group O, A and AB respectively. Moreover, the whorls have blood group O as the most common and then blood group B, A and AB respectively.

## CONCLUSION

Present study analyzes the geographical basis of fingerprint pattern in Pakistan. Furthermore, the association between finger patterns, ridge count, blood group and gender can be proved as an important tool for forensic experts and law enforcement agencies especially during preliminary investigation. Further studies are essential to enhance the authenticity of finger prints and its correlations in identification and detection of criminals.

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