Fingerprint patterns in relation to gender and blood groups - A study in Navi Mumbai

Amit Patil[1,*], Amrit Malik[2], Treza Shirole[3]

[1]Professor & HOD, [2,3]UG Student, Dept. of Forensic Medicine & Toxicology, Dr. DY Patil Medical College, Navi Mumbai

***Corresponding Author:**
Email: dramp1976@gmail.com

Abstract

Introduction: Human identification can be done by using various physical and mental characteristics. Being unique, fingerprints can be used to identify an individual. Strong correlation has been found in earlier studies between the fingerprint pattern and gender and blood group.

Objectives: The objective of the study was to determine correlation (if any) between the fingerprint pattern and blood group and gender.

Materials and Method: The study was conducted on 170 subjects [70 males and 100 females] in the age group of 18-65 years. The fingerprint pattern of the study participants was compared with the gender and ABO-Rh blood group after taking their verbal consent.

Results: Amongst ABO blood group, the most common blood group was B (36.47%), followed by O (35.88%), A (18.23%) and AB (9.4%). Rh + ve was the most common rhesus factor (95.88%). The loop was the most common pattern (62.35%), followed by whorl (32.94%) and arch (4.7%). There was significant association between the fingerprint pattern and ABO blood group (P value < 0.05).

Conclusion: The present study confirms that loop is the most common fingerprint pattern while arch was the least common. The study revealed significant association between the fingerprint pattern and ABO blood group. No statistical significant association was found between the fingerprint pattern and gender.

Keywords: Fingerprint pattern, ABO blood group, Gender, Identification

Introduction

Human identification from physical and mental characteristics is a crucial objective of forensic investigation. It involves study of physical or pathological, functional or mental characteristic features which are unique to an individual. Human identification is essential for personal, socio-legal reasons.(1) Data used for personal identification include tattoo marks, anthropometry, dactylography, lip prints, blood grouping, DNA fingerprinting, stature determination, determination of age and sex, bite marks, hand writing, iris and retinal prints, mannerisms etc. As fingerprint has a unique characteristic pattern, it can be used to identify someone.(2)

Fingerprint is a greasy and oily impression of the friction ridges of the finger. These friction ridges are raised portions of the epidermal part of the skin of the finger digits and palmar or plantar surface. The earliest work on fingerprints and its use for personal identification were carried out many years ago in India.(3) Dermatoglyphics is the study of fingerprints.(4) It has been reported by Cummins and Kennedy that the unique characteristics pattern of epidermal skin ridges is uniquely differentiated in definitive forms during the 3rd and 4th intrauterine life.(5) It is said that the fingerprint patterns are genetically determined and are constant throughout the life of an individual from birth till death.(6)

Bloterogel and Bloterogel in their study had expressed a correlation between physical characters and blood groups.(7) Hahne reported blood group O association with more loops and less with whorls than blood group A.(8) Herch reported loop as the most common pattern in A blood group.9 Study done on Gowda Saraswat Brahmin community by Gowda and Rao, reported high frequency of loops with moderate whorls and low arches in the individuals of A, B and O blood group.(10)

Dermatoglyphics studies done earlier have found strong association between fingerprint patterns and blood groups.(11,12) Earlier studies done have reported that primary fingerprint pattern is same for different blood groups where loop was the most common pattern followed by whorls and arch was the least common.(9-13) Similar fingerprint studies done has concluded existence of strong association between distribution of fingerprint patterns, blood group and gender.(14-16)

Early detection of the crime is a challenge with available forensic tools in crime investigation. Many times, fingerprints and some blood stains are the only evidence left at the challenging crime scene for identification of the victim or the crime perpetrators. The present study intends to identify existence of significant association if any between fingerprint patterns and gender as well as blood group. This study will be of immense help in determination of gender and blood group and vice versa from the fingerprints,

thereby improving the genuineness of fingerprints in crime investigation and identification of the criminals.

Materials and Method

The present study was carried out at Dr D Y Patil Medical College, Navi Mumbai on 170 subjects. The subject were students [medical, nursing, physiotherapy], teaching and non-teaching staff between the age group of 18 years to 65 years who voluntarily consented to participate in the study. The study project was started after approval from the Institutional Ethics Committee.

The verbal consent of all the participants was obtained after explaining them about the aims and objectives of the study. The subjects were given unique enrollment number and their details such as sex and age were noted on a performa. ABO blood group of the subject participants were obtained from their identity cards. Before taking fingerprints, the subjects were asked to clean their hands with a hand sanitizer to remove any dirt and grease to obtain clean and legible fingerprints. The tips of the finger, that is the entire area above the crease of the first phalangeal joint, was painted with black ink with the help of a roller. Then a rolled fingerprint from radial to ulnar border [from inwards to outwards] was obtained on to the specified space of a bond paper with normal pressure. In this manner, fingerprints of all the ten fingers were obtained for everyone on the proforma. Magnifying glass was used to identify and study the fingerprint patterns. They were identified as Loops, Whorls and Arches based on the ridge appearance according to Henry's system of classification. Study subjects with permanent scars on fingers and thumbs, deformities of hand or fingers due to injury or diseases, and those with extra, webbed fingers were excluded from the study.

Data collected was subjected to statistical analysis using frequency distribution and Chi-square test with the help of Statistical Package of Social Sciences [SPSS] version 20.0 [Statistical Package for Social Sciences, Inc., Chicago, IL, USA]. A P-Value < 0.05 was considered statistically significant for association of variables.

Results

In this study, of the 170 subjects participated, 58.82% were females while 41.17% were males. The dominant ABO blood group in the population was group B (36.47%), followed by group O (35.88%), group A (18.23%) and then AB group (9.4%). Rh +ve was the dominant Rhesus factor (95.88%). When ABO-Rh blood group was considered, the prevalence was in the following order O +ve (35.29%), B +ve (34.70%), A +ve (17.64%), AB +ve (8.23%), B -ve (1.76%), AB -ve (1.17%), A -ve and O -ve (0.58%) respectively.

Females had higher percentage of O blood group followed by B group while males had higher percentage of B blood group followed by O group (Table 1). In both the sexes, blood group AB was the least common. Chi-square test was applied to know the association between blood group and gender. There is no significant correlation or association between the blood group and gender of an individual [P value > 0.05]. Rh +ve was the dominant Rhesus blood group among both males and females. There was no significant association between gender and Rhesus blood group as P value was > 0.05 (Table 2). As per Table 3, no significant association was found between gender and ABO-Rh blood group [P > 0.05]. The general distribution of fingerprint pattern showed that the dominant pattern was loop (62.35%), followed by whorl (32.94%) and then arch (4.7%). Both the sexes, showed higher percentages of loops, followed by whorls and arches. Males had higher percentage of whorls as compared to females while females had higher percentage of loops (Table 4).

Table 5 shows cross tabulations of the Chi-square test between fingerprint patterns and ABO blood group. Within the respective blood groups, loop had higher percentages compared to whorl and arch. The Chi-square statistics is 19.081 and the P- value is 0.004. There is a strong association between fingerprint patterns and ABO blood group [P < 0.05]. In Rhesus blood groups, loops were the most common followed by whorls and arches (Table 6). No significant association was found between fingerprint pattern and Rhesus blood group [P < 0.05].

Table 1: Distribution of ABO blood group with regards to gender

	Blood group [%]				
	A	**B**	**AB**	**O**	**Total**
Sex					
M [N-70]	12 [7.05%]	28 [16.47%]	9 [5.29%]	21 [12.35%]	70 [41.17%]
F [N-100]	19 [11.17%]	34 [20%]	7 [4.11%]	40 [23.52%]	100 [58.82%]
Total	31[18.23%]	62 [36.47%]	16 [9.4%]	61 [35.88%]	170 [100%]
Chi-square test	3.1328				
P - Value	0.3716				
Statistical Significant at 5% level	No				

Table 2: Distribution of Rhesus blood group with regards to gender

Rhesus Factor	Gender [%]		Total [%]
	Female	Male	
Rh +ve	95 [55.88%]	68 [40%]	163 [95.88%]
Rh -ve	5 [2.94%]	2 [1.17%]	7 [4.11%]
Total	100 [58.82%]	70 [41.17%]	170 [100%]
Chi-square test	0.4789		
P - value	0.48892		
Statistical Significant at 5% level	Not significant		

Table 3: Distribution of ABO-Rhesus blood group with regards to gender

	Blood group [%]								
	A +ve	A -ve	B +ve	B -ve	AB +ve	AB -ve	O +ve	O -ve	Total
Sex									
M [N-70]	12 [7.05%]	0	26 [15.29%]	2 [1.17%]	9 [5.29%]	0	21 [12.35%]	0	70
F [N-100]	18 [10.58%]	1 [0.58%]	33 [19.41%]	1 [0.58%]	5 [2.94%]	2 [1.17%]	39 [22.94%]	1 [0.58%]	100
Total	30 [17.64%]	1 [0.58%]	59 [34.7%]	3 [1.76%]	14 [8.23%]	2 [1.17%]	60 [35.29%]	1 [0.58%]	170
Chi-square test	7.857								
P - value	0.345								
Statistical significant at 5% level	No								

Table 4: Distribution of fingerprint patterns and blood group of study population

Fingerprint pattern	Gender [%]		Total [%]
	Female	Male	
Arch	5 [2.94%]	3 [1.76%]	8 [4.7%]
Loop	68 [40%]	38 [22.35%]	106 [62.35%]
Whorls	27 [15.88%]	29 [17.05]	56 [32.94%]
Total	100 [58.85%]	70 [41.17%]	
Chi-square test	3.889		
P - Value	0.14306		
Statistical significant at 5% level	Not significant		

Table 5: Distribution of fingerprint patterns with regards to ABO blood group

Fingerprint pattern	ABO blood group				Total	
	A	B	AB	O	N	%
A	1 [0%]	2 [1.76%]	4 [2.35%]	1 [0.58%]	8	4.7
L	18 [10.58%]	39 [22.94%]	7 [4.11%]	42 [24.70%]	106	62.35
W	13 [7.64%]	20 [11.74%]	5 [2.94%]	18 [10.58%]	56	32.94
Total	31 [18.23%]	62 [36.47%]	16 [9.41%]	61 [35.88%]	170	100
Chi-Square test	19.081*					
P - Value	0.004					

Statistical significant at 5% level	Yes

Table 6: Distribution of fingerprint pattern within Rhesus blood groups

Print Pattern	Blood Group [%]		Total [%]
	Rh +ve	Rh -ve	
A	8 [4.9%]	0	8 [4.7%]
L	102 [62.57%]	4 [2.35%]	106 [62.35%]
W	53 [32.51%]	3 [1.76%]	56 [32.94%]
TOTAL	163 [95.88%]	7 [4.11%]	170 [100%]
Chi-square test	0.593		
P - value	0.743		
Statistical significant at 5% level	Not significant		

Discussion

In the present study, females and males had higher percentage of loops as well as whorls. Similar study done on 200 medical students of Kasturba Medical College, Mangalore, have reported that frequency of loops as well as arches is greater in females while frequency of whorls were greater in males.[14] In the present study, there was no significant association between gender and fingerprint pattern [P > 0.05]. Similar observation was reported by other researchers.[17, 18]

The distribution of the fingerprint pattern in different ABO blood groups [A, B, AB and O] and in Rhesus blood groups revealed that the Loop had the highest percentage, followed by whorls and the arches. It means that irrespective of the blood group, loop was the commonest fingerprint pattern followed by whorl and arch. Similar findings were observed by previous researchers.[9-14,17]

The distribution of fingerprint patterns in individuals with the ABO-Rhesus blood groups was the same for A +ve, B +ve, B -ve, AB +ve, O +ve and O -ve where loop was the commonest followed by whorls and the least were arches. These findings agree more or less with Bharadwaja et al, Prateek and Keerthi and Dennis Eboh.[11,14,17] However, they observed that in A -ve individual's whorls was the commonest and in O -ve individuals loop was the commonest. AB -ve individuals had equal percentages of each fingerprint pattern.

This study revealed statistical significant association between fingerprint pattern and ABO blood group [P < 0.05]. This was in conformity with similar earlier studies done by various researchers.[11,12,14] But this finding did not match with observations of Kshirsagar et al, Dennis Eboh and Odokuma et al., who did not find any association between fingerprint patterns and ABO blood groups.[13,17,18]

Conclusion

The present study has identified loop as the most common type of fingerprint pattern. The study has also revealed significant association between fingerprint pattern and ABO blood group. Unfortunately, this study failed to identify significant association between gender and fingerprint pattern. The result of this study is significant as it can help the investigators to determine the blood group from the fingerprint pattern and vice versa investigating the crime. It is suggested to carry similar studies in future to search association between the fingerprint pattern and gender and blood group.

References

1. Limson K.S., Julian R. Computerized recording of the palatal rugae pattern and an evaluation of its application in forensic identification. J Forensic Odontostomatol. 2004; 22:1-4.
2. Encarta. Microsoft Encarta Dictionary, 1993-2008, Microsoft Corporation. 2009.
3. Cummins H. Palmar and Plantar Epidermal Ridge Configuration [Dermatoglyphics] in Europeans and Americans. Am J Phys Anthrop1926; 179:741-802.
4. Herschel W.J. Skin furrows of the hand. Nature 1880; 23 (578):76.
5. Cummins H., Kennedy R. W. Physiological Examination of visual organ and of the cutaneous system. Am J Crim Law Criminol1940; 31: 343-56.
6. Vij K. Textbook of Forensic Medicine and Toxicology. 3rd ed. Elseiver 2005, New Delhi.89-91.
7. Bloterogel H., Bloterogel W. Blutgrype and Dactylogramm: Konstitutions Merk Male der Poliomyelitis. Krapam Zt Rehse Hindrih1934; 56:143-63.
8. Seema M.A., Gandhi D., Singh M. Dermatoglyphics Study and Review of Literature. Novel Sci Int J Med Sci 2012; 1 (6):191-8.
9. Herch M. Pappilarmuster Bei Engeotorenen der Loyalty Insehm, Berichungan Swischen Pappillarmuster and Bluntgrainppen Beidiessen an Liner Dentschem Verglei Chsgrmppe Ztschr F Rasseh Physio 1932; 5:163-68.
10. Gowda M.S., Rao C.P. A study to evaluate relationship between dermatoglyphic features and blood groups. J Ant Soc India 1996; 45:39.
11. Bharadwaja A., Saraswat P.K., Aggarwal S.K., Banerji P., Bharadwaja S. Pattern of fingerprints in different

ABO blood groups. J Indian Acad Forensic Med 2004; 26(1): 6-9.
12. Mehta A.A., Mehta A.A. Palmar dermatoglyphics in ABO, RH Blood groups. Int J Bill Med Res 2011; 2(4): 961-64.
13. Kshirsagar S.V., Burgul S.N., Kamkhedkar S.G., Maharashtra A. Study of fingerprint patterns in ABO blood group. J Anat Soc India 2003; 52 (1); 82-115.
14. Prateek R., Keerthi R.P. A study of fingerprints in relation to gender and blood. J Indian Acad Forensic Med 2010; 32 (1): 11-14.
15. Sandip K Raolti, Kalpesh A Shah, Viras C Patel, Anand K Menat, Rakesh N Mori, Nishith K Chaudhari. An effort to determine Blood groups and Gender from Fingerprints. National Journal of Community Medicine Jan-Mar 2013; Volume 4 (1): 158-160.
16. Radhika R.H. Pattern of fingerprints and their relation with blood groups. Indian Journal of Basic and Applied Medical Research; March 2016; 5 (2): 744-49.
17. Dennis E.O. Eboh. Fingerprint patterns in relation to gender and blood group among students of Delta State University, Abraka, Nigeria. Journal of Experimental and Clinical Anatomy. 2013; Vol 12 (2): 81-86.
18. Odokuma E.I., Igbigbi P.S., Emundianughe T.S. A study of thumb print patterns and ABO Blood group distribution. J Exp Clin Anat 2008; 7(1): 22-26.