Content available at: https://www.ipinnovative.com/open-access-journals

International Journal of Clinical Biochemistry and Research

Journal homepage: https://www.ijcbr.in/

Original Research Article

Study of fingerprint patterns in relation to gender and blood groups

S. A. Pratinidhi[1,*], Vaishali Lunawat[2], Mohak Tilokchandani[3], Chaitanya Bhujbal[3], Rutuja Shejul[3], Madhumita Sahoo[3]

[1]*Dept. of Biochemistry, Bharatratna Atalbihari Vajpayee Medical College & Hospital, Pune, Maharashtra, India*
[2]*Dept. of Phamacology, Bharatratna Atalbihari Vajpayee Medical College & Hospital, Pune, Maharashtra, India*
[3]*MIMER Medical College, Pune, Maharashtra, India*

ARTICLE INFO

Article history:
Received 04-06-2023
Accepted 24-06-2023
Available online 14-07-2023

Keywords:
Dermatoglyphics
Fingerprint patterns

ABSTRACT

Introduction: Dermatoglyphics (fingerprint/dactylography) is derived from the Greek word "Derma=Skin, Glyph=Carve." Dermatoglyphics is defined as the scientific study of naturally occurring epidermal ridges and their configuration on the digits, palms and soles apart from flexion crease and secondary folds.
Objective: The objective of the study was to determine correlation if any exits between the fingerprint pattern and blood group and gender.
Materials and Methods: The general study design selected for this article was cross-sectional study. Here, the primary outcome variable is to determine correlation (if any) between the fingerprint pattern and blood group and gender. A total of 271 students volunteered for the study.
Results: Loops were found to the most prevalent type of fingerprint in all blood groups. Blood groups and primary fingerprint patterns were found to be associated with the association being statistically significant.
Conclusion: The correlation between the said entities would enable better authentication and prediction of identity of a person and thereby has the potential for great application in the field of forensics.

1. Introduction

Dermatoglyphics (fingerprint/dactylography) is derived from the Greek word "Derma=Skin, Glyph=Carve." Dermatoglyphics is defined as the scientific study of naturally occurring epidermal ridges and their configuration on the digits, palms and soles apart from flexion crease and secondary folds. The term was coined by Anatomist Harold Cummins in 1926. A fingerprint is formed on any opaque surface and is the impression of the friction ridges on the finger of a human.[1] The matching of two fingerprints is among the most widely used and most reliable biometric techniques. Fingerprint matching only considers the obvious features of a fingerprint.[2]

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.[3] 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. 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

* *Corresponding author*.
E-mail address: mayashilpa5@gmail.com (S. A. Pratinidhi).

https://doi.org/10.18231/j.ijcbr.2023.025

for personal identification were carried out many years ago in India.[4] Dermatoglyphics is the study of fingerprints.[5] 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 month intrauterine life.[6] It is said that the fingerprint patterns are genetically determined and are constant throughout the life of an individual from birth till death. Dermatoglyphics studies done earlier have found strong association between fingerprint patterns and blood groups.[7,8]

Dermatoglyphics is constant and idiosyncratic even in monozygotic twins from birth till demise. Fingerprint is the personal identification of a human being.[9] Fingerprint is helpful in medicolegal case for recognition of suspect, victims, and another person who touches the surface and for the diagnosis of inheritable disease. Fingerprint scans are also used in digital mission of India, biometric systems, validating electronic registration, cashless transactions, library access, and forensic purposes.[10,11] ABO blood group system was discovered at University of Vienna by Austrian Scientist Karl Landsteiner. ABO and Rh blood group systems are of major importance compared to other systems.[11] ABO is further classified into four principal types: A, B, AB, and O. There are two antigens and two antibodies responsible for ABO type. Rh blood group is one of the most complex blood groups in human and it is further classified into Rh-positive and Rh-negative due to the presence of absence of D antigen. Various diseases usually influence particular blood group like duodenal ulcer in O and gastric ulcer in A blood group.[12,13] The aim of this study was to find correlation between ABO and Rh blood group with dermatoglyphic pattern in human beings.

Bloterogel and Bloterogel in their study had expressed a correlation between physical characters and blood groups.[14] Hahne reported blood group O association with more loops and less with whorls than blood group A. 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.[15]

2. Materials and Methods

The current study was conducted in MIMER Medical College Talegaon(D). Second year and other students who volunteered were the subjects for the study A total of 271 students were enrolled for the study. The general study design selected for this article was a cross-sectional study. While selecting the subject the following criteria was followed-.

2.1. Inclusion criteria

People who know their blood group were included in this study.

2.2. Exclusion criteria

All people who had damaged their pulp of the finger due to any injury, mehandi, or trauma are excluded in this research as we need intact finger pulp. The students were told to press there each finger on stamp pad and there finger prints of all ten digits were taken on A 4 size white paper. The pattern of finger was anaysed using lens. The pattern was divided into four types.

Loops, whorls, arches and composite were noted. Also, blood group and Rh status was noted down and result was prepared and anaysed.

Primary Outcome: The primary outcome variable was to determine correlation (if any) between the fingerprint pattern and blood group and gender.

3. Results and Discussion

Fingerprints form a crucial part of a person's identity and also the citadel on which the science of forensic identification rests. It forms part of the means that help determine the identity of an individual for all forensic purposes. Blood groups on the other hand, while being determined by the antigens present on the RBC surface are inherent characteristics of the individual and vary from individual to individual The present study aims at finding correlations between these two parameters of an individuals identity. The present study indicates that the incidence of blood group B was highest followed by O, A and AB blood groups respectively (Table 1). Studies conducted by Khalid, M., and M. A. Qureshi and others[8,16,17] have yielded similar results.

Bharadwaja, et al. Rastogi and Pillai and Sudhikshya, et al. however found O blood group to have a higher incidence.[7,18,19] These differences could perhaps be explained by variations in the genetic make up of the study populations of the respective studies which may also explain why incidence of A and O blood groups was maximum in few studies.[20] The current study exhibited a significantly high incidence of Rh+ve (90.5%) subjects as compared to Rh-ve (10.5%) which is following the other studies conducted by various researchers.[7,21,22]

Table 1: Blood group and number in the study population

Blood Group	No of participants
A	75
B	100
AB	19
O	77

The incidence of loops was higher in males (890) than females (607), studies of Mehdipour and Farhaud[23] also showed similar results. While the ridge pattern density is one of the parameters that helps differentiate gender based on Baye's Theorem, the incidence in the type of fingerprint could also have assistive role in gender differentiation.[22]

Table 2: Fingerprint patterns in the study population

Type of fingerprint	Percentage founfd in study population
Loops	55.23
Whorls	25.75
Arches	13.94
Composite	5.05

There was a predominance of loops in all the blood groups. The incidence of loops was highest in blood group B, followed by blood groups O, A and AB. This correlates with the study of Deopa, et al.[24] which also found the highest incidence of loops in blood group B. However, studies of Mehta and Mehta,[8] Sudhikshya, et al.[19] and Vinay and Gowri[25] found the highest incidence of loops in blood group O and the lowest incidence in blood groups A and B and studies of Shashikala and Aswini[26] proved the highest rate of incidence in AB. The incidence of whorls in our study was highest in blood group B and lowest in blood group AB. This is in agreement with the studies of Deopa, et al.[24]

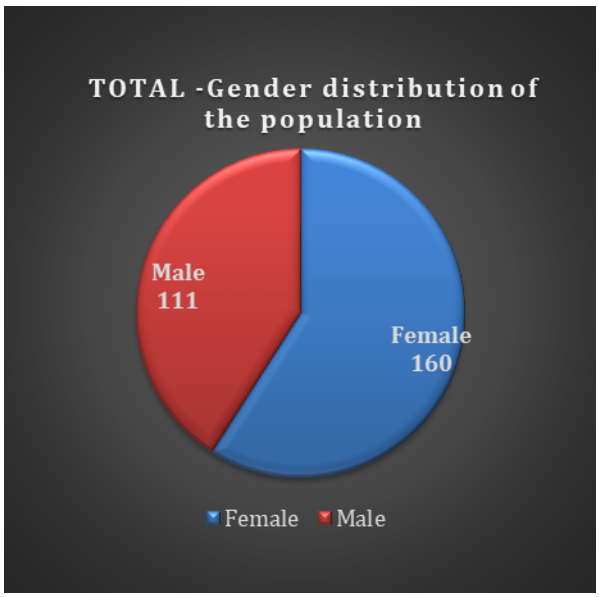

Fig. 1: Gender distribution of the study population

Table 3: Frequencies of various fingerprint patterns with respect to blood groups (ABO system)

Blood Group	Loop frequency	Whorl frequency	Arch Frequency	Composite Frequency
A	410	184	115	41
B	569	250	123	58
AB	102	35	45	8
O	416	229	95	30

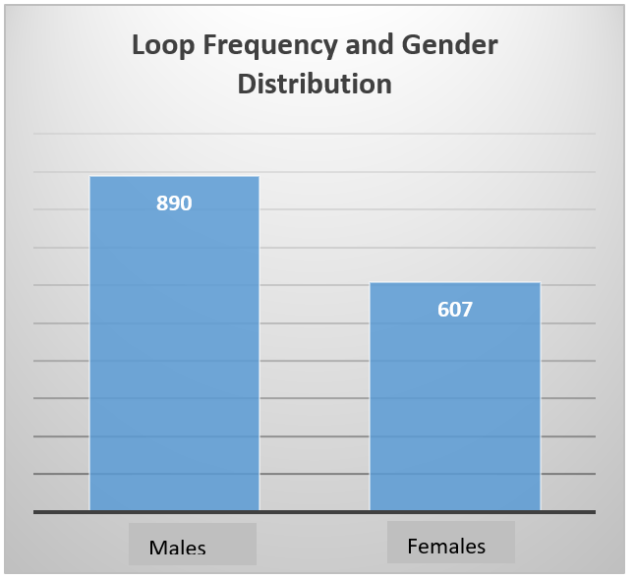

Fig. 2: Loop frequency with respect to gender distribution of study population

The incidence of both loops and whorls is more in Rh positive individuals, which is as per the findings of Bharadwaja, et al.[7] and Mehta and Mehta.[8] The fact that there is steep skew in the incidence of Rh positive individuals compared to negative and the fact the loops are the most common form of fingerprints, as has been the finding of this study, this association maybe spurious and detailed studies to understand this distribution are warranted.

Table 4: Frequencies of various fingerprint patterns with respect to blood groups (Rh)

Rh status	Loops	Whorls	Arches	Composite
Positive	1372	644	350	134
Negative	125	54	28	3

The chi-square test performed on the data collection in the present study showed a significant association between blood groups and primary fingerprint patterns (x2=23.96, p=12.59). This showed the rejection of the null hypothesis and reveals that there is an association between fingerprint patterns and blood groups. There is need of detailed studies to delineate the nature of this association and to further enlighten how fingerprint patterns vary with blood groups. This association has application in the field of forensic identification and could help increase the accuracy of the process of forensic identification when combined with other parameters

Table 5: Chi square test of association between blood groups and fingerprint patterns

Observed	Expected	Chi-square
460	448	0.25
569	560	0.14
102	106	0.15
416	431	0.52
184	202	1.6
260	252	0.01
35	49	3.5
229	194	6.3
156	149	0.3
181	186	0.13
53	35	9.3
125	143	2.3
		Total = 23.96

4. Conclusion

The present study this concluded that fingerprint patterns and blood groups are significantly associated with one another while also bringing to notice that loops have the highest prevalence among fingerprint types and that they have a higher prevalence among males as compared to females. The association between fingerprint patterns and blood groups needs to be studied in depth as it may reveal more accurate modalities of identification and possible genetic correlation may also be researched.

5. Strengths and Limitations

It was beyond the scope of the present study to evaluate whether a genetic correlation exists between fingerprint patterns and blood groups and detailed studies are required in the area of this subject matter as such genetic associations may help transform the field of forensic medicine while also enlightening newer means of accurate identification which will have a wide spectrum of impacts on various other fields.

6. Summary

The present study revealed a statistically significant association between primary fingerprint patterns and blood group distribution in the population.

Fingerprint patterns form unique identification features of an individual and their correlation with gender and blood group along with the knowledge of prevalence of various fingerprint patterns will help in authenticating and predicting the identity of a person among other uses in the field of forensic medicine.

7. Source of Funding

None.

8. Conflict of Interest

None.

References

1. Hemanth J, Balas VE, editors. Biologically Rationalized Computing Techniques For Image Processing Applications. India: Springer; 2018.
2. Li SZ, editor. Encyclopedia of Biometrics. vol. Vol 2. Germany: Springer; 2009.
3. Limson KS, Julian R. Computerized recording of the palatal rugae pattern and an evaluation of its application in forensic identification. *J Forensic Odontostomatol*. 2004;22(1):1–4.
4. Cummins H. Palmar and Plantar Epidermal Ridge Configuration [Dermatoglyphics] in Europeans and Americans. *Am J Phys Anthrop*. 1926;179:741–802.
5. Herschel WJ. Skin furrows of the hand. *Nature*. 1880;23(578):76.
6. Cummins H, Kennedy RW. Physiological Examination of visual organ and of the cutaneous system. *Am J Crim Law*. 1940;31:343–56.
7. Bharadwaja A, Saraswat PK, Aggarwal SK, Banerji P, Bharadwaja S. Pattern of fingerprints in different ABO blood groups. *J Indian Acad Forensic Med*. 2004;26(1):6–9.
8. Mehta AA, Mehta AA. Palmar dermatoglyphics in ABO, RH Blood groups. *Int J Bill Med Res*. 2011;2(4):961–4.
9. Kanchan T, Chattopadhyay S. Distribution of fingerprint patterns among medical students. *J Indian Acad Forensic Med*. 2006;28(2):65–8.
10. Pillay VV. Textbook of forensic medicine and toxicology. 15th ed. Hyderabad: Paras Medical Publishers; 2009. p. 53–94.
11. Galton F. Finger prints. London: Macmillan and Co; 1892.
12. Aird I, Bentall HH, Roberts JA. A relationship between cancer of stomach and the ABO blood groups. *Br Med J*. 1953;1:799–801.
13. Aird I, Bentall HH, Mehigan JA, Roberts JA. The blood groups in relation to peptic ulceration and carcinoma of colon, rectum, breast, and bronchus; an association between the ABO groups and peptic ulceration. *Br Med J*. 1954;2:315–21.
14. Bloterogel H, Bloterogel W. Blutgrype and Dactylogramm: Konstitutions Merk Male der Poliomyelitis. *Krapam Zt Rehse*. 1934;56:143–63.
15. Gowda MS, Rao CP. A study to evaluate relationship between dermatoglyphic features and blood groups. *J Ant Soc India*. 1996;45:39.
16. Khalid M, Qureshi MA. Frequencies of blood group antigens and corresponding alleles in the population of Mirpur, Azad Jammu Kashmir, Pakistan. *J Anim Planet Sci*. 2006;16(3-4):96–8.
17. Ghasemi N, Ayatollahi J, Zadehrahmani M, Nasiri A, Abedi A, Shokraneh S, et al. Frequency of ABO and Rh blood groups in middle school students of Yazd province. *Iran J Pediatr Hematol Oncol*. 2010;1(1):27–30.
18. Rastogi P, Pillai KR. A study of fingerprints in relation to gender and blood group. *J Indian Acad Forensic Med*. 2010;32(1):11–4.
19. Sudikshya K, Maharjan N, Adhikari N, Shrestha P. Qualitative analysis of primary fingerprint pattern in different blood group and gender in Nepalese. *Anat Res Int:*. 2018;2018:2848974. doi:10.1155/2018/2848974.
20. Jaff MS, O'briain DS. Excess of blood group B in primary myelofibrosis. *Vox Sang*. 1987;52(3):250–3.
21. Verma U, Singroha R, Malik P. A study to find correlation between dermatoglyphic patterns and ABO blood groups. *Int J Anat Res*. 2015;3(3):1293–7.
22. Narayana BL, Rangaiah YKC, Khalid MA. Study of fingerprint patterns in relation to gender and blood group. *J Evol Med Dent Sci*. 2016;5(14):630–4.
23. Mehdipour M, Farhud DD. A dermatoglyphic study of Iranaianmuslims part I: Finger patterns and ridge- counts. *Iran J Public Health*. 1978;7(4):196–206.
24. Deopa D, Prakash C, Tayal I. A study of fingerprint in relation to gender and blood group among medical students in Uttarakhand region. *J Indian Acad Forensic Med*. 2014;36(1):23–7.

25. Gowri SR, Mangala, Vinay G. To assess the relation between finger print pattern and blood groups. *Indian J Clin Anat Physiol*. 2019;6(4):488–91.
26. Shashikala RL, Ashwini SJ. Digital dermatoglyphic and ABO blood groups. *Indian J Forensic Med Pathol*. 2011;4(2):77–81.

Author biography

S. A. Pratinidhi, Professor and HOD

Vaishali Lunawat, Tutor

Mohak Tilokchandani, Interns

Chaitanya Bhujbal, Interns

Rutuja Shejul, Interns

Madhumita Sahoo, Interns

Cite this article: Pratinidhi SA, Lunawat V, Tilokchandani M, Bhujbal C, Shejul R, Sahoo M. Study of fingerprint patterns in relation to gender and blood groups. *Int J Clin Biochem Res* 2023;10(2):149-153.