January - June 2022 Volume 31 Issue 1
PRINT ISSN: 2277-1867
ONLINE ISSN: 2277-8853

JOURNAL OF FORENSIC MEDICINE SCIENCE AND LAW

Official Publication of Medicolegal Association of Maharashtra

MULTISPECIALITY, MULTIDISCIPLINARY, NATIONAL
PEER REVIEWED, OPEN ACCESS, MLAM (SOCIETY) JOURNAL
Indexed with Scopus (Elsevier) & Index Copernicus (Poland)

Editorial Office Address
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JOURNAL OF FORENSIC MEDICINE SCIENCE AND LAW
(Official Publication of Medicolegal Association of Maharashtra)
Email.id: mlameditor@gmail.com

PRINT ISSN: 2277-1867
ONLINE ISSN: 2277-8853

Original Research Article

Analysis of Primary Fingerprint Patterns in Medical Students of Banda District Uttar Pradesh.

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Article Info

Received on: 27.10.2021
Accepted on: 16.01.2022

Key words:
ABO blood group, Dactylography, Fingerprint pattern, Rh blood group.

Abstract

Background: A reliable personal identification is important in many situations like civil, criminal, commercial and financial transaction frauds. Dactylography is considered as the most effective and reliable method of personal identification. **Objective:** The objective of the present study was to find out the pattern of primary fingerprints in individuals with different ABO and Rh blood groups along with an evaluation of the relationship between primary fingerprint patterns and blood groups in both sexes. **Methods:** In the present cross-sectional study, fingerprints and ABO & Rh blood groups of 190 medical students belonging to the age group of 17-29 years were collected & data were analyzed by the chi-square test. **Results:** Maximum subjects (39.47%) belonged to the blood group 'O' followed by blood group 'B'. The majority (93.68%) belong to the Rh +ve blood group. Loop patterns were the most common primary fingerprint pattern followed by whorls and arches in both males & females in all blood groups. All fingers of both hands except ring finger showed the highest frequency of loop primary fingerprint pattern. **Conclusion:** The present study shows that the general distribution of the primary fingerprint pattern is related to gender and blood group 'B'. Primary fingerprint pattern distribution is also related to the individual digit in all blood groups except 'AB' blood group.

1. Introduction

Study of epidermal ridges on non-hairy part of palm, fingers, toes, and soles is known as dactylography. Configurations of ridge pattern are determined by both heredity and accidental or environmental influence.[1] Handwriting, lip prints, DNA fingerprinting, tattoo marks, scar marks, superimposition etc. are other methods of personal identification. The pattern of papillary ridges in hands is completely established between 11th to 24th weeks of gestation.[2] Arrangement and distribution of fingerprint patterns are unique and permanent to an individual and

How to cite this article: Garg P, Mustaria PS, Kumar N, Bansal MK, Yadav M. Analysis of Primary Fingerprint Patterns in Medical Students of Banda District Uttar Pradesh. J For Med Sci Law 2022;31(1):28-32.

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no two hands (even twins) resemble each other. Therefore, fingerprinting is widely accepted and adopted as most reliable method of personal identification. Galton described four types of primary fingerprint patterns i.e., loop, whorl, arch and composite.[3]

Fingerprints follow the Locard's Principle of Exchange. Fingerprint secretions contain various chemical residues and their metabolites which can be used for the forensic purposes.[4] They can be found in crime scene from which the presence of a suspect or a victim can be easily proved.

Clinically, "ABO" and "Rhesus" are considered most important blood groups. "Rhesus" system is classified into "Rh +ve" and "Rh –ve" on the basis of 'D' antigen.[5] Inheritance of both dermatoglyphics patterns and ABO blood group is polygenic.[6] Bloterogel also expressed a correlation between physical characters and blood groups.[7] A reliable personal identification is important in many situations like civil, criminal, commercial and financial transaction frauds. Therefore, the objective of present study was to find out the pattern of primary finger prints in individuals with different "ABO" and "Rh" blood groups along with evaluation of relationship between primary fingerprint patterns and blood groups in both sexes.

2. Materials and methods:

Present study was a cross sectional study, conducted in Department of Forensic Medicine & Toxicology and Department of Physiology, Government Allopathic Medical College (GAMC), Banda (Uttar Pradesh) during period of 3 months (August 2018 to September 2018). Total 190 medical students belonging to the age group 17-29 years were randomly selected for the study to avoid selection bias. Written informed consent was obtained from every participant prior to study. Ethical clearance was obtained from Institutional Ethics Committee. Subjects with hand deformity like permanent scars on fingers, suffering from chronic skin disease, having extra or bandaged fingers were excluded from study.

Students were asked to wash hands thoroughly with soap and water and dry them using a towel. Fingerprints were collected using the blue stamp pad of Camlin company size 15.7 cm X 9.6 cm. Fingertips were smeared with ink and fingerprints of all the ten digits were taken separately on respective blocks on the same paper sheet. Basic details such as name, age, sex was noted. "ABO" and "Rh" blood group types were known by slide agglutination method using antiserum A, B and D. The fingerprint patterns were examined with the help of a powerful magnifying lens and were classified as loops, whorls and arches based on the appearance of ridgelines. Variables were tabulated and analyzed using software "SPSS 20". The distribution of primary fingerprint patterns and its relationship with different blood groups in both sexes were evaluated by using chi square test.

3. Results:

In the present study, 190 subjects participated out of which 118 were males and 72 were females. Highest number of the subjects belonged to blood group 'O' 75 (39.47%), followed by blood group 'B', 'A' and 'AB' respectively. Blood groups 'A' and 'B' were found more frequent among females while blood groups 'O' and 'AB' were more common in males (**Table 1**).

Majority of subjects (93.68%) were of Rh-positive group while only 6.31% were Rh-negative. Maximum subjects belonged to blood group 'O' (75) followed by blood group 'B', 'A' and 'AB' (**Table 2**).

Table 1: Distribution of subjects according to sex and blood groups

Sex	Blood groups				Total
	A	B	AB	O	
	n (%)	n (%)	n (%)	n (%)	N (%)
Male	18 (15.25)	40 (33.89)	12 (10.16)	48 (40.67)	118 (100.0)
Female	12 (16.66)	26 (36.11)	7 (9.72)	27 (37.5)	72 (100.0)
Total	30 (15.78)	66 (34.73)	19 (10.00)	75 (39.47)	190 (100.0)

Table 2: Distribution of subjects according to Rh blood groups

Blood group	Rh-positive	Rh-negative	Total
	n (%)	n (%)	N (%)
A	28 (93.30)	02 (6.70)	30 (100.0)
B	64 (96.96)	02 (3.01)	66 (100.0)
AB	19 (100.0)	00 (0.00)	19 (100.0)
O	67 (89.33)	08 (10.66)	75 (100.0)
Total	178(93.68)	12 (6.31)	190 (100)

Loop patterns were the most common primary fingerprint pattern followed by whorls and arches. The relation of primary fingerprint patterns and sex was found to be statistically significant ($P<0.05$) by Chi square test analysis. In comparison between both sexes, loop patterns were higher in incidence in

females (64.3%) than in males (49.74%), but whorl and arch patterns were more frequent in males (35.93% and 14.32%, respectively) compared to females (22.63% and 13.05%, respectively) (Table 3).

Table 3: Distributions of primary finger print patterns in relation to sex

Primary fingerprint pattern	Male	Female
	n (%)	n (%)
Loop	587 (49.74)	463 (64.30)
Whorl	424 (35.93)	163 (22.63)
Arch	169 (14.32)	94 (13.05)
Total	1180 (100)	720 (100)
Statistics	χ^2= 43.25 *P* value <0.0001	

Table 4 shows that loop patterns were predominant in all blood groups with highest percentage in blood group 'B'. Chi square test revealed that the relation between primary patterns of fingerprints and blood group 'B' was statistically significant (*P*<0.05) while relation between primary patterns of fingerprints and blood group 'A' and 'O' was not statistically significant. Frequency of loop patterns was higher in both Rh +ve and Rh −ve individuals, followed by whorls and arches. In the present study primary fingerprint patterns are not observed in Rh −ve blood group 'AB'. In this study, in 'B' blood group, the frequency of loop pattern (55.93%) and whorl pattern (30.15%) were higher in Rh +ve blood group than in Rh −ve blood group (50% loops and 15% whorls), but the incidence of arches was more (35%) in Rh −ve blood group than in Rh +ve blood group (*P*< 0.001) (Table 4). Table 5 & table 6 shows the frequency of loop pattern was high in all the fingers of both hands except ring finger while frequency of whorls was higher in the ring fingers of all the blood groups. In the present study, highest frequency of arches was observed in thumb as compared to other fingers in all blood groups. Chi square test showed the rejection of null hypothesis in all blood groups except 'AB' blood group.

Table 4: Distribution of primary fingerprint pattern among different blood groups

Type of finger print	Blood group A		Blood group B		Blood group AB		Blood group O	
	Rh +ve	Rh – ve	Rh +ve	Rh – ve	Rh +ve	Rh – ve	Rh +ve	Rh – ve
	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)
Loop	148 (52.85)	15 (75.0)	358 (55.93)	10 (50.0)	105 (55.26)	00 (0.0)	369 (55.07)	45 (56.25)
Whorl	100 (35.71)	03 (15.0%)	193 (30.15)	03 (15.0)	64 (33.68)	00 (0.0)	202 (30.14)	22 (27.5)
Arch	32 (11.4)	02 (10.0)	89 (13.90)	07 (35.0)	21 (11.05)	00 (0.0)	99 (14.77)	13 (16.25)
Total	280 (100)	20 (100)	640(100)	20(100)	190(100)	00	670(100)	80(100)
Statistics	$\chi^2 = 4.05$ p=0.13		$\chi^2 = 7.55$ p=0.02		NA	NA	$\chi^2 = 0.28$ P=0.865	
	(Not Significance)		(Significance)				(Not Significance)	

Table 5: Distribution of primary fingerprint pattern in different fingers of right hand

Indivi-dual finger	Blood group											
	A			B			AB			O		
	Loop	Whorl	Arch	Loop	Whorl	Arch	Loop	Whorl	Arch	Loop	Whorl	Arch
Thumb (%)	13 (43.3)	10 (33.3)	07 (23.3)	30 (45.4)	24 (36.3)	12 (18.1)	09 (47.3)	06 (31.5)	04 (21.0)	30 (40.0)	25 (33.3)	20 (26.6)
Index (%)	16 53.3	10 (33.3)	04 (13.3)	34 (51.5)	21 (31.8)	11 (16.6)	11 (57.8)	06 (31.5)	02 (10.5)	41 (54.6)	21 (28.0)	13 (17.3)
Middle (%)	22 (73.3)	05 (16.6)	03 (10.0)	45 (68.1)	10 (15.1)	11 (16.6)	10 (52.6)	05 (26.3)	04 (21.0)	51 (68.0)	10 (13.3)	14 (18.6)
Ring (%)	09 30.0	20 (66.6)	01 (3.3)	25 (37.8)	36 (54.5)	05 (7.57)	08 (42.1)	10 (52.6)	01 (5.26)	35 (46.6)	37 (49.3)	03 (4.0)
Little (%)	23 76.6	04 (13.3)	03 (10.0)	48 (72.7)	11 (16.6)	07 (10.6)	12 (63.1)	06 (31.5)	01 (5.26)	52 (69.3)	16 (21.3)	07 (9.33)
Statistics	$\chi^2 = 30.24$ p=0.0002			$\chi^2 = 36.79$ p=0.0001			$\chi^2 = 7.13$ p=0.521			$\chi^2 = 43.18$ p=<0.0001		
	(Significance)			(Significance)			(Not Significance)			(Significance)		

Table No.6 Distribution of primary fingerprint pattern in different fingers of left hand

Individual finger	Blood group											
	A			B			AB			O		
	Loop	Whorl	Arch	Loop	Whorl	Arch	Loop	Whorl	Arch	Loop	Whorl	Arch
Thumb	15 (50.0)	09 (30.0)	06 (20.0)	34 (51.5)	17 (25.7)	15 (22.7)	11 (57.8)	04 (21.0)	04 (21.0)	41 (54.6)	16 (21.3)	18 (24.0)
Index	19 (63.3)	07 (23.3)	04 (13.3)	39 (59.0)	18 (27.2)	09 (13.6)	11 (57.8)	06 (31.5)	02 (10.5)	36 (48.0)	22 (29.3)	17 (22.6)
Middle	19 (63.3)	08 (26.6)	03 (10.0)	39 (59.0)	16 (24.2)	11 (16.6)	11 (57.8)	05 (26.3)	03 (15.7)	47 (62.6)	17 (22.6)	11 (14.6)
Ring	07 (23.3)	22 (73.3)	01 (3.33)	26 (39.3)	31 (46.9)	09 (13.6)	09 (47.3)	10 (52.6)	00 (0.0)	28 (37.3)	43 (57.3)	04 (5.33)
Little	20 (66.6)	08 (26.6)	02 (6.66)	48 (72.7)	12 (18.1)	06 (9.09)	13 (43.3)	06 (31.5)	00 (0.0)	53 (70.6)	17 (22.6)	05 (6.66)
Statistics	$\chi^2 = 26.57$ p=0.0008			$\chi^2 = 22.35$ p=0.004			NA			$\chi^2 = 47.27$ p=<0.0001		
	(Significance)			(Significance)						(Significance)		

4. Discussion:

In the present study we found that blood groups 'A' and 'B' were more frequent among females while blood groups 'O' and 'AB' were more common in males which is in agreement to the previous reports by Bharadwaja A et al.[4] and Rastogi P et al.[8] However different results were observed by studies done by Garg P et al.[9] (most frequent blood group A) and Desai et al.[10] (most frequent blood group B). As expected, majority of subjects belonged to Rh-positive blood group in our report consistent with other studies done in various countries, i.e., India[4, 8], Nigeria[11] Iran[12] and Iraq.[13]

We observed that loop patterns were the most common primary fingerprint pattern followed by whorls and arches and similar have been reported in previous works done by various authors.[4,8,10] Our study also shows that distribution of primary fingerprint pattern is related to gender ($P< 0.05$). In comparison between both sexes, loop patterns were more frequent in females (64.3%) than in males (49.74%), but whorl and arch patterns were more frequent in males (35.93% and 14.32%, respectively) compared to females (22.63% and 13.05%, respectively). These results are in consistent with Sudikshya KC et al.[14] and Sangam et al.[15] except for the arches. In contrast to present study, Mehdipour M et al.[16] demonstrated higher frequency of loops in males compared to females.

We found that loop patterns were predominant in all blood groups with highest percentage in blood group 'B'. Similar findings were observed by Deopa D et al.[17] However different results were observed by Mehta AA et al.[18] where highest percentage of loop pattern was reported in blood group "O". Results of our study also suggest that general distribution of primary fingerprint pattern is related to blood group "B" but not related to blood group "A" and "O".

In our study, loop and whorl patterns are more frequent in B+ve blood group while arches in B-ve blood group, our observations are different from studies done by Bharadwaja A et al[4] where higher incidence of loops were observed in B−ve blood group. We observed high frequency of loop pattern in all fingers of both hands except ring finger which is in agreement with the previous reports.[4] Fayrouzet al.[19] observed high frequency of loop pattern ring finger in all blood groups.

In present study, frequency of whorls was higher in the ring fingers of all blood groups. Our results are different from Bharadwaja et al[4] which observed higher frequency of whorls in blood group 'A' and 'AB' while higher frequency of loops in blood group 'B' and 'O' in ring fingers. Result of our study shows that primary fingerprint pattern distribution is related to individual digit in all blood groups except "AB" blood group.

5. Conclusions:

The results of present study showed that general distribution of primary fingerprint pattern is related to gender and blood group 'B'. Primary fingerprint pattern distribution is also related to individual digit in all blood groups except 'AB' blood

group. It is widely accepted that fingerprints are unique, individualistic, permanent and never alike. Therefore, the association of primary fingerprint pattern with different blood groups and gender will enhance the authenticity of fingerprints in identification of an individual. This association could also be used for prediction of certain diseases.

Acknowledgement: The authors acknowledge the help of all student and other health care workers of the institution who helped in the study.

Contributor ship of Author: All authors equal contribution.

Ethical Clearance: Yes.

Conflict of interest: None declared.

Source of Funding: Nil.

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