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STUDY OF FINGERPRINT PATTERN IN RELATION TO GENDER AND BLOOD GROUP IN JHALAWAR REGION

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Abstract
Dermatoglyphics, the study of epidermal ridges on palm, sole, and digits, is considered as most effective and reliable evidence of identification. Finger prints are the impressions made by fine ridges present on finger tips which are highly individualistic. The fingerprint ridges develop between 2nd and 3rd months of intra uterine life and remain unchanged in an individual throughout life. Out of many blood grouping systems available, ABO and Rh systems are the most important and are considered for the present study. Due to the immense potential of fingerprints as an effective method of identification an attempt has been made in the present work to analyse their correlation with gender and blood group of an individual. This study is carried out on 100 subjects (50 male and 50 female) having different ABO blood groups and belonging to different age groups. All the 10 fingerprints are taken and divided into loops, whorls, arches and composite. The results show that majority of the subjects belonged to blood group O. The fingerprint pattern of loops is most commonly found followed by whorls, arches and composite. Loops are higher in males whereas whorls and arches are found more in females. Composites are being in same proportion in both sexes. Highest frequency of loops is seen in O positive blood group followed by B positive. Among loops ulnar loops are predominant.
Keywords: Fingerprints, Loops, Whorls, Arches, Blood Group, Pattern, Gender.

Introduction

Through decades of scientific research, the hand has come to be recognized as a powerful tool in the diagnosis of psychological, medical, and genetic conditions[1]. Human identification from physical and mental characteristics is a crucial objective of forensic investigation. The term Identity, also called sameness is defined as whatever makes an entity definable and recognizable[2].

Human identification is essential for personal, socio-legal reasons. 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. A fingerprint is an impression of the friction ridges of all or any part of the finger. A friction ridge is a raised portion of the epidermis on digits or on the palmer and plantar skin. These ridges are also referred to as dermal ridges or dermal papillae. [2, 3]

Dermatoglyphics is the study of fingerprints. The term dermatoglyphics was coined by Harold Cummins in 1926, which is used for the studies of epidermal ridges on the non-hairy part of palm, fingers, toes, and soles. He found that the configurations of ridge pattern are determined partly by heredity and partly by accidental or environmental influence, which produce stress and tension in their growth during fetal life. It has been accepted and adopted internationally. Finger prints appear for the first time between the 12th to 16th week of intrauterine life and their formation is completed by the 24th week of intrauterine life. Fingerprint patterns are genotypically determined and remain unchanged throughout life and that the patterns of no two hands resemble each other. Even the fingerprints of twins are not similar.[4,7]

Finger smeared with blood, grease, dirt or slight perspiration may leave their impressions on weapons, clothing, glass panes, utensils, furniture, door handles, window sills etc, hence considerable care should be taken in handling such articles during the investigation of crime, and any articles found to possess such chance prints should be preserved for further exanimation. Fingerprint is undoubtedly the most reliable and acceptable evidence till date in the court of law. So it can be used as the most convenient, reliable and cheapest method of individual identification. [6] Medico-legal importance of fingerprinting includes identifying the criminal, in cheques, in bank notes or passports as a means of identification, in case of mass disasters, to prevent impersonation, in case of accidental exchange of new born infants and to identify unknown corpses.[2,5]

Depending upon the arrangement of papillary ridges, Sir Henry Galton classified fingerprints into four major types: Loop (65%), Whorl (25%), Arch (7%) & Composite (2-3%).[6] Blood group systems was discovered in 1901 by Karl Landsteiner. A blood type (Also called a blood group) is a

classification of blood based on the presence or absence of inherited antigenic substances on the surface of RBC's. The two most important ones are ABO and the Rh system. The ABO type is further divided into A, B, AB and O groups according to the presence of corresponding antigen in plasma. Rhesus system is classified into Rhesus positive (Rh +ve) and Rhesus negative (Rh -ve) according to the presence or absence of D antigen. [2,9]

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. Due to the immense potential of fingerprints as an effective method of identification an attempt has been made in this study to analyse fingerprint patterns, their correlation with gender and blood group of an individual and also to determine the distribution of different fingerprint patterns among population of Jhalawar region.

Materials and Methods

This prospective study was conducted in Department of Forensic Medicine, Jhalawar Medical College, and Jhalawar over 100 subjects of both sex and of different age groups. A proper informed written consent was taken from the participants. The prospective study was conducted after taking permission from the Institutional Ethical Committee JMC, Jhalawar.

Inclusion criteria:

The study included the samples of subjects who definitely volunteered and were selected without gross variations in their built and nourishment.

Exclusion criteria:

(i) Individual with any hand deformity like permanents scars on fingers which may be congenital or acquired due to trauma on fingers.

(ii) Individuals suffering from any chronic skin disease, having worn fingerprints or extra or bandaged fingers.

Each individual was asked to wash his/her hands thoroughly with soap and water to remove dirt and oil and dry them using a towel. He/she was then asked to press his/her fingertips on the stamp pad and then on respective blocks of Proforma to transfer the fingerprint impression. The care was taken to avoid sliding of fingers to prevent smudging of the print. The fingerprint patterns were studied with the help of a magnifying lens and were identified into basic four patterns as follows: loops, whorls, arches, and composites. Blood groups were taken from their ID cards. The distribution of fingerprint patterns in both hands of individuals and its relationship with sex and different ABO blood groups and Rh blood types was evaluated and analyzed.

Results:

A detailed fingerprint study with proper technique was carried out in Department of Forensic Medicine and Toxicology, JMC, Jhalawar during the period of March 2021 to May 2021. A total number of 100 subjects participated in the study out of which 50 were males and 50 were females.

Table 1: Distribution of blood groups of subjects according to gender

Blood Groups	Male	Female	Total
A	8 (8.0%)	6 (6.0%)	14 (14.0%)
B	19 (20.0%)	16 (16.0%)	35 (35.0%)
AB	2 (2.0%)	3 (3.0%)	5 (5.0%)
O	21 (21.0%)	25 (25.0%)	46 (46.0%)
Total	**50**	**50**	**100 (100.0%)**

The dominant ABO blood group in study population was group O 46 (46.0%), followed by B 35(35.0%), A 14(14.0%) and then AB 5(5.0%). Blood group O had the highest frequency in both males and females followed by blood groups B, A and AB. (Table No.1)

Table 2: Distribution of blood groups of subjects according to Rh factor

Blood Group	Rh positive	Rh negative
A	12 (12%)	2 (2%)
B	33 (33%)	2 (2%)
AB	5 (5%)	0 (0%)
O	44 (44%)	2 (2%)
Total	**94 (94%)**	**6 (6%)**

Rh (+)ve was the dominant Rhesus factor (94%) and Rh (-)ve was 6%. When ABO-Rh blood group was considered, the prevalence was in the following order O (+)ve 44%, B (+)ve 33%, A (+)ve 12%, and AB (+)ve 5%. Among Rh (-)ve subjects, blood groups A, B and O were equally predominant with 2%. AB (-)ve group was not found in study population. (Table No.2)

Table 3: Distribution of primary fingerprint patterns among the subjects

Fingerprint Pattern	Total Number	Percentage
Loops	583	58.3%
Whorls	324	32.4%
Arches	77	7.7%
Composite	16	1.6%
Total	**1000**	**100%**

Table 3 shows distribution of primary fingerprint patterns of all the fingers of both hands of all the subjects. The general distribution of fingerprint pattern showed that the dominant pattern was loop (58.3%), followed by whorl (32.4%), arch (7.7%) and then composite (1.6%).

Table 4: Distribution of fingerprint patterns according to gender

Fingerprint Pattern	Male	Female
Loop	311 (53.34%)	272 (46.66%)
Whorl	155 (47.84%)	169 (52.16%)
Arches	36 (46.75%)	41 (53.25%)
Composite	8 (50.0%)	8 (50.0%)

Male had higher percentage (53.34%) of loops as compared to female (46.66%) while female had higher percentage of arches (53.25) and whorls (52.16%). Composites showed equal incidence in both sexes. (Table 4)

Table 5: Distribution of fingerprints among different blood groups with Rh factors

Fingerprint Pattern	Blood Groups							
	A +ve	**A -ve**	**B +ve**	**B -ve**	**AB +ve**	**AB-ve**	**O +ve**	**O -ve**
Loops	31	13	187	13	27	0	306	6
Whorls	34	5	106	6	14	0	150	9
Arches	11	2	21	2	8	0	31	2
Composite	3	1	4	1	1	0	5	1

Table 5 shows distribution of fingerprint patterns among different blood groups with Rh factors. Loops had the highest frequency in all Rh positive and Rh negative blood groups except A +ve and O –ve blood group where whorls were dominant, followed by arches and composites. O positive blood group had the highest number of all the patterns among Rh positive blood groups. Among Rh negative, loops were more in blood group A, whorls and arches in O blood group. Composites were more in O +ve group, followed by B +ve blood group.

Discussion:

Fingerprints are the impressions made by fine ridges present on finger tips which are highly individualistic. Herschel used fingerprints for personal identification in India as a sign in contracts. The advantages of using fingerprint patterns as a means of identification is that it can be filed and saved and retrieved when needed. The system of classification which is in use even today is a modification of system proposed by Sir Francis Galton and was modified by Sir Edward Henry. The classification is known as Henry Galton method or Henry's system of classification. This system of classification is most efficient and is in almost universal use. The four basic fingerprint patterns, which are used in this study, are loops (65-67%), whorls (25-30%), arches (6-7%) and composites (3-4%). Composite pattern is the rarest.

A loop is that type of fingerprint pattern in which one or more of the ridges enter on either side of the impression, re-curve, touch or pass an imaginary line drawn from the delta to core and terminates or tends to terminate on or towards the same side of the impression from where ridge or ridges enter. Loops are further divided into two main types - radial loop and ulnar loop, according to their positioning and the flow of the ridges. Radial loop is so called because the ridges flow or terminate in the direction of radius bone of the forearm. Ulnar loop is so called because the ridges flow or terminate in the direction of ulnar bone of the forearm. A whorl is characterised by a circular pattern having one or more ridges revolve around the core making a complete circle. The whorls are subdivided into concentric, spiral, double spiral and almond shaped. Arches can be classified into plain arch and tented arch. Plain arch is made up of ridges lying one above the other. Tented arch consists of one up thrusting ridge, which tends to bisect superior ridges at right angles. In composites or compounds types, arches, loops and whorls are grouped together in the same impression. They also include a small number of irregular patterns which cannot be classified, they are known as accidentals. [4, 5]

In 2000-2001, Bharadwaja et al. conducted a study on 300 medical students in Rajasthan. The study reveals that subjects with blood group A have more of loops and those with blood group AB have more of whorls, this is inconsistence to the present study.[13]Study conducted by

Mehta AA at el.[10] in 2011, Sangam MR et al.[11] 2011 and Sudikshya KC et al.[12]in 2018 shows that blood group O have highest frequency of loops, which is similar to the result obtained in the present study. Dr. Rastogi et al. in 2010 had conducted a similar study on 200 medical students of Kasturba Medical College; Mangalore.[14] Bhavana et al. in 2013 conducted a study on 200 individuals from Hubli, Dharwad, and Karnataka. Loops were more in males and whorls were more in females in the present study, whereas loops were more in females and whorls were more in males in other studies.[15]

Arches were more in females in all the three studies. Frequency of loops were highest in all Rh positive and Rh negative blood groups except A positive and O negative where whorls were slightly predominant followed by arches and composites according to the present study. On comparison with other studies like the study done by Bhavana et al. in 2013 and by Dr. Rastogi in 2010, similar findings were observed except for A positive and O negative, which shows predominance of whorls. O positive blood group had the highest number of all the patterns among Rh positive blood groups, which is similar to the study of Dr Rastogi and in contradiction to the study of Bhavana et al. where more number of patterns were seen in B positive group. In Bhavana D's studies, loops and arches are more in blood group B and whorls are equally dominant in both B and O blood groups.

Conclusion:

The present study revealed that loops were the most common type of fingerprint pattern and composites were the least. In loop pattern the commonest pattern was ulnar loop. Loops were highest in males while whorls and arches were highest in females. Loops were predominantly found in all the blood groups except A positive where whorls were dominant. Highest numbers of all the patterns were identified in blood group O and least in AB among Rh positive blood groups. Composites were least commonly found in all the blood groups. The` most commonly found blood group was O positive and AB negative was found to be the rarest. Rh positive blood groups were more compared to Rh negative blood groups, which is proved in this original study and significant based on the statistical data also. In our study, it was observed that blood group B was the most commonly found among Rh positive blood groups followed by O, A and AB blood groups. Among Rh negative B and A blood groups were equally dominant followed by O and AB.

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