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Study of Relationship between Fingerprint Patterns and Gender among the Assamese Population of Barpeta

Jayasri Devi[1], Santanu Kumar Sarma[2], Tribeni Medhi[3], Priyankita Nath[4]
[1]Professor& Head, Department of Anatomy, FAAMC, Barpeta, Assam
[2]Assistant Prof. Department of Anatomy, FAAMC, Barpeta, Assam
[3]Associate Prof. Department of Anatomy, FAAMC, Barpeta, Assam,
[4]Assistant Prof. Department of Anatomy, MGM Medical College, Navi Mumbai, Maharashtra

Abstract:

Universally accepted tool for identification of an individual is fingerprint. Scientific analysis of fingerprints, lines, mounts and shape of the hands called 'dermatoglyphics'. There are three primary patterns of fingerprint viz., loops, whorls and arches which are unique in each individual and extensively used in forensic medicine as well as in biometrics. Fingerprints are affected by multiple factors including hereditary, environmental and regional. Hence our objective is to determine any association between patterns of fingerprint with regards to sexes in Assamese people of Barpeta. 200 peoples from different parts of Barpeta district were selected randomly for the study after taking proper informed consent. Applying 10 finger attributes fingerprint were collected on blank paper by using violet stamp pad and fingerprints were identified with the help of magnifying hand lens. After statistical analysis reveals a significant correlation between fingerprint patterns and sex differences among theAssamese population in Barpeta, indicating a notable association between dermatoglyphic traits and sexual dimorphism in this demographic group.

Key words: Loop, Whorl, Arches, Assamese, Gender

Corresponding author:

Dr. Priyankita Nath, Assistant Prof. Department of Anatomy, MGM Medical college, Navi Mumbai, Maharashtra, India, Email: priyankitanath@yahoo.com

Introduction:

The term dermatoglyphics comes from two Greek words (*derma* means skin and *glyph* meaning carve) and refers to the friction ridge formations which appear on the palms of the hands and soles of the feet which begin to develop in the 12th week of gestation and are complete by the 20th week of intrauterine life[1]. The scientific study of fingerprints, lines, mounts, and shapes of hands is known as dermatoglyphics. The term dermatoglyphics was coined by Dr. Harold Cummins[2], the father of American fingerprint analysis, even though the process of fingerprint identification had already been used for several hundred years. Dermatoglyphics refers to the formation of naturally occurring ridges on certain body parts, namely palms, fingers, soles and toes. Extensive research was conducted on the importance of skin-ridge patterns by Sir Francis Galton1892[3], demonstrating their permanence and fingerprint identification in his book '*Fingerprints'*. Fingerprint and dermal ridge pattern of each individual is unique characteristics. Even Fingerprints are different between similar twins also. Fingerprints are usually developed during intrauterine life do not change throughout the life of an individual, until destroyed by decomposition of the skin after death[4].

The fingerprints of both hands are not the same. Harold Cummins[1] and Charles Midlo M.D., in 1929 together with others, published the influential book '*Fingerprints, Palms and Soles'*, a bible in the field of dermatoglyphics. Classification of fingerprint patterns are done by Galton in 1892[3]. He divided into three basic patterns, namely arch, loop and whorl[5]. Factors like hereditary, environment, ethnicity[6] influence the fingerprint patterns which vary among populations which was reported by some researchers[7, 8,9]. Studies have found gender differences in fingerprint patterns, with females showing higher frequencies of loops and arches [10] compared to males with higher frequency of whorls. In present era in addition to criminal identification by analyzing fingerprint patterns, used as tools for biometric attendance in various work places as well as educational institutions. Therefore the objective of our study is to investigate the relationship between fingerprint patterns and gender in the Assamese population of Barpeta. This study aims to contribute to the existing body of knowledge on dermatoglyphics and provide insights into the factors that influence the fingerprint patterns in relation to gender in particular population.

Materials and methods:

The study was conducted in the Department of Anatomy, FAAMC, Barpeta. A total of 200 participants (100 males, 100 females) aged 18 years and above were randomly selected from different parts of Barpeta District, excluding those with finger injuries or anatomical abnormalities. Written informed consent was obtained from all participants, and ethical clearance was secured from the Institutional Ethics Committee. Participants were instructed to clean their hands before fingerprinting. Fingerprints were collected using a violet stamp pad (Supreme Delux Company, size 96 x 160mm). Participant information (age, name, and sex) was recorded on a predesigned proforma with serial number on a blank paper. Fingerprints of all 10 fingers (Fig. 1) were analyzed using a magnifying hand lens and classified into arches, loops, and whorls according to Galton's [3] classification. Data were recorded in a tabulated form and separated by gender. Statistical Analysis-

The Chi-square ($\chi 2$) test was used to compare variables, and a P-value < 0.05 was considered significant.

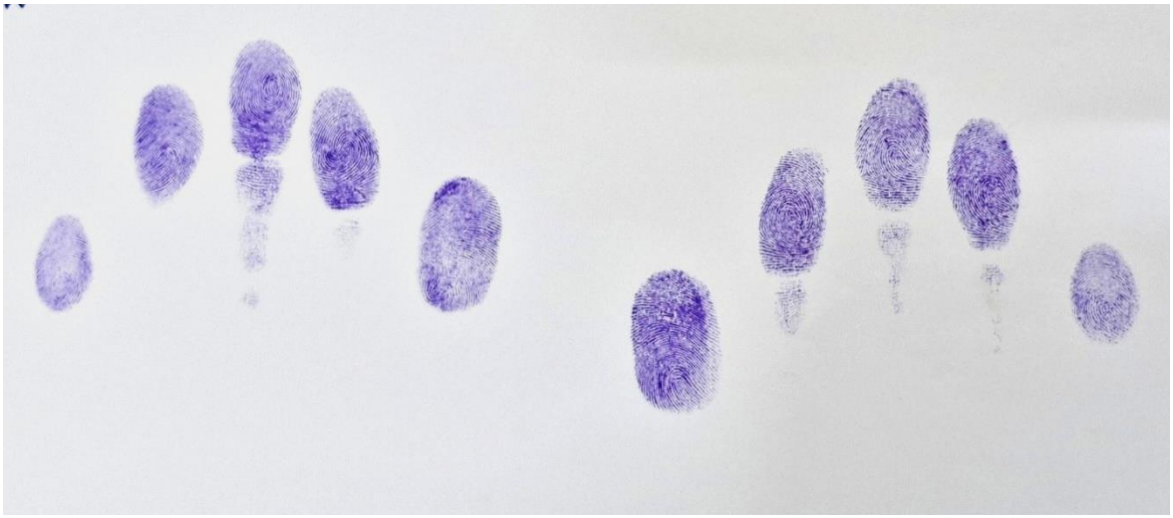


Fig 1 : Finger prints of ten fingers of a participant

Results:

In this study 200 Assamese people of different parts of the Barpeta district were participated among which 100 were male and 100 were female. For observation we have used 10 finger attributes, therefore total number of fingers in each sex was 1000. In general distribution (Table 1) of primary fingerprint patterns(Fig 5) in our study identified as loop(Fig 2) , whorl (Fig 3) and arches(Fig 4). Among 200 numbers of participants (Table 1,

Fig 5), highest number of loops(48.2%) were recorded followed by whorls(27.7%) and lowest recorded patterns were arches(24.1%). In statistical analysis(Table 1), highly significant association(i.e., $p<0.05$) noted in different fingerprint patterns among Assamese people of Barpeta.

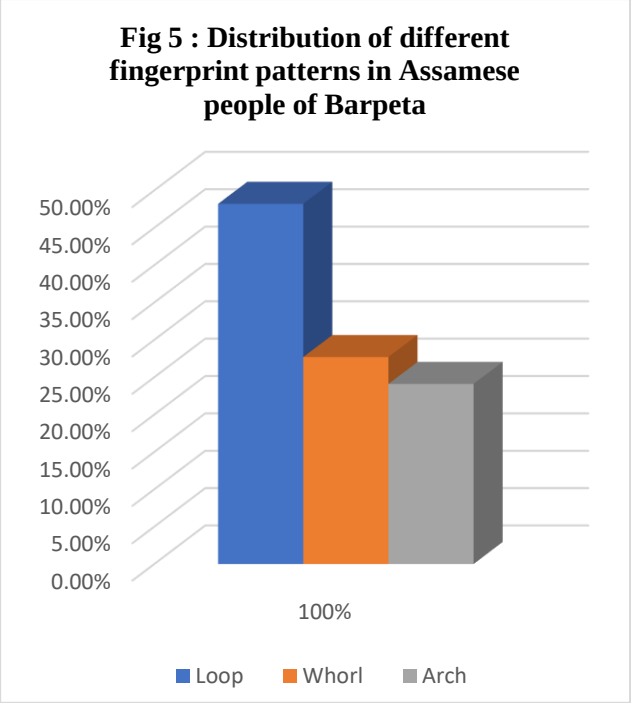
Table 1. General distribution of primary fingerprint patterns in all 10 fingers

Fingerprint patterns	Number (%)
Loop	964 (48.20%)
Whorl	554 (27.70%)
Arch	482 (24.10%)
Total	2000 (100%)
Chi-square test	193.08
P-Value	0.00
Statistical significance at 5% level	Significant

Fig 2 : Loop

Fig 3 : Whorl

Fig 4 : Arch



According to Table 2, distribution of different fingerprint patterns(Fig 6) showed that loops were highest in males 504(50.4%) followed by whorls 296(29.6%) and lowest recorded fingerprint pattern were arches 200(2.0%). In females(Table 3) like males, distribution of different fingerprint patterns(Fig 7), highest number of loops 460(46.0%) were recorded followed by arches 282(28.2%), but lowest recorded patterns of fingerprint were whorls 258(25.8%) instead of arches.

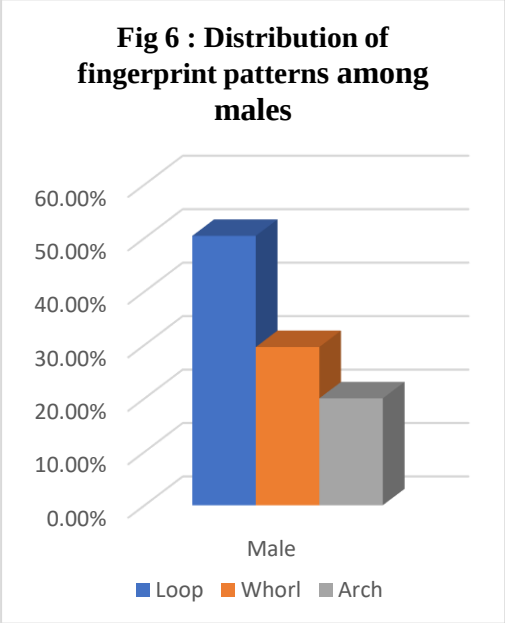
Table 2. Distribution of fingerprint patterns in all 10 fingers among males

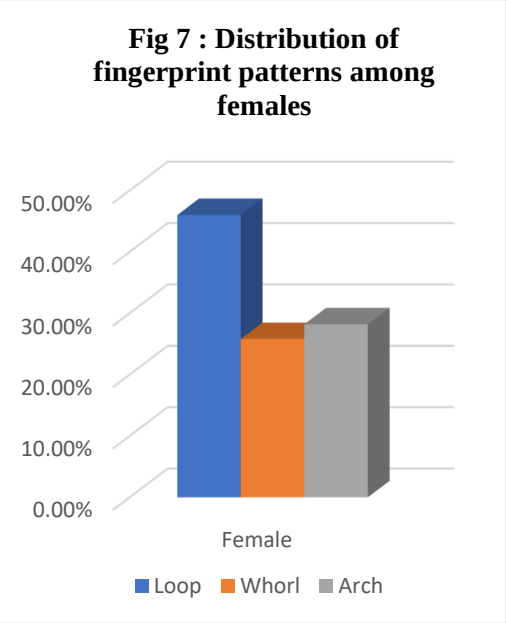
Fingerprint patterns	Number (%)
Loop	504 (50.40%)
Whorl	296 (29.60%)
Arch	200 (20.00%)
Total	1000 (100%)

Table 3. Distribution of fingerprint patterns in all 10 fingers among females

Fingerprint patterns	Number (%)
Loop	460 (46.00%)
Whorl	258 (25.80%)
Arch	282 (28.20%)

Total	1000 (100%)





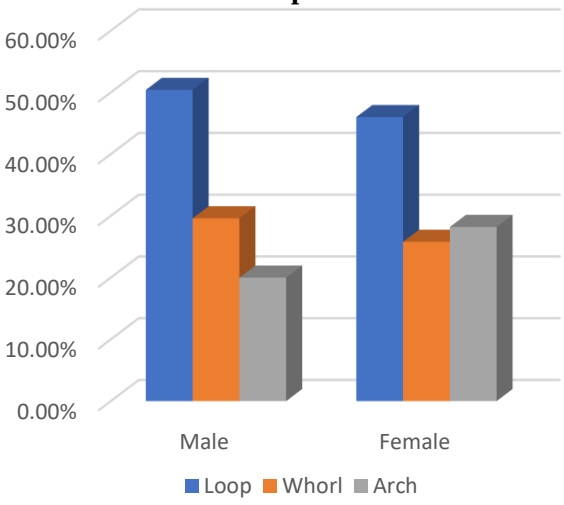
During study of primary fingerprint patterns in regards to gender(Fig 8) of Assamese population of Barpeta it was noted that in both sexes(Table 4) commonest fingerprint patterns were loops 504(50.4%) in males and 460(46.0%) in females. Among males second commonest pattern of fingerprints recorded as whorls 296(29.6%), whereas among females it was found that arches were the second commonest 258(25.8%) fingerprint patterns. Arches 200(20.0) were less common among males(Fig 6) in comparison to females. In this study less common pattern of fingerprint recorded as whorls 258(25.8%) among females (Fig 7).

Table 4. Distribution of primary fingerprint patterns in relation to gender

Gender	Number of fingerprint patterns (%)			Total
	Loop	Whorl	Arch	
Male	504 (50.4%)	296 (29.6%)	200 (20.0%)	1000
Female	460 (46.0%)	258 (25.8%)	282 (28.2%)	1000
Total	964 (48.2%)	554 (27.7%)	482 (24.1%)	2000
Chi-square test	10.43			
P-Value	0.0055			
Statistical significance at 5% level	Significant			

After statistical analysis regarding relation between different fingerprint patterns and gender among Assamese population of Barpeta, chi-square value recorded as 10.43(Table 4) and P-value was calculated as 0.0055 (<0.05) which was significant (Table 4).

Fig 8 : Distribution of different fingerprint patterns in relation to gender among Assamese people of Barpeta



Discussion:

Our study of the Assamese population in Barpeta revealed that loops (48.20%) were the most common fingerprint pattern, followed by whorls (27.70%) and arches (24.10%). This finding is consistent with previous research in Indian populations [1, 11, 14]. Similar patterns were also observed in populations from Kathmandu, Nepal [13], Madugiri and River State, Nigeria [14, 15], Kurdistan, Iraq [16], and Muscat, Oman [17].

In our study among males, the most common fingerprint pattern was loops (50.40%), followed by whorls (29.60%) and arches (20.00%). This finding is supported by several studies [1, 18, 19, 20, 22]. In females, the most common pattern was also loops (46.00%), followed by arches (28.20%) and whorls (25.80%). Our findings in females are consistent with those of Kukadiya et al. [11] and other researchers [1, 21].

In comparison with other studies, they havefound different findings. For example, Ranjan et al. [22] found that arches were the most common pattern in North Indian males, while Binorkar et al. [23] reported loops as the most common pattern in the population of Nanded District, Maharashtra, similar findings also recorded by Soman et al.[24].

In statistical Analysis our study found a significant association ($P < 0.05$) between fingerprint patterns and gender, which is consistent with some previous research [22]. However, other studies have reported non-significant results [13, 14].

Conclusion

Our study revealed a significant association ($P < 0.05$) between fingerprint patterns and gender in the Assamese population of Barpeta. The most common fingerprint pattern in the overall population was loops, followed by whorls and arches. In males, the pattern was similar, while in females, loops were followed by arches and whorls. This result may be due to the ethnicity and environmental factors of the studied population. Further research on different populations using various methods may provide more insights into the relationship between fingerprint patterns, gender, and ethnicity.

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