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Original Research

Comparative analysis of sex differences in frequencies of dermatoglyphic patterns by individual fingers

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ABSTRACT:

Background: 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. **Aim of the study:** To compare sex differences in frequencies of dermatoglyphic patterns by individual fingers. **Materials and methods:** The participants in this study were undergraduate students from different faculties in the university. A total of 200 undergraduate students were selected for the study. Demographic details were obtained by interviewer-administered questionnaire. These details included age, gender and place of origin (province of residence). Eligible students were asked to wash their hands thoroughly to remove dirt, and to dry them before obtaining fingerprints. Digital prints of all ten fingers were obtained for each individual. We carefully examined digital prints to identify the following patterns, using a hand lens (magnification $10\times$). **Results:** In the present study, a total of 200 undergraduate students was 100. The mean age of the participants was 23.68 years. It was observed that the loop pattern is the most common pattern in the study population followed by whorl and arch. On comparing the pattern between genders, the results were found to be statistically non-significant. **Conclusion**: Within the limitations of the present study, it can be concluded that loops pattern is the most common fingerprint pattern in the study population. The results between genders is statistically non-significant.

Keywords: fingerprints, dermatoglyphic patterns, loops, whorls

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INTRODUCTION

Fingerprints (digital dermatoglyphics) are a unique form of evidence that greatly contribute towards personal identification in forensic science. ¹ Because they are unique for each individual and are strongly influenced by genetics, they also perform a significant role in anthropology, human genetics, ethnology and medicine. They are characterized by alternating strips of raised friction ridges and grooves present in a variety of patterns. ² These patterns start to develop between the 5th and 6th week of intrauterine life, and are fully formed by the 21st week. ³ These patterns do not change throughout postnatal life and their development is determined by several genes. ⁴ 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. The term dermatoglyphics was coined by Harold Cummins in 1926, which is used for the studies of epidermal ridges on the nonhairy 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. ⁵ It is based on the principle that the individual peculiarities of the patterns formed by the arrangements and distribution of the papillary or epidermal ridges on the fingertips are absolutely constant and persistent throughout life, from infancy to old age, and that the patterns of two hands do not resemble each other. Even the fingerprints of twins are not similar.⁶

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Hence, the present study was conducted

MATERIALS AND METHODS

The ethical clearance for the study was approved from the ethical committee of the hospital. All subjects were informed about the purpose, nature and possible risks of the study, before written informed consent was obtained. The participants in this study were undergraduate students from different faculties in the university. A total of 200 undergraduate students were selected for the study. Demographic details were obtained by interviewer-administered questionnaire. These details included age, gender and place of origin (province of residence). Eligible students were asked to wash their hands thoroughly to remove dirt, and to dry them before obtaining fingerprints. Digital prints of all ten fingers were obtained for each individual.We carefully examined digital prints to identify the following patterns, using a hand lens (magnification 10×)

1. Loops

- Ulnar loop (UL)
- Radial loop (RL)
- 2. Whorls
- Plain whorl (PW)

- Double loop whorl (DLW)
- Central pocket loop (CPL)
- Accidental whorl (AW)

3. Arches

- Plain arch (PA)
- Tented arch (TA)

The statistical analysis of the data was done using SPSS version 11.0 for windows. Chi-square and Student's t-test were used for checking the significance of the data. A p-value of 0.05 and lesser was defined to be statistically significant.

RESULTS

In the present study, a total of 200 undergraduate students were selected between the age group of 18 to 25 years. The number of male students was 100 and female students was 100. The mean age of the participants was 23.68 years. Table 1 shows the digital dermatoglyphics patterns distribution among study population. It was observed that the loop pattern is the most common pattern in the study population followed by whorl and arch (Figure 1). On comparing the pattern between genders, the results were found to be statistically non-significant.

Table 1: Digital dermatoglyphics patterns distribution among study population

	Arch (%)	Whorl (%)	Loop (%)
Male	5.02	36.39	60.98
Female	4.65	35.28	60.25
Male + Female	4.89	36.2	59.36

Fig 1: Digital dermatoglyphics patterns distribution



DISCUSSION

In the present study, we analysed the digital dermatoglyphics of 200 undergraduate students. We observed that the loop pattern is most common in the study population, followed by whorl and arch. The results between genders were compared by statistical analysis and were found to be statistically non-

significant. The results were compared with studies from the literature. Karmakar B et al analyzed sexual dimorphism in the component structures among the Chuvashian population of Russia, finger and palmar dermatoglyphics of 547 individuals (293 males, 254 females). The sex differences in two categories of dermatoglyphic traits (22 quantitative traits and 38 asymmetry and diversity traits) are reflected differently and contradictory with other ethnic groups. However, a common feature of the factor 1 "digital pattern size factor" (finger ridge counts from the first category of traits) indicate its degree of universality when compared with other populations, which suggests that the variability of finger ridge counts is determined by the same genes that control the pattern types. The factors "intra-individual finger diversity factor", and "bi-lateral asymmetry factor" extracted from second the category of dermatoglyphic traits are also similar in both sexes. However, these components are hardly described in the literature. The nature of variation of these components (from two categories of dermatoglyphic traits) appears with a good similarity between sexes, which suggests their common biological validity of the underlying component structures of the finger and palmar dermatoglyphic characters. 7 Bai JKS et al investigated the accuracy of various methods employed in gender determination such as lip prints, mandibular canine index (MCI), fingerprints, and correlation between them. The study group consisted of 300 samples aged between 18 and 25 years. Lip prints, fingerprints, and impressions of lower mandibular arches were collected. Type II lip print pattern and loop pattern of fingerprints were the predominant patterns in both males and females, and mesiodistal width of right MCI has greater sexual dimorphism than left MCI. They concluded that although lip prints, fingerprints, and MCI had their own specifications, correlation of the three parameters did not show any significance.8

Wijerathne BT et al evaluated gender-wise diversity of digital dermatoglyphic traits in a sample of Sinhalese people in Sri Lanka.Four thousand and thirty-four digital prints of 434 Sinhalese individuals (217 males and 217 females) were examined for their digital dermatoglyphic pattern distribution. The mean age for the entire group was 23.66 years. The loop pattern is observed more frequently compared to whorl and arch in the Sinhalese population. Females have a more ulnar loop pattern than males. The plain whorl pattern is observed more frequently in males compared to females. The double loop pattern is observed more frequently on the right and left thumb (digit 1) of both males and females. Pattern intensity index, Dankmeijer index and Furuhata index are higher in males. They concluded that ulnar loop is the most frequently occurring digital dermatoglyphic pattern among the Sinhalese. All pattern indices are higher in males. To some extent, dermatoglyphic patterns of Sinhalese are similar to North Indians and other Caucasoid populations.⁹ Kc S et al studied fingerprints in 300 Nepalese of known blood groups of different ages and classified into primary patterns and then analyzed statistically. In both sexes, incidence of loops was highest in ABO blood group and Rh +ve blood types, followed by whorls and arches, while the incidence of whorls was highest followed by loops and arches in Rh –ve blood types. Loops were higher in all blood groups except "A – ve" and "B –ve" where whorls were predominant. The fingerprint pattern in Rh blood types of blood group "A" was statistically significant while in others it was insignificant. In middle and little finger, loops were higher whereas in ring finger whorls were higher in all blood groups. Whorls were higher in thumb and index finger except in blood group "O" where loops were predominant. This study concludes that distribution of primary pattern of fingerprint is not related to gender and blood group but is related to individual digits. ¹⁰

CONCLUSION

Within the limitations of the present study, it can be concluded that loops pattern is the most common fingerprint pattern in the study population. The results between genders is statistically nonsignificant.

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