

# Dermatoglyphic Patterns Among Undergraduate Students of a Medical College: A Descriptive Cross-sectional Study

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## ABSTRACT

**Introduction:** Dermatoglyphics is the science that deals with the study of dermal ridge patterns on the digits, palms and soles as a whole. The present study is based on fingerprints related with the dermatoglyphic patterns of digits of hands. Apart from individual identification in institutions, it is also useful in forensic investigations to identify the criminals or dead bodies in accidental cases. This study aimed to find out the fingerprint patterns in right and left hands of undergraduate medical students. **Methods:** The study was performed in 200 students (97 males and 103 females) from first and second years of MBBS and B.Sc. nursing streams. The fingerprints were collected individually by pressing each of the finger tips on the stamp pad and then pressing it on A4 sized plain paper until the best finger print was observed. **Results:** Out of 2000 fingerprints, 1218(60.9%) were loops, 581 (29.05%) were whorls, 134(6.7%) were arches, and 67(3.35%) were composites. In males, there were 620 loops, 226 whorls, 98 arches and 26 composites whereas 602 loops, 351 whorls, 36 arches and 41 composites were found in females. **Conclusion:** The loop patterns were more common than other fingerprint patterns. Comparatively arches and loops were more common in males and whorls and composites in female.

**Key words:** Arch, Dermatoglyphics, Fingerprint, Loop, Whorl

## INTRODUCTION:

Fingerprint is an important tool for identification of an individual which is not matched even between identical twins. It is an impression on the epidermis of the tips of each of the finger. Its study is known as Dactylography which is derived from Greek words, “daktylos” meaning ‘finger’ and “graphein” meaning ‘to write’. It is also known as Dactyloscopy or Dermatoglyphics. [1] Dermatoglyphics is defined as the science which deals with the study of dermal ridge configuration on the digits, palms and soles as a whole. The

dermatoglyphic pattern appears as early as 10-16 weeks of intra-uterine life.[2] Dermatoglyphic pattern remains same throughout life. It is disturbed if the skin is damaged to a depth at least about 1mm. In addition to identification of individuals in institutions, it is also used in forensic investigations of crimes, gender identification of buried dead bodies and correlation of blood grouping.[3,4,5,6] Various conditions as hypertension, obesity and diabetes have also been found to be associated with dermatoglyphic findings.[7,8,9] Dermatoglyphics is also helpful in diagnosis of chromosomal disorders and genetic diseases.[10,11]

The fingerprints have been classified into following patterns:[12]

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1. Arch
2. Loop
3. Whorl

Fingerprints can also be classified as follows:[10]

1. Visible prints: visible to the naked eye.
2. Latent prints: not seen by naked eye and visible by dusting, fuming or chemical reagents.
3. Impressed prints or plastic prints: visible to the naked eye forming impression on clay, wax, paint etc. surfaces which take impression.

Even monozygotic twins developing from the same fertilized egg have distinctive fingerprints. The fingerprints are an indispensable tool for the identification and gender differentiation in the context of ever-increasing frequency of crimes.[13]

This study aimed to evaluate the fingerprint patterns of right and left hands in a population of medical students.

## **METHODS:**

This was an observational cross sectional study carried out in the Department of Anatomy, Lumbini Medical College and Teaching Hospital (LMCTH) from 20 December, 2019 to 10 January, 2020. Ethical clearance was obtained from the institutional review committee (IRC-LMC: 01-J/019 ). A total of 200 undergraduate students from the first and second years of MBBS and B.Sc. Nursing were enrolled into the study. Informed consents were taken from the participants. The fingerprints were collected following the procedure mentioned here.

*First Step:* Each of the students was asked to rub his/her hands by towel and wash the hands if necessary. Then he/she was asked to press a finger tip on a stamp pad and rub it firmly with all fingers; first on right hand then on left hand fingers.

*Second Step:* They were asked to press the finger tip on a clear A4 size paper firmly so that their fingerprints were printed in the paper.

*Third Step:* No name and address of the participants were taken so that the records remained anonymous. They were assured that their prints would not be misused and all the samples after study would be destroyed.

*Fourth Step:* They were asked to give finger

prints till a clear print was obtained in the given paper and this print was recorded. Bad prints with faint print and bold print in which fingerprints were difficult to observe were discarded.

*Fifth Step:* After the fingerprint was obtained, pattern of the fingerprint was noted in a paper either as arch, whorl, loop or composite of each of the right and left fingers with the help of a lens or by naked eye.

The samples were thus collected one by one from all the participants. Fingerprints from burned, inflamed or scarred hands were excluded. The prints were taken with the fingers applied with regular and firm pressure on a bold paper. Entire prints of ten fingers of the participants were prepared. Only plain prints were included and roll prints were not taken.

The data thus collected were entered into Statistical Package for Social Sciences (SPSS™) software version 20. The parameters analyzed were the pattern frequency in males and females on their right and left hands.

## **RESULTS:**

The present study of dermatoglyphic patterns obtained 2000 fingerprints from each of the ten fingers of 97 males and 103 females. Out of them, 1218 (60.9%) were loops (607 in right hand and 611 in left hand), 581 (29.05%) were whorls (306 in right and 275 in left), 134 (6.7%) were arches (59 in right and 75 in left), and 67 (3.35%) were composites (28 in right and 39 in left). The frequency and the percentage of all fingerprint patterns are shown in table 1. The frequency and percentage of loops, whorls, arches, and composites of males and females in right and left hands are also shown. The study also showed that the frequencies of loops and arches were relatively higher in males as compared with females whereas the whorl and composite patterns were more common in females as compared with males.

The composite pattern was not observed in the middle, ring, and little fingers of male right hands and the middle finger of female left hands. Similarly, arch was not observed in the thumbs and middle fingers of female right hands.

Table 2 shows the comparison of the present study's findings with that of other published works.

## **DISCUSSION:**

*Table 1: Distribution of fingerprint patterns in males and females.*

| Patterns          | Loop          |                | Whorl          |                 | Arch          |               | Composite     |               |               |
|-------------------|---------------|----------------|----------------|-----------------|---------------|---------------|---------------|---------------|---------------|
|                   | Male          | Female         | Male           | Female          | Male          | Female        | Male          | Female        |               |
| <b>Right hand</b> | <b>Thumb</b>  | 60<br>(61.9%)  | 47<br>(45.6%)  | 29<br>(29.1%)   | 45<br>(43.7%) | 4 (4.1%)      | -             | 4 (4.1%)      | 11<br>(10.7%) |
|                   | <b>Index</b>  | 44<br>(45.4%)  | 61<br>(59.2%)  | 28<br>(28.9%)   | 32<br>(31.1%) | 20<br>(20.6%) | 8<br>(7.8%)   | 5 (5.1%)      | 2 (1.9%)      |
|                   | <b>Middle</b> | 73<br>(75.5%)  | 82<br>(79.6%)  | 15<br>(15.5%)   | 19<br>(31.1%) | 9 (9.3%)      | -             | -             | 2 (1.9%)      |
|                   | <b>Ring</b>   | 56<br>(57.1%)  | 37<br>(35.9%)  | 34<br>(35.1%)   | 62<br>(60.2%) | 7 (7.2%)      | 2<br>(1.9%)   | -             | 2 (1.9%)      |
|                   | <b>Little</b> | 78<br>(80.4%)  | 71<br>(68.9%)  | 12<br>(12.4%)   | 28<br>(27.2%) | 7 (7.2%)      | 2<br>(1.9%)   | -             | 2 (1.9%)      |
| <b>Left hand</b>  | <b>Thumb</b>  | 65<br>(67.0%)  | 57<br>(55.3%)  | 20<br>(20.6%)   | 39<br>(37.9%) | 6 (6.2%)      | -             | 6 (6.2%)      | 7 (6.8%)      |
|                   | <b>Index</b>  | 46<br>(47.4%)  | 45<br>(43.7%)  | 30<br>(30.9%)   | 42<br>(40.8%) | 19<br>(19.6%) | 12<br>(11.7%) | 2 (2.1%)      | 4 (3.9%)      |
|                   | <b>Middle</b> | 62<br>(63.9%)  | 76<br>(73.8%)  | 20<br>(20.6%)   | 17<br>(16.5%) | 13<br>(13.4%) | 10<br>(9.7%)  | 2 (2.1%)      | -             |
|                   | <b>Ring</b>   | 51<br>(52.6%)  | 42<br>(40.8%)  | 33<br>(34.0%)   | 54<br>(52.4%) | 9 (9.3%)      | -             | 4 (4.1%)      | 7 (6.8%)      |
|                   | <b>Little</b> | 85<br>(87.6%)  | 84<br>(81.6%)  | 5 (5.2%)        | 13<br>(12.6%) | 4 (4.1%)      | 2(1.9%)       | 3 (3.1%)      | 4 (3.9%)      |
| <b>Total</b>      | 620<br>(31%)  | 602<br>(30.1%) | 226<br>(11.3%) | 351<br>(17.55%) | 98<br>(4.9%)  | 36<br>(1.8%)  | 26<br>(1.3%)  | 41<br>(2.05%) |               |

Fingerprint is the worldwide important tool for the individual identification and gender differentiation proven by many studies. Sam NM et al.[1] recorded relatively high frequency (6.35%) of composites which is higher than present study (3.3%). The study of Mehta AA et al.[2] showed the percentage of whorls in male index finger as 45% and ring finger as 63.57% which were higher than those of loops and arches. This finding was in contrast to other studies and the present study as well. In overall distribution, fingerprint patterns in both hands among males and females were not significantly different.

Shrestha I et al.[14] had shown maximum number of arches i.e. 15.28% compared to other studies and it exceeded by 9.1% as compared with our study which showed only 6.7% arches. Loop pattern was shown as the most common pattern (60.9%) in the present study which is similar to the study by Kumar A et al.[12] Maximum whorls (42.2%) were shown in the study by Das NK et al.[15] and this finding was very different from the present study (29.1%).

In the study of Kanchan T et al.,[16] loops were most often found on little finger (77.7%)

*Table 2. Comparison of dermatoglyphics pattern among different studies.*

| Author                 | Year        | Sample size | Arch %     | Loop %      | Whorl %     | Composite % |
|------------------------|-------------|-------------|------------|-------------|-------------|-------------|
| Kanchan T. et al.[16]  | 2006        | 110         | 4.5        | 57.5        | 38          | -           |
| Sam NM. et al.[1]      | 2015        | 200         | 6.2        | 57.1        | 30.35       | 6.35        |
| Ray AK. et al.[3]      | 2015        | 200         | 20.5       | 47.05       | 28.75       | 3.25        |
| Kumar A. et al.[12]    | 2018        | 400         | 4.5        | 57.2        | 38.3        | -           |
| Das NK. et al.[15]     | 2018        | 200         | 5.5        | 52.3        | 42.2        | -           |
| Shrestha R. et al.[17] | 2019        | 200         | 7.5        | 51.8        | 40.15       | 0.7         |
| Hirachan N. et al.[18] | 2019        | 250         | 7.3        | 52.6        | 39.4        | 0.6         |
| Shrestha I. et al.[14] | 2019        | 196         | 15.28      | 52.71       | 27.38       | 4.6         |
| <b>Present Study</b>   | <b>2020</b> | <b>200</b>  | <b>6.7</b> | <b>60.9</b> | <b>29.1</b> | <b>3.3</b>  |

followed by middle finger (73.7%) and index finger (49.1 %). Frequency of whorls was maximum on the ring finger (55%) followed by thumb (53.6%) and index finger (38.2%). Fifty six percent of the total arches were present on the index finger. This preference for arches on the index finger was marked in males (68%) when compared to females (44%). There was insignificant difference in overall distribution of fingerprint pattern in both hands among males and females which was almost similar to present study.

The study by Shrestha R et al.[17] and Hirachan N et al.[18] showed minimum number of composites which were 0.7% and 0.6% respectively. Some of the studies including those by Kanchan T et al.[16], Kumar A et al.[12] and Das NK et al.[15] did not find the composite pattern. The present study also did not observe composite and arch patterns in some fingers of males and females.

Loops were seen on all of the digits, whorls were predominant on thumb, index and ring fingers. Percentages of patterns of finger prints seen in the study of Hamid S et al.[11] were loops (57.6%), whorls (30.3%) and arches (7.4%) which were almost similar to the present study where loops (60.9%) were followed by whorls (29.1%), and arches (6.7%) respectively. Furthermore, loops were predominantly found on middle finger (25.52%) followed by little finger (23.6%), thumb (18.05%), ring finger (17.01%) and frequency of whorls was maximum on the index finger (27.72%) followed by thumb (25.08%) and ring finger (24.75%). Out of all arches, 48.64% were present on the thumb and middle fingers. There was insignificant difference in overall distribution of fingerprint patterns in both hands among males and females when compared with present study.[11]

The distribution of various patterns of the finger prints in our study were almost similar with previous studies with only few differences. This type of study is very important for the individual identification as well as for comparison of fingerprints of students in any other fields like engineering, management, commerce, and so on with the fingerprints of health science students.

There are a few limitations of our study. Ink method was used to record finger prints as digital method was not feasible. Besides this, our sample included students from a single medical college and

therefore our findings may not be generalized to all health science students.

## **CONCLUSION:**

Fingerprint is a guideline parameter for the individual identification in present days. The maximum number of fingerprints were recorded as loops followed by whorls, arches, and composites. Loops and arches were the dominant fingerprint patterns in males while whorls and composites were dominant in females. Loops were most common in little finger while whorls were recorded most from ring finger. Arches were most common in index fingers and composites were most common in thumb finger.

**Conflict of interest:** Authors declare that no competing interest exists.

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