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# Analysis and Detection of Fingerprint Patterns Across Three Generations in Families of the Vidarbha Region Population

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***Abstract***

*Fingerprint patterns are unique and reliable for identification. This study focuses on a comparative analysis to determine the inheritance of fingerprint patterns across three generations in families of the Vidarbha region population. The sample collection process for this comparative analysis involved working with 100 families. The study aims to gain insights into the hereditary aspects of fingerprint characteristics among three generations. The research methodology involves the collection of fingerprint samples which were taken by ink and roll method and the analysis of patterns using magnifying lenses. The results reveal that there may be a possibility of genetic influence and concordance in fingerprints patterns, contributing to our understanding of dermatoglyphics. The study indicates a strong hereditary influence on fingerprint patterns across three generations. The research has implications for transmission of fingerprint pattern, genetics and personal identification.*

**Keywords:** Fingerprint patterns, inheritance, dermatoglyphics, concordance, magnifying lenses

## INTRODUCTION

Fingerprints serve as essential evidence in forensic science, making them widely accepted across the globe. These prints possess several notable characteristics, including their Uniqueness, Permanence, Universal, Inimitable even identical twins possess distinct fingerprints, which have become a universally accepted tool for crime investigations by law enforcement agencies.

In 1890, Sir Francis Galton categorized them into three types: Arch, Loop, and Whorl, which became known as the A, L, W System. Later, in 1896, Sir Edward Richard Henry, who was the Inspector General of Police in Lower Bengal, expanded this classification to include a fourth group: Composite. The ridges on the fingertips create various patterns [1].

Fingerprints are impressions made by the tiny ridges on the fingertips, and their formation depends on how the fingers contact a surface or object. These prints can be either complete or partial [2].

Dermatoglyphics, which develop before birth, remain unchanged throughout a person's life. The ridges start forming in the third month of fetal development and are fully developed by the sixth month. Although the exact purpose of these ridges is not fully understood, they are believed to enhance

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touch sensitivity. The basic dimensions, shapes, and spacing of dermatoglyphics seem to be influenced by genetic factors. Research indicates that multiple genes are involved, making the inheritance pattern complex. Genes that regulate the development of skin layers, as well as the underlying muscles, fat, and blood vessels, may contribute to the ridge patterns. Additionally, the finer details of these skin ridge patterns are affected by other factors during fetal development such as substances consumed during pregnancy and the intrauterine environment [3].

Recent dermatoglyphic studies have investigated the hereditary transmission of fingerprints in related individuals. [4] reported dominant loop patterns among North Indian populations and suggested genetic influence in dermatoglyphic traits. Intergenerational similarities were observed between Indian family members in thumb and index fingers [5]. A comparative study among South Indian families by [6] demonstrated statistically significant concordance in pattern between parents and offspring. Other studies, like [7] and [8], talked about the importance of genetic inheritance in the intensity and distribution of fingerprint patterns, accepting the prenatal environmental influence.

**The Various Types of Patterns Include Such as**

- *Arch:* Arch is a pattern in which the ridges run from one side to the other, slightly rising in the center, making no backward turn. An arch is also known as a patternless pattern [4].
- *Plain Arches:* Fingerprint pattern where ridges flow smoothly in a gentle wave from one side to the other without loops, recurves, or sharp angles.
- *Tented Arches:* Fingerprint pattern where ridges rise sharply at the center, forming a tent-like angle or vertical upthrust [5]. A loop is a type of fingerprint pattern in which ridges enter from one side, curve back, and then exit from the same side, featuring one core and one delta [4].
- *Ulnar Loop:* A loop pattern that opens toward the ulna (little-finger side) of the hand.
- *Radial Loop:* A loop pattern that opens toward the radial bone (thumb side) of the hand [6].
- *Whorl:* Whorl is a fingerprint pattern where ridges form circular or spiral shapes around a core, making at least one complete circuit and having two deltas [4].
- *Plain Whorl:* A common whorl pattern where concentric ridges surround a clear core and a line drawn between the two deltas cuts at least one recurving ridge.
- *Spiral Whorl:* A whorl pattern in which ridges coil continuously around the core like a whirlpool or spring, forming a spiral shape [6].

Composite print is a fingerprint showing a combination of two or more basic patterns (arch, loop, and whorl).

- *Central Pocket Loop:* Central pocket loop is a loop pattern in which ridges around the core deviate to form a central pocket.
- *Lateral Pocket Loop:* Lateral pocket loop is a loop where ridges bend sharply on one side forming a side pocket, with core ridges existing on the same side of both deltas.
- *Twinned Loop:* Twinned loop is a fingerprint containing two distinct loops, one encircling the other, with core ridges exiting on opposite sides of the deltas.
- *Accidental Pattern:* Accidental pattern is irregular fingerprint combining multiple patterns that cannot be classified elsewhere, including arches with pockets [4].[Figure:1]

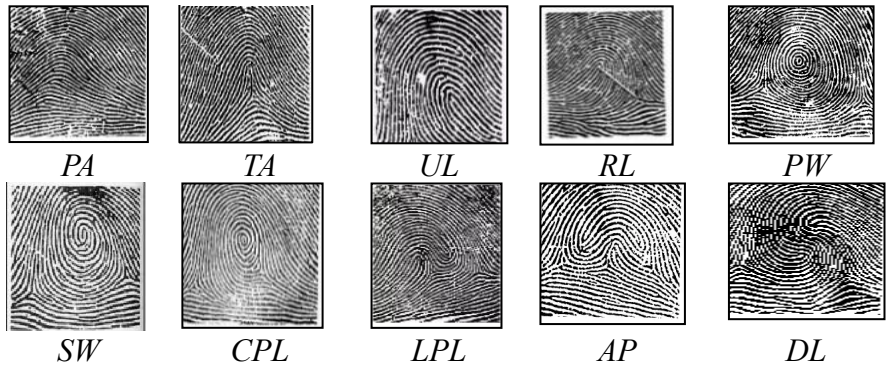


**Figure 1.** Type of fingerprint patterns observed in the study population.



 

## METHODOLOGY

The current study was carried out to examine the hereditary transmission of fingerprint patterns across three generations from each family, namely grandfather, father and children, ensuring representation and continuity of lineage. The study was carried out in 100 families belonging to different districts of Vidarbha region like Nagpur, Amravati, Chandrapur, Pulgaon, Paratwada, etc. Participants were from three generations: grandparents, parents and children. Participants (Male and Female). The participants ranged from under 18 years (children) to above 60 years (elderly). Families were selected based on voluntary participation and availability of data from three generations of lineage. For analysis, the thumb, index, ring finger of both the right and left hands were selected, as these fingers provide clear and distinct ridge patterns suitable for comparative analysis.

For fingerprint recording, the standard ink and roller method was employed to obtain clear and well-defined ridge impressions. Initially, hands of all the participants were thoroughly washed with soap and water, and then dried them completely to remove dirt, sweat, and oil that could interfere with ridge clarity. A thin, uniform layer of black printing ink was then prepared on a clean glass slab using a rubber roller. The selected fingers thumb, index, and ring fingers of both the right hand and the left hand were gently rolled over the ink slab to evenly coat the ridges. Each finger was subsequently rolled on a properly labeled white paper sheet to obtain complete and accurate impressions. The fingerprint sheets were allowed to air-dry before examination.

Once dried, the fingerprint impressions were observed under a magnifying lens to ensure clarity and accuracy and also try to visualize the figure print through our own department develop fingerprint power for better clarity, [9]. The prints were analyzed based on fingerprint patterns, such as loop, whorl, and arch, based on standard fingerprint classification criteria.

After analysis the fingerprint patterns were systematically compared among grandparents, parents, and children to assess the frequency and distribution of patterns across generations. This comparative analysis helped identify possible hereditary trends in fingerprint patterns while reaffirming that, despite similarities in pattern types, individual ridge details remained unique [10].

Microsoft Excel was used for statistical analysis to assess the hereditary association of fingerprint patterns in three generations. A Chi-square ($\chi^2$) test was used to examine whether the distribution of fingerprint patterns in grandparents, parents and children was significantly different from the expected frequencies (Tables 1 and 2) [11].

The observed and expected frequencies of Loop, Whorl and Arch patterns were compared by Chi-square formula:

$$\chi^2 = \sum \frac{(O - E)^2}{E}$$

where:

O = Observed frequency

E = Frequency expected

The degrees of freedom (df) were determined as follows:

$$df = (r - 1)(c - 1)$$

A correlation analysis was also conducted to explore similarities between generations. Statistical significance was set at $p < 0.05$.

 

## RESULT AND DISCUSSION

**Table 1.** Comparative analysis of fingerprint pattern matching across generations.

| S. N. | Families | Overall matching in % | Finger showing maximum pattern matching in three generations | Finger showing maximum pattern matching in two generations |
|---|---|---|---|---|
| 1 | F1 | 77.778 | RT,LT,RR,LR | LI |
| 2 | F2 | 38.889 | LT | RT,LI |
| 3 | F3 | 50 | RR | RT,LI,LR,LI |
| 4 | F4 | 55.556 | RT,LT | RR,LR |
| 5 | F5 | 83.334 | RR,LI | RT,LT,LR,RI |
| 6 | F6 | 72.223 | LI | RT,LT,RR,LR,RI |
| 7 | F7 | 77.778 | RT,RI | LT,RR,LR,LI |
| 8 | F8 | 72.223 | RT | LT,RR,RI |
| 9 | F9 | 55.556 | No similarity shown | RT,LT,RR,LR,RI |
| 10 | F10 | 72.223 | No similarity shown | RT,LT,RR,LR,RI,LI |
| 11 | F11 | 55.556 | No similarity shown | RT,LT,RR,LR,RI,LI |
| 12 | F12 | 77.778 | RT,LT,RR,LR | LI |
| 13 | F13 | 66.667 | RT,LT | RR,LR,RI, |
| 14 | F14 | 50 | RR,LR,RI | No similarity shown |
| 15 | F15 | 88.889 | RT,LT.RR | LR,RI,LI |
| 16 | F16 | 55.556 | No similarity shown | RR,LR,RI,LI |
| 17 | F17 | 83.334 | RT,LT | RR,LR,RI,LI |
| 18 | F18 | 66.667 | No similarity shown | RT,RR,LR,RI |
| 19 | F19 | 55.556 | No similarity shown | RT,LT,RR,LR,RI,LI |
| 20 | F20 | 77.778 | LR,LI | RT,LT,RR,RI |
| 21 | F21 | 83.333 | LR | RT,LT,RR,RI,LI |
| 22 | F22 | 83.334 | RT,LT | RR,LR,RI,LI |
| 23 | F23 | 83.334 | RT,LT | RR,LR,RI |
| 24 | F24 | 66.667 | LT,RR,LR,RI,LI | RT |
| 25 | F25 | 94.445 | LT,RR,LR,RI,LT | RT |
| 26 | F26 | 94.445 | RT,LT,LR,RI,LI | RR |
| 27 | F27 | 61.112 | No similarity shown | RT,LT,RR,LR,RI |
| 28 | F28 | 66.667 | No similarity shown | RT,LT,RR,LR,RI |
| 29 | F29 | 94.444 | RT,LT,RR | RI,LI |
| 30 | F30 | 66.667 | No similarity shown | RT,LT,RR,RI |
| 31 | F31 | 72.222 | No similarity shown | RT,LT,RR,RI |
| 32 | F32 | 88.889 | RT,LT | RR,RI,LI |
| 33 | F33 | 66.667 | RR,RI | RT,LR,LI |
| 34 | F34 | 33.333 | No similarity shown | RT |
| 35 | F35 | 72.222 | No similarity shown | RT,LT,RR,LR,RI,LI |
| 36 | F36 | 66.667 | No similarity shown | RT,LT,RR,LR,RI,LI |
| 37 | F37 | 33.333 | LR | RT,LI |
| 38 | F38 | 61.111 | RI,LI | RT,RR,LR |
| 39 | F39 | 44.444 | No similarity shown | RT,LT,RR,LR |
| 40 | F40 | 33.334 | No similarity shown | LT,RR,LI |
| 41 | F41 | 66.667 | No similarity shown | RT,LT,RR,LR,RI,LI |
| 42 | F42 | 50 | RR | RT,RI,LI |
| 43 | F43 | 44.444 | RI | RR,LR,LI |
| 44 | F44 | 55.556 | RI,LI | RT,RR |
| 45 | F45 | 33.333 | No similarity shown | RT,RR,LR |
| 46 | F46 | 77.778 | RI,LI | RT,LT,RR,LR |
| 47 | F47 | 44.444 | No similarity shown | RT,LT,RR,LR,RI |
| 48 | F48 | 11.111 | No similarity shown | RR |
| 49 | F49 | 11.111 | No similarity shown | RR |

 

| | | | | |
|---|---|---|---|---|
| 50 | F50 | 50 | RR | LR,RI,LI |
| 51 | F51 | 77.778 | RT,LT,RR,LR | RL |
| 52 | F52 | 44.444 | No similarity shown | LT,RR,LR,RI |
| 53 | F53 | 72.223 | RT,LR | RT,RR,RI,LI |
| 54 | F54 | 55.556 | No similarity shown | LT,RR,LR,RI,LI |
| 55 | F55 | 61.112 | LT | RT,LR,RI,LI |
| 56 | F56 | 38.889 | RT,LR | LT,RR,RI,LI |
| 57 | F57 | 77.778 | LT,LI | RT,RR,LR,RI |
| 58 | F58 | 83.333 | LT,LR,RI | RT,RR,LI |
| 59 | F59 | 50 | RI | RT,RR,LR,LI |
| 60 | F60 | 83.333 | LT,RR,LR | RT |
| 61 | F61 | 66.667 | RI,LI | RT,RR,LR |
| 62 | F62 | 66.667 | LT,RR | LR,RI,LI |
| 63 | F63 | 44.444 | No similarity shown | LT,RR,RI,LI |
| 64 | F64 | 44.444 | No similarity shown | RI,LI |
| 65 | F65 | 72.222 | RT | LT,RR,LR,RI,LI |
| 66 | F66 | 44.444 | No similarity shown | RT,LT,RR,LR,RI,LI |
| 67 | F67 | 72.222 | RI,LI | LT,RR,LR,RI |
| 68 | F68 | 77.778 | RT,LR,RI | LI |
| 69 | F69 | 55.556 | RI | RT,LT,RR,LI |
| 70 | F70 | 55.556 | LT,LI | RT,LR |
| 71 | F71 | 22.222 | No similarity shown | LR,RI,LI |
| 72 | F72 | 94.444 | RT,LT,RR,LR,RI | LI |
| 73 | F73 | 66.667 | RT,LR | LT,RI,LI |
| 74 | F74 | 55.556 | RT | LT,RR,LR,RI,LI |
| 75 | F75 | 100 | RT,LT,RR,LR,RI,LI | No similarity shown |
| 76 | F76 | 72.222 | RT,LT,LR | RR,RI,LI |
| 77 | F77 | 88.889 | RR,LR,LI | RT,RI,LI |
| 78 | F78 | 61.111 | RI,LI | RT |
| 79 | F79 | 55.556 | LI | LT,RR,RI |
| 80 | F80 | 77.778 | No similarity shown | RT,LT,RR,LR,RI,LI |
| 81 | F81 | 72.222 | RT,LT,LR | RR,RI,LI |
| 82 | F82 | 77.778 | RT,LT,RR | RI,LI |
| 83 | F83 | 55.556 | No similarity shown | LT,RT,RR,LI,RI |
| 84 | F84 | 55.556 | No similarity shown | LT,RT,LR,RR,LI |
| 85 | F85 | 44.444 | No similarity shown | LT,RR,LI,RI |
| 86 | F86 | 33.333 | No similarity shown | RT,RR,LI |
| 87 | F87 | 33.333 | No similarity shown | LT,RT |
| 88 | F88 | 55.556 | RT,RI | LR,RR |
| 89 | F89 | 22.222 | No similarity shown | LT,LI |
| 90 | F90 | 33.333 | No similarity shown | LT,LR,RR |
| 91 | F91 | 61.111 | RI | LT,LR,RR,LI |
| 92 | F92 | 55.556 | No similarity shown | RT,LR,RR,LI,RI |
| 93 | F93 | 50 | RT | LR,LI,RI |
| 94 | F94 | 50 | RR | RT,LR,RI |
| 95 | F95 | 66.667 | LT,LR,RI | RT,RR,LI |
| 96 | F96 | 66.667 | RR | LT,RR,LR,LI |
| 97 | F97 | 50 | RT,LR | LT,RR,LI |
| 98 | F98 | 72.222 | RT,LR | LT,RR,LI |
| 99 | F99 | 83.333 | RT,LT,RR,LR,LI | No similarity shown |
| 100 | F100 | 22.222 | No similarity shown | LI,RI |





 

**Table 2.** Abbreviations and meaning of fingerprints pattern and its parameters.

| S. N. | Abbreviation | Meaning | Abbreviation | Meaning |
|---|---|---|---|---|
| 1 | RT | Right Thumb | UL/RL | Ulnar loop/Radial loop. |
| 2 | LT | Left Thumb | PA/TA | Plain arch/Tented arch. |
| 3 | RI | Right Index | SW/CW | Spiral whorl/Concentric whorl. |
| 4 | LI | Left Index | DL | Double loop. |
| 5 | RR | Right Ring | CPL | Central pocket loop. |
| 6 | LR | Left Ring | AP | Accidental pattern. |

## Overall Matching Across Three Generations

The analysis of fingerprint pattern concordance within the lineage of grandfather–father–children shows that overall matching was high in several of the families, with 69 families showing concordance rates above 50% in all three generations and the 8 families showed 50% matching of patterns in all three generations. Some of the families show very strong patterns of hereditary transmission [12].

This reflects a strong hereditary influence in the transmission of pattern types: Loop, Whorl, Arch. The data indicate that good number of families from sample population tends to fall within high matching ranges, mostly starting from 55.55% to 94.44%, thus supporting the claim of genetic inheritance of pattern types.

Family F75 (from sample population) showed 100% matching in all six fingers tested: right thumb, left thumb, right index finger, left index finger, right ring finger, and left ring finger. This was the only family that found perfect intergenerational matching. This finding provides strong support for the fact that, in some lineages, fingerprint patterns show great genetic continuity [13].[Figure:2]

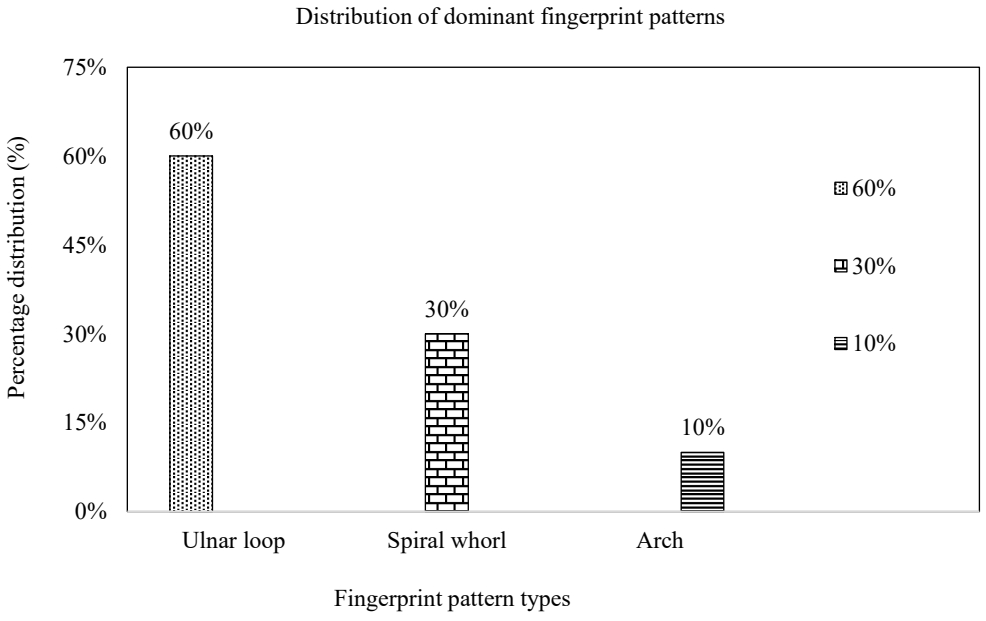


**Figure 2.** Percentage distribution of dominant fingerprint patterns in the study population Sample size (n = 1800 fingerprint samples).

Three-generation continuity was clear across the families in certain digits such as RT, LT, and RR. Consistent three-generation matches were particularly present in: Right Thumb (RT), Left Thumb (LT), Right Ring (RR), and Left Ring (LR). These findings demonstrate that the patterns of the thumb and ring fingers are stable across generations (Table 3) (Figure 3).



 

**Table 3.** Statistical distribution of fingerprint pattern types in the population studied.

| Selected finger | Loop (%) | Whorl (%) | Arch (%) |
|---|---|---|---|
| Right Thumb | 80 | 17 | 3 |
| Right Ring | 26 | 70 | 4 |
| Right Index | 53 | 43 | 3 |
| Left Thumb | 57 | 40 | 2 |
| Left Ring | 33 | 63 | 1 |
| Left Index | 62 | 34 | 1 |

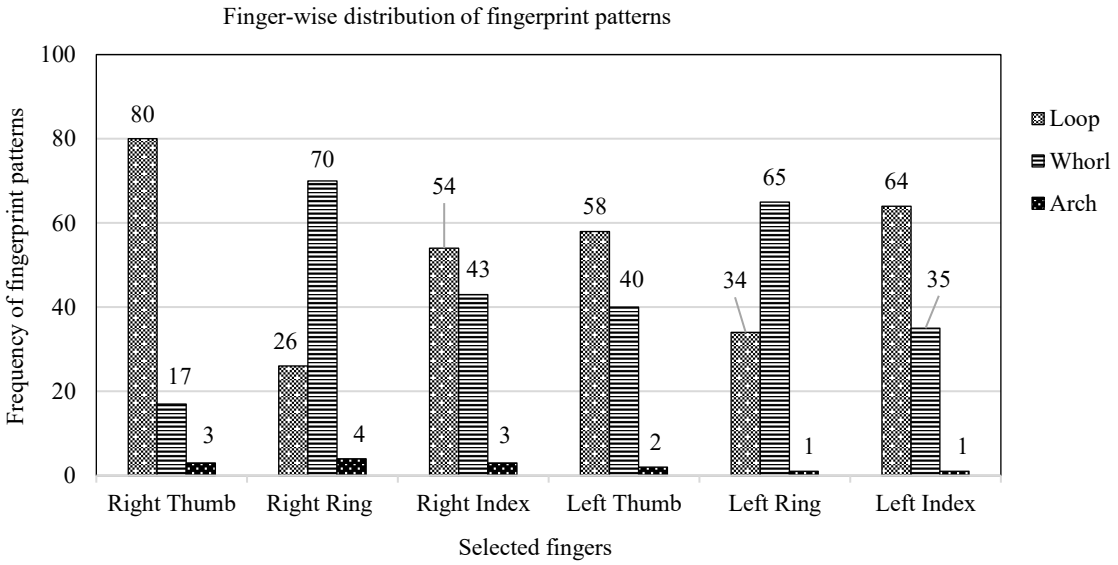


**Figure 3.** Finger-wise distribution of dominant fingerprint patterns across generations

In the absence of three-generation matching, two-generation matching remained prevalent. The following pairings exhibited a high incidence of two-generation matching: Grandfather→ Father, Father → Children. These findings suggest that, even when complete concordance is not transmitted across all three generations, partial inheritance can take place.

Most Common Fingerprint Morphologies are the predominant patterns identified across a sample population of 1,800 fingerprints:

- *Loop Pattern* – Dominant, the frequency distribution shows that ulnar loops are the most common pattern in all six digits and appear regularly in all three generations. This distribution matches the trend in the general population, where loops are genetically dominant in most Vidarbha populations.
- *Whorl Pattern* – Second Most Common pattern (Spiral and Plain whorls) recurred with a lower frequency than the loops, while whorl designs were more prevalent on thumbs and index fingers
- *Arch Pattern* – Least Common among the pattern types examined, plain arch and tented arch configurations were the rarest.

The Chi-square analysis revealed a statistically significant association between distribution of fingerprint patterns and generations of family ($\chi^2 = 1921.86$, df = 1680, p = 0.000032). The obtained p-value was < 0.05, hence null hypothesis was rejected, indicating that hereditary factors may influence the inheritance of fingerprint pattern in three generations.



 

Correlation analysis also showed moderate positive similarity between grandparents, parents and children in dominant fingerprint pattern types, especially ulnar loop and whorl patterns (Figure 4).

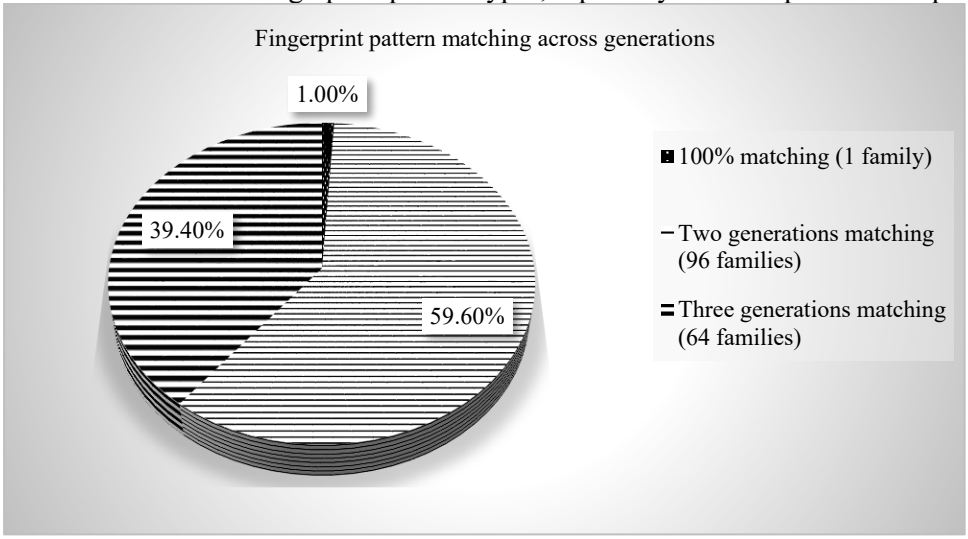


**Figure 4.** Comparative fingerprint patterns matching across three generations among families

## LIMITATIONS

The current study has been conducted among the selected families of certain districts of Vidarbha only; hence, the results might not be representative of the wider population groups in this region or even nationally. Though 100 families and 1,800 fingerprints were studied, the sample size used for this investigation can affect its applicability to other populations having different genetic or environmental backgrounds.

Moreover, the study only involved qualitative comparisons among various fingerprint patterns among the three generations of selected families. It did not use any of the quantitative biometric measures in studying fingerprints, nor was there any genetic analysis of fingerprints in this study. The impact of environmental and developmental effects on fingerprint development, such as intrauterine conditions and developmental pressures, has not been assessed quantitatively.

Finally, the study was limited to selected fingers including thumb, index, and ring fingers and not ten fingers. Hence, a more generalized conclusion about the hereditary features of dermatoglyphics requires future large-scale investigations involving diverse populations using sophisticated statistical methods and digital fingerprint analysis techniques.

## CONCLUSION

The present study was done to study fingerprint patterns in 100 families from Vidarbha region with 1,800 fingerprint samples in three generations. Results showed significant similarities of distribution of fingerprint patterns among relatives especially in the patterns of loops and whorls.

Statistical analysis by Chi-square test showed significant association of fingerprint patterns with hereditary lineage. But hereditary influence seems to be important, but the formation of fingerprints is also influenced by environmental factors and intrauterine development. Therefore, fingerprint inheritance should not be seen as entirely deterministic.

The present study supports the role of genetics in dermatoglyphic traits and reiterates the uniqueness of the ridge details of everyone. Further studies on larger population and advanced biometric analysis techniques are recommended to improve the understanding of hereditary dermatoglyphic traits.

## REFERENCES



 

1. Welcome to Training Division of Delhi Police. Delhipolice.gov.in. 2026. Available from: https://training.delhipolice.gov.in/
2. Fingerprint Forensic Expert in Hyderabad | BFI. BRILLIANT FORENSIC INVESTIGATION | Forensic expert Services India | Handwriting Signature Verification Expert Delhi NCR| Fingerprint Expert services| Cyber Forensic Data recovery|Polygraph lie detector test in Janakpuri, Delhi NCR| Noida | Gurgaon | Ghaziabad| Lucknow| Varanasi| Courts| Faridabad| Sonipat| Haryana| Best Forensic Lab in Delhi| Training Internship in forensic lab. 2026. Available from: https://forensicexpertinvestigation.com/fingerprint-forensic-expert-in-hyderabad/.
3. Sushma Paudel, Sushmita Paudel, Samikshya Kafle. A Dermatoglyphic Study of Primary Fingerprints Pattern in Relation to Gender and Blood Group Among Residents of Kathmandu Valley, Nepal. IET Biometrics. 2025 Jan 1;2025(1).
4. Sharma R, Kaushal S. Dermatoglyphic patterns in North Indian population and their genetic significance. Indian J Forensic Med Toxicol. 2018;12(3):45–51.
5. Moorthy TN. Inheritance of fingerprint pattern among Indian family members. Int J Med Toxicol Leg Med. 2018;21(3):119–121.
6. Karmakar B, Majumder PP, Roy S, Mukherjee N. Mode of inheritance of dermatoglyphic pattern intensity index on fingers in five Indian populations: A comparative study between individual trait and its factor. Ann Hum Biol. 2005;32(5):445–468.
7. Bhatnagar D. Quantitative dermatoglyphic analysis in familial trait inheritance. Int J Hum Genet. 2019;19(1):23–30.
8. Karmakar B, Majumder PP, Roy S, Mukherjee N. Mode of inheritance of dermatoglyphic pattern intensity index on fingers in five Indian populations: A comparative study between individual trait and its factor. Ann Hum Biol. 2005;32(5):445–468.
9. Ansari QA, Parihar P, Chincholkar S, Dohare K, Dhore MS. Efficacy and Efficiency of Fingerprint Powder Derived from Natural Flowers – Development and Evaluation of Sustainable Fingerprint Powders. Res Rev J Life Sci. 2025;15(3):6–17.
10. admin. History of Fingerprint in India. Homeopathy Resource by Homeobook.com. 2023. Available from: https://www.homeobook.com/history-of-fingerprint-in-india/.
11. Fundamentals of Fingerprint Analysis, Second Edition : Moses Daluz, Hillary: Amazon.in: Books. Amazon.in. 2026. Available from: https://www.amazon.in/Fundamentals-Fingerprint-Analysis-Second-Hillary/dp/1351043196 .
12. Geethalakshmi C, Rohatgi S. Forensic examination of fingerprint patterns among different generations in South Indian families. Indian J Forensic Med Toxicol. 18(2):70–78. 2024.
13. Karmakar B, Majumder PP, Roy S, Mukherjee N. Mode of inheritance of dermatoglyphic pattern intensity index on fingers in five Indian populations: A comparative study between individual trait and its factor. Ann Hum Biol. 2005;32(5):445–468.



 