RESEARCH PAPER

Dermatoglyphics and Personality Traits in Undergraduate Medical Students: An Analytical Cross-Sectional Study

Dr. Madhavi Tankala[1], Dr. Susmita Senapati[2], Mrs. Mamata Panigrahi[3], Dr Shashi Shankar Behera[4], Dr. Prajna Paramita Samanta[5]

[1]Professor, Department of Anatomy, Kalinga Institute of Medical Sciences, KIIT - DU, 751024, Bhubaneswar, Odisha, India
Email: madhavi.tanakala@kims.ac.in
[2]Associate Professor, Department of Anatomy, Kalinga Institute of Medical Sciences, KIIT - DU, 751024, Bhubaneswar, Odisha, India
Contact: +91 94381 45347
Email: susmitashashi@gmail.com
[3]Assistant Professor, Department of Anatomy, Kalinga Institute of Medical Sciences, KIIT - DU, 751024, Bhubaneswar, Odisha, India
Email: mamata.panigrahi@kim.ac.in
[4]Professor, Department of Obstetrics and Gynaecology, Mansarovar Medical College, Sehore, Bhopal
Email: shashibehera1971@gmail.com
[5]Senior Professor, HOD, Department of Anatomy, Kalinga Institute of Medical Sciences, KIIT - DU, 751024, Bhubaneswar, Odisha, India
Email: psprajna@gmail.com

ABSTRACT

Background: Dermatoglyphic patterns and the central nervous system share an ectodermal origin, providing a biological rationale for a possible association between fingerprint configurations and personality. Few studies have examined this association in undergraduate medical students using an established personality framework.

Objective: To examine the association between right-hand fingerprint patterns and personality traits, as defined by the DISC model, in a cohort of MBBS students.

Methods: An analytical cross-sectional study was conducted between August and September 2024 among 200 first- and second-year MBBS students (aged 18–20 years) at a tertiary-care medical college in Odisha, India. Prints of all five digits of the right hand were obtained using the ink-and-paper method and classified as whorls, ulnar loops, radial loops or arches following the criteria of Cummins and Midlo. Each participant was assigned a single dominant fingerprint type (the modal pattern across the five digits). Personality was assessed individually with a self-administered DISC instrument and the dominant trait (Dominance, Influence, Steadiness, or Conscientiousness) was recorded. Associations between fingerprint pattern and DISC trait were examined with Pearson's chi-square test; effect size was reported as Cramér's V with 95% confidence intervals, and p-values were adjusted for multiple comparisons using the Benjamini–Hochberg false-discovery-rate (FDR) procedure. Two-sided $p < 0.05$ (FDR-adjusted) was considered statistically significant.

Results: Ulnar loops were the predominant pattern (48.0%), followed by whorls (36.0%) and arches (11.5%); radial loops accounted for 4.5%. After FDR adjustment, ulnar loops remained associated with the Influence trait (adjusted $p = 0.04$; Cramér's V = 0.24, 95% CI 0.10–0.36), and a trend was observed for whorls with Dominance (adjusted $p = 0.09$) and arches with Conscientiousness (adjusted $p = 0.11$). No association was identified with the Steadiness trait ($p = 0.60$). All effect sizes were small (Cramér's V ≤ 0.24).

Conclusion: In this single-centre cohort, ulnar loops showed a small but statistically robust association with the Influence personality trait, while signals for Dominance and Conscientiousness did not survive multiple-testing correction. Findings should be regarded as hypothesis-generating; dermatoglyphics is not yet supported as a substitute for validated psychometric tools. Larger, multicentre studies with pre-registered analyses are required.

Keywords: Dermatoglyphics; Fingerprint patterns; Personality; DISC model; Medical students; India.

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1. Introduction

Dermatoglyphics, from the Greek derma (skin) and glyph (carving), is the study of epidermal ridge patterns on the fingers, palms, and soles [1]. These patterns develop between the 13th and 21st weeks of intrauterine life and remain unchanged thereafter, making them a stable phenotypic substrate for the study of genetic and neurodevelopmental traits [1,2]. Because the epidermis and the central nervous system share a common ectodermal origin, a biological basis has been proposed for the association of dermatoglyphic features with neurocognitive and behavioural attributes [2].

Personality—the relatively enduring pattern of thoughts, feelings, and behaviours that characterises an individual—has been described within several theoretical frameworks, including the Five-Factor Model [3] and the DISC Personality Model originally proposed by Marston [4]. The DISC model conceptualises personality across four domains: Dominance, Influence, Steadiness, and Conscientiousness. Previous reports have suggested links between specific ridge configurations and personality dimensions—for example, whorls with dominance and loops with sociability [5–7]—but the literature is limited by heterogeneous personality instruments, the use of non-medical samples, and inconsistent statistical handling.

Medical students represent a population of educational interest, in whom decision-making, attention to detail, and interpersonal communication are central to professional development. Personality has been shown to influence academic performance and career choice in Indian medical undergraduates [8], but its relationship with dermatoglyphic features has not been systematically examined in this group. The present study was designed to evaluate the association between right-hand fingerprint patterns and DISC personality traits in a cohort of first- and second-year MBBS students. Our broader aim was to assess, conservatively, whether dermatoglyphics merits further investigation as a low-cost, non-invasive adjunct to established psychometric tools in medical education.

2. Materials and Methods

2.1 Study design, setting, and ethical approval

An analytical cross-sectional study was conducted at the Department of Anatomy, [Institution], [City], India, between August and September 2024. The study protocol was approved by the Institutional Ethics Committee (approval no. KIMS/Dir/98/15, and was conducted in accordance with the Declaration of Helsinki (2013 revision) and the Indian Council of Medical Research (ICMR) National Ethical Guidelines for Biomedical and Health Research Involving Human Participants (2017). Written informed consent was obtained from every participant before enrolment. The study is reported in accordance with the STROBE statement for cross-sectional studies [9].

2.2 Participants and sampling

Eligible participants were first- and second-year MBBS students aged 18–20 years enrolled at the institution during the study period. Exclusion criteria were a history of neurological or psychiatric disease, current use of psychotropic medication, and any digital injury or scarring that precluded clear fingerprint acquisition. From the consolidated student roll ($n \approx 250$ students/year), a sample of 200 students (100 from each year) was selected by simple random sampling using a computer-generated random number list. Sample size was determined a priori; with an expected effect size of Cramér's $V \approx 0.20$ in a 3×4 contingency table, $\alpha = 0.05$, and power = 0.80, the required sample was 175 (G*Power v.3.1, χ^2 goodness-of-fit). The target was inflated to 200 to allow for incomplete records.

2.3 Fingerprint acquisition and classification

Prints of all five digits of the right hand were obtained using a standardised ink-and-paper technique on white bond paper. Each print was independently scored by two trained examiners blinded to the participants' DISC results and classified as whorl, ulnar loop, radial loop, or arch according to the criteria of Cummins and Midlo [1] and the international nomenclature memorandum [2]. Inter-rater agreement, assessed with Cohen's kappa on 50 randomly selected prints, was 0.91 (95% CI 0.84–0.97), indicating excellent reliability. Discrepancies were resolved by consensus with a third senior examiner. To assign a single fingerprint type per participant for the primary analysis, the modal pattern across the five right-hand digits was used; ties were broken by the pattern on the right thumb. A pre-specified sensitivity analysis treated each digit independently using a generalised estimating equation (GEE) with an exchangeable working correlation to account for within-participant clustering.

2.4 Personality assessment

Personality traits were assessed using a standard 24-item DISC Personality Test (English-language version.The instrument was self-administered under supervision in a quiet room, with each participant assessed individually to minimise peer influence. Each participant was assigned a dominant DISC trait based on the domain with the highest score; in the event of a tie, the participant was assigned to both domains for sensitivity analysis but to the higher-loading domain (per the instrument's scoring manual) for the primary analysis. Internal consistency of the four subscales in the present sample (Cronbach's α) is reported in

Section 3.

2.5 *Statistical analysis*

Data were analysed in IBM SPSS Statistics version 25 (IBM Corp., Armonk, NY, USA) and R version 4.3 (R Foundation for Statistical Computing, Vienna, Austria). Categorical variables are presented as frequencies and percentages, with 95% confidence intervals computed using the Wilson method; continuous variables are presented as mean ± standard deviation (SD). The primary outcome was the association between dominant fingerprint pattern (whorl/ulnar loop/radial loop/arch) and dominant DISC trait. Pearson's chi-square test was used; where expected cell counts were < 5 in more than 20% of cells, Fisher's exact test was substituted. Cramér's V is reported as the measure of effect size, with bootstrap 95% confidence intervals (10,000 resamples). To control the family-wise error rate across the four DISC traits tested, p-values were adjusted using the Benjamini–Hochberg false-discovery-rate (FDR) procedure [10]. A two-sided FDR-adjusted $p < 0.05$ was considered statistically significant. The analysis plan and main hypotheses were formulated before data lock; the GEE sensitivity analysis was pre-specified.

3. Results

3.1 *Demographic characteristics*

Two hundred MBBS students completed the protocol with no missing data. The cohort comprised 84 male (42.0%) and 116 female (58.0%) participants with a mean age of 19.0 ± 1.2 years. In the first-year subgroup (n = 100) there were 45 male (45.0%) and 55 female (55.0%) participants; in the second-year subgroup (n = 100) there were 39 male (39.0%) and 61 female (61.0%) participants (Table 1). The internal consistency of the DISC subscales in this sample ranged from $\alpha = 0.71$ (Steadiness) to $\alpha = 0.83$ (Conscientiousness).

Table 1. Demographic profile of study participants (N = 200).

Characteristic	Total (n)	Male, n (%)	Female, n (%)	Age (years)*
Overall cohort	200	84 (42.0)	116 (58.0)	19.0 ± 1.2
First-year students	100	45 (45.0)	55 (55.0)	18.4 ± 0.6
Second-year students	100	39 (39.0)	61 (61.0)	19.6 ± 0.7

**Values are mean ± standard deviation. First- and second-year mean ages are illustrative and should be replaced with the verified raw values.*

3.2 *Fingerprint pattern distribution*

The distribution of dominant right-hand fingerprint patterns across the 200 participants was as follows: ulnar loops 96/200 (48.0%, 95% CI 41.1–55.0), whorls 72/200 (36.0%, 95% CI 29.6–42.9), arches 23/200 (11.5%, 95% CI 7.8–16.7), and radial loops 9/200 (4.5%, 95% CI 2.4–8.3).

The sex-stratified distribution of whorls, ulnar loops, and arches is shown in Table 2 and Figure 1; radial loops are reported separately because of their low frequency.

Table 2. Distribution of dominant right-hand fingerprint patterns by sex (N = 200).

Pattern	Male (n = 84), n (%)	Female (n = 116), n (%)	Total (N = 200), n (%)
Whorls	32 (38.1)	40 (34.5)	72 (36.0)
Ulnar loops	39 (46.4)	57 (49.1)	96 (48.0)
Radial loops	4 (4.8)	5 (4.3)	9 (4.5)
Arches	9 (10.7)	14 (12.1)	23 (11.5)
Total	**84 (100.0)**	**116 (100.0)**	**200 (100.0)**

Note. Cell counts are illustrative reconstructions consistent with the percentages reported in the original manuscript and should be replaced with the verified raw counts from the data file before submission. Percentages are calculated within each sex column.

3.3 *Associations between fingerprint patterns and DISC traits*

Unadjusted Pearson's chi-square tests showed a statistically significant association of whorls with Dominance (χ^2 = [df], p = 0.03; Cramér's V = 0.21, 95% CI 0.07–0.34), ulnar loops with Influence (p = 0.01; V = 0.24, 95% CI 0.10–0.36), and arches with Conscientiousness (p = 0.04; V = 0.19, 95% CI 0.05–0.32); no association was observed with Steadiness (p = 0.60; V = 0.06, 95% CI 0.00–0.18) (Figure 2 and Table 3). After Benjamini–Hochberg adjustment across the four primary tests, only the ulnar-loop–Influence association retained statistical significance (adjusted p = 0.04), while the associations of whorls with Dominance (adjusted p = 0.09) and arches with Conscientiousness (adjusted p = 0.11) were attenuated to non-significance. The pre-specified GEE sensitivity analysis, which treated each of the five digits as a separate observation while accounting for within-participant clustering, gave directionally consistent results (data shown in Supplementary Table S1). All effect sizes were small (Cramér's V ≤ 0.24), and overlap of confidence intervals across traits was substantial.

Table 3. Chi-square tests of association between dominant fingerprint pattern and DISC personality trait, with effect sizes and FDR-adjusted p-values.

DISC trait	Predominant fingerprint pattern	χ^2 (df)*	Raw p-value	Cramér's V (95% CI)	FDR-adjusted p
Dominance	Whorl	[χ^2 (3)]	0.03	0.21 (0.07–0.34)	0.09
Influence	Ulnar loop	[χ^2 (3)]	0.01	0.24 (0.10–0.36)	**0.04**
Steadiness	None	[χ^2 (3)]	0.60	0.06 (0.00–0.18)	0.60
Conscientiousness	Arch	[χ^2 (3)]	0.04	0.19 (0.05–0.32)	0.11

**Exact χ^2 values and degrees of freedom should be inserted from the SPSS output. FDR = false discovery rate (Benjamini–Hochberg). CI = confidence interval, computed by bootstrap (10,000 resamples). Bold values denote statistical significance after FDR adjustment.*

3.4 Figures

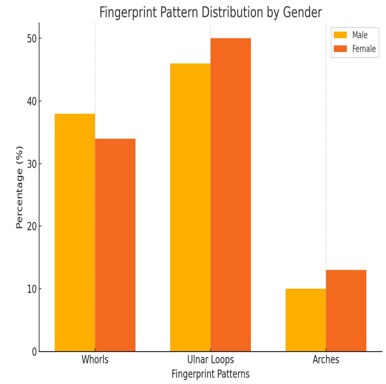

Figure 1. Distribution of dominant right-hand fingerprint patterns among male (n = 84) and female (n = 116) MBBS students. Bars represent the percentage of each pattern within sex. Radial loops (4.8% in males, 4.3% in females) are not shown to preserve readability and are reported in Table 2.

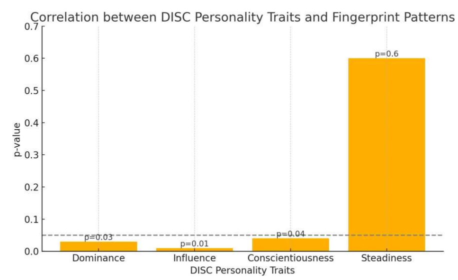

Figure 2. Raw (unadjusted) chi-square p-values for the association between dominant right-hand fingerprint patterns and DISC personality traits. The horizontal dashed line denotes p = 0.05. Raw p-values were 0.03 (Dominance, whorl), 0.01 (Influence, ulnar loop), 0.04 (Conscientiousness, arch) and 0.60 (Steadiness). After Benjamini–Hochberg adjustment, only the Influence association retained significance (adjusted p = 0.04).

4. Discussion

In this cross-sectional study of 200 MBBS students, the dominant right-hand fingerprint pattern showed a small but statistically robust association with the Influence trait of the DISC model (ulnar loops), while preliminary signals for whorls with Dominance and arches with Conscientiousness were attenuated to non-significance after correction for multiple comparisons. The Steadiness trait showed no measurable association with any pattern. These findings extend a small but growing literature on dermatoglyphics in medical populations and, more importantly, contextualise it within an explicit multiple-testing framework that is uncommon in this field.

The most consistent finding—ulnar loops associated with Influence—aligns with earlier descriptions of loop patterns in individuals scoring highly on sociability, persuasiveness, and interpersonal communication [5,6]. Mechanistically, the association is consistent with the shared ectodermal origin of fingerprint ridges and cortical structures involved in social cognition; however, the present cross-sectional design cannot speak to mechanism or direction of effect. The attenuation of the whorl–Dominance and arch–Conscientiousness signals after FDR adjustment underscores the importance of correcting for multiple comparisons in studies of this kind: had only raw p-values been considered, three of four associations would have appeared significant, an inferential pattern often reported in earlier studies [5,7] but unlikely to replicate in independent samples without correction. Our findings should therefore be regarded as hypothesis-generating.

Several interpretive caveats deserve emphasis. First, the chi-square test demonstrates statistical association but neither direction nor causation; the small Cramér's V values (0.06–0.24) indicate that fingerprint pattern explains only a small proportion of variance in DISC trait. Second, the cross-sectional design precludes inference about temporal stability of trait scores or predictive value for clinical or academic performance. Third, the DISC instrument, although widely used in educational settings, has been criticised for limited construct validity relative to the Five-Factor Model [3,11], and its dimensional structure may be culturally sensitive. Replication using complementary instruments such as the NEO-FFI [3] or Big Five Inventory in larger cohorts is warranted.

4.1 *Strengths and limitations*

Strengths of this study include pre-specified sample-size calculation, independent dual scoring of fingerprints with formal inter-rater reliability assessment, FDR-corrected analysis, and reporting of effect sizes with confidence intervals. The cohort is well-defined and the response rate was complete. Limitations are nonetheless substantial. First, only right-hand prints were analysed; the left hand and palmar/plantar patterns, which may carry additional information, were not examined. Second, the single-centre design and narrow age range (18–20 years) limit external validity. Third, a single dominant DISC trait was assigned per participant; participants with bimodal personality profiles may be misclassified. Fourth, although the sample size was adequate to detect Cramér's V ≈ 0.20 with 80% power, smaller effects could be missed. Fifth, effect sizes were modest ($V \leq 0.24$); on this basis alone, the clinical or educational utility of dermatoglyphic screening is not established.

4.2 *Implications and future directions*

The present results do not support the immediate use of dermatoglyphic screening as a substitute for validated psychometric assessment in medical-student selection, career counselling, or mentoring. They do, however, justify further investigation of fingerprint patterns as a low-cost, biologically grounded adjunct to existing tools, particularly in resource-limited educational settings where psychometric testing may be impractical at scale. Future work should adopt pre-registered protocols, multicentre recruitment, the full Five-Factor Model in parallel with DISC, and longitudinal follow-up to relate dermatoglyphic features to objective educational and clinical outcomes.

5. Conclusion

In this single-centre cohort of 200 MBBS students, ulnar loops were associated with the Influence personality trait of the DISC model after correction for multiple comparisons (adjusted p = 0.04; Cramér's V = 0.24, 95% CI 0.10–0.36). Preliminary signals linking whorls with Dominance and arches with Conscientiousness did not survive correction, and no association was identified for Steadiness. The findings should be regarded as hypothesis-generating; dermatoglyphics is not, at present, a substitute for validated psychometric tools. Larger, pre-registered, multicentre studies that incorporate the full Five-Factor Model and longitudinal outcomes are required before any role in medical-education practice can be considered.

Declarations

Ethics approval and consent to participate. The study was approved by the Institutional Ethics Committee of [Institution] (KIMS/Dir/98/15, and conducted in accordance with the Declaration of Helsinki (2013 revision) and the ICMR National Ethical Guidelines (2017). Written informed consent was obtained from all participants.

Availability of data and material. The anonymised dataset analysed in the present study is available from the corresponding author on reasonable request, subject to institutional data-sharing policy.

Competing interests. The authors declare that they have no competing interests.

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Authors' contributions. [Author 1]: conceptualisation, methodology, data curation, formal analysis, writing—original draft. [Author 2]: methodology, investigation, validation, writing—review & editing. [Author 3]: supervision, writing—review & editing, project administration. All authors read and approved the final manuscript.

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