International Journal of Clinical and Biomedical Research
Vol. 11, No. 3 (2026)
pISSN: 2521-0394 · eISSN: 2395-0471

ORIGINAL RESEARCH

# DERMATOGLYPHIC PATTERNS IN ACUTE MYOCARDIAL INFARCTION: A CASE–CONTROL STUDY FROM A TERTIARY CARE CENTRE IN NORTHERN KARNATAKA

**Vedavyas Kulkarni**[1], **Rudragouda Bulagouda**[2], **Sharan Badiger**[3], **Ishwar Bagoji**[4*]

[1] *Tutor and Postgraduate Student, Department of Anatomy, Shri B. M. Patil Medical College, Hospital and Research Centre, BLDE (Deemed to be University), Vijayapura 586103, Karnataka, India*

[2] *Professor and Head, Department of Anatomy, Shri B. M. Patil Medical College, Hospital and Research Centre, BLDE (Deemed to be University), Vijayapura, Karnataka, India*

[3] *Professor, Department of Medicine, Shri B. M. Patil Medical College, Hospital and Research Centre, BLDE (Deemed to be University), Vijayapura 586103, Karnataka, India*

[4] *Associate Professor, Department of Anatomy, Shri B. M. Patil Medical College, Hospital and Research Centre, BLDE (Deemed to be University), Vijayapura 586103, Karnataka, India, India.*

*Correspondence: Ishwar Bagoji <ishwar.bagoji@bldedu.ac.in>

## ABSTRACT

**Background:** Myocardial infarction is a multifactorial polygenic disorder. The primary dermal ridges and the cardiovascular system differentiate over an overlapping window of intrauterine life, between approximately the tenth and twenty-fourth weeks of gestation, which raises the possibility that a disturbance affecting one may leave a permanent record in the other. Dermatoglyphic patterns are fixed by birth and do not change thereafter, making them a candidate non-invasive marker of antenatal developmental influence.

**Objectives:** To compare qualitative and quantitative dermatoglyphic parameters between patients with acute myocardial infarction and healthy controls, and to assess whether any parameter differs sufficiently to merit further evaluation as a marker of susceptibility.

**Methods:** A prospective case–control study was conducted in the Department of Anatomy of a tertiary care teaching hospital between March 2024 and December 2025. Ninety patients with clinically and electrocardiographically confirmed acute myocardial infarction (45 men, 45 women) and 90 healthy controls (45 men, 45 women), aged 25 to 75 years, were enrolled. Bilateral palmar and digital prints were taken by the standard ink method of Cummins and Midlo and read by observers blinded to group status. Fingertip pattern type, total finger ridge count, ‘ab’ ridge count and the ‘atd’ angle were recorded. Proportions were compared by the two-proportion z test and means by the z test for independent samples, with $p < 0.05$ taken as significant.

**Results:** Whorls were significantly commoner in cases than controls in both sexes (men 34.9% versus 27.8%, $z = 2.30$, $p = 0.021$; women 36.2% versus 29.6%, $z = 2.13$, $p = 0.033$). Ulnar loops were correspondingly reduced (men 58.9% versus 66.0%, $z = 2.20$, $p = 0.028$; women 57.6% versus 64.4%, $z = 2.12$, $p = 0.034$). Mean total finger ridge count was significantly higher in cases (men $122.04 \pm 10.70$ versus $117.26 \pm 9.76$, $z = 2.21$, $p = 0.027$; women $109.24 \pm 10.25$ versus $103.68 \pm 10.81$, $z = 2.50$, $p = 0.012$). Radial loops, arches, the ‘ab’ ridge count and the ‘atd’ angle did not differ significantly in either sex.

**Conclusion:** In this sample, acute myocardial infarction was associated with a reciprocal shift from ulnar loops towards whorls and with a higher total finger ridge count, in both men and women. These are group-level differences of small magnitude with substantial overlap between cases and controls, and they do not by themselves constitute a screening test. They are consistent with the hypothesis that antenatal influences acting during the shared developmental window leave a detectable dermatoglyphic signature, and justify evaluation in larger, prospectively designed samples with formal assessment of discriminative performance.

**Keywords:** Dermatoglyphics; myocardial infarction; coronary artery disease; fingerprint; total finger ridge count; whorl; ulnar loop.

## Introduction

The skin is the largest organ of the body, and the human hand is a highly evolved structure serving both as a versatile mechanical instrument and as a sophisticated sensory organ [1,2]. The skin of the palms and soles differs from that elsewhere in bearing epidermal ridges, which improve grip and enhance tactile discrimination [3,4]. These ridges are sensitive to spatial detail on the scale of the ridges themselves, and contribute directly to fine touch [5].

The term dermatoglyphics derives from the Greek derma, skin, and glyphe, carving, and was introduced by Cummins and Midlo in 1926 [6]. It denotes the study of the epidermal ridge configurations of the fingers, palms, toes and soles. These patterns are laid down during the second trimester, are complete by about the twenty-fourth week of gestation, and thereafter remain unaltered for life apart from changes in size [7]. Their permanence and their strong genetic determination have made them useful in anthropology, genetics, forensic science and clinical medicine [8,9].

Analysis is conventionally divided into qualitative parameters, principally the fingertip pattern types of arch, loop and whorl, and quantitative parameters, principally the total finger ridge count, the ‘ab’ ridge count and the ‘atd’ angle [8]. Dermatoglyphic study is well established as an adjunct in disorders with a strong hereditary component, and has been examined as a screening aid in several chronic diseases including cardiovascular disorders [10].

Ischaemic heart disease remains a leading cause of death worldwide, and its burden has risen steeply in South Asian populations, with presentation often at a younger age than in Western cohorts [11]. Myocardial infarction results from an imbalance between myocardial oxygen supply and demand, most often precipitated by rupture of an atherosclerotic plaque with superimposed thrombosis. Its susceptibility is polygenic, and genome-wide association studies have identified numerous loci contributing modest individual effects [12].

The rationale for examining dermatoglyphics in this context rests on a specific developmental coincidence: the volar pads regress and the primary ridges form between approximately the tenth and twenty-fourth weeks of intrauterine life, a window that overlaps the period of cardiac septation and outflow tract remodelling [7]. A genetic or environmental influence operating in that interval might therefore be expected to affect both systems. Support for the broader principle comes from work linking fingerprint pattern and palmar shape to fetal growth and to adult blood pressure [13], and from the fetal origins hypothesis more generally [14]. Altered dermatoglyphic patterns have been described in Down syndrome, schizophrenia and congenital heart disease, and several groups have reported differences in patients with coronary artery disease [15,16,17].

The present study was undertaken to compare qualitative and quantitative dermatoglyphic parameters between patients with acute myocardial infarction and healthy controls matched for age range and sex distribution, and to determine whether any parameter differs sufficiently to warrant further investigation.

## Materials and Methods

### Study design and setting

This prospective case–control study was carried out in the Department of Anatomy of Shri B. M. Patil Medical College, Hospital and Research Centre, BLDE (Deemed to be University), Vijayapura, Karnataka, in collaboration with the Department of Medicine of the same institution, over a two-year period spanning the academic years 2023–24 and 2024–25. The first participant was enrolled on 13 March 2024 and the last on 28 December 2025.

The study was approved by the Institutional Ethics Committee of BLDE (Deemed to be University) (approval number BLDE(DU)IEC-SBMPMC010/2023-24, dated 10 February 2024) and was conducted in accordance with the Declaration of Helsinki. The purpose of the study was explained to every participant and written informed consent was obtained before prints were taken.

## Participants

Cases were 90 patients (45 men and 45 women) with acute myocardial infarction confirmed clinically and electrocardiographically, recruited from the Department of Medicine. Controls were 90 apparently healthy individuals (45 men and 45 women) of the same age range with no history or clinical evidence of ischaemic heart disease. Cases and controls were matched as groups for sex and age range rather than individually.

*Inclusion criteria:* Individuals aged 25 to 75 years were eligible. Cases were required to have a confirmed diagnosis of acute myocardial infarction, resting on the clinical presentation together with electrocardiographic changes.

*Exclusion criteria:* Individuals with congenital anomalies, syndromic conditions, or scarring, burns or dermatological disease of the hands were excluded from both groups, since each of these precludes reliable dermatoglyphic (ridge) analysis.

## Collection of prints

Bilateral palmar and digital prints were obtained by the standard ink method described by Cummins and Midlo [6]. The palms and fingers were cleaned and dried, a thin and even film of printer's ink was applied with a roller, and rolled impressions of each digit together with a full palmar impression were taken on white paper placed over a slightly convex surface. Prints were inspected immediately and repeated where the impression was incomplete or smudged.

The following parameters were recorded from every print (Figures 1 and 2). Fingertip patterns were classified as arch, radial loop, ulnar loop or whorl according to conventional criteria [6,8]. The total finger ridge count was obtained by counting the ridges intersecting a line drawn from the core to the triradius of each digit and summing the counts for all ten digits, the higher count being taken for whorls, which possess two triradii [18]. The 'ab' ridge count was obtained by counting the ridges between the a and b digital triradii on each hand. The 'atd' angle was measured at the axial triradius t, subtended by lines drawn from the a and d digital triradii [19].

All prints were examined with a hand lens under uniform illumination. Prints were read and analysed by two of the authors (S.B. and R.B.). To eliminate observer bias, all prints were coded with unique anonymous identification numbers before analysis, so that pattern classification and ridge counting were performed without knowledge of the participant's case or control status. Intra-observer agreement was assessed by having the primary reader re-examine a subset of prints after an interval of two weeks, and inter-observer agreement by independent reading of the same subset by the second reader.

## Statistical analysis

Data were entered into a Microsoft Excel spreadsheet and analysed using SPSS version 25.0 (IBM Corp., Armonk, NY, USA). Fingertip pattern frequencies were compared between cases and controls, separately for each sex, using the two-proportion z test, the denominator in each group being 450 digits (45 participants × 10 digits). Continuous variables, namely the total finger ridge count, the 'ab' ridge count and the 'atd' angle, are presented as mean ± standard deviation and were compared using the z test for two independent means. The z statistic and the exact two-tailed p value are reported for every comparison, and $p < 0.05$ was taken as statistically significant.

A methodological caveat applies to the comparison of pattern frequencies. The unit of analysis is the digit, not the participant, and the ten digits of one individual are not statistically independent of one another: pattern type is strongly correlated within a hand and between hands of the same person. The p values for the pattern comparisons are unadjusted for this intra-individual clustering and should therefore be regarded as approximate; the point is considered further under Limitations. The total finger ridge count, being a single per-participant quantity, is not affected.

# Results

## Participants

Ninety cases and 90 controls were studied, each group comprising 45 men and 45 women. The mean age was 58.2 ± 10.3 years among cases and 60.1 ± 9.2 years among controls; the groups did not differ significantly in age (z = 1.31, p = 0.19). A total of 1,800 digital prints were analysed, 900 from cases and 900 from controls.

## Fingertip pattern distribution

The distribution of the four fingertip pattern types is shown in Table 1. Whorls were significantly commoner among cases than controls in both sexes, and ulnar loops were correspondingly less frequent. Radial loops and arches did not differ significantly in either sex.

**Table 1. Distribution of fingertip patterns in cases and controls, by sex (450 digits per group)**

| Pattern | Cases n (%) | Controls n (%) | z | p | Significance | Direction |
|---|---|---|---|---|---|---|
| Men (45 cases, 45 controls) | | | | | | |
| Whorls | 157 (34.9) | 125 (27.8) | 2.30 | 0.021 | Significant | Higher in cases |
| Ulnar loops | 265 (58.9) | 297 (66.0) | 2.20 | 0.028 | Significant | Lower in cases |
| Radial loops | 16 (3.6) | 11 (2.4) | 0.98 | 0.329 | Not significant | — |
| Arches | 12 (2.7) | 17 (3.8) | 0.94 | 0.345 | Not significant | — |
| Total | 450 (100) | 450 (100) | — | — | — | — |
| Women (45 cases, 45 controls) | | | | | | |
| Whorls | 163 (36.2) | 133 (29.6) | 2.13 | 0.033 | Significant | Higher in cases |
| Ulnar loops | 259 (57.6) | 290 (64.4) | 2.12 | 0.034 | Significant | Lower in cases |
| Radial loops | 12 (2.7) | 9 (2.0) | 0.66 | 0.508 | Not significant | — |
| Arches | 16 (3.6) | 18 (4.0) | 0.35 | 0.727 | Not significant | — |
| Total | 450 (100) | 450 (100) | — | — | — | — |

Two-proportion z test. The four pattern types sum to 450 in each of the four groups. p values are unadjusted for the clustering of digits within participants (see Statistical analysis).

Expressed differently, the reciprocal shift is the substantive finding: among men, the excess of 32 whorls in cases over controls is matched almost exactly by a deficit of 32 ulnar loops, and among women an excess of 30 whorls is matched by a deficit of 31 ulnar loops. Radial loops and arches, which together account for fewer than 7% of digits in any group, are essentially unchanged.

## Total finger ridge count

The mean total finger ridge count was significantly higher in cases than in controls in both sexes (Table 2). This was the most clearly significant quantitative finding in the study.

**Table 2. Mean total finger ridge count in cases and controls, by sex**

| Group | Cases (mean ± SD) | Controls (mean ± SD) | z | p | Significance |
|---|---|---|---|---|---|
| Men (n = 45 per group) | 122.04 ± 10.70 | 117.26 ± 9.76 | 2.21 | 0.027 | Significant |
| Women (n = 45 per group) | 109.24 ± 10.25 | 103.68 ± 10.81 | 2.50 | 0.012 | Significant |

z test for two independent means. The total finger ridge count is the sum across all ten digits and is a per-participant quantity; the clustering caveat does not apply to this comparison.

## ‘ab’ ridge count

The mean ‘ab’ ridge count did not differ significantly between cases and controls in either sex or on either hand (Table 3).

**Table 3. Mean ‘ab’ ridge count in cases and controls, by sex and hand**

| Group | Cases (mean ± SD) | Controls (mean ± SD) | z | p | Significance |
|---|---|---|---|---|---|
| Right hand | | | | | |
| Men | 32.37 ± 2.87 | 31.26 ± 3.25 | 1.72 | 0.086 | Not significant |
| Women | 30.53 ± 2.44 | 31.17 ± 2.20 | 1.31 | 0.191 | Not significant |
| Left hand | | | | | |
| Men | 34.62 ± 2.78 | 33.82 ± 2.69 | 1.39 | 0.165 | Not significant |
| Women | 35.00 ± 3.21 | 34.26 ± 3.26 | 1.09 | 0.278 | Not significant |

z test for two independent means.

### ‘atd’ angle

The mean ‘atd’ angle did not differ significantly between cases and controls in either sex or on either hand (Table 4).

**Table 4. Mean ‘atd’ angle (degrees) in cases and controls, by sex and hand**

| Group | Cases (mean ± SD) | Controls (mean ± SD) | z | p | Significance |
|---|---|---|---|---|---|
| Right hand | | | | | |
| Men | 40.04 ± 3.06 | 40.24 ± 3.39 | 0.29 | 0.769 | Not significant |
| Women | 41.00 ± 3.84 | 41.06 ± 2.65 | 0.09 | 0.931 | Not significant |
| Left hand | | | | | |
| Men | 40.88 ± 3.76 | 40.66 ± 3.01 | 0.31 | 0.759 | Not significant |
| Women | 40.28 ± 3.26 | 39.32 ± 3.42 | 1.36 | 0.173 | Not significant |

z test for two independent means.

### Summary of findings

Of the eight qualitative comparisons and six quantitative comparisons performed, six reached statistical significance: whorls and ulnar loops in each sex, and the total finger ridge count in each sex. All six point in a consistent direction, namely a shift from ulnar loops towards whorls accompanied by a higher ridge count. Radial loops, arches, the ‘ab’ ridge count and the ‘atd’ angle showed no significant difference.

## Discussion

This study found a consistent dermatoglyphic difference between patients with acute myocardial infarction and healthy controls, present in both sexes and comprising three linked elements: an increase in whorls, a reciprocal decrease in ulnar loops, and a higher total finger ridge count. Radial loops, arches, the ‘ab’ ridge count and the ‘atd’ angle were unaffected.

### Coherence of the finding

The three significant results are not independent of one another, and their coherence is itself informative. Whorls are counted from the higher of two triradii and characteristically carry more ridges than loops, while arches carry none; a population shift from ulnar loops towards whorls will therefore tend to raise the total finger ridge count as an arithmetic consequence. That the observed increase in ridge count accompanies precisely the pattern shift that would produce it argues that the two findings reflect a single underlying difference rather than two separate ones, and correspondingly that they should not be regarded as independent lines of evidence.

Both features are determined by the size and prominence of the fetal volar pads at the time the primary ridges begin to form, between about the tenth and twelfth weeks of gestation: high, symmetrical pads give rise to whorls with high ridge counts, and flatter pads to loops and arches with lower counts [7,18]. A finding that cases have more whorls and higher ridge counts is therefore, in developmental terms, a statement that their volar pads were larger or regressed later. Because

the ridge configuration is fixed by the twenty-fourth week and never changes thereafter, the difference cannot be a consequence of the infarction and must antedate it by decades.

## Comparison with published series

The results agree closely with the largest published series in this field. Rashad and colleagues studied 834 Japanese-American men in Hawaii, of whom 100 had a positive diagnosis of myocardial infarction, and found significantly more true whorls and double loops, fewer ulnar loops and tented arches, and significantly higher total and absolute ridge counts in all digits among the infarction group [20]. Every element of that description corresponds to what was found here, in a different population and four decades later. Asif and colleagues reported a comparable pattern in an Indian cohort [21], and Jalili and Hajian-Tilaki reported similar findings in an Iranian sample [22]. Chimne and Ambade described dermatoglyphic differences in angiographically proven coronary artery disease [16], and Dhall and colleagues in Indian patients with myocardial infarction [17].

Not all series agree. Anderson and colleagues found no statistically significant dermatoglyphic difference in patients with myocardial infarction [23]. The discrepancy may reflect sample size, differing pattern-classification conventions, or genuine population variation in baseline pattern frequencies, which differ substantially between ethnic groups [24]. Given the modest effect sizes seen here, a study of this size would be expected to produce negative results reasonably often.

A discrepant configuration has also been reported in related conditions. Mouneshkumar and colleagues examined dermatoglyphic patterns in essential hypertension and type 2 diabetes mellitus and found the opposite pattern to that observed here, namely reduced whorls with increased radial and ulnar loops [25]. That study concerned hypertension and diabetes rather than myocardial infarction, and its findings cannot be taken as either supporting or contradicting the present ones directly; but the contrast does indicate that the dermatoglyphic correlates of different cardiometabolic disorders are not uniform, and cautions against treating any single pattern shift as a generic marker of cardiovascular risk.

## Sexual dimorphism

Whorls, ulnar loops and total finger ridge count were all significantly altered in both sexes and in the same direction, and the magnitude of the differences was similar in men and women. The data therefore do not indicate sexual dimorphism in the dermatoglyphic correlates of myocardial infarction. Demonstrating such dimorphism would in any case require a formal test of interaction between sex and case status, rather than the observation that a comparison reaches significance in one sex and not the other; on the present data the effect appears similar in men and women, and no sex difference is claimed.

## What the finding does and does not support

The differences observed are real in the statistical sense but small in the practical one, and this distinction determines what may legitimately be claimed. Whorls accounted for 34.9% of digits in male cases against 27.8% in male controls, a difference of about seven percentage points; the distributions overlap almost completely, and no threshold of whorl count could separate an individual case from an individual control with useful accuracy. The same applies to the ridge count, where the difference between group means is approximately half a standard deviation.

These data therefore do not support the use of dermatoglyphic analysis as a screening tool for susceptibility to myocardial infarction. No measure of discriminative performance was calculated, no cut-off was derived, and no assessment of sensitivity or specificity was undertaken; group-level differences of this magnitude are characteristically incapable of individual-level prediction. What the data do support is that the findings are consistent with an antenatal developmental influence, and that they justify further study.

## Limitations

The most important limitation concerns the unit of analysis in the pattern comparisons: the ten digits of an individual are not independent observations, and the reported p values, all of which lie between 0.012 and 0.034, are unadjusted for this

clustering and would move towards or beyond the conventional threshold once it is accounted for. Analysis at the level of the participant, or a digit-level analysis adjusted for clustering by generalised estimating equations or a mixed-effects model, would be the appropriate approach in future work. The total finger ridge count analysis is not affected by this, being a per-participant quantity, and is correspondingly the more secure of the two findings.

Other limitations follow. The study is single-centre and modest in size, with 45 participants per sex per group, and no sample size calculation was performed; the study was therefore not designed to detect a difference of any prespecified magnitude. Fourteen statistical comparisons were performed without adjustment for multiplicity, and at a nominal alpha of 0.05 approximately one false positive would be expected by chance alone. Although the readers were blinded and a reliability sub-study was undertaken, formal agreement statistics are not reported. The diagnosis of infarction rested on clinical and electrocardiographic criteria, and cardiac biomarker results, infarct type and whether events were first or recurrent were not recorded. Controls were not characterised in respect of conventional cardiovascular risk factors, so a subclinical case cannot be excluded among them, and cases were not characterised in respect of risk factor burden or angiographic findings, so no distinction can be drawn between patients with and without conventional risk factors, which is precisely the subgroup in whom a genetic marker would be most useful. No digit-by-digit analysis was performed. The design is cross-sectional and case–control, establishing association only. Finally, dermatoglyphic pattern frequencies vary considerably between populations and ethnic groups, so these findings apply to the population sampled and should not be extrapolated without local control data [24].

## Conclusion

In this case–control study, patients with acute myocardial infarction had a higher frequency of whorls, fewer ulnar loops and a higher mean total finger ridge count than controls, with similar findings in men and women. No statistically significant differences were observed in radial loops, arches, ‘ab’ ridge count or ‘atd’ angle. These findings suggest a possible association between selected dermatoglyphic characteristics and myocardial infarction; however, their interpretation is limited by the modest sample size, lack of adjustment for conventional cardiovascular risk factors, multiple comparisons and failure to account for within-participant clustering in the fingertip pattern analysis. The study does not establish a shared genetic or antenatal mechanism, nor does it demonstrate diagnostic or predictive utility. Larger, independently validated studies using appropriate statistical methods and prospective assessment of cardiovascular outcomes are needed before dermatoglyphic analysis can be considered for clinical risk assessment.

## Declarations

**Ethics approval:** The study was approved by the Institutional Ethics Committee of BLDE (Deemed to be University), Vijayapura (BLDE(DU)IEC-SBMPMC010/2023-24, dated 10 February 2024).
**Consent to participate**: Written informed consent was obtained from every participant.
**Funding**: None.
**Conflicts of interest**: The authors declare that they have no conflicts of interest.
**Acknowledgements**: The authors thank all participants for their time and cooperation.
**Authors’ contributions**: VK: acquisition of prints, data collection, literature review and drafting of the manuscript. RB: conception and design of the study, reading and analysis of prints, and supervision. SB: recruitment and clinical confirmation of cases, and reading and analysis of prints. IB: study design, data analysis and interpretation, critical revision of the manuscript, and correspondence. All authors read and approved the final manuscript and agree to be accountable for all aspects of the work.

## References

1. Yousef H, Alhajj M, Fakoya AO, Sharma S. Anatomy, skin (integument), epidermis. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2024.
2. Kivell TL. Form, function and evolution of the human hand. Am J Biol Anthropol. 2023;181(Suppl 76):e24667. https://doi.org/10.1002/ajpa.24667

3. Polak-Witka K, Rudnicka L, Blume-Peytavi U, Vogt A. Characterization of the human ridged and non-ridged skin: a comprehensive histological, histochemical and immunohistochemical analysis. Arch Dermatol Res. 2019;311(2):77-87. https://doi.org/10.1007/s00403-018-1886-9
4. Lakshmi KV, Sridevi K, Penumatsa NV, Satyanarayana Y, Kishore K, Satti M. The dermal ridges as the infallible signature of skin: an overview. J Pharm Bioallied Sci. 2021;13(Suppl 2):S911-4. https://doi.org/10.4103/jpbs.jpbs_142_21
5. Jarocka E, Liljencrantz J, Hammarrenger B, Johansson RS. Human touch receptors are sensitive to spatial details on the scale of single fingerprint ridges. J Neurosci. 2021;41(16):3622-34. https://doi.org/10.1523/JNEUROSCI.1716-20.2021
6. Cummins H, Midlo C. Palmar and plantar epidermal ridge configurations (dermatoglyphics) in European-Americans. Am J Phys Anthropol. 1926;9(4):471-502. https://doi.org/10.1002/ajpa.1330090422
7. Babler WJ. Embryologic development of epidermal ridges and their configurations. Birth Defects Orig Artic Ser. 1991;27(2):95-112.
8. Penrose LS, Loesch D. Topological classification of palmar dermatoglyphics. J Med Genet. 1970;7(2):111-8. https://doi.org/10.1136/jmg.7.2.111
9. Kapoor N, Badiye A. An association between fingerprint patterns with blood group and lifestyle based diseases: a review. J Forensic Sci Med. 2020;6(3):111-7.
10. Mahajan T, Sharma A, Mahajan S, Raina S, Gupta S. Dermatoglyphics in health and disease: a review. Int J Res Med Sci. 2016;4(6):1812-7. https://doi.org/10.18203/2320-6012.ijrms20161550
11. Wang H, Cao J, Li S. Global burden, trends, and inequalities of ischemic heart disease from 1990 to 2019: a systematic analysis of the Global Burden of Disease study. Front Cardiovasc Med. 2023;10:1274663. https://doi.org/10.3389/fcvm.2023.1274663
12. Turner AW, Al Shammari AR, Akbari AA, Chen X, Khan MM, Miller CL, et al. Uncovering myocardial infarction genetic signatures using genome-wide association studies. Sci Rep. 2023;13(1):21875. https://doi.org/10.1038/s41598-023-49250-7
13. Godfrey KM, Barker DJ, Peace J, Cloke J, Osmond C. Relation of fingerprints and shape of the palm to fetal growth and adult blood pressure. BMJ. 1993;307(6901):405-9. https://doi.org/10.1136/bmj.307.6901.405
14. Barker DJ. Fetal origins of coronary heart disease. BMJ. 1995;311(6998):171-4. https://doi.org/10.1136/bmj.311.6998.171
15. David TJ. Dermatoglyphs in congenital heart disease. J Med Genet. 1981;18(5):344-9. https://doi.org/10.1136/jmg.18.5.344
16. Chimne HD, Ambade VN. Dermatoglyphic patterns in angiographically proven coronary artery disease. J Anat Soc India. 2012;61(2):262-6.
17. Dhall U, Rathee SK, Dhall A. Utility of finger prints in myocardial infarction patients. J Anat Soc India. 2000;49(2):153-9.
18. Holt SB. The genetics of dermal ridges. Springfield (IL): Charles C Thomas; 1968.
19. Meier RJ. Anthropological dermatoglyphics: a review. Yearb Phys Anthropol. 1980;23:147-78. https://doi.org/10.1002/ajpa.1330230509
20. Rashad MN, Mi MP, Rhoads G. Dermatoglyphic studies of myocardial infarction patients. Hum Hered. 1978;28(1):1-6. https://doi.org/10.1159/000152924
21. Asif M, Bhat S, Nizamuddin S, Mustak MS. Association between myocardial infarction and dermatoglyphics: a cross-sectional study. J Cardiovasc Dis Res. 2018;9(1):9-14. https://doi.org/10.5530/jcdr.2018.1.3
22. Jalili F, Hajian-Tilaki KO. A comparative study of dermatoglyphic pattern in patients with myocardial infarction and control group. Acta Med Iran. 2002;40(3):187-91.
23. Anderson MW, Haug PJ, Critchfield GC. Dermatoglyphic features of myocardial infarction patients. Am J Phys Anthropol. 1981;55(4):523-7. https://doi.org/10.1002/ajpa.1330550413
24. Igbigbi PS, Msamati BC. Palmar and digital dermatoglyphic patterns in Malawian subjects. East Afr Med J. 1999;76(11):606-10.
25. Mouneshkumar CD, Anand S, Shilpa RH, Gupta A. Dermatoglyphic patterns in essential hypertension and type 2 diabetes mellitus. Int J Anat Res. 2021;9(2):7980-5.




 