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**Research Article**

# QUALITATIVE ANALYSIS OF PALMAR DERMATOGLYPHIC PATTERN AND ABO BLOOD GROUP IN KASHMIRI POPULATION

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**A R T I C L E I N F O**

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**A B S T R A C T**

***Background:*** Dermatoglyphics is the study of the patterns of skin ridges (epidermal ridges) present on the human fingers, palms, toes and the soles. This was a cross-sectional, observational study conducted in the Department of Anatomy in collaboration with the Blood bank of Government Medical College and Associated Hospitals, Srinagar, for a period of eighteen months.

***Material and methods:*** Palmar prints of a total of 385 cases (291 males and 94 females) were studied in this study and their blood group was determined by anti-sera method. The prints were analyzed and various qualitative parameters [finger tip pattern like loop(L), whorl(W) and arch(A) and palmar interossei (PI) pattern] were studied and recorded.

***Results:*** The mean pattern of loops was highest in O blood (5.58), and least in AB blood group (3.73). The mean pattern of arches was highest in AB blood group (0.83and lowest in O blood group (0.35). The mean pattern of whorls was highest in AB blood group(5.43), and lowest in O blood group(4.07). The "no pattern" among the palmar interossei was most common, with most "no pattern" most common with O (mean of 5.45), followed by B (mean of 5.41) and A (mean of 5.22) blood groups. Loop pattern was next in common in interossei followed by arches and whorls. The results of the study revealed statistically significant decreased number of loops in AB blood group with highest frequency of loops in O blood group.



## INTRODUCTION

Dermatoglyphics is the study of the patterns of epidermal ridges present on the human fingers, palms, toes and the soles. [(1)] The scientific and systematic study of dermatoglyphic patterns began in 1823 with the publication of Purkinje's thesis (1823) [(2)]. Fingerprint has long been considered as an important morphological trait for studying individual variation within the domain of biological anthropology, human biology, morphology and anatomy [(3)]. Identical twins have similar but not identical fingerprints [(4)]. Papillary ridge embryogenesis begins at 3 months and completes by 6 month of age and remains unchanged thereafter[(1)].Genetic process of dermatoglyphic traits is complex and is not completely understood[(5)] .Their variable characteristics are not duplicated in other people, even in monozygotic twins or even in the same person, from one location to another[(6)] .Galton (1892) divided the ridge patterns on the distal phalanges of the fingertips into three groups, namely: Arches, Loops and Whorls.[(1)]

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Karl Landsteiner discovered Blood group system in 1901[7]. 30 major blood antigens and a hundred rare antigens have been appreciated that vary in frequency distribution amongst various races of humans [(8)]. Clinically, "ABO" and "Rhesus" are of major significance [(8)]. The ABO system designated as A, B, AB and O types according to the presence of corresponding antigen on RBC[(8)]. The study of fingerprints are constant and individualistic and is a biometric method that it can be used to identify humans according to the ABO blood group and thus can be useful in forensic medicine and identification purpose. [(9)] Fingerprints collected from the crime scene and from the items of evidence of crime have been successfully used to identify suspects, victims or any other person who had touched the surface in question. [(10)]

### *Aim of the study*

The study was a cross sectional study conducted in Kashmiri population with aim to establish qualitative relationship between qualitative parameters (Finger ridge pattern, palmar patterns of interdigital areas and palmar creases) of palmar dermatoglyphic pattern and ABO blood group in Kashmiri population.

## MATERIALS AND METHODS

This observational study was conducted in Postgraduate Department of Anatomy in collaboration with the blood bank, Postgraduate Department of Pathology. This study consisted of 385 cases of normal subjects, males and females whose blood group was then determined. Blood groups was determined on the basis of presence or absence of agglutination [7].

***Inclusion Criteria:*** All healthy individuals 18-65 years of age and Ethnic Kashmiri population.

***Exclusion Criteria***

1. Individuals with history of chronic diseases like Diabetes mellitus, hypertension.
2. Individuals suffering from chronic skin diseases e.g. eczema, leprosy, chronic dermatitis.
3. Individuals with psychiatric disorders like schizophrenia, major depressive disorder.
4. Individuals with scars due to trauma on fingers or deformities of hand.
5. Individuals not ethnically Kashmiri.

The palmar imprint was taken by standard ink method [11]. After taking proper consent, all participants were instructed to wash their hands thoroughly with soap and water to remove dirt and grease over the palm. The ink roller or applicator ink was applied to cover the entire palm including wrist creases, thenar and hypothenar borders and digits. The wrist was placed on a sheet of paper over a foam pad on a flat table and the hand was gently, uniformly and firmly moved forwards to press on the paper. The foam pad was used to fill the concavity of the palm when pressed firmly on the paper. Then each digit was pressed and rolled gently to get their print. The hand was cleaned with soap, water and spirit after getting the prints.

Blood sample was collected by pricking the finger with a sterile lancet after cleaning it with methylated spirit. A drop of blood from each subject was mixed with Anti-serum A, Anti-serum B and Anti-serum D on a clean glass slide/tile. Blood groups was determined on the basis of presence or absence of agglutination [7]. People with erythrocytes having A antigens on their erythrocyte membrane surfaces are designated blood type A, and those whose erythrocytes have B antigens are blood type B. Some people have both A and B antigens on their erythrocytes, in which case they are type AB. People with neither A nor B antigens are designated blood type O [7].

| Blood Group | Agglutinations with Anti-A and Anti-B agglutinin | |
|---|---|---|
| | Anti-A serum | Anti B serum |
| A | + | - |
| B | - | + |
| AB | + | + |
| O | - | - |

The prints were studied using a magnifying lens and analyzed and following parameters studied:

***Finger ridge patterns***: loops (Figure a), whorls (Figure b), arches (Figure c).

***Palmar patterns of interdigital areas:*** Palmar patterns of interdigital area II(2), III(3), IV( 4) and Hypothenar area (Figure d)

**Figure a** Loop

**Figure b** Whorl

**Figure c** Arch

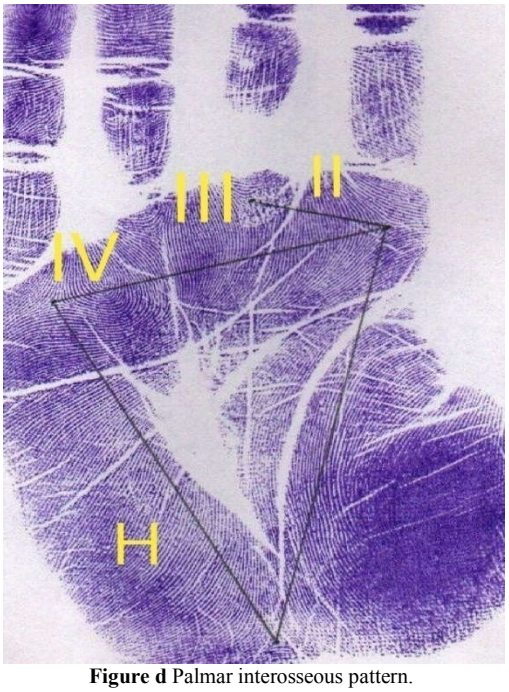


**Figure d** Palmar interosseous pattern.

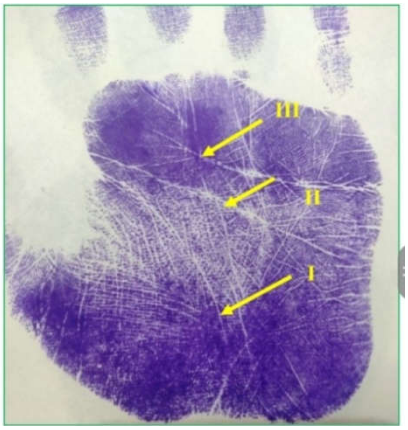


**Figure d** Palmar creases.

***Palmar creases***

Radial longitudinal crease (I) becomes distinct with the flexion of carpometacarpal joints of the thumb.

Proximal (II) and distal transverse creases (III) become distinct with the flexion of the metacarpophalangeal joints of the second to fifth fingers.

Base on the relationship between I and II proximal creases, palm creases were classified into closed, open and meeting creases (12).

Closed crease: I and II meet to form a common crease.
Open crease: I and II do not meet.
Meeting crease: I and II meet on the radial border of the palm

## RESULTS

The data was analyzed statistically using SPSS software and Anova. Following observations were made in the present study:

***Age Distribution***

The mean age of subjects with blood groups A, AB, B and O was 27.37, 28.00, 27.09, 28.18 respectively. The age was comparable in the study Groups (Table 1) (Figure 1) and statistically non-significant between the blood groups.

***Distribution of cases according to Blood group***

In this study, the order of prevalence of various blood groups was: O+ve(31.95%) > B +ve(31.95%) > A +ve(24.16%) > AB +ve( 7.79%) > O –ve(4.16%) > B –ve(3.38%) > A –ve(2.86%) >AB –ve(1.56%

***Distribution of fingertip pattern***

In this study loops were most predominant fingertip pattern (52.36%) followed by whorls (42.96%). Arches were the least common fingertip pattern (4.67%). (Table 3, Figure 2)

**Table 1** Age distribution among blood groups

| Blood Group | Minimum | Maximum | Mean | Std. Deviation |
|---|---|---|---|---|
| A | 18 | 56 | 27.37 | 8.597 |
| AB | 18 | 54 | 28.00 | 8.562 |
| B | 18 | 52 | 27.09 | 8.901 |
| O | 18 | 53 | 28.18 | 8.830 |
| Total | 18 | 56 | 27.62 | 8.756 |

p= 0.76

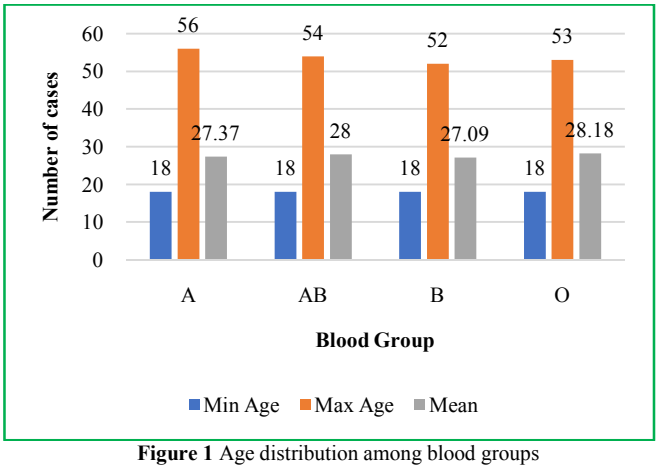


**Figure 1** Age distribution among blood groups

**Table 2** Distribution of cases according to Blood group and Rh Factor

| Blood Group | Rh -ve | Rh +ve | Total |
|---|---|---|---|
| A | 11 (2.86%) | 82 (21.30%) | 93 (24.16%) |
| AB | 6 (1.56%) | 24 (6.23%) | 30 (7.79%) |
| B | 13 (3.38%) | 110 (28.57%) | 123 (31.95%) |
| O | 16 (4.16%) | 123 (31.95%) | 139 (36.10%) |
| Total | 46 (11.95%) | 339 (88.05%) | 385 (100%) |

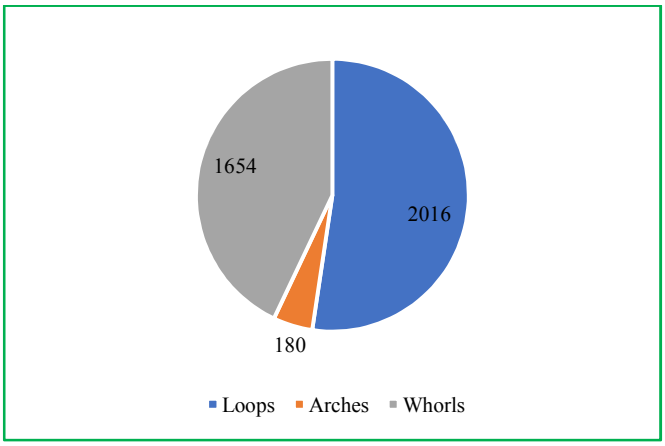


**Figure 2** General distributions of primary fingertip patterns in all fingers of both hands

***Loops and ABO blood group***

The mean pattern of loops (Table 4, Figure 3) were highest in O blood (5.58), followed by B (5.31) and A(5.12). Mean pattern of loops were lowest in AB blood group (3.73). These results were statistically significant.

***Arches and ABO blood group***

In this study the mean pattern of arches (Table 5, Figure 4) were highest in AB blood group (0.83), followed by A and B (both 0.49). The mean pattern of arches was lowest in O blood group (0.35). The results were statistically not significant.

**Table 3** General distributions of primary fingertip patterns in all fingers of both hands

| Pattern of finger print | Total | Percentage |
|---|---|---|
| Ulnar Loops | 2016 | 52.36% |
| Arches | 180 | 4.67% |
| Whorls | 1654 | 42.96% |
| Total | 3850 | 100% |

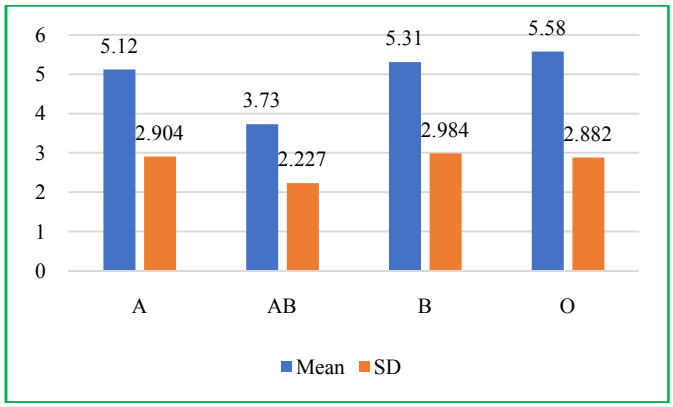


**Figure 4** Frequency of loops in ABO groups

**Table 4** Frequency of loops in ABO groups

| BloodGroup | Minimum | Maximum | Mean | Std. Deviation | Sum | % of Total Sum |
|---|---|---|---|---|---|---|
| A | 0 | 10 | 5.12 | 2.904 | 476 | 23.6% |
| AB | 0 | 6 | 3.73 | 2.227 | 112 | 5.6% |
| B | 0 | 10 | 5.31 | 2.984 | 653 | 32.4% |
| O | 0 | 10 | 5.58 | 2.882 | 775 | 38.4% |
| Total | 0 | 10 | 5.24 | 2.904 | 2016 | 100.0% |

p = 0.017*.

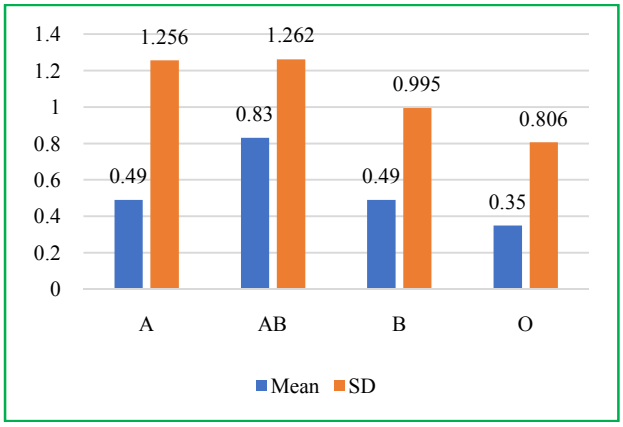


**Figure 4** Frequency of arches in ABO groups

**Table 5** Frequency of arches in ABO groups

| BloodGroup | Minimum | Maximum | Mean | Std. Deviation | Sum | % of Total Sum |
|---|---|---|---|---|---|---|
| A | 0 | 6 | .49 | 1.256 | 46 | 25.6% |
| AB | 0 | 5 | .83 | 1.262 | 25 | 13.9% |
| B | 0 | 4 | .49 | .995 | 60 | 33.3% |
| O | 0 | 5 | .35 | .806 | 49 | 27.2% |
| Total | 0 | 6 | .47 | 1.031 | 180 | 100.0% |

p = 0.131.

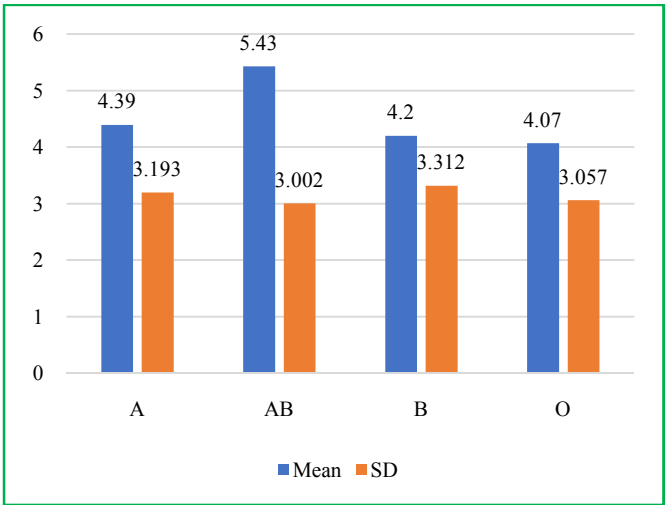


**Figure 5** Frequency of whorls in ABO groups

**Table 6** Frequency of whorls in ABO groups

| BloodGroup | Minimum | Maximum | Mean | Std. Deviation | Sum | % of Total Sum |
|---|---|---|---|---|---|---|
| A | 0 | 10 | 4.39 | 3.193 | 408 | 24.7% |
| AB | 0 | 10 | 5.43 | 3.002 | 163 | 9.9% |
| B | 0 | 10 | 4.20 | 3.312 | 517 | 31.3% |
| O | 0 | 10 | 4.07 | 3.057 | 566 | 34.2% |
| Total | 0 | 10 | 4.30 | 3.176 | 1654 | 100.0% |

p = 0.194.

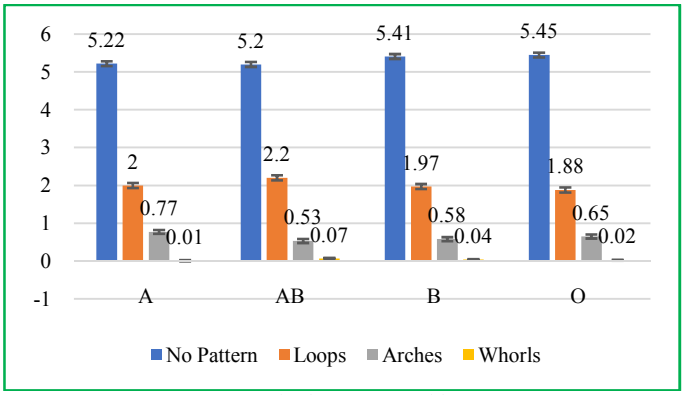


**Figure 65** Pattern of palmar Interossei in ABO groups

### *Whorls and ABO blood groups*

In this study, the mean pattern of whorls(Table 6, Figure 5) were highest in AB blood group(5.43), followed by A blood group(4.39), followed by B blood group(4.20). The mean pattern of whorls was lowest in O blood group (4.07). These results were statistically non-significant.

### *Pattern of palmar Interossei in ABO groups*

In this study, the no pattern among the palmar interossei was most common, with most no pattern most common with O blood group(mean of 5.45), followed by B blood group(mean of 5.41) and A blood group(mean of 5.22). AB blood had the least no pattern palmar interossei pattern (mean of 5.20). Loop pattern was next in common in interossei with mean value for AB(2.20)>A (2.0) >B(1.97)>O(0.65). Loops were followed by arches with mean value for A(0.77)>O(0.65)>B(0.58)>AB(0.53). Whorls were the least common pattern with mean value for AB(0.07) B(0.04)>O(0.02)>A(0.01).These results were not statistically significant.

### *Open and closed palmar creases among ABO groups*

In our study closed type of palmar creases were more common than open type in all blood groups (Table 8). B blood group has more closed creases than open (1.64:0.36) compared with O (1.58:0.42), A(1.53:0.47) and AB(1.27:0.73), which is statistically non-significant.

**Table 7** Pattern of palmar Interossei in ABO groups

| BLOODGROUP | PI No Pattern | PI Loop | PI Arch | PI Whorl |
|---|---|---|---|---|
| A(sum) | 485 | 186 | 72 | 1 |
| (mean+-SD) | 5.22+-1.57 | 2.00 +-1.8 | 0.77 +- 0.92 | 0.01+- 0.10 |
| AB(sum) | 156 | 66 | 16 | 2 |
| (mean+-SD) | 5.20+-1.66 | 2.20+-1.73 | 0.53+-0.82 | 0.07+-0.37 |
| B(sum) | 666 | 242 | 71 | 5 |
| (mean+-SD) | 5.41+-1.34 | 1.97+-1.47 | 0.58+-0.74 | 0.04+-0.29 |
| O(sum) | 757 | 261 | 91 | 3 |
| (mean+-SD) | 5.45+-1.69 | 1.88+-1.62 | 0.65+-0.83 | 0.02+-0.14 |
| Total(sum) | 2064 | 755 | 250 | 11 |
| (mean+-SD) | 5.36+-1.55 | 1.96+-1.625 | 0.65+-0.825 | 0.03+-0.221 |
| p-Value | 0.641 | 0.685 | 0.082 | 0.823 |

**Table 8** Open and closed palmar creases among ABO groups.

| Blood Group | Open Crease | Closed Crease |
|---|---|---|
| A | 44 | 142 |
| | 0.47+-0.84 | 1.53+-0.84 |
| AB | 22 | 38 |
| | 0.73+-0.98 | 1.27+-0.98 |
| B | 44 | 202 |
| | 0.36+-0.77 | 1.64+-0.77 |
| O | 59 | 219 |
| | 0.42+-0.79 | 1.58+0.79 |
| Total | 169 | 601 |
| | 0.44+-0.81 | 1.58+-0.81 |

p = 0.151.

## DISCUSSION

The mean pattern of loops (table 4, figure 3) were highest in O blood group (5.58), followed by B(5.31) and A( 5.12) and lowest in AB blood group (3.73). These results were statistically significant. Mehta and Mehta [13] also found highest frequency of loops in O blood group and least frequency in AB blood group, the results being statistically significant. Our study also agrees with the study conducted by Shivhare *et al* [14] and Singh *et al*[15] in loops being least common in AB blood group. Our findings vis-à-vis loops being highest among O blood group also correlate with the findings of Deopa *et al* [16]. Our findings are however different from the study conducted by Bharadwaj *et al*[17] in which loops were most common in A blood group and least common in O blood group and in the study conducted by Kshirsagar *et al*[18] in which loops were highest in B blood group and lowest in O blood group.

In this study, the mean pattern of whorls (table 6, Figure 5) were highest in AB blood group (5.43), followed by A blood group (4.39), followed by B blood group (4.20) and lowest in O blood group (4.07). These results were statistically non-significant. Our study correlates with the findings of Bharadwaj *et al*[17] and Deopa *et al*[16] in whorls being highest in AB blood groups. Our study also correlates with the findings of Mehta and Mehta[13] in whorls being most common among subjects of O blood group. Our study, however, does not correlate with the findings of Kshirsagar *et al*[18] in which whorls were highest in O blood group and lowest in AB blood group. Our study also does not correlate with the findings of Shivhare *et al* [14] which show highest whorls in A blood group and lowest in B blood group.

In this study the mean pattern of arches (table 5, figure 4) were highest in AB blood group (0.83), followed by A and B (both 0.49). The mean pattern of arches were lowest in O blood group (0.35). The results were statistically not significant. Our study completely correlates with the findings of Singh *et al*[15] in which arches were highest in AB blood group and least common in O blood group. Our findings also correlate with studies conducted by Kshirsagar *et al*[18], Mehta and Mehta[13] and Shivhare *et al*[14] vis-à-vis preponderance of arches in AB blood group. Our study is in contrast to the study conducted by Bharadwaj *et al*[17] which showed highest frequency of arches in B blood group and lowest in AB blood group.

In this study, the no pattern among the palmar interossei was most common, with no pattern most common with O blood group(mean of 5.45), followed by B blood group(mean of 5.41) and A blood group(mean of 5.22). AB blood had the least no pattern palmar interossei pattern (mean of 5.20). Loop pattern was next in common in interossei with mean value for AB(2.20) >A (2.0) >B(1.97)>O(0.65). Loops were followed by arches with mean value for A(0.77)>O(0.65)>B(0.58)>AB(0.53). Whorls were the least common pattern with mean value for AB(0.07)B(0.04)>O(0.02)>A(0.01).These results were not statistically significant. These findings correlate with the findings of Mehta and Mehta (13) in being statistically insignificant.

In our study closed type of palmar creases were more common than open type in all blood groups (Table 8). B blood group has more closed creases than open (1.64:0.36) compared with O (1.58:0.42), A(1.53:0.47) and AB(1.27:0.73), which is statistically non-significant. The reference to open and close creases with respect to ABO and blood groups was not found in the existing literature to the best of our knowledge.

## CONCLUSION

In this study loops were most predominant fingertip pattern (52.36%) followed by whorls (42.96%). Arches were the least common fingertip pattern. The results of the study reveal statistically significant decreased number of loops in AB blood group with highest frequency of loops in O blood group. Thus, there seems to be an association between less loops and AB blood group and this can find forensic and anthropological application.

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**Conflict of interest:** None

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