*Original Article*

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# Palmar Dermatoglyphic Study in Diabetes Mellitus in Davangere District

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**Abstract**

*Background and Objectives:* Diabetes mellitus is one of the most common endocrine disorders affecting almost 6% of the world's population. The global prevalence of diabetes mellitus is rapidly increasing as a result of population ageing, urbanization and associated lifestyle changes. The present study was to identify patterns of dermal ridges on finger tips and palms in Diabetics and non Diabetics which will be helpful in predicting the onset of Diabetes Mellitus in early detection programme. *Source of data:* The present study was carried out on 80 Diabetic patients in S.S. Institute of Medical Sciences and Research Centre, Davangere which was compared with 80 normal healthy individuals. *Method:* The palm prints and finger prints of patients and controls were taken by INK Method as described by CUMMINS and MIDLO. The Parameters like arches, loops, whorls, patterns in interdigital areas and 'atd' angle in both hands were noted. *Results:* Arch patterns were significantly reduced in the finger tips of diabetics, with no significant difference in the mean counts of ulnar & radial loops between diabetics & controls. However whorl pattern was found to be significantly decreased in Diabetics when compared to controls. The frequency of patterns in interdigital areas I3 was increased where as decreased in I2 & I5 in diabetics significantly. The atd angle was increased in diabetics when compared to controls which were statistically insignificant.

**Keywords:** Dermatoglyphics; Diabetes Mellitus; Arches; Whorls; Loops; atd Angle.

## Introduction

Dermatoglyphics is the scientific study of epidermal ridges and their configurations on the palmar region of hand and fingers and plantar region of foot and toes. The term dermatoglyphics was coined by Cummins and Midlo in 1926 and was derived from Greek words 'derma' means skin and 'glyphics' means carvings [1]. The original ridge characteristics are not disturbed unless the skin is damaged to a depth of about one millimeter [2].

With regard to the high incidence of Diabetes Mellitus in the world, the existence of such relation might be important in the screening programme for prevention of Diabetes Mellitus. If an individual with specific pattern of dermatoglyphics, then the person can be screened for prevention by controlling other risk factors in early detection programme [3].

Dermatoglyphic analysis can be done by

*Finger Tip Patterns*

a. *Arch(A):* An arch is the simplest pattern. It consists of more or less parallel ridges. The ridges curve the pattern area. The curve is proximally concave.
b. *Loop(L):* It is the most frequent pattern on finger tip. In this configuration, series of ridges enter and leave the pattern area on same side.

1. Ulnar Loop (Lu): In Ulnar Loop, ridges opens on the ulnar side.
2. Radial Loop (Lr): In Radial Loop, ridges open on the radial side.

*Triradius*: The triradius is located on the finger tip and on the same side where the loop is crossed.

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*c. Whorl(W):* According to Galton's classification, whorl is any ridge configuration with two or more triradii.

*Palmar Pattern Configurations*

They include the thenar area, interdigital areas and hypothenar area.

*Hypothenar (Hypo):* Hypothenar area is situated along the lower part of ulnar border of hand and labelled as 'Hypo'.

*Thenar (Th):* Thenar area is situated at the base of the thumb and labelled as 'Th' First, Second, Third, Fourth Interdigital Areas (ID1, ID2, ID3, and ID4): The first, second, third, fourth interdigital areas are found in the distal palm in the region of heads of metacarpal bones. Each is bordered laterally by a digital triradii.

*atd angle:* It is formed by lines drawn from digital triradius 'a' to the axial triradius 't'and from axial triradius 't' to the digital triradius 'd'. The more distal the position of t, the larger the 'atd' angle. 'atd' angle is the most widely used method in interpreting the position of triradius 't' [4].

*Method of Dermatoglyphic Printing*

The present study was carried out on 80 Diabetic patients in S.S. Institute of Medical Sciences and Research Centre, Davangere, which was compared with 80 normal healthy individuals after obtaining clearance from Instituitional Ethical Committee. Dermatoglyphic prints were taken by the "INK METHOD" as described by CUMMINS and MIDLO (1961) [5] and analysed to find variations in dermatoglyphic features among diabetics & controls.

Subjects were asked to clean their hands with soaps and water after informed written consent. They were also asked to dry their hands but to leave some moisture. The requisite amount of Camel quick drying duplicating ink daub was placed on the glass slab. It was uniformly spread by the rubber roller to get a thin even ink film on the glass slab.The thin film of ink was applied on the palm by passing the inked rubber roller uniformly over the palm and digits taking care that the hollow of the palm and the flexor creases of the wrist were uniformly inked.

Left hand of the subject was then placed on the sheet of paper (kept over the pressure pad) from proximal to distal end. The palm was gently pressed between inter-metacarpal grooves at the root of fingers and on the dorsal side corresponding to thenar and hypothenar regions. The palm was then lifted from the paper in reverse order, from the distal to proximal end. The fingers were also printed below the palmar print by rolled finger print method. *The tips of the fingers were rolled from radial to ulnar side to include all the patterns.* The same procedure was repeated for right hand on separate paper. The printed sheets were coded with name, age, sex, and for case group and control group. The prints were then subjected for detail dermatoglyphic analysis with the help of magnifying hand lens.The details were noted on the same paper with the pencil or pen.

The Parameters like arches, loops, whorls, patterns in interdigital areas and 'atd' angle in both hands were noted. Observations were tabulated and analyzed for statistical significance by applying Chi-square test.

## Results

**Table 1:** Illustrates frequency of distribution of finger tip patterns of diabetics & controls

| Patterns | Cases Right Hand | % | Controls Right Hand | % | Cases Left Hand | % | Controls Left Hand | % |
|---|---|---|---|---|---|---|---|---|
| Arch | 48 | 13.33 | 23 | 7.66 | 30 | 8.33 | 25 | 8.33 |
| Radial Loop | 7 | 2.33 | 5 | 1.66 | 8 | 2.66 | 4 | 1.33 |
| Ulnar Loop | 185 | 61.66 | 189 | 63 | 184 | 61.33 | 167 | 55.66 |
| WHORL | 60 | 20 | 82 | 27.33 | 67 | 22.33 | 99 | 33 |

**Table 2:** Illustrates frequency of distribution of finger tip patterns in diabetics & controls

| Patterns | Cases M & F | % | Controls M & F | % | x | p | s/ns/hs |
|---|---|---|---|---|---|---|---|
| Arch | 78 | 13 | 47 | 7.83 | 8.9 | 0.003 | S |
| Radial Loop | 15 | 5 | 9 | 1.5 | 1.69 | 0.19 | NS |
| Ulnar Loop | 367 | 61.16 | 356 | 59.3 | 0.76 | 0.38 | NS |
| Whorl | 127 | 21.16 | 181 | 30.16 | 12.08 | 0.0005 | HS |

X- Chi square test, p-significance, S-significant, NS-not significant, HS-highly significant, M-males, F-females

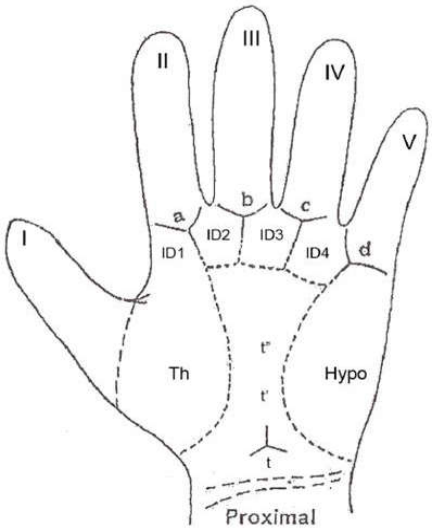


**Fig. 1:** Palm showing interdigital areas (ID), thenar & hypothenar eminence & atd angle(t).

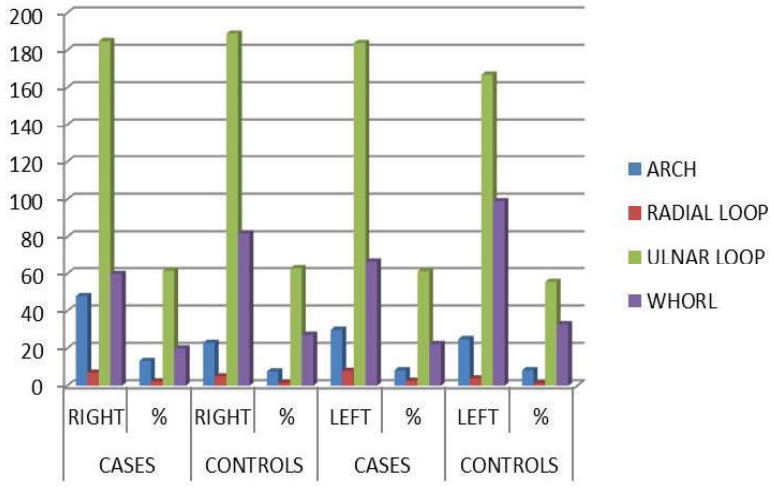


**Chart 1:** Illustrates number & percentage of patterns of individual fingers in the right & left palm of diabetics & controls

**Table 3:** Illustrates frequency of interdigital patterns in diabetics & controls

| Loop in Interdigital Areas | Cases | % | Controls | % | x | P | s/ns/hs |
|---|---|---|---|---|---|---|---|
| I1 | 5 | 4.16 | 11 | 9.16 | 2.41 | 0.12 | NS |
| I2 | 2 | 1.66 | 6 | 5 | 5.98 | 0.014 | HS |
| I3 | 56 | 46.66 | 36 | 30 | 7.05 | 0.007 | HS |
| I4 | 51 | 42.5 | 49 | 40.8 | 0.06 | 0.79 | NS |
| I5 | 6 | 5 | 18 | 15 | 6.667 | 0.009 | HS |

X- Chi square test, p-significance, S-significant, NS-not significant, HS-highly significant

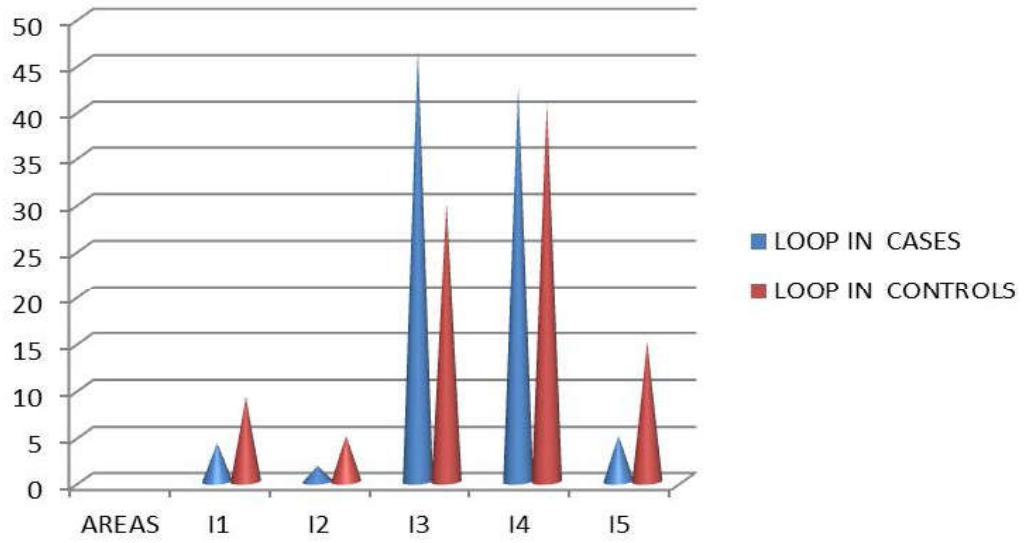


**Chart 2:** Illustrates percentage of loops in interdigital patterns in diabetics & controls

**Table 4:** Illustrates mean of atd angle in right hand & left hand in cases & controls

| Atd | Right | Right |
|---|---|---|
| Angle | Males | Females |
| Cases | 39.5 | 43.53 |
| Controls | 39.7 | 42.56 |

| Atd | Left | Left |
|---|---|---|
| Angle | Males | Females |
| Cases | 44.3 | 43.53 |
| Controls | 38.86 | 42.53 |

| Atd | Total |
|---|---|
| Angle | M & F |
| Cases | 42.73 |
| Controls | 40.9 |

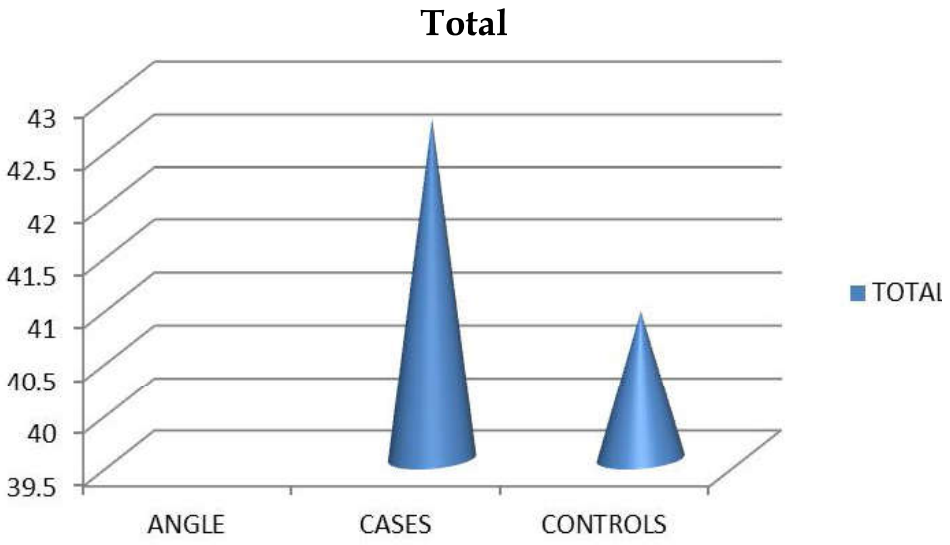


**Chart 3:** Illustrates mean of atd angle in cases & controls

## Discussion

In the present study of 80 diabetics & 80 controls, the frequency of distribution of finger tip patterns in both hands were : arches; diabetics- 13%, controls- 7.83%, whorls; diabetics-21%, controls-30%, ulnar loop; diabetics-61%, controls-59%, radial loop; diabetics-5%, controls-1.5%. Diabetics had significant increased arches than controls. Whorl pattern was found to be significantly decreased in diabetics when compared to controls.

The results of Hashim HMA obtained from Chi-square test and t-test showed the occurrence of whorls of index and little finger increased in double samples of males (54%, 36%) compared to controls(16%,46%) and ulnar loops increased (26%, 64%) compared to Controls (32%,84%).Where as in females, whorls decreased to 38% and ulnar loops increased (16%, 38%) compared to controls 24% and (62%, 6%) respectively [6].

Bandana sachdev observed arches; diabetics- 9.9%, controls- 3.6%, whorls; diabetics- 32%, controls-59%, loop; diabetics- 57%, controls-37%. Diabetics had significant lower arches than controls. Both male and female diabetics showed a significant increase in frequency of loops, and arches and a decreased in the frequency of whorls especially in digit III i.e. Middle finger in right hand of females and left hand of males had chances of type 2 DM [7].

In the present study of 80 diabetics & 80 controls, there was an increase in $I_3$ pattern (46.66%) which was statistically significant in diabetics when compared to controls (30%), while thenar /$I_1$, $I_4$, did not show any statistical significance. There was a decrease in $I_2$ (1.6%) & hypothenar area (5%) when compared to controls $I_2$ (5%) & hypothenar area (18%) which was statistically significant. Thenar/ $I_1$: diabetics-4.1%, controls-9.1%, ; $I_2$ diabetics- 1.6 %, controls- 5%, $I_3$; diabetics- 46.6 %, controls-30%, $I_4$; diabetics- 42.5 %, controls-40 % hypothenar area; diabetics- 5%, controls-18 %. Ana tarca observed a spectacular diminution of the pattern frequency for the masculine series, in the interdigital space IV, up to 19.16% versus 48.6% - the value recorded in the men of the reference sample [8].

In the present study, atd angle was decreased in right hand of male diabetics when compared to female diabetics & increased atd angle was seen in left hand of male diabetics when compared to controls. Atd angle was increased in cases when compared to controls. The mean of atd angle in cases was 42.73 & in controls 40.90. These values did not show any statistical significance. Atd in right hand of males: diabetics-39.5, controls-39.7, right hand of females: diabetics-43.53, controls-42.5, left hand of males: diabetics-44.3, controls-38, left hand of males: diabetics-43, controls-42.

Vadgaonkar Rajanigandha observed that there was a statistically significant increase in the atd angle on both hands of both sexes in diabetics when compared to the controls, who showed narrower angles [9]. Manoj sharma observed that there was a statistically significant increase in the right atd angle mean values (43.66) in diabetics when compared to the controls, who showed narrower angles (40) [10].

## Conclusion

The following conclusions can be made from present study.

Arch patterns were significantly reduced in the finger tips of diabetics, with no significant difference in the mean counts of ulnar & radial loops between diabetics & controls. However whorl pattern was found to be significantly decreased in the right hand of Diabetics when compared to controls.

The frequency of patterns in interdigital areas I3 was increased where as decreased in I2 & I5 in diabetics significantly.

The atd angle was increased in diabetics when compared to controls which was statistically insignificant.

There were significant differences in the diabetics in various dermatoglyphic features when compared to normal. Hence it is possible to identify the at risk population with the help of dermaoglyphics, which can serve as an aid in the diagnosis of diabetics at an earlier age.

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