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Dermatoglyphic Patterns as a Predictive Marker in Diabetes Mellitus: A Cross-Sectional Study in the Bangalore Population

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Abstract

Dermatoglyphics the scientific study of ridge patterns on fingers and palms—has been explored as a potential tool for identifying genetic and metabolic disorders. This study investigates the dermatoglyphic features in individuals diagnosed with diabetes mellitus, analyzing both qualitative and quantitative parameters such as fingerprint patterns, ridge counts, and atd angles. A cohort of 25 diabetic patients aged between 35 and 85 years was assessed using the kajal print method. Statistical analyses, including t-tests, were applied to derive population means and compare findings against established norms. The study found increased total finger ridge counts (TFRC) and characteristic fingerprint patterns among diabetics, suggesting that dermatoglyphics may offer valuable insight into early detection and risk profiling of diabetes.

Keywords: *Dermatoglyphics, Ridge count, atd angle, Diabetes mellitus, Fingerprint patterns, Kajal method*

1. Introduction

Dermatoglyphics, derived from the Greek words *derma* (skin) and *glyph* (carving), refers to the scientific analysis of ridge formations on the fingers and palms [1]. These patterns, which are fully established by the fourth month of fatal life, remain unchanged throughout an individual's life unless the dermis is severely damaged [2]. Dermatoglyphic analysis has evolved from a forensic tool to an investigative method in medical genetics and disease diagnostics. Diabetes mellitus, a complex metabolic disorder, has shown correlation with specific dermatoglyphic features. This study focuses on identifying potential biomarkers in fingerprint patterns that may aid early detection of diabetes.

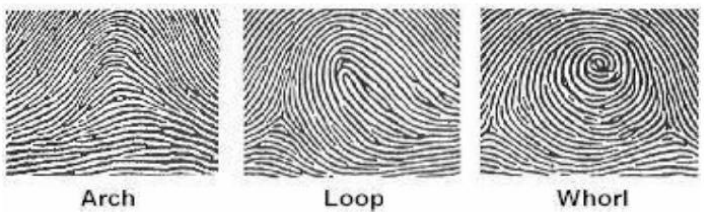

Figure 1: Basic types of fingerprints

Arches: These occur only about 5% of the total fingerprints. The ridges of the finger run continuously from one side of the finger to the other without any backward turn. Normally, there is no delta in an arch pattern. There are two sub-types of arch patterns: Plain arch, Tented arch.

Loops: These can be seen in almost 60 to 70% of the fingerprints that are encountered. The ridges make a backward turn in loops, but they do not twist. This imprint on the fingerprint is similar to the reverse image that we see when we look at ourselves in the mirror. A loop pattern has only one delta. There are three sub-categories of loops: Radial loops, Ulnar loops, Double loop.

Whorls: These can be found in about 25 to 35% of the fingerprints that are encountered. Some of the ridges in a whorl make a turn through at least one circuit, therefore any pattern that contains two or more deltas will be a whorl. There are three sub-groups of whorls: Plain whorl, Central pocket loop whorl, Accidental whorl.

Diabetes is a metabolic disease in which a person has high blood glucose level, it is either by inadequate amount of insulin production or the body cells do not respond to the insulin produced. There are three main types/ three major classifications of diabetes are TYPE 1 diabetes is an autoimmune condition in which the immune system attacks the beta cells of pancreas that produce insulin [3]. Caused due to HLA genes. TYPE 2 diabetes is a condition in which the body cannot use the insulin efficiently and leads to high amount of production by pancreas until it can hold on the demand and then results in low insulin production. Gestational diabetes (GD) is due to insulin-blocking the hormones produced during pregnancy. This type of diabetes only occurs during pregnancy [4]. General symptoms of diabetes include: excessive thirst and hunger, frequent urination, drowsiness or fatigue, dry, itchy skin, blurry vision, slow-healing wounds [5].

Management of diabetes can be done by monitoring the blood sugar level, regular exercise, directed medications, proper diet, regular visit to the healthcare.

2. Objectives of the Study

- To identify dominant dermatoglyphic patterns associated with diabetes.
- To compare dermatoglyphic traits between diabetic subjects and control norms.
- To evaluate the predictive strength of these patterns in early detection of diabetes.

3. Material and Methods

Dermatoglyphic prints were collected using the kajal method. Materials included A4 sheets, kajal, wet tissues, soap, magnifying glass, and a protractor. Ridge counts, a-b, b-c, c-d distances, and atd angles were recorded for each participant.

3.1 Methodology Sample Selection: Twenty-five clinically diagnosed diabetic individuals (11 females and 14 males) from Bangalore were recruited. The kajal method was used to take the hand prints. The materials used were – kajal, A4 sheet papers, wet tissue papers, magnifying glass, soap, pencil, protractor, table. Hands of the patients were washed with soap and water, the a kajal was applied evenly in both right and left palm and was imprinted covering the maximum part of the paper on an A4 sheet, and the individual finger prints were taken on a new sheet by slowly rotating the finger from right to left direction.

This method is most effective in order to collect the complete imprint of the palm. These prints were studied with magnifying lens for observation.

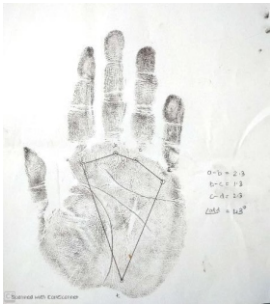

Figure 2: Palm print by kajal method

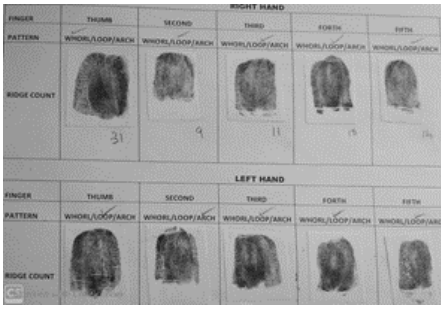

Figure 3: Finger prints by kajal method

Precautions to be taking during collecting the prints

1] Do not overlap the prints by rotating twice or more.

2] Do not apply too much of kajal it leads the kajal to smerge around.

3] Do not apply too much pressure for imprinting kajal.

Statistical Tools: Arithmetic mean, variance, standard deviation, standard error, and t-tests were used to analyze the data and compare with standard population means.

4. Results and Discussion

Data analysis

In the present study the 25 samples (11 females and 14 males) were collected using Kajal method and analysed using t-test in a statistical method. The age group of the samples range between 35 to 85.

Table 1: of results including both quantitative and qualitative parameters and mean of each parameter

Parameters	F	fx	Fd^2	Mean ($\bar{x}$)	S^2	SD	$S\bar{x}$
TFRC	25	4196.29	37354.21	167.85	1556.42	39.45	7.89
WHORL	15	107	19.75	7.1	1.41	1.18	0.3
LOOP	10	84	20.4	8.4	2.06	1.43	0.45
atd angle (R)	24	979	542.56	40.8	23.58	4.85	0.99
atd angle (L)	23	940	503.6	40.8	22.9	4.7	1.0
a-b (R)	24	55.4	2.6	2.3	0.11	0.33	0.06
a-b (L)	23	55.5	2.24	2.14	0.1	0.31	0.06
c-d (R)	23	48.3	1.88	2.1	0.08	0.28	0.05
c-d (L)	22	34.2	1.62	1.94	0.07	0.26	0.05
c-d (L)	22	45.1	1.93	2.05	0.09	0.3	0.06

Table 2: Analysis of all the parameters and their concluding remarks

Parameters	Degree of Freedom	Upper Limit	Lower Limit	Conclusion
TFRC	2.064	184.14	151.56	$\mu_1 = 184.14 > \bar{x} = 167.85 > \mu_2 = 151.56$
WHORL	2.145	7.75	6.45	$\mu_1 = 7.55 > \bar{x} = 7.1 > \mu_2 = 6.45$
LOOP	2.262	9.53	7.26	$\mu_1 = 9.53 > \bar{x} = 8.4 > \mu_2 = 7.26$
atd angle (R)	2.069	42.84	38.75	$\mu_1 = 42.85 > \bar{x} = 40.8 > \mu_2 = 38.75$
atd angle (L)	2.075	42.85	38.75	$\mu_1 = 42.85 > \bar{x} = 40.8 > \mu_2 = 38.75$
a-b (R)	2.059	2.62	2.18	$\mu_1 = 2.62 > \bar{x} = 2.3 > \mu_2 = 2.18$
a-b (L)	2.074	2.5	1.92	$\mu_1 = 1.66 > \bar{x} = 2.14 > \mu_2 = 1.42$
c-d (R)	2.069	2.27	1.93	$\mu_1 = 2.27 > \bar{x} = 2.1 > \mu_2 = 2.0$
c-d (L)	2.094	2.2	1.92	$\mu_1 = 2.2 > \bar{x} = 1.94 > \mu_2 = 1.92$
b-c (L)	2.080	1.9	1.28	$\mu_1 = 1.58 > \bar{x} = 1.92 > \mu_2 = 1.28$
c-d (L)	2.157	2.17	1.93	$\mu_1 = 2.17 > \bar{x} = 2.05 > \mu_2 = 1.93$

The above table shows the conclusion of the analysis that is the population mean range between which the parameters lies in proximity.

- **TFRC:** Mean TFRC was 167.85, higher than the standard average of 160.
- **Fingerprint Patterns:** A predominance of loop patterns (mean = 8.4) over whorls (mean = 7.1) was observed.
- **ATD Angles:** Mean angles for both hands were 40.8°, consistent with normal ranges (40°–45°).
- **Ridge Distances:** Mean values for a-b and c-d distances were slightly lower than standard, while b-c remained consistent.

Comparative analysis aligned partially with prior findings from larger-scale studies in diverse geographic populations [5-13]. The elevated TFRC and frequency shifts in ridge patterns support the hypothesis that dermatoglyphics may reflect underlying genetic predispositions in diabetes.

5. Conclusion

The study affirms the utility of dermatoglyphic parameters especially TFRC and loop/whorl ratios as supplementary indicators in diabetic profiling. Though not definitive diagnostic tools, these markers can aid in risk assessment and early screening when combined with clinical evaluations.

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