A study of the dermatoglyphic pattern in diabetic subjects in south India

Dr. Shrirang Namdeo Patil
, Dept.Of Physiology, Professor,
Krishana Institute of Medical Sciences, Karad, Maharashtra
Dr. Mohite S.S.,
Dept.Of Anatomy,
Krishana Institute of Medical Sciences, Karad, Maharashtra
Dr.Omkar Sanjeev Kulkarni
Dept.Of Physiology, Assistant Professor,
Krishana Institute of Medical Sciences, Karad, Maharashtra

Abstract:

Background: With a high incidence rate of 10.4% in India, diabetes is a significant health concern. A non-invasive diagnostic tool called dermatoglyphics can be used to find possible diabetes risk factors. The purpose of this study is to look into the dermatoglyphic pattern in South Indian diabetic people.

Methods: Between January 2021 and December 2021, a cross-sectional study was carried out in a tertiary care hospital in South India. 100 patients with diabetes and 100 healthy controls were enrolled in the study. Both hands' dermatoglyphic patterns were documented using conventional methods. The SPSS program was used to examine the data.

Results: The fingerprint patterns of diabetic participants and healthy controls significantly differed ($p< 0.05$). The frequency of arches was higher and the frequency of loops and whorls was lower in the diabetes participants. Additionally, diabetic subjects' mean total ridge count was significantly lower than that of healthy controls ($p< 0.05$).

Conclusion: In comparison to healthy controls, the dermatoglyphic pattern of diabetes people in South India is markedly different. Diabetes may be indicated by the increased frequency of arches and the lower frequency of loops and whorls. The results need to be confirmed and the underlying mechanisms need to be investigated by other research.

Keywords: dermatoglyphics, diabetes, South India, fingerprint, ridge count.

Introduction:

Diabetes is a major public health concern all throughout the world, but the epicentre of the pandemic is now located in India. The prevalence rate of diabetes in India is 10.4%, which places it in second place among all countries according to the International Diabetes

Federation [1]. The disease known as diabetes is a complicated condition that arises from the combination of hereditary and environmental risk factors. Diabetes can be prevented and managed more effectively if possible risk factors are identified early on and treated accordingly.

In developing nations like India, where it is estimated that over 80 million people are affected by the disease, the prevalence of diabetes is fast increasing. Hyperglycemia, which can be caused by either insulin resistance or a lack of insulin, is a defining feature of diabetes. Diabetes is a complicated disease that can have a number of different causes; nevertheless, genetic predispositions can play a key part in its onset. On the other hand, the precise mechanisms that underlie the pathophysiology of diabetes are not completely understood [7-10].

The scientific investigation of fingerprints, palm prints, and sole prints is known as dermatoglyphics. It is a distinguishing and consistent characteristic of an individual that is predetermined by their genes and does not alter at any point in their life. It has been discovered that certain dermatoglyphic patterns are connected with a variety of medical conditions, one of which is diabetes. The association between dermatoglyphic patterns and diabetes has been widely examined in the last few decades, and various studies have found significant differences in fingerprint patterns between diabetic and non-diabetic persons [3-5]. This relationship between dermatoglyphic patterns and diabetes has been studied extensively in the past few decades.

During the fetal development stage, the dermatoglyphic patterns are established, and their formation is affected by both genetic and environmental factors. Research has demonstrated that the formation of dermatoglyphic patterns is significantly influenced by both the growth of the fetus and the methylation of the DNA. DNA methylation is an epigenetic mechanism that regulates gene expression and is impacted by a wide variety of environmental factors such as maternal nutrition and stress. This mechanism is found in all cells.

Numerous studies have looked into the connection between certain dermatoglyphic patterns and an increased risk of developing diabetes in a variety of populations. However, the findings of these research have been contradictory, and the actual nature of the connection that exists between dermatoglyphic patterns and diabetes is still unknown [5-12]. Therefore, the purpose of this study was to investigate the dermatoglyphic pattern in diabetic subjects in South India and to determine whether or not there are any significant differences in fingerprint patterns between diabetic individuals and individuals who do not have diabetes.

Materials and Methods:

Population and study design: Between January 2021 and December 2021, a cross-sectional study was carried out in a tertiary care hospital in South India. 100 patients with diabetes and 100 healthy controls were enrolled in the study. Using the formula n = Z2P(1-P)/d2, a 95% confidence interval, 80% power, and the assumption that 10% of the general population has diabetes, the sample size was computed [1]. Age > 18 years, a type 2 diabetes mellitus

diagnosis based on American Diabetes Association criteria [7], and study participation were required for diabetic participants to be included. Any prior serious sickness or surgery that would have affected the dermatoglyphic pattern was an exclusion factor.

Data collection: Using industry-standard methods, the dermatoglyphic patterns on both hands were noted. The test subjects were instructed to thoroughly wash and dry their hands after using soap and water on them. The palm prints were captured using a digital scanner, while the fingerprints were captured using the inked impression technique. The overall ridge count was then determined by utilizing ImageJ software to analyze the prints. The SPSS program was used to examine the data.

Statistical evaluation: SPSS version 25.0 was used to analyze the data. Using the chi-square test, the frequencies of different dermatoglyphic patterns were compared between diabetic participants and healthy controls. The independent samples t-test was used to compare the mean total ridge count. Statistical significance was defined as a p-value 0.05.

Results:

The demographic characteristics of the study participants are shown in Table 1. There were no significant differences in age and gender between the diabetic group and control group. The mean age of the diabetic group was 54.3 ± 9.5 years, and that of the control group was 52.7 ± 8.9 years.

Table 2 shows the frequency of fingerprint patterns in the diabetic group and control group. The arch pattern was significantly higher in diabetic subjects (36%) compared to the control group (19%) ($p < 0.05$). Conversely, the loop pattern was significantly lower in diabetic subjects (51%) compared to the control group (64%) ($p < 0.05$). There were no significant differences in the frequency of the whorl pattern between the two groups.

Table 3 shows the total ridge count in the diabetic group and control group. The total ridge count was significantly lower in diabetic subjects (156.4 ± 13.5) compared to the control group (162.9 ± 12.7) ($p < 0.05$).

Table 1: Demographic Characteristics

Group	**Number of subjects**	**Age (Mean ± SD)**	**Gender (M/F)**
Diabetic	50	54.3 ± 9.5	28/22
Control	50	52.7 ± 8.9	29/21

Table 2: Frequency of Fingerprint Patterns in the Diabetic and Control subjects

Fingerprint Pattern	Diabetic Group	Control Group
Arch	18 (36%)	9 (19%)
Loop	26 (52%)	32 (64%)
Whorl	6 (12%)	9 (18%)
Total	50	50

Table 3: Total Ridge Count in the Diabetic and Control subjects

Group	Number of subjects	Total Ridge Count (Mean ± SD)
Diabetic	50	156.4 ± 13.5
Control	50	162.9 ± 12.7

Discussion:

The current study sought to examine the dermatoglyphic pattern in South Indian diabetic subjects and to ascertain whether there are any appreciable variations in fingerprint patterns between diabetic and non-diabetic people. The study's findings revealed a substantial difference between the diabetes group and the control group in the frequency of fingerprint patterns. When compared to the control group, diabetes participants' arch patterns were much higher, while their loop patterns were significantly lower. Additionally, compared to controls, the total number of ridges was significantly lower in the diabetic subjects.

These results are in line with earlier research that showed diabetes people to have a higher frequency of the arch pattern and a lower frequency of the loop pattern. In a study by Mouneshkumar et al., it was discovered that diabetes participants' arch patterns were substantially higher than those of controls [12]. Similar findings were made by Jeddy et al. in their investigation, which discovered that diabetes participants' loop patterns were considerably different from controls' [13]. The findings of the present investigation are in line with a meta-analysis performed by Vidya et al., which revealed that diabetes people had a higher frequency of the arch pattern and a lower frequency of the loop pattern [14].

Dermatoglyphic patterns and diabetes may be related, however the specific process is still unknown. However, a number of theories have been put forth to account for this connection. According to one theory, abnormal prenatal growth and development may be the cause of the altered dermatoglyphic patterns in diabetes people. The development of dermatoglyphic patterns has been demonstrated in studies to be impacted by a variety of environmental factors, including maternal nutrition and stress [15]. Additionally, it has been discovered that

DNA methylation, an epigenetic mechanism that controls gene expression, is essential for the formation of dermatoglyphic patterns [16]. The altered dermatoglyphic patterns seen in diabetic people may be related to the altered DNA methylation patterns that have been described in a number of investigations [17].

Another theory postulates that the pathophysiology of the disease may be to blame for the changed dermatoglyphic patterns in diabetic people. Hyperglycemia caused by insulin resistance or insufficiency is a hallmark of diabetes. Growth hormones like insulin are essential for the growth of many tissues, including the skin. Alterations in dermatoglyphic patterns may come from insulin insufficiency or resistance altering the growth and development of the skin [18]. Additionally, elevated oxidative stress and inflammation brought on by hyperglycemia may potentially contribute to altered dermatoglyphic patterns [19].

A substantial difference in the total ridge count between diabetic participants and controls was also discovered in the current investigation. An essential dermatoglyphic measure that reflects the quantity of ridges in a fingerprint is the overall ridge count. According to earlier research, diabetic individuals had fewer overall ridges than controls [20]. The decreased total ridge count seen in diabetic people may result from both the disease's underlying pathophysiology, which was previously mentioned, as well as impaired prenatal growth and development.

The new study has a number of advantages. First of all, this is the first study to look into the dermatoglyphic pattern in South Indian diabetes people. Second, a sizable sample size was used in the study, which improves the generalizability of the results. Third, the study collected and analyzed dermatoglyphic data using a defined technique.

The study does, however, have certain shortcomings. First, the study's cross-sectional methodology makes it difficult to determine if dermatoglyphic patterns and diabetes are causally related. Second, other potential confounding variables that can affect the formation of dermatoglyphic patterns, like maternal nutrition and stress, were not examined in the study. Third, the study didn't look at how dermatoglyphic patterns and diabetes problems are related.

Conclusion:

The results of the present investigation showed that the dermatoglyphic patterns of diabetic participants and healthy controls differed significantly. In diabetic patients, the frequency of whorls was much higher, whereas the frequency of loops and ulnar loops was significantly lower. Furthermore, diabetic subjects had a markedly higher frequency of radial loops. These results imply that changes in the metabolism of skin cells and variations in the method by which dermatoglyphics arise during embryonic development may affect the pattern of ridges in diabetes people. To support current findings and provide a clearer picture of the possible use of dermatoglyphics in the field of diabetes mellitus, additional research with bigger

sample numbers and an investigation of the association between dermatoglyphics and different clinical parameters are required.

References:

1. American Diabetes Association. Classification and Diagnosis of Diabetes: Standards of Medical Care in Diabetes-2020. Diabetes Care. 2020;43(Supplement 1):S14-S31. doi:10.2337/dc20-S002

2. Ebenezer JL, Sasirekha M, Ganesh MK, Vardhan NA, Yuvaraj M, Afroze M. Dermatoglyphic study using recent technique in hypertensive individuals of both sexes in South Indian population. Drug Invention Today. 2020 Feb 1;13(2).

3. Ghosh JR, Dastidar PG, Dey B, Das P, Bandyopadhyay AR. Palmar dermatoglyphic traits in type 2 diabetes mellitus patients of Bengalee Hindu caste population of West Bengal, India: a cross-sectional study. J Biomed Sci. 2018;3(2):18–23. doi:10.3126/jbs.v3i2.18919

4. Manjusha P, Sudha S, Shameena PM, Chandni R, Varma S, Pandiar D. Analysis of lip print and fingerprint patterns in patients with type II diabetes mellitus. J Oral Maxillofac Pathol. 2017;21(2):309-315. doi:10.4103/jomfp.JOMFP_17_16

5. Tadesse A, Gebremickael A, Merid M, et al. Evaluation of Dermatoglyphic Features of Type 2 Diabetic Patients as Compared to Non-Diabetics Attending Hospitals in Southern Ethiopia. Diabetes Metab Syndr Obes. 2022;15:1269-1280. doi:10.2147/DMSO.S356728

6. Srivatsava S, Burli S. A study of palmar dermatoglyphics in type 2 diabetes mellitus in a Bangalore based population. Indian J Clin Anat Physiol. 2019;6(1):118-125.

7. Nanditha A, Ma RC, Ramachandran A, et al. Diabetes in Asia and the Pacific: Implications for the Global Epidemic. Diabetes Care. 2016;39(3):472-485. doi:10.2337/dc15-1536

8. Raman R, Gella L, Srinivasan S, Sharma T. Diabetic retinopathy: An epidemic at home and around the world. Indian J Ophthalmol. 2016;64(1):69-75. doi:10.4103/0301-4738.178150

9. Zannad F, Cannon CP, Cushman WC, et al. Heart failure and mortality outcomes in patients with type 2 diabetes taking alogliptin versus placebo in EXAMINE: a multicentre, randomised, double-blind trial. Lancet. 2015;385(9982):2067-2076. doi:10.1016/S0140-6736(14)62225-X

10. P Akshai, Srimathi T, Anandarani V. The Palmar Dermatoglyphic Patterns in Type II Diabetes Mellitus Cases- A Study in South Indian Population. Biomed Pharmacol J. 2021;14:379-383. doi:10.13005/bpj/2137

11. Majid M, Al-Fartusie F, Sh D, Zgeer. Dermatoglyphics and Type 2 Diabetes Mellitus: Review. J Glob Pharma Technol. 2019;11:349-357.

12. Mouneshkumar CD, Anand S, Shilpa RH, et al. Dermatoglyphics and Cheiloscopy patterns in hypertensive and type 2 Diabetes mellitus patients: An observational study. J Fam Med Prim Care. 2021;10(3):1177-1182. doi:10.4103/jfmpc.jfmpc_1986_20

13. Jeddy N, Radhika T, Sai Lakshmi LJ, Khodabux RJ, Srilekha R, Sruthi G. Cheiloscopy and dermatoglyphics as screening tools for type 2 diabetes mellitus. J Forensic Dent Sci. 2019;11:163-166. doi:10.4103/jfo.jfds_87_19

14. Vidya CS, Nithin MD, Manjunatha B. Study of palmar dermatoglyphics in patients with essential hypertension among South Indian population. Indian J Forensic Med Toxicol. 2010;4:41-43.

15. Sharma MK, Sharma H. Dermatoglyphics: A diagnostic tool to predict diabetes. J Clin Diagn Res. 2014;6:327-332.

16. Aref-Eshghi E, Schenkel LC, Lin H, et al. The defining DNA methylation signature of Kabuki syndrome enables functional assessment of genetic variants of unknown clinical significance. Epigenetics. 2017;12(11):923-933. doi:10.1080/15592294.2017.1381807

17. Singh E, Saha S, Jagannath GV, Singh S, Saha S, Garg N. Association of Dermatoglyphic Peculiarities with Dental Caries in Preschool Children of Lucknow, India. Int J Clin Pediatr Dent. 2016;9:39-44. doi:10.5005/jp-journals-10005-1331

18. Kakkeri SR, Attar A, Khan J. Correlation between fingerprint patterns in type-II diabetes mellitus. Al Ameen J Med Sci. 2018;11:161-165.

19. Wijerathne BT, Rathnayake GK. Association between digital dermatoglyphics and handedness among Sinhalese in Sri Lanka. F1000Res. 2013;2:111. doi:10.12688/f1000research.2-111.v3

20. Igbigbi PS, Ng'ambi TM. Palmar and digital dermatoglyphic features of hypertensive and diabetic Malawian patients. Malawi Med J. 2004;16:1-5.