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Original Article

Study on Finger Ridge Pattern of Palmar Dermatoglyphics and their Association of Type 2 Diabetes Mellitus in Bangladeshi Population.

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Abstract:

The skin on the palmar surface of human hands & the planter surface of the feet differ from skin found also where on the body. The projection of dermal papillae which are interdigitate with epidermal evagination, is called epidermal ridges. By the 17thweek of intrauterine life, these ridges are permanent and remain unchanged throughout life, with the exception of a little increase in size that coincides with growth. Thus, it is quite helpful to predict various genetically acquired disorders. Diabetes mellitus is a condition of partial genetic background. The objective of this study was to determine whether type II diabetes mellitus in Bangladeshi people was associated with a certain finger ridge pattern. This observational cross sectional study was conducted in Sylhet MAG Osmani Medical College from July 2018 to June 2019. A total of 200 subjects were included; among them, 100 were diagnosed patients of type II DM and the rest were healthy individuals. The age and sex of the research participants were matched between the groups under investigation. The ink and paper method was used for making a print of the finger. A mounted hand lens was used to examine the prints. The distribution of finger ridge pattern between the diabetics and controls showed that the ulnar loops ($p = 0.003$) and whorls ($p = 0.001$) were significantly higher in diabetic group; whereas arches ($p = <0.001$) and radial loops ($p = <0.001$) were found to be significantly higher in control group. The study came to the conclusion that type II DM has the unique characteristics of the finger ridge distribution patterns in palmar dermatoglyphics, it can be employed as a reliable screening method for type II DM early diagnosis.

Key words: Dermatoglyphics, Arch, Whorl, Radial loop, Ulnar loop, Type II DM.

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Introduction:

The name "Dermatoglyphics" was invented by Cummin and Midlo in 1926. "Derma" means skin and "glyphic" means carvings.[1] It is a scientific study about patterns of epidermal ridge on the palmar and planter aspect of finger tips, palms, soles and toes.[2]Skin is made of the epidermis and dermis. The junction of the dermis and epidermis is uneven. The projection of dermis is called papillae. When the papillae interdigitate with evagination of the epidermis known as epidermal ridges.[3]The epidermal ridges are seen in the embryonic period of the 10th week but by the 17th week of intrauterine life, they were abidingly formed. These ridges generate grooves on the surface of the palms and soles.[4] These ridges and the formation of conture are not influenced by increasing age, environmental or developmental variation in the postnatal period without increasing size in comparison with normal growth.[5] As such, it has assist to forecast different genetically acquired disorder.[6] Any anomaly resulting fromgenetic or other factors expresses its outcome before the end of 20 weeks of foetal development.[7] Epidermal ridges and their constitution display a group of features

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that empower the biology of an individual. Though dermatoglyphics and their structure are genetically ascertained and the alignment of ridges stays constant throughout life, they have become valuable, like supportive boost for the detection of hereditary disorders.[8] Epidermal ridge form exhibit important visualization in the diseased case with a powerful or some genetic background.[9] It has been clearly founded that long term disease such as diabetes and hypertension have a genetic background.[10] Diabetes mellitus is a worldwide endocrine, genetic disorder affecting about 537 million people worldwide and it is estimated that by the year of 2045, it will be 783 million or one adult in 10 people with diabetes. In Bangladesh, there were a total of 8.4 million diabetic people in 2019, and it is estimated that in 2045, around 15 million of her people will have diabetes, making hertenth ranked country in the world at that time.[11] Previous multiple studies done in different world regions revealed a significant correlation between different finger ridge pattern and type II DM.[12] Unfortunately, Bangladesh has not yet seen a lot of similar studies. Therefore, the purpose of this study was to determine whether finger ridge patterns of dermatoglyphics are associated with diabetes or not in the Bangladeshi population. Also, finger ridge pattern can be used as a predictive tool to identify type II diabetes mellitus in high-risk individuals early on.

Materials and Methods

This observational cross-sectional study was conducted in Sylhet MAG Osmani Medical College, Sylhet, Bangladesh, from July 2018 to June 2019. Institutional ethical approval was obtained prior to commencement of the study. Informed written consent also taken from every study subjects. This study was performed on 100 subjects (50 male and 50 female) with NIDDM confirmed by clinical and laboratory assessment obtained from OPD of Medicine, Sylhet M.A.G Osmani Medical College Hospital, Bangladesh. Inclusion criteria for cases includes: blood sugar level- Fasting- 120mg% and postprandial 180mg%, Absence of any other genetic disorder, any congenital disease of fingerprint, or any dermatoglyphic abnormalities. Whereas Inclusion criteria for controls includes: peoples with an age above 30 years, has a normal blood sugar levels and there should be no family history of diabetes mellitus. The control group consists of 100 subjects and they were obtained from a locality. In this study, 100 X 10 = 1000 finger prints of the diabetic patients and 100 X 10 = 1000 finger prints of the controls were collected. The dermatoglyphic prints of both groups were examined under mounted hand lens.

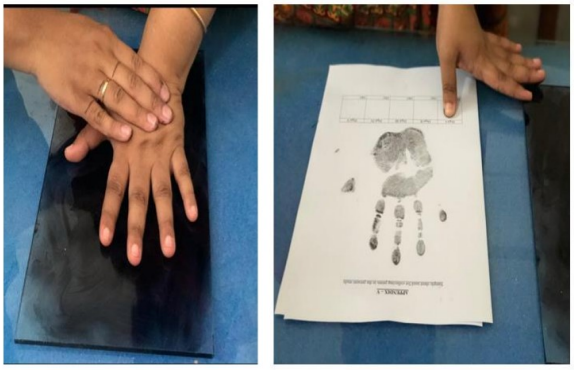

Figure 1: Photomicrograph showing the method of dermatoglyphic printing

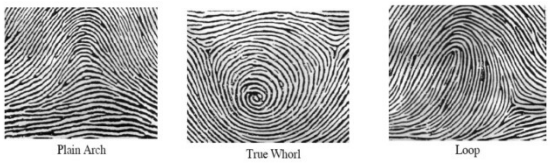

Figure 2: Different types of finger ridge patteern

The subject was asked to wash his hands with soap and water, wipe with a towel, and dry before inking. Thus, the hands were free from any oily or greasy substances from dirt. The glass slab was cleaned, dried, and placed on the table. A small amount of press ink was put on the glass slab and spread over it, making a thin uniform layer with the movement of the hand roller. This uniformity of ink film was checked by lifting the slab and observing it against a light source. A few sheets of news-print paper were clipped with the printing paper, so that the printing ground was somewhat yielding. Then the edge of it was aligned with that of the tabletop. The subject was asked to relax his hand and remain passive during the whole process of inking the hands and making prints, giving the

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operator complete freedom in the manipulation. In finger printing, rolled inking and printing methods were used to obtain a complete impression of the ball of the finger. The finger printing prevailed placing the finger on ink film, rolling from ulnar to radial margin, ensuring complete coverage. Any missed spots were gently filled with ink and press onto paper, ensure full impress & lifted carefully. All 10 fingers of both hands are printed for each subject. The finger was observed to see whether the inking extended from near the tip of the finger to a level slightly proximal to the flexion crease of the distal interphalangeal joint. If any space was not inked, ink was rubbed gently over that area with a gloved finger. The printing paper was then aligned to the margin of the table and the inked finger was pressed ulnar edged down near the edge of the printing paper. The finger was rolled to the opposite edge of the former with the same motion as in inking. Care was taken so that the finger did not move in the opposite direction while taking it off the paper. All ten fingers of the two hands of each patient and control subject were printed in this way on the respective sheets. For the right hand the fingerprints were numbered as R_1, R_2, R_3, R_4, R_5 for the thumb to little finger and the left hand as L_1, L_2, L_3, L_4, L_5 for the thumb to the little finger.

The finger ridge patterns were classified according to Cummins and Midlo (1961) into four groups - whorls, ulnar loops, radial loops, and arches. In x4 magnification under dissecting microscope lens in good light, the finger ridge pattern of each finger was identified and recorded separately in a register. The percentage frequencies of different patterns were thus determined for different groups separately. The percentage frequencies of different patterns were also calculated for individual fingers in the two groups. The type of data found in this study was quantitative. For the variables of finger patterns i.e., whorls, radial loops, ulnar loops and arches, we did the percentage frequency and their distributions compared using Chi-Square test. Statistical analyses were done using a computer-based programme called Statistical Package for Social Sciences (SPSS), version 25. A p-value of <0.05 considered as statistically significant difference.

Results:

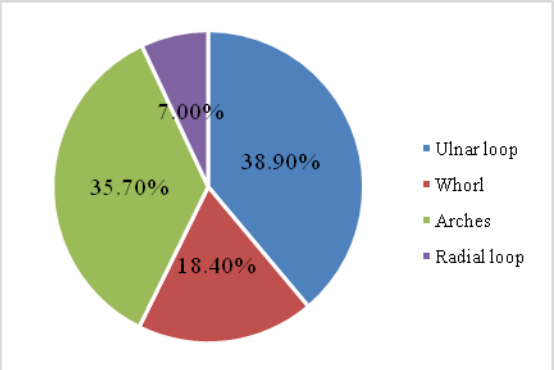

Figure 3: The frequencies of finger ridge patterns in the both hands of control groups

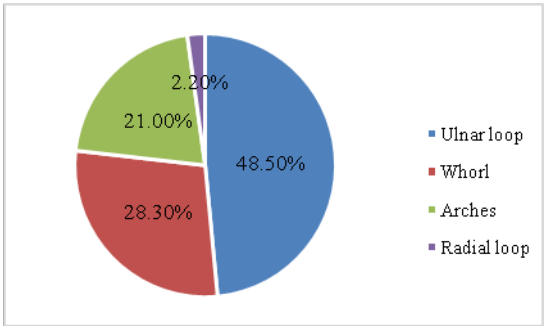

Figure 4: Pie diagram showing the percentage frequencies of various patterns on finger tips of both hands of patients group.

Ulnarloop predominately found in both control group (38.9%) and diabetic group (48.5%). Arches were common in control group (35.7%), but whorl common in diabetic group (28.3%). Radial loop found least common in both control group (7.0%) and diabetic group (2.2%) (Figure 3 and Figure 4).The differences of ulnar loop (389 vs 485, χ^2 = 18.73, p = <0.001), whorl (184 vs 283, χ^2 =27.38, p = <0.001), arches (357 vs 210, χ^2 = 53.19, p = <0.001) and radial loop (70 vs 22, χ^2 = 27.58, p = <0.001) between the control and diabetes groups found statistically significant. Ulnar loop and whorl were found significantly higher in diabetes group. In contrast, arches and radial loop were found significantly higher in control group. Similar significant differences of the digital patterns between the control and diabetes groups observed in both right and left hands too (Table I).

Table I: Frequency of Finger ridge patterns on both hands of control &patients' groups:

Digital Pattern		Right Hand		Left Hand		Both Hand	
		Control (n=500)	Patient (n=500)	Control (n=500)	Patient (n=500)	Control (n=1000)	Patient (n=1000)
Ulnar loop	Number	204	250	185	235	389	485
	Statistics	$\chi^2 = 8.54$; p = 0.00347		$\chi^2 = 10.26$; p = 0.00135		$\chi^2 = 18.73$; p <0.0001	
Whorl	Number	97	141	87	142	184	283
	Statistics	$\chi^2 = 10.68$; p = 0.00108		$\chi^2 = 17.13$; p = <0.0001		$\chi^2 = 27.38$; p = <0.0001	
Arches	Number	163	101	194	109	357	210
	Statistics	$\chi^2 = 19.78$; p = <0.0001		$\chi^2 = 34.21$; p = <0.0001		$\chi^2 = 53.19$; p = <0.0001	
Radial loop	Number	36	8	34	14	70	22
	Statistics	$\chi^2 = 18.64$; p = <0.0001		$\chi^2 = 8.75$; p = 0.00309		$\chi^2 = 27.58$; p = <0.0001	

Discussion:

In this study, 200 participants were enrolled (100 diabetes and 100 healthy control subjects), and the participants were matched in terms of both gender and age. The fingertip patterns in the hands were distributed as follows: arches; diabetics- 21%, controls-35.7%, whorls; diabetics-28.3%, controls-18.4%, ulnar loops; diabetics-48.5%, controls-38.9%, radial loops; diabetics-2.2%, controls-7%. It was discovered that the frequency of the ulnar loop and whorl pattern was higher in diabetic patients than the control group. These differences were statistically significant (Table I). In the case of the individual digits – digit II, III, V showed a higher frequency of the ulnar loop while digit I showed a lower frequency of ulnar loop in the patients than in the controls. Digit IV showed higher frequencies of whorl and digit I showed lower frequencies of radial loops and arches in the DM patients than in the controls. This study was carried out only on Bangladeshi people.

Shamim conducted the same research on a type-2 DM patients from Bangladesh and discovered the similar patterns: increase of ulnar loop (53.5%) and whorl (38%) in diabetics than controls, arches (6.5%) and radial loop (2%) pattern are decrease in type-2 DM than controls.[13]Waite cited Arefin reported the sequence of frequencies of patterns on 2000 British DM patients and found the sequence of frequencies was ulnar loop, whorl, arch then radial loop.[14] Devi and Ahmed studied 80 diabetics and 80 normal persons. They found ulnar loops shows dominance of all digit except digit I. whorls are chiefly confined to digit I, radial loops were present only in digit ii of Diabetics.[15]Ravindranathshowed an increase in ulnar and radial loop patterns in diabetics but a decrease in number of whorl pattern in diabetics as compared to controls.[16] Bandana Sachdev noticed arches; diabetics- 9.9%, controls- 3.6%, whorls; diabetics - 32 %, controls-59 %, loop; diabetics- 57 %, controls-37 %. Diabetics had significantly lower arches than controls.[17] Manoj Kumar Sharma observed arches; diabetics-5.2%, controls- 4.35%, whorls; diabetics- 47 %, controls-37 %, loops; diabetics- 48%, controls-57 % & it was statistically significant.[6]Nayek et.al worked on 100 NIDDM and 100 controls, they showed whorls pattern are significantly lower in diabetics than control.[4] Cummins and Midlo cited Arefin worked on 5000 American, They reported the decreasing order of sequence

of occurrence of patterns being ulnar loop followed by Whorl, radial loop and then arch from higher to lower frequencies which contradicts with the present study.[2]Sengupta worked on Indian diabetic patients and found that in diabetes mellitus patients, whorls were comparably more than loops.[18]Many authors observed a tendency towards higher whorl frequency in Indian people, including Bangladeshi.[13]The ethnic heterogenecity or limited population samples under study could be the cause of this variation in pattern sequence. Unfortunately, this study only used a small sample size from one particular center. Therefore, the author would like to suggest, conducting additional multi-center research.

Conclusion:

According to this study, there was a notable variation in the finger ridge pattern between the control group and those with type II DM. While an individual's diabetics showed a slightly greater rise in the whorl and ulnar loop than normal individuals, but a lower distribution of the arch and radial loop patterns compared to controls. So, this study findings suggest that future mass screening programmes for type II DM may benefit from an analysis of finger ridge pattern.

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