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ORIGINAL ARTICLE

Palmar dermatoglyphic traits in type 2 diabetes mellitus patients of Bengalee Hindu caste population of West Bengal, India: a cross-sectional study

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ABSTRACT

Background
Dermatoglyphics is frequently used in understanding the proximity with non-communicable diseases including diabetes mellitus. Diabetes mellitus is one of the most common non-communicable diseases all over the world. The present study is an attempt to understand the association of palmer dermatoglyphic traits [i.e. a-b ridge count (ABRC), c-d ridge count (CDRC), presence of multiple number of axial triradii (t, t' & t") in a single palm, td ridge count (TDRC), atd angle, btd angle and ctd angle] with type 2 diabetes mellitus (T2DM).

Material and methods
Subjects included 30 clinically diagnosed adult female T2DM patients and 60 healthy controls from the Bengalee Hindu Caste population of West Bengal, India. Bilateral palm prints were collected following standard ink and roller method.

Results
Present study revealed that T2DM patients have significantly ($p<0.05$) lower ABRC, CDRC and TDRC. On the other hand, significantly ($p<0.05$) higher presence of multiple number of axial triradii t, t' & t" was found in the palm of T2DM patients compared to the controls. T2DM patients also demonstrated significantly ($p<0.05$) higher values of atd and btd angle. However, T2DM patients demonstrated significantly ($p<0.05$) lower value of ctd angle than that of controls, only when both hand were considered.

Conclusion
The results the present study indicated that dermatoglyphic traits may be used for early identification of at risk individuals for surveillance with a view to prevent the disease onset.

Keywords
Dermatoglyphics, Palmar Ridge Counts, Axial Triradii, Palmar Angles, Type 2 Diabetes Mellitus, Bengalee Population, India.

Introduction:

Dermatoglyphic traits played an informative role in prognosis of several pathological disorders were well documented [1]. Dermal patterns were fully formed within the 7th -24th week of gestation and being unaltered throughout the life of an individual [2, 3]. Dermatoglyphic characters were strongly determined by heredity and commonly used in clinical diagnosis of medical disorders [1, 4]. The similar type of peculiar dermal configurations can occur both in normal and abnormal subjects in a different frequencies [5]. Earlier studies proved the strong proximity between the dermatoglyphics patterns and chromosomal aberrations like as, Down's syndrome, Klinefelter's syndrome, Turner syndrome, Cri-du-chat syndrome, Fragile X syndrome and Autism [1, 6-19]. Additionally, dermatoglyphics has also been subject matter of several studies on complex and non-communicable disease like Breast Cancer, and E-β thalassemia [20-23]. According to the world health organization (WHO) (2002) non-communicable diseases accounted for almost 60% of the world wildmortality and 46% of the global burden of disease in the year of 2000, and by the year 2020, it is estimated that non-communicable diseases would cause 73% of the global deaths and 60% of the global prevalence of the disease. Diabetes mellitus is one of the most common non-communicable diseases globally [24].There are two major forms of diabetes mellitus, namely type 1 diabetes mellitus and type 2 diabetes mellitus (T2DM). T2DM accounts for about 90 to 95% of those with diabetes and includes individuals who have insulin resistance and usually have relative (rather than absolute) insulin deficiency [25]. Countrywide ranking on people with diabetes revealed that India, the diabetes capital of the world, occupies the highest position with 31.7 million diabetic people in the year 2000 and it will be about 79.4 million in the year 2030 [24, 26].According to the National Urban Survey Report, Kolkata (Eastern India) have 11.7 percent national burden of the disease diabetes mellitus in India, among all the metropolitan cities[27].It was also observed that individuals with family history of diabetes and who belongs to certain ethnic group had a higher risk of developing diabetes, and thus indicated significant genetic influences [28,29]. Apart from the detection of chromosomal and congenital aberrations several dermatoglyphic studies also proved the relation of unusual dermatoglyphic traits with diabetes mellitus [30-35]. However, very fewworks have been reported on T2DM patients, especially in context of Eastern India [36-40].In addition to those, present study was incorporated a-b ridge count (ABRC), c-d ridge count (CDRC), presence of multiple number of axial triradii (t, t' & t") on the same palm, td ridge count (TDRC), atd angle, btd angle and ctd angle to understand the relation between dermatoglyphics and T2DM.

Material and methods

The present cross sectional study was conducted in adult Bengalee Hindu caste population of Kolkata, West Bengal, India.

The study period was from June, 2015 to Aug, 2015. Present study included thirty clinically diagnosed adult T2DM female patients and sixty controls without having any family history of T2DM. The ratio of cases to controls included in the analysis was 1:2. The response rate was about ninety percent. Informed consent was obtained from the participants prior to this study.

For cases, women were excluded if they were insulin dependent diabetic patients, age below 40 years and if they had any genetic disorder. Women were also excluded if they had finger or hand deformities including oligodactyly and polydactyly, as well as presence of skin problems (eg. Burnt).

For controls, women were included if they had normal insulin level, age above 40 years, had no finger or hand deformities and skin problem, as well as had no family history (up to 3 generation) of diabetes mellitus.

Bilateral palm prints of every individual were collected (by P. GhoshDastidar) according to the standard ink and roller method by using black duplicating ink, rubber roller, glass and white paper[3]. Patients were asked to wash their both hands with soap and water before collecting print. Dermatoglyphic traits were classified according to Schaumann and Alter's classification [1].

The ABRC, CDRC and TDRC were computed by the countingof the in-between ridges, by drawing a straight line of a to b triradii on II interdigital area, c to dtriradii on IV inter digital area and distal axial triradii t or t' or t" on the Hypothenar area to triradiid on theV digital triradii of the palms. The palmar angles atd, btd & ctd formed by lines drawn from the digital triradius a, b & c to the axial triradius end from that of t to the V digital triradius d. If the palms have multiple number of axial triradius t then the distal one was used to measure, those being named as t' and t". All the data were interpreted and analyzed in SPSS (version 16.0) for descriptive statistics and inferential statistics. Cut off value were set on 95% probability level.

Results

Table -1 Distribution of ABRC among the T2DM patien and controls (Mean ± SD)

ABRC	T2DM (n=30)	Control (n=60)
Left Hand	34.20±2.91*	39.28±4.76
Right Har	31.70±3.11*	36.37±5.08
Both Han	32.95±3.24*	37.82±5.12

*p<0.05

Table 1 revealed significantly (p<0.05) lower ABRC in the left, right and both hands of the T2DM patients than that of controls. However,

Table -2 Distribution of CDRC among the T2DM patien and controls (Mean ± SD)

CDRC	T2DM (n=30)	Control (n=60)
Left Hand	24.13±17.20*	34.67±9.06
Right Hand	24.00±16.74*	34.02±8.91
Both Hand	24.07±16.83*	34.34±8.96

*p<0.05

table 2 demonstrated that T2DM patients have significantly (p<0.05) lower CDRC in comparison to the controls.

Table -3 Distribution of the palmar axial triradiit among the T2DM patients and controls

Palmar Axial Triradii		t%	t'%	t"%	χ2 value (2df)
Left Hand	T2DM (n=30)	22 (73.34)	4 (13.33)	4 (13.33)	9.286*#
	Control (n=60)	55 (91.67)	5 (8.33)	0 (0.00)	
Right Hand	T2DM (n=30)	20 (66.67)	8(26.67)	2 (6.66)	13.177*#
	Control (n=60)	57 (95.00)	2 (3.33)	1 (1.67)	
Both Hand	T2DM (n=60)	42 (70.00)	12(20.00)	6(10.00)	18.794*#
	Control (n=120)	112(93.34)	7(5.83)	1 (0.83)	

*p<0.05; #Yate's correction

Table 3 revealed significantly (p<0.05) higher occurrence of multiple number of axial triradii (*t*, *t'* &*t"*) in a single palms on the left and right as well as in both hands among the T2DM patients than that of controls.

Table -4 Distribution of TDRC (td ridge count) among the T2DM patients and controls

TDRC	T2DM (n=30) Mean ± SD	Control (n=60) Mean ± SD
Left Hand	88.50±24.07*	98.12±14.16
Right Hand	82.03±28.02*	96.30±15.28
Both Hand	85.27±26.10*	97.21±14.71

*p<0.05

However, table 4 showed significantly (p<0.05) lower TDRC among T2DM patients compared to the controls.

Table -5 Distribution of atd angle among the T2DM patients and controls

atd Angle	T2DM (n=30) Mean ± SD	Control (n=60) Mean ± SD
Left Hand	48.37±13.22*	42.98±5.41
Right Hand	49.23±15.49*	43.12±7.17
Both Hand	48.30±14.28*	43.05±6.33

Table - 6 Distribution of btdangle among the T2DM patients and controls (Mean ± SD)

btd Aangle	T2DM (n=30)	Control (n=60)
Left Hand	29.13±9.48*	25.72±3.48
Right Hand	30.83±11.22*	26.70±4.85
Both Hand	29.98±10.33*	26.21±4.23

*p<0.05

Table 7 distribution of ctd angle among the T2DM patients and controls

ctd Angle	T2DM (n=30) Mean ± SD	Control (n=60) Mean ± SD
Left Hand	12.79±10.96	15.88±4.64
Right Hand	13.90±11.74	15.83±5.35
Both Hand	13.33±11.29*	15.86±4.96

*p<0.05

Comparison of atd (Table 5) and btd (Table 6) angle revealed significantly (p<0.05) higher values in T2DM patients than that of controls. However, there was no significant (p>0.05) difference in ctd angle on the left and right hand between T2DM patients and controls. But in combination of the both hands T2DM patients have found significantly (p<0.05) lower ctd angle than that of controls.

Discussion

The occurrence of unusual dermatoglyphic traits was frequently used as clinical marker of several pathological disorders [1]. Earlier studies were already proved the association of dermatoglyphic traits and diabetics mellitus [30-34]. Apart from those, fewer dermatoglyphic investigations were reported on T2DM.Studiesdemonstrated higher frequency of ulnar loop, radial loop, composite, plain arch, hypothenar pattern, as well as polymorphic nature of palmar C line and higher presence of 4th interdigital pattern among the T2DM patients[39, 40]. Rakate et al. reported significantly

(p<0.05) lower ABRC in T2DM females and significantly (p<0.05) higher ABRC in T2DM males than that of control males and females[38]. Contrary to that, Sharma and Sharma demonstrated no significant difference in ABRC between diabetic patients and controls [34]. However, both studies revealed significantly (p<0.05) higher atd angle in diabetic patients than that of controls [34, 38]. Srivastava and Rajasekar also reported significantly (p<0.05) higher atd angle in diabetic patients [35]. Sharma and Sharma reported the presence of multiple axial triradiit, t' &t" in the same palm of the diabetic patients[34]. The TDRC (td ridge count) was another dermatoglyphic measure that provides an important supplement of atd angle to measure the proximity with chromosomal aberrations and medical disorders as well [41, 42].

However, to best of the knowledge, apart from the ABRC, atd angle and presence of multiple number of axial triradii, other dermatoglyphic traits which were included in the present study like, CDRC, TDRC, btd angle and ctd angle were not well documented. The results of present study revealed significantly (p<0.05) lower ABRC (Table 1), CDRC (Table 2) and TDRC (table 4) separately in both hands as well as in combination of both hands among the T2DM patients compared to the controls. Contrary to that, T2DM patients had significantly (p<0.05) higher occurrence of multiple number of palmar axial triradii t, t' & t" (Table 3), in same palm on their left and right hand as well as in combining both hands than that of controls. Moreover, the present study also revealed significantly (p<0.05) higher atd (Table 5) and btd angle (Table 6) among T2DM patients compared to controls. Interestingly, there were no significant differences in ctd angle (Table 7) between T2DM patients and controls in their left and right hand. However, when both hands were combined, significantly (p<0.05) lower value of ctd angle was found in the T2DM patients than that of controls.

Conclusion

In conclusion, dermatoglyphic traits in terms of higher values of ABRC, CDRC, TDRC, atd angle, btd angle, and lower value of ctd angle as well as the more occurrence of multiple number of axial triradii in a single palm as observed in the present study may be used as a screening tool to identify the persons who are at risk of developing T2DM. Because, early prediction and diagnosis of patients for T2DM may improve the treatment result and prevent further complications. However, one of the limitations of the present study is the small sample size. More studies are needed in larger sample for effective prevention strategies.

Competing interests

Authors declared that they do not have any competing interest.

Authors' contribution

All authors have equally contribution for this study, including study design, manuscript write up, statistical analysis and revision. All authors critically revised and approved the final manuscript.

Acknowledgments

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Abbreviations

a-b ridge count (ABRC), c-d ridge count (CDRC), td ridge count (TDRC), type 2 diabetes mellitus (T2DM), world health organization (WHO)

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