Dermatoglyphics Study of Parameters Like Axial Triradii in Diabetes Mellitus

Bichitrananda Roul¹, Sadananda Rath², Mamita Nayak³

¹Associate Professor, Department of Anatomy, Fakir Mohan Medical College and Hospital, Balasore, Odisha. ²Professor and HOD, Department of Anatomy, MKCG Medical College, Berhampur, Odisha. ³Assistant Professor, Department of Pathology, AHRCC, Cuttack, Odisha.

ABSTRACT

BACKGROUND
It is widely accepted that the dermal ridges develop during early foetal life & are constant (stable) throughout life, unique to the individual & therefore significant as a means of identification. It is proved that dermatoglyphics is of polygenic inheritance & like many other hereditary characters show racial & social variations. An attempt has been made to create a data base of the dermatoglyphic patterns among the diabetics of southern Orissa which may be helpful in early prediction of the disease & thus prevents its complications.

METHODS
Fifty male diabetic patients diagnosed with insulin dependent diabetes mellitus (Type-1), of age ranging from 25 to 40 years and fifty cases of normal controls of similar age group were included in this study. Similarly fifty patients, diagnosed as cases of non-insulin dependent type of diabetes mellitus (Type-2), of age more than 40 years and fifty three cases of normal controls of similar age group without family history of diabetes, of either type-1 or type-2 up to two previous generations, were studied and analysed in this study. Fifty female diabetic patients diagnosed as IDDM cases, of age ranging from 25 to 40 years and fifty cases of normal controls of similar age group and fifty female diabetic patients of Type-2 variety (NIDDM) and fifty female controls of age group more than 40 years were included in this study.

RESULTS
The palm prints of the control & patients were taken & studied for Axial triradii (the most useful indicator that has been elaborately studied in the subjects from southern Orissa). This parameter showed a high level of significance in comparison to the other parameters. Observations revealed that the maximum percentage of patterns were those of t’ & t”.

CONCLUSIONS
The axial triradius t also proved to be the most reliable and significant parameter in case of the NIDDM patients irrespective of sex. Both males and females diagnosed as cases of non-insulin dependent diabetes possessed either t’ or t” on their palms irrespective of the side of the hands.

KEYWORDS
Dermatoglyphics, Axial Triradii
BACKGROUND

It is widely accepted that the dermal ridges develop during the early foetal life & are constant (stable) throughout life, unique to the individual & therefore significant as a means of identification. It is proved that dermatoglyphics is of polygenic inheritance & like many other hereditary characters show racial & social variations. The dermal ridges develop during 2nd to 4th week of foetal life & fully formed by the 14th week of foetal development. Therefore any environmental factor influencing the development of finger ridges during the process of foetal growth amount to an increase familial prevalence of dermatoglyphic variations in the individual. It is clinically significant as certain specific dermatoglyphic pattern indicates some serious developmental anomalies due to chromosomal & environmental factors.

Cummins & Midlo (1947), mentioned the significance of fingerprint in the diseases like mongolism, schizophrenia, neurofibromatosis, psoriasis, epilepsy & congenital abnormalities such as polydactyly & spina bifida. Hale et al (1961), reported the dermatoglyphics changes in congenital heart disease & Klinefelter syndrome by Holt (1963), Turner syndrome by Holt & Lindstern (1964), trisomy 17 & 18 by Uchida et al (1962) & Pen Rose 1963. On the basis of following conditions exhibiting unusual pattern frequencies we sought to determine, whether dermatoglyphics could be employed as a prediction index for Diabetes mellitus.

According to Harrison's principle of internal medicine (2011), Diabetes mellitus is classified broadly in to four types:

1. Type – I- DM (IDDM),
2. Type – II – DM (NIDDM)
3. Type –III- DM (Gestational diabetes mellitus)
4. Type – IV –DM (Other specific types)

Out of the four types we have taken Type - I & Type - II diabetes mellitus into consideration in our elaborate research work on Diabetes. An attempt has been made to create a data base of the dermatoglyphic pattern among the diabetics of southern Orissa which may become helpful for the early prediction of the disease & thus prevents its complications.

METHODS

Fifty male diabetic patients, diagnosed as cases of insulin dependent diabetes mellitus (Type-1), of age ranging from 25 to 40 years and fifty cases of normal controls of similar age group were included in this study. Similarly fifty patients, diagnosed as cases of non-insulin dependent type of diabetes mellitus (Type-2), of age more than 40 years and fifty cases of normal controls of similar age group without family history of diabetes, of either type-1 or type-2 up to two previous generations, were studied and analysed in this study. Fifty female diabetic patients diagnosed as IDDM cases, of age ranging from 25 to 40 years and fifty cases of normal controls of similar age group and fifty female diabetic patients of Type-2 variety (NIDDM) and fifty female controls of age group more than 40 years were included in this study.

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Type of Cases</th>
<th>No. of Cases</th>
<th>Age</th>
<th>Source of Selection</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Type-1 Diabetics</td>
<td>100</td>
<td>25 to 40 years</td>
<td>Outdoor and Indoor diabetic patients attending department of Medicine, M.K.C.G Medical College, Berhampur and diagnosed patients of diabetes mellitus among people of district Ganjam.</td>
</tr>
<tr>
<td>2.</td>
<td>Type-2 Diabetics</td>
<td>100</td>
<td>More than 40 years</td>
<td>Medical students and Local people of Southern Odisha, without family history of diabetes mellitus</td>
</tr>
<tr>
<td>3.</td>
<td>Controls</td>
<td>100</td>
<td>25 to 40 years</td>
<td>Diabetics of southern Orissa were selected for the present study. Care has been taken to include one patient from one family and it was ensured that, the patients did not have relation with each other. Only those patients with definite clinical features of diabetes mellitus of either Type-1 or Type-2 and investigated accurately with their glucose tolerance tests well analysed and diagnosed and established according to the criteria of the National Diabetes Data Group, were selected for the study. Cases of doubtful or dubious diagnosis, were kept out of purview of the study. For the patient, associated diseases, congenital abnormalities and as far as possible, diseases producing dermatoglyphic changes other than diabetes were ruled out. The finger and palmar prints of the diagnosed groups of either Type-1 or Type-2 diabetics with regard to sex and family history of diabetes of either type were compared with the control group. Normal controls (100 in number) of both sex(50 males &amp; 50 females) belonging to Ganjam district, of age between 25 years to 40 years, without any known family history of diabetes mellitus of either Type 1 or Type II, or any other congenital or hereditary illness were selected as control group. Similarly 100 normal controls of both sex (50 males &amp; 50 females) of the same geographic region of southern Orissa aged more than 40 years were chosen for the study.</td>
</tr>
<tr>
<td>4.</td>
<td>Controls</td>
<td>100</td>
<td>More than 40 years</td>
<td>Finger and palm prints of the diagnosed groups of either Type-1 or Type-2 diabetics were used with regard to sex and family history of diabetes of either type were compared with the control group.</td>
</tr>
</tbody>
</table>

The cases were selected, from the patients diagnosed as cases of diabetes mellitus, from the same geographic region attending outdoor and indoor of the department of Medicine of M.K.C.G Medical College, Berhampur during the period from June 2009 to June 2011. Each patient and control was subjected to through history taking, treatment history and family history. Presence or absence of family history of the patient was ascertained, by detail interview with family members and cross checking of clinical records. Patients from Ganjam district of southern Orissa were selected for the present study. Care has been taken to include one patient from one family and it was ensured that, the patients did not have relation with each other. Only those patients with definite clinical features of diabetes mellitus of either Type-1 or Type-2 and investigated accurately with their glucose tolerance tests well analysed and diagnosed and established according to the criteria of the National Diabetes Data Group, were selected for the study. Cases of doubtful or dubious diagnosis, were kept out of purview of the study. For the patient, associated diseases, congenital abnormalities and as far as possible, diseases producing dermatoglyphic changes other than diabetes were ruled out. The finger and palmar prints of the diagnosed groups of either Type-1 or Type-2 diabetics with regard to sex and family history of diabetes of either type were compared with the control group.

Normal controls (100 in number) of both sex(50 males & 50 females) belonging to Ganjam district, of age between 25 years to 40 years, without any known family history of diabetes mellitus of either Type 1 or Type II, or any other congenital or hereditary illness were selected as control group. Similarly 100 normal controls of both sex (50 males & 50 females) of the same geographic region of southern Orissa aged more than 40 years were chosen for the study.

Procedure for Obtaining Fingerprints

Finger and palm prints were obtained by using the "ink and pad" technique as described in the standard book “Practical Finger Printing” by B. C. Bridges (1963) - (a) Positioning of the mounting Sunmika Glass and paper.
be held out of the way while the palm is being printed, either voluntarily by the patient or by an assistant. The number on the roller allows the paper to conform to the shape of the palmar surface, ensuring that all parts of the surface are recorded. The completed print was removed from the roller. The second hand was printed in a similar fashion, using the other half of the quarto sheet. The remaining ink on the palms and fingers was removed by means of ether and then soap and water.\(^1\)

**Parameter Evaluated**

Axial Triradii of the Palm ("T")

---

### Results

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Males</th>
<th>Females</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Diabetic</td>
<td>Control</td>
</tr>
<tr>
<td>Tri-axial Radius I</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LH t</td>
<td>7(15.6%)</td>
<td>29(68.8%)</td>
</tr>
<tr>
<td>LH t’</td>
<td>32(67.8%)</td>
<td>14(32.2%)</td>
</tr>
<tr>
<td>LH t”</td>
<td>11(23.5%)</td>
<td>7(19.6%)</td>
</tr>
</tbody>
</table>

Table 2. Frequency Distribution of Axial Triradii in Palms of Left Hands of Type-1 (Insulin Dependent) Diabetes Mellitus Cases and Normal Controls

It can be observed from the above table that the frequency distribution of the different types of t i.e. the axial triradii observed in left palms of 50 Type-1 diabetic males are compared with the frequency distribution of the different types of t observed in 50 normal male controls of their left palms and of similar age and racial distribution. Similarly the frequency distribution of the different types of t observed in the left palms of 50 insulin dependent diabetic females has been noted down in comparison with that of 50 normal female controls. It has been shown that the parameter t is found in 11.2% of male diabetics and in 15.5% of female diabetics in comparison to 59.7% in normal male controls and in 69% of normal female controls respectively.

The parameter t’ has been shown to be observed in 62.9% of male diabetics and 50.6% of female diabetics of insulin dependent type in comparison to 27.8% and 23.0% of male and female controls respectively. The parameters t” has been shown to be seen in 25.8% of male diabetics and 33.7% of female diabetics in comparison to 12.3% and 7.9% of male and female controls.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Males</th>
<th>Females</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Diabetic</td>
<td>Control</td>
</tr>
<tr>
<td>Tri-Axial Radius I</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RH t</td>
<td>5(10.0%)</td>
<td>35(70.0%)</td>
</tr>
<tr>
<td>RH t’</td>
<td>35(70.0%)</td>
<td>11(22.0%)</td>
</tr>
<tr>
<td>RH t”</td>
<td>10(20.0%)</td>
<td>4(8.0%)</td>
</tr>
</tbody>
</table>

Table 3a. Frequency Distribution of Axial Triradii in Palms of Left Hands of Type-1 (Insulin Dependent Diabetes Mellitus) Cases and Normal Controls

This table indicates that the parameter t is seen in maximum number of normal controls of either sex. Larger percentage of both male and female diabetics have the parameter t’ on their left palms in comparison to their
respective controls. Also, a reasonable number of cases diagnosed as Diabetes Mellitus of insulin dependent type have been noted to possess the parameter $t''$ in comparison to a smaller number of controls of both sexes. The level of significance being 0.1% in both sexes measured by the Chi-square test method.

This table indicated the frequency distribution of different types of observed in right palms of 50 male cases of type I DM and 50 female cases of Type-1 DM of age between 25 to 40 years in comparison to those of 50 male and 50 female controls respectively of similar age groups and from same geographical and racial origin.

The parameter $t$ has been observed in 5 cases of male diabetics out of 50 cases examined and in 11 cases of female diabetics out of 50 cases with a level of percentage being 10.0% and 20.7% respectively. While 35 normal males and 30 normal females possessed on their right palms out of a total of 50 male controls and 50 female controls. The parameter $t'$ has been observed in 35 cases of male diabetic’s i.e. in 69.6 in comparison to 22.6% of male controls i.e. in 11 normal controls out of 50 normal samples taken into consideration. $t'$ has been observed in a higher percentage of female diabetics i.e. 51.9% in comparison to 30.9% of female controls.

The parameter $t''$ has been observed in higher percentage of male and female diabetics in comparison to controls. Thus 20.2% of male diabetics and 27.2% of female diabetics possessed $t''$ in their right palms in comparison to 7.2% and 9.7% of controls. The level of significant difference being 0.1% in both the groups. The level of significance has been obtained by the Chi-square test method taking each group into consideration.

The above table provides information about the percentage of different types of $t$, i.e. the axial triradii observed in the palms of the left hands of 50 Type-2 male diabetics and 50 Type-2 female diabetics in comparison to 50 normal male controls and 50 normal female controls of similar age race and geographical distribution.

It has observed that the parameter is found in 22.3% cases of male diabetics and in 21.2% cases of female diabetics of Type-2 variety in comparison to 64.5% cases of normal male controls and 70.4% of normal female controls respectively Similarly the parameter $t''$ is seen in 63.3% of male diabetics and 68.5% cases of female diabetics but only 25.8% of normal male controls and 23.4% of normal female controls have $t'$ in their left palms.

But the parameter $t''$ is found in only 14.2% cases of male diabetics in comparison to 10% male controls while only 10% cases of female diabetics and 6.1% normal female controls show $t''$ in the palms of their left hands.

Thus, this table indicated that the parameter $t$ is seen in maximum number of normal controls of either sex and $t'$ is seen in maximum number of male diabetics. But $t''$ is seen in very few cases of diabetics of both sexes and least seen in the controls. Still then it is observed that a higher percentage of the diabetics both males and females possess $t'$ and $t''$ on their left palms in comparison to the controls. The level of significance being 0.1% in both the groups obtained by measuring the $P$-value from the Chi-square test method.

This table depicts the facts about the different percentages of parameters $t$, $t'$ & $t''$ seen in the palms of the right hands of 50 male and 50 female diabetics of non-insulin dependent type and their comparisons with the 50 male and 50 female controls of age more than 40 years and of same race and from similar geographical region.

It has been observed that the parameter $t$ is found in 19.6% cases of male diabetics and in 24.0% female diabetics in comparisons to 68.8% and 60.2% of normal male and female controls respectively.

The parameter $t'$ is observed in 67.8% of male diabetics in comparison to 23.6% of normal male controls 59.2% of female diabetics in comparison to 31.6% of normal female controls.

The quantitate parameter $t''$ is found in 12.5% cases of male diabetics and in 16.6% cases of female diabetics in comparison to 7.5% of male normal controls and 8.1% of normal female controls respectively.

Thus the parameter $t''$ is found in less number of diabetics of both sexes and still less in the controls of both sexes. While $t'$ is found in maximum number of diabetics both males and females and the parameter $t$ is found in maximum number of normal males and females. The table thus depicts the fact that greater number of Type-2 diabetics (both males and females) possess $t'$ and $t''$ in their right palms in comparison to their normal controls.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Males</th>
<th></th>
<th></th>
<th>Females</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Tri-Axial Radius I</td>
<td>Diabetic</td>
<td>Control</td>
<td>Diabetic</td>
<td>Control</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LH $t$</td>
<td>11(22.3%)</td>
<td>12(24.5%)</td>
<td>11(21.2%)</td>
<td>13(25.8%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LH $t'$</td>
<td>32(63.3%)</td>
<td>33(65.5%)</td>
<td>34(68.5%)</td>
<td>36(70.4%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LH $t''$</td>
<td>7(14.2%)</td>
<td>5(10.0%)</td>
<td>5(10.2%)</td>
<td>3(6.1%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>sample</td>
<td>50</td>
<td>50</td>
<td>50</td>
<td>50</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P &lt; 0.001</td>
<td>P &lt; 0.001</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Table 3b. Frequency Distribution Tri-Axial in the Palms of Left Hands of Type-2 Non-Insulin Dependent Diabetics and Normal Controls*
From the above data mentioned the P value was deduced by Chi-square Test method which indicated that the level of significant differences was 0.1% in both the groups.

DISCUSSION

Several authors have studied the dermatoglyphics in diabetes mellitus but have not mentioned the type of diabetes mellitus in accordance with the age of onset of the disease and very few literatures are available regarding the study of dermal ridges in non-insulin dependent diabetics.

Axial Triradii

This parameter has been studied vividly by the various authors indicating that I is reliable parameter regarding the detections of pre-diabetics indicating that diabetic individuals exhibited higher frequency of t´ & t" that t-triradii right- p= 0.0001, left- p=0.0001. Similar observations have been stated by Chakravarthi[2] that higher frequency of t" triradii are observed in diabetics than controls. Vomita[10] also reported a higher frequency of t" in diabetics. B.Richards[8] also denoted a higher frequency of t´ & t" in type-1 diabetics. All these findings are corroborative with the observations recorded in the tables-3a, 3b, 3c where the parameter has been analysed in both left and right palms of both Type-1 and Type-2 diabetics.

CONCLUSIONS

Axial triradius is the most useful indicator that has been elaborately studied in subjects selected from Western Orissa. This parameter showed a high level of significance in comparison to other parameters. Observation revealed that the maximum percentage of t´ & t" were found in the diabetics both male and female irrespective of the side of the hand studied. A higher percentage of the Type-1 diabetics possessed t´ in their palms i.e. the axial triradius in the palm was present at a distance of more than 40% of the total palm length (measured from distal wrist crease to the proximal crease at the base of third digit). This corroborates with S. Mandasescu, B. Richards and other authors like A. Zeigler, R. Mathies,[11] who indicated that the position of axial triradius could be the single most useful indicator for possessed t´ than the Type-2 diabetics, but there was no significant difference between the Type-1 and Type-2 diabetics regarding the t´ parameter. Using this information, it is possible to produce the following diagnostic statements. If position is t, then diagnosis is "probably normal". If position is t', then diagnosis is "probably diabetic". If position is t", then diagnosis is "probably type-2 diabetic".

The axial triradius t also proved to be the most reliable and significant parameter in case of the NIDDM patients irrespective of sex. Both males and females diagnosed as cases of non-insulin dependent diabetics possessed either t´ or t" on their palms irrespective of the side of the hands i.e. whether right or left. The normal controls possessed t’ or t" or t on their palms but in lesser number of diabetics. 16 cases out of 112 cases of male diabetics possessed t" in their left palms while 18.7% of male diabetics possessed t" in their right palms. But a greater percentage of female diabetics possessed t’ in their left palms. The t" was also present in only 16.6% of female diabetics in their right palms The Type-2 male diabetics possessed t’ or t" in lesser percentage than their Type-1 counterparts. But a greater percentage of Type-2 female diabetics possessed t” in comparison to their Type-1 female counterparts. Thus, the presence of t’ or t" on the palm of either hand indicated that the subject is prone for diabetes mellitus.

ACKNOWLEDGEMENT

The authors thank to Dr. Niharika Padhy, Associate Professor, Anatomy, MKCG Medical College & Dr Madhusmita Panda, Associate Professor, Anatomy, SCB Medical College, for their guidance during this research work.

REFERENCES