

# Comparative Study of Dermatoglyphic Patterns of Diabetes Mellitus and Diabetic with Hypertension Patients of Hilly Region

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## Abstract

**Introduction:** The study of dermatoglyphics patterns on the digital and palmar region and its association with various diseases, especially having genetic causes, has been reported by various workers in the past. Recently, the number of patients with diabetes and hypertension (HTN) have strikingly increased in the most countries. The prevalence of HTN in patients with Type 2 diabetes is known to be 1.5-3 times higher than in the age-matched non-diabetic population.

**Materials and Methods:** A total of 100 Type 2 diabetic patients (50 males and 50 females) were compared with 100 diabetics with HTN patients. Dermatoglyphics patterns atd, dat, adt angles, absolute finger ridge count (AFRC), total finger ridge count (TFRC), a-b ridge count, main line index, and pattern index line were studied.

**Results:** The mean values of TFRC and AFRC were higher in male and lower in female diabetic group than diabetic with HTN group. The mean values of a-b ridge count were lower in male and higher in female in comparison to diabetic with HTN group, and a significant difference was found. The mean values of atd and adt were higher in diabetic group than diabetic with HTN group.

**Conclusion:** Dermatoglyphics provide a simple, inexpensive, anatomical, and non-invasive means of determining the diseases which have a strong hereditary basis and can be employed as a method of screening for diabetes mellitus of high-risk population on early detection, thus reducing the morbidity and mortality.

**Key words:** Anatomical, Hypertension, Population, Significant

## INTRODUCTION

The term “dermatoglyphics” was coined by Cummins and Mildo in 1926 and was derived from the Greek words “derma” means skin and “glyphics” means carvings.<sup>1</sup> Each dermatoglyphic configuration is unique. They are genetically determined and influenced by physical, topographical and environmental factors. The peculiar patterns of the epidermal ridges serve as a diagnostic

tool in a number of diseases that have a strong hereditary background. Diabetes mellitus (DM) is one such disease with a strong genetic basis and certain dermatoglyphic variations are expected in DM.<sup>2</sup> DM and hypertension (HTN) are two of the most common diseases in westernized industrialized civilizations and the frequency of both diseases increases with increasing age. The prevalence of HTN in diabetic individuals appears to be approximately two-fold that in the non-diabetic population. It markedly enhances development of macrovascular and microvascular diseases in these individuals. Both DM and HTN are major independent risk factors for accelerated atherosclerosis and ischemic heart disease. The relevance of dermatoglyphics is not to diagnose, but to prevent by predicting a disease, not for defining an existing disease, but to identify people with the genetic predisposition to develop certain diseases.<sup>3</sup>

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## MATERIALS AND METHODS

The present study was performed out in the Department of Anatomy, Sikkim Manipal Institute of Medical Sciences, Gangtok, Sikkim from July 2013 to Jan 2015. Prints of 100 patients (50 males and 50 females) diagnosed with DM and diabetic with HTN were taken; their age group ranges from 21 to 80 years. An equal number of males and females were selected in cases to avoid the bias of sex in the result. All were clinically diagnosed and confirmed by investigations as diabetic and diabetic with HTN patients without any special genetic disease that could affect their dermatoglyphic patterns. The ethical clearance was obtained from the Institutional Ethics Committee prior to this study, and informed consent was informed from the participants.

### Materials Required

Black duplicating inks, ink pad, white paper, magnifying hand lens, cotton puffs, scale, pencil pen, protractor - to measure atd angle and needle with a sharp point for ridge counting.

### Procedure

Dermatoglyphics prints were taken by the “Ink Method” as described by Cummins<sup>4</sup> and Cummins and Mildo.<sup>5</sup> Patients were asked to wash both their hands with soap and water, so as to remove any oil or dirt. The duplicating ink is smeared on both hands uniformly over the palm and digits taking care that hollow of the palm and the flexor creases of the wrist were uniformly inked. The hand of the patient was then placed on the bond paper from proximal to distal end. The palm was gently pressed between intermetacarpal grooves at the root of fingers and on the dorsal side corresponding to thenar and hypothenar regions. The palm was then lifted from the paper in reverse order, from distal to proximal end. The fingers were also printed below the palmar print by rolled fingerprint method. The tips of the fingers were rolled from radial to ulnar side to include all the patterns. The procedure was repeated with the other hand on a separate paper. The prints were then subjected for detail dermatoglyphic analysis with the help of magnifying hand lens, and ridge counting was done with the help of a sharp needle.

## RESULTS AND OBSERVATION

The mean values of total finger ridge count (TFRC) and absolute finger ridge count (AFRC) were higher in male diabetic patients and lower in female diabetic patients than diabetic with HTN patients. No significant difference was found (Table 1). Whereas, the mean values of a-b ridge count were lower in male diabetic and higher in female

diabetic than diabetic with HTN patients. A significant difference was found in the right hand of females (Table 2 and Figures 1 and 2).

The mean values of atd angle were higher in diabetic group than diabetic with HTN group except in left hand of male. The mean values of dat angle were lower in right hands and higher in left hands of diabetic group than diabetic with

**Table 1: Comparison of TFRC and AFRC in DM and DM+HTN patients group**

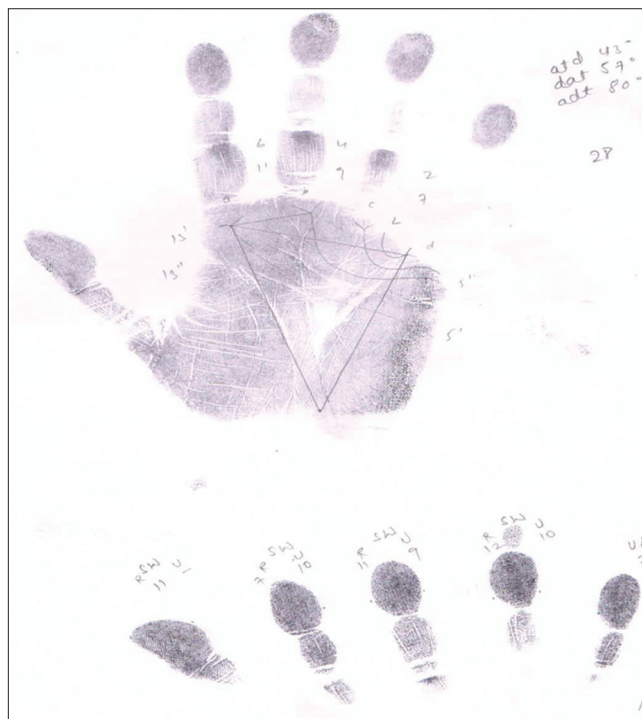
Parameters	Mean±SD			
	TFRC		AFRC	
	Male	Female	Male	Female
DM	87.54±19.88	81.76±29.36	116.36±34.90	104.20±45.78
DM+HTN	83.12±30.73	84.34±28.99	110.38±49.61	115.40±53.32
P value	0.324	0.585	0.438	0.226

DM: Diabetes mellitus, HTN: Hypertensive, TFRC: Total finger ridge count, AFRC: Absolute finger ridge count, SD: Standard deviation

**Table 2: Comparison of a-b ridge counts of both hands of DM and DM+HTM groups**

Parameters	Mean±SD			
	Right a-b ridge count		Left a-b ridge count	
	Male	Female	Male	Female
DM	20.54±8.14	21.46±8.52	20.68±7.31	21.22±8.83
Control	21.24±7.29	19.36±5.95	21.76±7.70	20.38±5.75
P value	0.539	0.049	0.388	0.468

DM: Diabetes mellitus, HTN: Hypertensive, SD: Standard deviation



**Figure 1: Dermatoglyphics patterns of right hand of diabetic group patient**

HTN group. The mean values of adt angle were higher in males and lower in female's diabetic group than diabetic with HTN group. No significant difference was found (Table 3 and Figures 1 and 2).

In right hands, the mean values of fingertip ridge counts were lower in all digits except in 2<sup>nd</sup>, 4<sup>th</sup>, and 5<sup>th</sup> digits in male than diabetic with HTN group. In left hands, the mean values of fingertip ridge counts were lower in all digits of diabetic group than diabetic with HTN group except in 2<sup>nd</sup>, 4<sup>th</sup> and 5<sup>th</sup> digits. No significant difference was found (Table 4).

The mean values of pattern intensity index were higher in males and lower in females of diabetic group than diabetic with HTN group. No significant difference was found (Table 5).

The mean values of main line index were higher in right hands of male and left hands of females of diabetic group than diabetic with HTN. No significant difference was found (Table 6).

The most frequently occurring main line formula was 11-9-7, 11-7-7, 9-7-5, and 7-5-5. However, less frequently

occurring types were categorized under "rest." In diabetic males, the 9-7-5 (30%) was predominant followed by 7-5-5 (25%), 11-9-7 and 11-7-7 while in diabetic with HTN males, the 7-5-5 (29%) was predominant followed by 9-7-5, 11-9-7 and 7-5-5. In diabetic females, the 9-7-5 (28%) was predominant followed by 7-5-5, 11-7-7 and 11-9-7 while in diabetic with HTN females, the 9-7-5 (32%) was predominant followed by 7-5-5, 11-7-7, and 11-9-7 (Table 7 and Figures 1 and 2).

In the present study, we observed an increase in ulnar loops in the right hand of male diabetic and decreased frequency in the left hand of male and in both hands of female diabetic. In diabetic with hypertensive (HTN) patients, the frequency of the ulnar loop pattern was found to be increased in both male and female cases (Figures 1 and 2).

**Table 3: Comparison of atd, dat and adt angles in the both hands of DM and DM+HTN groups**

Parameter	Group	Mean±SD			
		Male		Female	
		Right hand	Left hand	Right hand	Left hand
"atd" angle	DM	41.48±7.31	40.86±5.02	43.38±6.46	43.56±6.39
	DM+HTN	41.66±6.05	42.44±7.73	41.92±6.42	42.28±5.91
	P value	0.894	0.201	0.266	0.331
"dat" angle	DM	58.48±4.58	59.08±4.22	56.94±4.36	57.06±5.75
	DM+HTN	59.42±4.25	58.96±6.75	57.28±4.69	57.00±5.38
	P value	0.258	0.900	0.712	0.959
"adt" angle	DM	79.80±7.16	79.86±5.54	79.28±6.09	79.34±6.04
	DM+HTN	78.94±6.18	78.44±6.16	80.84±5.92	81.12±5.22
	P value	0.482	0.193	0.231	0.118

DM: Diabetes mellitus, HTN: Hypertensive, SD: Standard deviation



**Figure 2: Dermatoglyphics patterns of right hand of diabetic with hypertension group patient**

**Table 4: Comparison of fingertip ridge counts in the right hands of DM and DM+HTN groups**

Parameters	Groups	Right hand			Left hand		
		DM	DM+HTN	P value	DM	DM+HTN	P value
D1	Male	14.16±6.55	14.42±8.18	0.850	11.58±7.50	11.82±6.26	0.412
	Female	12.56±6.89	13.44±6.55	0.483	11.06±6.68	13.88±6.95	0.471
D2	Male	11.68±5.77	10.64±7.18	0.453	9.80±7.20	9.68±5.30	0.149
	Female	9.62±6.78	12.18±8.09	0.053	11.68±7.29	11.72±6.13	0.414
D3	Male	10.04±4.94	10.04±6.26	1.000	10.68±6.75	11.00±6.44	0.761
	Female	10.86±5.71	11.98±7.96	0.430	10.92±7.48	11.92±6.70	0.396
D4	Male	14.66±6.73	13.58±7.21	0.445	13.76±7.61	12.22±6.36	0.957
	Female	13.24±7.15	14.72±7.49	0.233	13.12±7.49	13.62±7.00	0.733
D5	Male	9.12±3.93	7.92±4.45	0.178	9.06±5.43	8.14±3.75	0.426
	Female	7.90±4.40	8.82±4.90	0.262	7.86±3.68	8.30±4.29	0.441

DM: Diabetes mellitus, HTN: Hypertensive

**Table 5: Comparison of pattern intensity index of both hands of DM and DM+HTN groups**

Parameters	Mean±SD			
	Right pattern intensity index		Left pattern intensity index	
	Male	Female	Male	Female
Diabetic	1.48±0.31	1.33±0.38	1.39±0.37	1.30±0.40
DM+HTN	1.40±0.38	1.42±0.39	1.30±0.46	1.38±0.40
P value	0.241	0.219	0.241	0.369

DM: Diabetes mellitus, HTN: Hypertensive, SD: Standard deviation

**Table 6: Comparison of MLI of both hands of DM and DM+HTN groups**

Parameters	Mean±SD			
	Right a-b ridge count		Left a-b ridge count	
	Male	Female	Male	Female
Diabetic	9.04±1.88	8.56±1.84	8.02±1.64	8.44±1.94
DM+HTN	8.80±1.86	8.86±1.94	8.24±1.82	8.18±1.74
P value	0.538	0.455	0.908	0.504

MLI: Main line index, DM: Diabetes mellitus, HTN: Hypertensive, SD: Standard deviation

**Table 7: Frequency of principal mainline formula**

Parameters	Groups	Principal mainline formula (%)					
		DM			DM+HTN		
		Right hand	Left hand	Right+ left	Right hand	Left hand	Right+ left
11-9-7	Male	28	8	18	16	8	12
	Female	10	12	11	20	6	13
11-7-7	Male	8	12	10	8	12	10
	Female	30	24	15	26	8	17
9-7-5	Male	26	34	30	26	28	27
	Female	12	18	28	26	38	32
7-5-5	Male	20	30	25	24	34	29
	Female	32	26	28	26	28	27
Rest	Male	18	16	17	26	18	22
	Female	16	20	18	22	20	21

DM: Diabetes mellitus, HTN: Hypertensive

## DISCUSSION

In the present study, we found increased frequency of ulnar loops in the right hand of diabetic patients which is similar to the studies of Ravindranath and Thomas, Chakravartii and decreased frequency of ulnar loops in left hand of diabetic male and both hands of diabetic female which is similar to results of Sant *et al.*<sup>6-8</sup> However, we found decrease in whorls in diabetic of both sexes similar to Ravindranath and Thomas.<sup>6</sup>

In the present study, the mean TFRC was higher in diabetic patients. This was consistent with the findings of Ahuja *et al.*, Iqbal *et al.* and Barta *et al.* (1970).<sup>9-11</sup> While the mean values of AFRC was decreased in diabetics similar to

Ravindranath and Thomas, Sarthak and Jina, and Burute *et al.*<sup>12,13</sup>

The present study has shown that the mean values of a-b ridge count were found lower in male diabetic and higher in female diabetic than control and significant in the case of females. This was similar to the findings of Ziegler *et al.*, Oladipo and Ogunnowo, whereas Tarca *et al.*, Dam *et al.*, Verbov found decrease a-b ridge count in diabetic patients.<sup>14-18</sup>

The present study showed the higher values of atd angle in diabetic group. Similar findings were reported by Ravindranath and Thomas, Sant *et al.*, Platilová *et al.* and Rajnigandha *et al.*, Sharma and Sharma, and Mittal and Lala.<sup>6,8,19-22</sup> The values of atd angle in the present study are very close to the findings of Ravindranath and Thomas, Sharma and Sharma, Mittal and Lala as compared to other authors findings.<sup>6,21,22</sup> The mean values of dat angle and adt angle showed lower values in the right hands and higher in left hands similar to the findings of Sharma and Sharma, and Mittal *et al.*<sup>21,22</sup> There was no previous literature found on the diabetic with HTN patients pattern study and hence our present findings could not be compared.

## CONCLUSION

The dermatoglyphic investigation is absolutely cost-effective and requires no hospitalization and it can help in predicting the phenotype of a possible future illness. This study would be helpful to formulate counseling messages based on dermatoglyphic pattern prevalent among young generation and their possible stimulation to determine the young people's likelihood to develop diabetes in their later age. It can be used for mass screening program for prevention of DM.

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