



A Study on Dermatoglyphic Patterns Among The Healthy and Hypertensive Bengali Population of Kolkata, West Bengal, India

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KEYWORDS

Dermatoglyphics,
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ABSTRACT

Dermatoglyphics is the analysis of fingerprints as a genetic marker used in disease prognosis and diagnosis. The present study is an endeavor to apprehend the relationship between palmar dermatoglyphics and the incidence of hypertension. The dermatoglyphic analysis was carried out among (81 hypertensives and 82 normal controls) of both sexes, using the black ink method. The hypertensive males had significantly ($p < 0.01$) higher incidence of whorls and low frequency of ulnar loops (left hand, right hand and both hands) when compared with their normal control groups. Consequently, when the hypertensives (sex combined) were in comparison with the normal control group, the frequency of whorls was significantly high ($p < 0.01$). A significant difference ($p < 0.01$) in the mean values (males) of AFRC and PII was noted between the hypertensives and the normal controls. Nevertheless there was no significant difference in the mean values of TFRC, "atd" angles and MLI. Therefore, dermatoglyphics can be considered as a simple, non-invasive and inexpensive technique which can be used as a screening tool for the prognosis of the disease, hypertension for the early identification and determination of the disease.

Introduction

Dermatoglyphics is a scientific ridge pattern analysis used to designate the pattern analysis used to designate the patterns formed by epidermal ridges where each pattern is unique. Once formed in intrauterine life, these will not change throughout the life but are strongly affected by genetic as well as environmental factors. Hypertension or high blood pressure is a multifunctional disease or a chronic cardiac medical condition which affects a large segment of the population. It is generally associated with aging & inherited genetic factors. Hypertension is asymptomatic in most cases but a positive family history will enhance the risk and is often considered as a serious health problem. It is an avoidable and controllable chronic disease that causes considerable mortality and morbidity, as well as organ damage (Can Huseyin et al, 2014). Hypertension (HTN) is one of the most important risk factors related to cardiovascular morbidity and mortality (Kilic Mahmut et al 2015).

Genetic predisposition is a factor considered in the diagnosis of hypertension and individuals with family history of this factor are more likely to develop the disease. Dermatoglyphics studies fingerprints as a genetic and fetal development marker. Therefore the study of the co-relation between dermatoglyphic and hypertension can help in early identification of people with the

genetic predisposition to develop hypertension (Deepa and Khan, 2009). Dermatoglyphic analysis of fingerprints includes the type of pattern, number of lines on the fingers (the number of ridges within the pattern), and the sum of patterns and total number of lines (Abramova et al 1995). The contributions of this technique serve as a prognostic tool in diagnosing different diseases and also in identifying adverse events in intrauterine development.

The three basic dermatoglyphic landmarks found on the fingertip patterns are Trivadii, cores and Radiant (Fig-1). The triradius in the meeting point of three ridges and the geometric center of the triradius is designated as a triradial point. A straight line is drawn from the triradial point to the core of the specific pattern. The ridges that cut this line are counted as total finger ridge count (TFRC).

The core is the approximate center of the pattern. Radiants are the ridges that emanate from the triradius and enclose the pattern.

There are specific patterns of epidermal ridges on finger tips – loops (the ulnar loop has an open end of the loop towards ulnar side and the radial loop has an apex end towards the radial side), whorls (ridges are circular) and arches (ridges enter from one side make a rise in the center and exit through the opposite side) (Cfr. Fig. 2)

Many dermatoglyphic characteristics can be described quantitatively e.g. by counting the number of triradii or ridges within a pattern and measuring distances or angles between specified points (Fig. 3). The following parameters are considered in the present study – TFRC, AFRC, atd angle, PII, MLI.

The atd angle (Fig-4) is formed by lines drawn from the digital triradius (a) to the axial triradius (t) and from this triradius to the digital triradius (d).

Pattern intensity refers to the complexity of ridge configurations. It can be expressed by counting the number of triradius present. The main line formula serves as an indication of the general direction of a palmar ridge flow.

Mahdavi Shahri (2009) discovered that the increase in TFRC and ATD angles can be considered as a marker of hypertension risk. Godfrey et al (1993) concluded that whorls on the right hand are more strongly associated with higher systolic pressure than whorls on the left hand and people with long hands and a narrow palmar angle also have higher systolic pressure. Further, it was observed by Floris and Marine (1998) that planar creases in hypertensives patients are more of a transverse type and the total ridge count (TRC) is asymmetrical, both of these features being direct consequences of arterial blood pressure changes before birth. Comparing the percentage of arches, loops and whorls, Shabanizadeh et al (2006) observed a difference of dermatoglyphic pattern between the hypertensives and the control group. In another study by Palyzova D et al (1991) hypertensives patients had a lower frequency of fingertip ulnar loops, a higher frequency of whorls, a higher TFRC and a higher mean atd angles. Purshani (1984) highlighted that both fingertip whorls and narrow palmar angles are associated with high blood pressure in adult life. Similarly, Kulkarni & Herekar (2005) reported that hypertensive patients had a somewhat lower frequency of fingertip ulnar loops, a higher frequency of whorls and a higher TFRCs and also a somewhat higher mean atd angles. Therefore, the present study is an endeavor to compare the dermatoglyphics of persons (male and female) suffering from primary hypertension with that of a healthy normal age & sex matched control group.

Materials and Methods

The present study included 81 cases of hypertension or individuals suffering from hypertension (40 male and 41 female) and 82 normal individuals, age and sex matched control groups (40 males and 42 female). Persons were categorized as hypertensives when the individuals had blood pressure above 120/80 mm Hg and had no other secondary disease that could cause hypertension. The normal control group included persons with blood pressure below 120/80 mm Hg and with no family history of hypertension. The individuals of both the groups (normal control group and hypertensives) were of the age group 20-50 years of age. The blood pressure was measured using sphygmamometer. Individuals having diabetes mellitus, or suffering from any skin disease like eczema, leprosy etc involving finger or palm or having scar, congenital and acquired anomalies of finger or palm were excluded from both the groups.

The study was conducted on individuals who gave their consent for being included in this study. Standard ink method for fingerprints and palm prints as described in Cummins and Midlo (1961) were used. All the subjects were asked to wash both the hands and dry them under air to ensure clean imprinting patterns. Then they were instructed to give their finger and palmer dermatoglyphic impression following the standard protocol on plain white paper using the black ink method. In this method, a small paste of ink was placed on a slab and was spread into a thin film using a hand roller. The person then firmly presses his or her palm and fingers on the board and then on the white paper to get a complete impression of their palmer ridges and patterns for further analysis.

The prints were studied using hand lens for the finger tip pattern, Total finger ridge count (TFRC), Absolute finger ridge count (AFRC), "atd" angle. The pattern intensity index and the main line index were also calculated. Calculations were done among the hypertensives and normal healthy control groups, separately in males as well as females. The significance of difference between the hypertensives and normal healthy control group were calculated in males as well as females using the Chi square test & t-test. A p-value less than 0.05 is considered as significant and 0.01 as highly significant.

Results

In both the males and the females (left hands, right hands and both hands) the percentage of the ulnar loop is maximum among the normal control group and hypertensives. But in the males (both hands), the percentage of whorls (44.3%) is high and ulnar loops (49.5%) is low among the hypertensives when compared with the normal control group. The difference between the two groups (left hand, right hand & both hands) is statistically significant ($p < 0.01$) (Table 1). Similarly in females (both hands) the percentage of whorls (41.9%) is high and ulnar loops (48.8%) is low among the hypertensives when compared with their normal control group. The difference between the two groups is not statistically significant.

Thus, hypertensives males have significantly high whorls and low ulnar loops in their right hand, left hand as well as both hands combined when compared to those of the normal control group.

In case of the hypertensive individuals, the incidence of arch and radial loops are 4.5% and 3.3% respectively but those are 8.7% and 2.9% in normal control group. When the two groups are compared, the incidence of whorls was high (43.0%) and the incidence of ulnar loops was low (49.1%) among the hypertensives than among the normal control groups (Table 2). The difference between the two

groups is statistically significant ($p < 0.01$).

The difference between the mean values of TFRC among the males, females and overall sex combined between the hypertensives and the normal control group is found to be not significant (Table 3).

Table 4 shows that the mean values of AFRC was significantly higher among the hypertensive males ($p < 0.01$) when compared with the normal control group while no significant difference was observed in case of females and overall sex combined. As evident from Table 5, no significant difference in the mean values of the "atd" angle was observed between the hypertensives and normal control group males and females in the right hand, left hand and both hands (sex combined) respectively. The difference in the mean values of PII (sex combined) between the hypertensives and the normal control group are of statistical significance ($p < 0.05$). Significant difference of the mean values of PII is also observed between the hypertensive (males) and normal control groups ($p < 0.01$). No significant difference was found among the females between the hypertensives and normal control group (Table 6). No significant difference in the mean values of MLI (male, female, overall sex combined) was seen between the hypertensive and the normal control group (Table 7).

Discussions

Dermatoglyphics is used for personal identification, to evaluate population variability and as a diagnostic tool in clinical medicine useful for screening a large population (Holt S B, 1966; Plato et al 1973). Previous studies have reported significant decrease in frequency of ulnar loops and radial loops and increased frequency of whorls and arches in hypertensives. But the male and female pattern were not studied in detail (Jain et al 1984). Several studies reported significantly increased frequency of whorls (Pursnani et al 1989; Polyzova et al 1991; Godfrey et al 1993; Wheeler et al 1998) and decreased frequency of Ulnar loops (Polyzova et al 1991) among the hypertensives. In the present study, a significantly higher frequency of whorls (left hand, right hand & both hands of males) and low frequency of ulnar loops (left hand, right hand and both hands of males) was observed among the hypertensives when compared with the normal control group. This finding is in accordance with Kulkarni et al (2014). But no significant difference was seen in the finger tip patterns of the hypertensive females which is also reported by Reed (1995).

However in both groups of study population, the incidence of ulnar loops is higher than that of whorls. This is in congruence with the findings of Lahiri et al (2013). Conversely various studies demonstrated a higher incidence of whorl patterns are associated with hypertension (Iqbal et al, 2012; Oladipo et al, 2010). This may be due to ethnic or racial variation.

The difference in the mean values of TFRC (males, females and sex combined) was not significant. Our present study (mean values of TFRC) agrees with the findings of several studies (Jain et al, 1984; Pursnani et al, 1989; Polyzova et al, 1991; Lahiri et al 2013; Rudragouda et al, 2013; Oladipo 2010; Kulkarni et al, 2014) where increased TFRC is being reported in hypertensive compared with the normal control group. The mean values of AFRC was statistically significant between the hypertensive males when compared with their normal control group. No significant difference was found in case of the females and overall sex combined. Rudragouda et al, 2013 demonstrated no significant difference (male and female) in the mean values of AFRC between the hypertensive and the normal control group.

From the results of the present study it is observed that no significant difference was observed in the mean atd angles among the males and females of both the groups. This is in congruence with Jain et al (1984), Reed (1995), Oladipo (2010), Rudragouda et al, (2013). But other studies have also reported significant differences in the “atd” angles (Lahiri et al, 2013; Kulkarni et al, 2014; Polyzova et al, 1991; Pursnani et al, 1989; Godfrey et al, 1993). In the present study the pattern intensity index (PII) was found to be significant among the hypertensives and normal control group males and when both sex was combined ($p < 0.05$). But, no significant difference was seen in the females. Another parameter MLI shows no significant difference (male, female, sex combined) between the hypertensives and normal control groups (males and females). However none of the previous studies has evaluated the difference in the mean values of PII & MLI between the hypertensive and the normal control groups. The wide difference observed in the previous studies may be due either to the varying sample size or inclusion of secondary hypertension, racial and ethnic variation.

Conclusions

The results of this study highlights that the incidence of ulnar loops was more frequent among both the hypertensives and the normal control groups. When the two groups are compared, the incidence of whorls was higher and the incidence of unlar loops was lower among the males and females of the hypertensives than in the normal control groups. The difference between the two groups is statistically significant in males (left hand, right hand and both hands).

The finger print patterns highlight that there is a significantly increased frequency of whorls and decreased frequency of ulnar loops among the hypertensives than in the normal control group. The difference in the mean values of TFRC was not significant between the hypertensives and the normal control group. The mean values of AFRC (males) and PII (males and sex combined) was significantly higher among the hypertensive than the normal control group. No significant difference was observed in the “atd” angles and main line index between the hypertensive and the normal control group. Thus, the difference in the finger print pattern, ridge count and indices among the hypertensives and the normal controls apprehends the association of the disease with dermatoglyphics. However, the manifestation of these differences may vary due to racial and ethnic variation.

Dermatoglyphics, is a simple, noninvasive inexpensive technique which can be used as a screening tool for the prognosis of the disease, hypertension. Since the imprinting of the patterns is right from the birth and is affected by heredity. Therefore, the present study instigates a platform for the early identification and determination of the disease. Further studies would generate comprehensive data and impel a paradigm shift in the diagnosis of the disease.

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Author's contributions

TG carried out data acquisition, dataset tabulation, statistical analysis and helped to draft the manuscript. MG conceived and designed the study, analyzed the data and drafted the manuscript.

Conflict of interest

The authors declare that they have no conflict of interest.

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Images and Tables

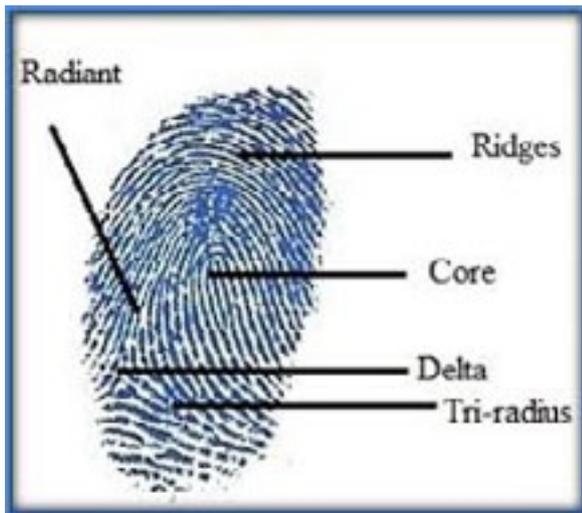
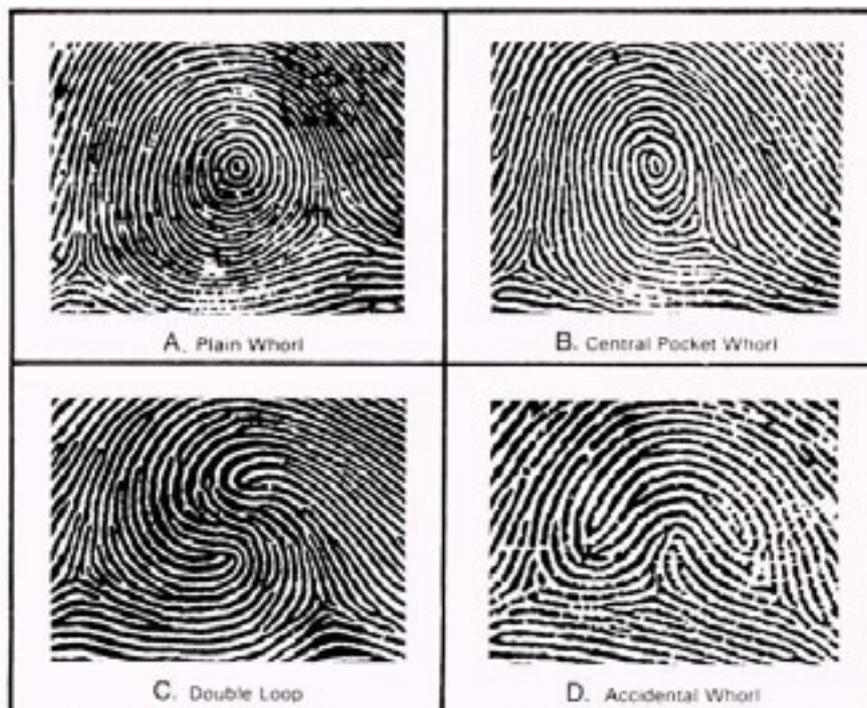
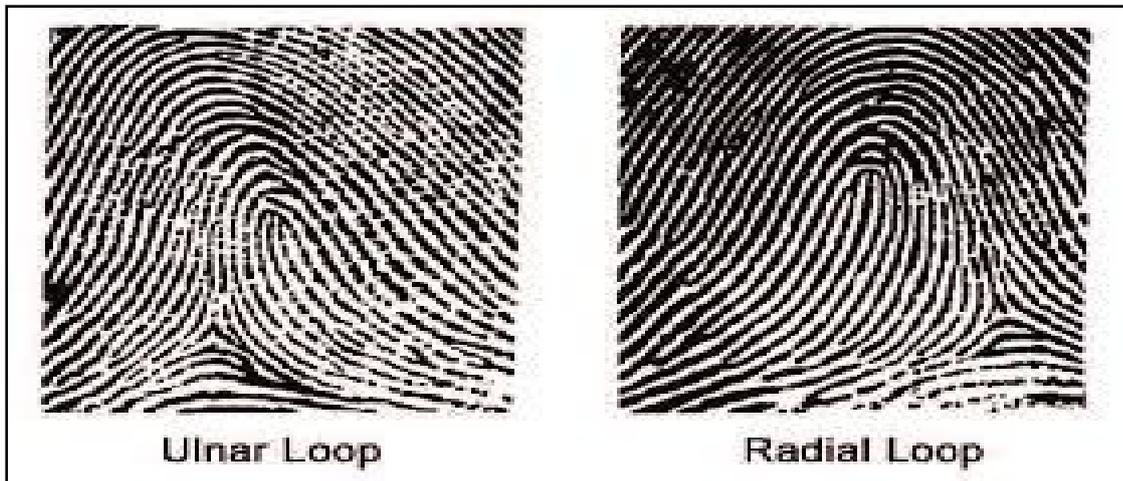


Figure 1: The Dermatoglyphic landmarks



Whorl



Figure 2: Fingerprint Patterns (Ulnar loop, Radial loop, Whorl, Plain arch)

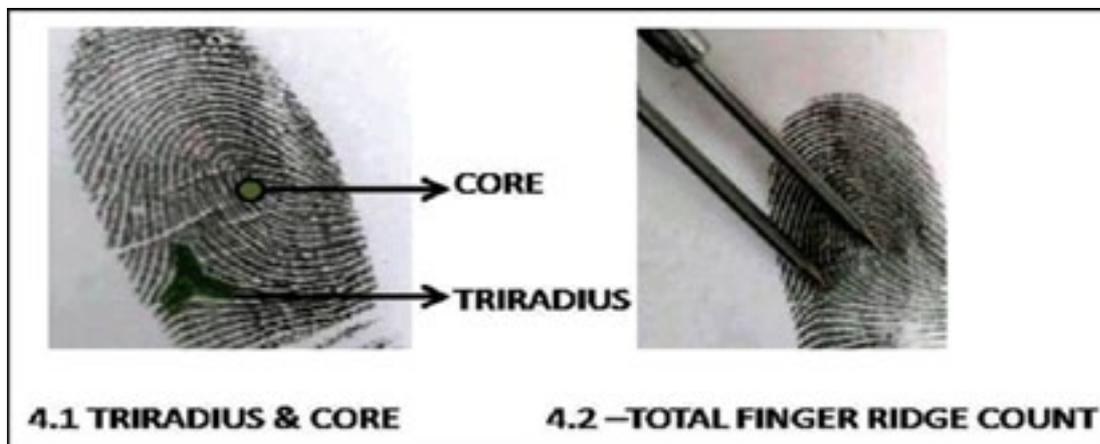


Figure 3: Triradius, Core and Total Finger Ridge Count

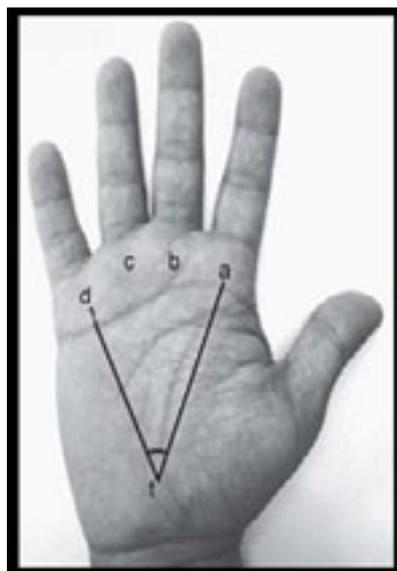


Figure 4: Palm showing ATD angle

Table-1 pattern distribution on fingertips of normal control and hypertensive male and female

Types of pattern	Male (n=80)											
	Left hand				Right Hand				Both hands			
	Control		Hypertensive		Control		Hypertensive		Control		Hypertensive	
	No	%	No	%	No	%	No	%	No	%	No	%
Arch	17*	8.5	9*	4.5	21*	10.4	6*	3.0	38*	9.4	15*	3.8
Ulnar loop	123*	61.2	96*	48.0	122*	60.4	102*	51.0	245*	60.8	198*	49.5
Radial Loop	6*	3.0	2*	1.0	11*	5.4	8*	4.0	17*	4.2	10*	2.5
Whorl	55*	27.4	93*	46.5	48*	23.8	84*	42.0	103*	25.6	177*	44.3
Types of pattern	Female (n=83)											
	Left hand				Right Hand				Both hands			
	Control		Hypertensive		Control		Hypertensive		Control		Hypertensive	
	No	%	No	%	No	%	No	%	No	%	No	%
Arch	22	10.5	13	6.3	12	5.7	9	4.3	34	8.1	22	5.3
Ulnar loop	104	49.5	96	45.7	113	53.8	108	51.4	217	51.7	204	48.8
Radial Loop	4	1.9	5	2.4	3	1.4	10	4.8	7	1.7	17	4.1
Whorl	80	38.1	92	44.7	82	39.0	83	39.5	162	38.6	175	41.9

* Chi square value is statistically significant, $p < 0.01$

TABLE -2 Fingerprint Patterns In Normal Control Group And Hypertensive Group

Group	Arch		Ulnar Loop		Radial Loop		Whorl	
	NO	%	NO	%	NO	%	NO	%
Normal Control(n=82)	72	8.7	462	56.1	24	2.9	265	32.2
Hypertensive(n=81)	37	4.5	402	49.1	27	3.3	352	43.0

* Chi square value is statistically significant, $p < 0.01$

TABLE-3 TFRC (Total Ridge Count) in Normal Control & Hypertensive Male and Female

TFRC	Group	Normal Control(n=82)	Hypertensive(n=81)	Inference
	Male(n=80)	(Mean±SD)	(Mean±SD)	Not significant
		65.84± 21.93	71.69± 22.02	
	Female(n=83)	68.80 ±25.86	72.40 ±22.19	Not significant
Overall Sex combined (n=163)	67.35 ± 24.00	72.04 ± 22.04	Not significant	

TABLE-4 AFRC (Absolute Finger Ridge Count) in Normal Control & Hypertensive Male and Female

AFRC	Group		Control (n=82)	Hypertensive(n=81)	Inference
			(Mean±SD)	(Mean±SD)	
Male(n=80)	Left Hand		81.24 ±37.10	100.91± 45.89	Significant*
	Right Hand				
Female(n=83)			93.92 ±47.25	98.68 ±39.56	Not significant
Overall Sex combined (n=163)			87.73 ± 42.94	99.78 ± 42.68	Not significant

*p<0.01

TABLE-5 ATD Angle in Normal Control & Hypertensive Male and Female

ATD angle	Group		Control(82)	Hypertensive(81)	Inference
			(Mean±SD)	(Mean±SD)	
Male(N=80)	Left Hand		40.05 ± 5.18	38.98 ±4.94	Not significant
	Right Hand		39.30 ±4.55	39.30± 6.50	
Female(N=83)	Left Hand		41.40 ±6.59	41.05 ±4.88	Not significant
	Right Hand		41.50± 10.13	40.73 ±5.23	
Overall sex combined (n=163)	Both hands		40.58 ± 7.00	40.02 ± 5.45	Not significant

TABLE-6 Pattern Intensity Index In Normal Control & Hypertensive Male And Female

P.I.I	Group		Control (n=82)	Hypertensive(n=81)	Inference
			(Mean±SD)	(Mean±SD)	
Male(n=80)	Left Hand		1.21± 0.37	1.40± 0.38	Significant*
	Right Hand				
Female(n=83)	Left Hand		1.31 ± 0.45	1.38 ± 0.37	Not significant
	Right Hand				
Overall sex combined (n=163)			1.26 ± 0.41	1.39 ± 0.37	Significant**

*p<0.01, **p<0.05

Table 7: Main line index in Normal control and hypertensive Male and Female

M.L.I	Group		Control (n=82)	Hypertensive(n=81)	Inference
			(MEAN±SD)	(MEAN±SD)	
Male(n=80)	Left Hand		10.43 ± 5.96	10.31 ± 1.80	Not significant
	Right Hand				
Female(n=83)	Left Hand		10.42 ± 1.65	9.95± 1.72	Not significant
	Right Hand				
Overall sex combined (n=163)			10.43 ± 4.32	10.13 ± 1.77	Not significant