

Research Article

The Study of Dermatoglyphic Patterns and Distribution of the Minutiae in Inherited Essential Hypertension Disease

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Abstract: The aim of this study is to determine the effects of dermatoglyphic patterns in inherited Essential hypertension disease which could be useful for early diagnosis and preventive care. The sample studied for this research was obtained from 40 patients with inherited Essential hypertension disease and 20 normal subjects without any symptoms of Essential hypertension disease until 2 generations ago. Print of their palm and fingers was obtained in two groups by printing ink. Patterns of finger tips, ATD angles, A-B ridge and the different types of minutiae were located, identified and quantified visually inside of four sectors of fingerprints. The result of this study showed two patterns of finger tips; Whorl and arch in diseases are more than normal people. The most common tips in normal people is loop. In average the number of the A-B ridge in female illnesses and male normal are respectively more on average than female normal and male illnesses. The ATD angle is lower in patients than in normal. Results of the survey on minutiae showed that frequency of the ridge Ending (E) is between 32-52.52 with the highest frequency. Frequency of Bifurcation (B) is lower than the ridge ending which it is between 17.39-35% in left hand, but in right hand the second most patterns is convergence (C) which is between 14.13-38.66%. The third most patterns in left hand was observed in pattern convergences (C) with a percentage between 8.62-32.6, but in right hand the third most patterns is bifurcations (B), which is between 3.57-24.81%. Also in some sector of fingers significant difference was found.

Keywords: A-B ridge, dermatoglyphic, fingerprint, inherited essential hypertension disease, minutiae

INTRODUCTION

Essential hypertension is a kind of common disease without any symptoms that can be detected and treated easily. Untreated Essential hypertension can damage organs such as kidney, heart, eyes and, brain (Brown *et al.*, 2001; Aziz *et al.*, 2008). It may also cause lethal complications, f.i., can unknown Essential hypertension increase the risk of heart diseases and kidney problems. That is why hypertension is called as a "silent killer".

Diagnosis of Essential hypertension when detect the person's blood pressure average was measured for several weeks higher than 14/90 mmHg in mature person which the first number is called the systolic blood pressure and the second number is called the diastolic blood pressure. Shorten this sentence Essential hypertension is the most important reasons of heart attack, stroke and renal failure. The risk of these diseases can be decreased by control of blood pressure. It is influenced by both genetic and familial factors (Kaplan, 1994). We hope to be able to prevent damage to other body organs with prior knowledge of this

disease by delivering results of these studies or even may be able to find out chromosome abnormalities.

Dermatoglyphics are epidermal ridge with difference patterns appearing around week 13 of pregnancy and take the shape of the receding volar pads, lastly around the 21st week after conception the fingerprint pattern are completed and they never change or move in lifetime. There are a lot of evidences to show that dermatoglyphics rely on genetic and also fingertips are different for everyone. No one has ever seen to have the same fingertip with other. Forming of dermatoglyphic control with several gene not one gene (Wertheim and Maceo, 2002; Babler, 1991; Palyzova *et al.*, 1991).

The study of fingerprint individuality can be traced back to more than 100 years ago. Galton (1892) was among the first to use certain fingerprint ridge line patterns, or minutiae, to study the individuality of fingerprints. In Galton (1892) claimed that a possibility of occurrence of a fingerprint configuration is 1.45×10^{11} . From then on, most fingerprint individuality studies have focused on minutiae based representations (Stoney

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and Thornton, 1986; Pankanti *et al.*, 2002). A convincing body of evidence now exists about the relationship between a distortion of dermatoglyphic patterns and prenatal stress caused by genetic and/or environmental factors (Schaumann and Alter, 1976; Babler, 1991).

Previous researches on minutiae mainly performed before 1990's, all revealed that fingerprint minutiae locations, when considered as two dimensional spatial point patterns and are NOT uniformly distributed (Sclove, 1979; Stoney and Thornton, 1986). Sclove (1979) showed that minutiae tend to cluster by analyzing the dependence among different cells of the grids.

A lot of dermatoglyphic studies have been carried out on diseases like Mental disorders, diabetes, Schizophrenia (Fatjó-Vilas *et al.*, 2008), klinefelter syndrome etc, to show that some dermatoglyphic patterns are more common in diseases (Jaajv *et al.*, 2006, 2008; Gyenis, 2000; Fananas and Van Os, 1996).

Due to the individual genetic infrastructure in relation to Essential hypertension and kind of fingerprint dermatoglyphic which the scientists offer this way as noninvasive way and a criterion to separate the people prone to blood pressure can diagnosis them to prevent of its development, if can prove this relation (David, 1981).

There is triradius point under each finger that was called A, B, C, D. lines between A triraduse point and B triraduse point which may show a significant difference among different people (Mahdavi *et al.*, 1388).

Fingerprints have a series of ridges and furrows which can be determined by minutiae point. Minutiae points are local ridge characteristics that occur at either a ridge bifurcation or at ridge ending. These characteristics involve the ridge ending (E), Bifurcations (B), Convergences (C), Point, Trifurcation, Fragments and Enclosures. In this study, the patterns of disease samples are compared with the patterns of normal samples (Jea, 2005).

MATERIALS AND METHODS

The study sample consists of 40 inherited essential hypertension individuals averaged 60 years old and 20

persons without any Symptoms of Essential hypertension disease till 2 generations ago. The persons suffering from hypertension had been under the supervision of doctor for long time.

Print of palms and phalanx of ten fingers were obtained by ink and a pad impregnated with ink rubbed into the palms and fingers and then is taken photo of palms and finger where stamped on paper. The major parts of ridge of fingerprints were obvious and some of them were excluded and magnification was used to improve visibility.

Code for each individual was considered, also fingers from little to thumb numbered 1-5 in each hand. All fingerprints were observed accurately, the ridge pattern configurations of arches, loops and whorls (Fig. 1) were detected and were compared among both group of patient and healthy. The ridges in area of A-B triradius point (Fig. 2 and 3) were counted and compared. The ATD angle (Fig. 2) that is made by A, T, D triradius points was measured.

Then different aspects of various minutiae on phalanx of all fingers were surveyed which a circle that was drawn on the fingers included triradius point of fingertip.

The specifications minutiae in present research are according to the spanish scientific police (Fig. 4). The profile minutiae in this study are based on the following description:

- **Bifurcation (B):** A point where a dermal ridge, originating from the left side of the fingerprint, splits into two (bifurcation +, sensu Champod *et al.*).
- **Convergence (C):** A point where two ridges, originating from the left side of the fingerprint, merge into one (bifurcation -, sensu Champod).
- **Break (BR):** a point where the course of a ridge is interrupted, as long as this discontinuity is not less than the width of the ridge nor larger than double its width.
- **Fragments (F) and Enclosures (EN):** These minutiae are considered small when their length is less than five times the width of the ridge; they are considered large when their length is five-ten times the width of the dermal ridge.

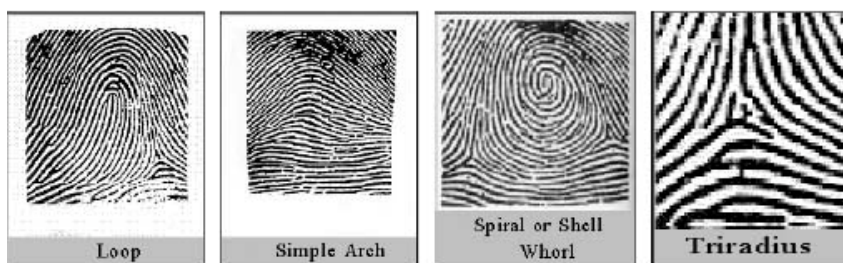


Fig. 1: Patterns of finger tipe, triradius point

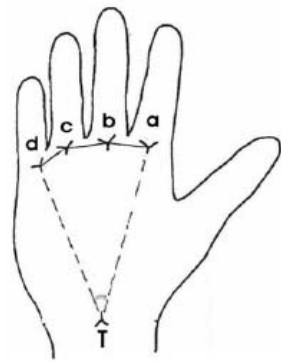


Fig. 2: A-B line, ATD angle

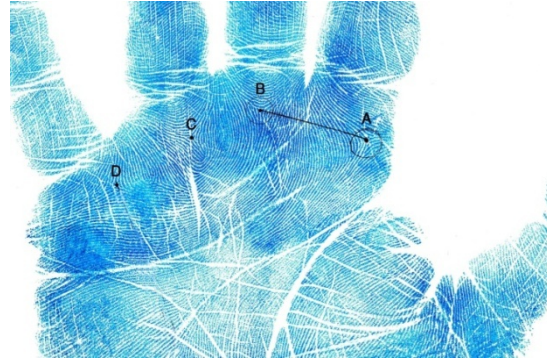


Fig. 3: The A-B ridge in a sample

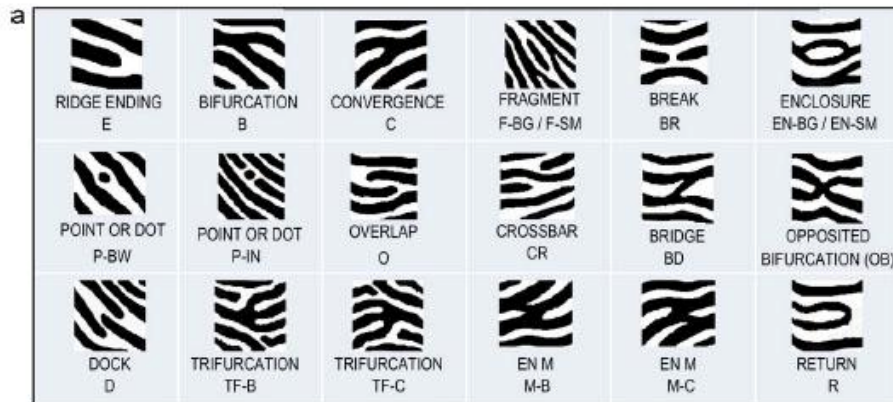
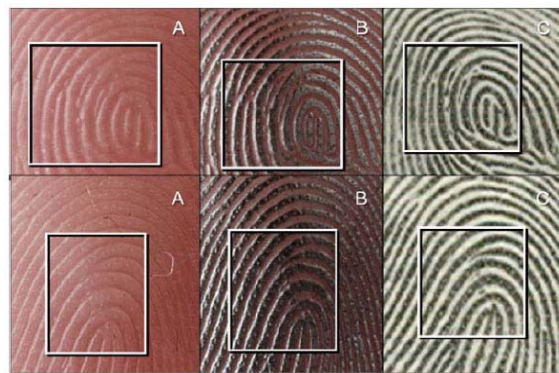


Fig. 4: (a) type of the minutiae used in study, (b) The division of the fingers

- **Point (P):** A small ridge fragment, as short as it is wide, which can be situated in the center of a break (P-IN) or between two ridges (P-BW).
- **Trifurcation (TF):** A point where one ridge divides into three ridges. If the division originates from the left side of the fingerprint, it is considered bifurcate or positive (TF-B) and convergent or negative (TF-C) if from the right side.
- **M:** A merging point of two convergences and one bifurcation (M-C) or vice versa (M-B), which presents a pattern similar to the letter M. (Champod, 1996; Neumann *et al.*, 2006, 2007).

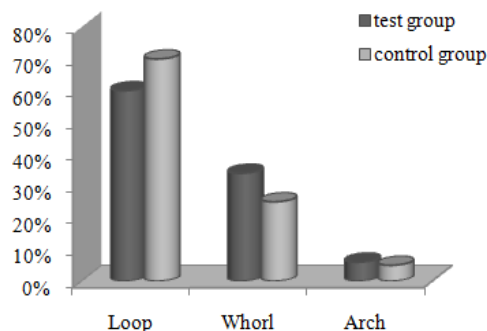
We analyzed types of minutiae inside of circle which each circle directed into four sectors by horizontal and vertical lines which circle involved triradius point of each finger. The size of the circle was the same for all fingers, except for few samples in which the size of the circle has been changed for the small finger. Then type of minutiae was counted for each sector separately.

RESULTS

The aim of this study is a comparison between patients of inherited Essential hypertension and healthy people which is shown by different aspect patterns of finger tips showed frequency of Whorl and Arch is more in patient group than in control group that this result is accordance whit godfery and palyzova which they had Saied there are significant relation between pattern of whorl and Essential hypertension disease (Fig. 5).

The result of counting of the A-B ridge has been collected in Table 1, which shows the mean of counting of ridge increase in test group in female but in male group, the mean of ridge count is less in patients than in healthy people and also there wasn't any significant difference observed between patient group and control group, which is shown by a p-value in both group of male and female more than 0/05.

ATD angle measured in both groups that have been showed in Table 2 which mean of ATD angle increase in both male and female patient groups. There is a significant difference in the left hand between patient and healthy women whose p-value is less than 0.05 (0.0015), but we didn't observe any significant difference among hands of other group.



	Loop	Whorl	Arch
Test group	60%	34%	6%
Control group	70%	25%	5%

Fig. 5: Frequency distribution of fingerprints types in all the people of both control group and test group

The type of minutiae was counted in each section of each finger separately. Table 3 and 4 shows percentage of type of minutiae in each sector in hand left and right hand women separately and Table 5 and 6 shows percentage of type of minutiae in each sector in hand left and right hand men. According to these observations, pattern the ridge Ending (E) is by far the most widely patterns minutiae in fingers of both of hands, between 32-52.52%. Pattern bifurcations (B) has the second highest percentage of patterns just in left hand with a percentage between 17.39-35, but in right hand the second most patterns is Convergence (C) which is between 14.13-38.66%. The third most patterns in left hand was observed in pattern convergences (C) with a percentage between 8.62-32.6, but in right hand the third most patterns is bifurcations (B), which is between 3.57-24.81%. Other patterns have low percentage. Some patterns are slightly more frequent than others such as; BR,P-BW,F-SM and F-BG (in right hand).

On the other hand percentage of pattern the ridge Ending (E) in right hand, sectors (2,3 and 4) is more in healthy people than in patient but about left hand women, percentage of sectors (1 and 2) of control group is more. The percentage of all sectors in left hand men are more in control group than in patient group except sector 2, which is vice versa. By contrast Convergences (C) The percentage in both of hands of women shows a rising tendency in patient group except sector 1 in right hand. But the percentage of convergences (C) in men

Table 1: The comparison of dermatoglyphics quantitative (a-b) ridge in inherited essential hypertension and control group

A-B ridge		Mean		p-value	
Sex	Hand type group	Right hand	Left hand	Right hand	Left hand
Female	Test	38.38	39.41	0.942441	0.976800
	Control	38.16	39.33		
Male	Test	36.80	36.84	0.226665	0.151446
	Control	39.00	39.50		

Table 2: The comparison of dermatoglyphics quantitative (atd angle) in inherited essential hypertension and control group

ATD angle		Mean		p-value	
Sex	Hand type group	Right hand	Left hand	Right hand	Left hand
Female	Test	40.80000	43.62500	0.420621	0.001538
	Control	39.40000	37.20000		
Male	Test	39.57143	40.16667	0.415388	0.293015
	Control	38.44000	37.90000		

Table 3: Distribution and comparison of frequencies of the minutiae in each sector separately in left hand women in both of test and control group

Hand left (women)								
	Control	Test	Control	Test	Control	Test	Control	Test
	Sector 1	Sector 1	Sector 2	Sector 2	Sector 3	Sector 3	Sector 4	Sector 4
E	42.59259	38.95349	44.82759	43.47826	49.48276	51.49254	39.65753	40.90909
C	19.44444	30.81395	17.24138	32.60870	8.620690	15.67164	17.80822	26.51515
B	32.40741	22.67442	29.88506	17.39130	35.00000	24.62687	34.31507	23.48485
BR	0.925926	1.744186	3.448276	2.173913	3.448276	0.746269	1.369863	1.515152
F-BG	0.000000	1.162791	0.000000	2.173913	0.000000	1.492537	1.369863	0.000000
O	0.00000	0.581395	0.000000	0.000000	3.448276	1.492537	0.000000	0.000000
R	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
EN-BG	0.000000	0.000000	0.000000	0.724638	0.000000	1.492537	0.000000	1.515152
P-IN	0.000000	0.581395	0.000000	0.000000	0.000000	0.000000	0.000000	0.757576
P-BW	1.851852	1.162791	0.000000	0.724638	0.000000	1.492537	0.000000	3.787879
EN-SM	0.000000	0.581395	0.000000	0.000000	0.000000	0.746269	5.479452	0.000000
F-SM	2.777778	0.581395	4.597701	0.000000	0.000000	0.000000	0.000000	0.000000
EN	0.000000	0.000000	0.000000	0.724638	0.000000	0.000000	0.000000	0.000000
OB	0.000000	0.581395	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
CR	0.000000	0.581395	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
TF-B	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
BD	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
P-BE	0.000000	0.000000	0.000000	0.000000	0.000000	0.746269	0.000000	0.000000
D	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.757576
F	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
TF-C	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.757576
P	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
M-B	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
TF	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000

Table 4: Distribution and comparison of frequencies of the minutiae in each sector separately in right hand women in both of test and control group

Hand right (women)								
	Control	Test	Control	Test	Control	Test	Control	Test
	Sector 1	Sector 1	Sector 2	Sector 2	Sector 3	Sector 3	Sector 4	Sector 4
E	32.00000	35.83815	48.80952	43.55828	44.56522	43.06931	44.30380	41.07143
C	38.66667	35.26012	28.57143	34.35583	14.13043	29.70297	31.64557	33.33333
B	22.66667	21.38728	3.571429	12.26994	23.91304	16.83168	8.860759	17.2619
BR	0.000000	0.000000	1.190476	1.840491	2.173913	2.475248	3.797468	0.000000
F-BG	0.000000	1.156069	3.571429	2.453988	1.086957	1.485149	1.265823	1.190476
O	0.000000	0.578035	1.190476	0.000000	0.000000	0.000000	0.000000	0.000000
R	0.000000	0.578035	0.000000	0.000000	0.000000	0.000000	0.000000	0.595238
EN-BG	0.000000	0.578035	4.761905	1.226994	0.000000	0.495050	1.265823	1.190476
P-IN	0.000000	0.000000	0.000000	1.226994	4.347826	0.990099	0.000000	1.190476
P-BW	0.000000	1.734104	2.380952	1.840491	2.173913	1.485149	0.000000	1.190476
EN-SM	5.333333	0.578035	0.000000	1.226994	1.086957	0.990099	1.265823	0.000000
F-SM	1.333333	0.000000	4.761905	0.000000	5.434783	0.990099	5.063291	0.595238
EN	0.000000	1.156069	0.000000	0.000000	0.000000	0.495050	0.000000	0.595238
OB	0.000000	0.000000	0.000000	0.000000	1.086957	0.000000	0.000000	0.595238
CR	0.000000	0.000000	0.000000	0.000000	0.000000	0.495050	0.000000	0.000000
TF-B	0.000000	0.578035	0.000000	0.000000	0.000000	0.000000	0.000000	0.595238
BD	0.000000	0.000000	0.000000	0.000000	0.000000	0.495050	1.265823	0.000000
P-BE	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
D	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.595238
F	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
TF-C	0.000000	0.578035	0.000000	0.000000	0.000000	0.000000	1.265823	0.000000
P	0.000000	0.000000	1.190476	0.000000	0.000000	0.000000	0.000000	0.000000
M-B	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
TF	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000

Table 5: Distribution and comparison of frequencies of the minutiae in each sector separately in left hand men in both of test and control group

Hand left (men)								
	Control	Test	Control	Test	Control	Test	Control	Test
	Sector 1	Sector 1	Sector 2	Sector 2	Sector 3	Sector 3	Sector 4	Sector 4
E	36.20690	48.18482	40.30612	48.94366	41.74757	38.67596	35.8209	38.16425
C	25.00000	20.13201	19.89796	20.77465	21.84466	18.46690	29.85075	27.05314
B	30.17241	24.09241	29.08163	21.83099	27.18447	30.66202	28.35821	22.22222
BR	1.724138	2.970297	2.040816	2.112676	0.970874	2.787456	1.492537	1.932367
F-BG	0.862069	0.660066	2.040816	1.760563	0.970874	0.696864	0.000000	0.483092
O	0.431034	0.990099	0.510204	0.000000	0.970874	0.348432	0.000000	0.483092
R	0.000000	1.320132	0.000000	0.000000	0.000000	0.000000	0.000000	0.966184
EN-BG	0.431034	0.990099	0.510204	1.056338	0.970874	0.348432	0.497512	0.966184
P-IN	0.862069	0.330033	0.000000	0.000000	0.485437	0.696864	0.000000	1.932367
P-BW	0.862069	0.000000	1.530612	1.408451	0.485437	3.484321	0.000000	1.932367
EN-SM	0.862069	0.000000	0.000000	0.352113	1.941748	0.000000	2.985075	0.483092
F-SM	1.724138	0.000000	3.061224	0.000000	1.456311	1.045296	0.497512	0.000000
EN	0.000000	0.330033	0.000000	1.056338	0.000000	0.348432	0.000000	0.483092
OB	0.431034	0.000000	0.000000	0.352113	0.485437	1.393728	0.000000	0.966184
CR	0.431034	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
TF-B	0.000000	0.000000	0.000000	0.352113	0.000000	0.696864	0.497512	0.483092
BD	0.000000	0.000000	0.000000	0.000000	0.485437	0.348432	0.000000	0.483092
P-BE	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
D	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.483092
F	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.483092
TF-C	0.000000	0.000000	0.510204	0.000000	0.000000	0.000000	0.000000	0.000000
P	0.000000	0.000000	0.510204	0.000000	0.000000	0.000000	0.000000	0.000000
M-B	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
TF	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000

Table 6: Distribution and comparison of frequencies of the minutiae in each sector separately in right hand men in both of test and control group

Hand right (men)								
	Control	Test	Control	Test	Control	Test	Control	Test
	Sector 1	Sector 1	Sector 2	Sector 2	Sector 3	Sector 3	Sector 4	Sector 4
E	41.73913	43.43066	52.52101	46.93878	51.27119	44.94774	46.42857	43.87352
C	35.21739	24.45255	27.73109	26.87075	22.0339	29.26829	26.33929	35.96838
B	17.39130	24.81752	16.38655	18.36735	17.37288	15.67944	19.19643	12.64822
BR	0.869565	1.094891	0.000000	0.340136	1.271186	1.045296	1.339286	1.581028
F-BG	0.000000	0.729927	0.840336	1.020408	0.423729	1.393728	0.446429	0.790514
O	0.000000	0.000000	0.000000	0.340136	0.000000	0.696864	0.000000	0.000000
R	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
EN-BG	0.869565	1.459854	0.420168	0.000000	0.423729	0.000000	0.446429	0.000000
P-IN	0.000000	0.000000	0.000000	0.680272	0.423729	1.045296	0.000000	0.000000
P-BW	0.434783	0.000000	0.000000	1.360544	1.694915	1.045296	0.892857	1.185771
EN-SM	0.869565	0.729927	1.260504	0.340136	0.847458	0.348432	2.678571	0.395257
F-SM	1.304348	0.364964	0.840336	0.000000	2.966102	0.696864	0.000000	0.395257
EN	0.434783	0.364964	0.000000	1.020408	0.000000	1.045296	0.892857	0.395257
OB	0.434783	0.000000	0.000000	0.680272	0.847458	0.348432	0.446429	0.395257
CR	0.000000	0.364964	0.000000	0.000000	0.423729	0.000000	0.446429	0.000000
TF-B	0.000000	0.364964	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
BD	0.434783	1.094891	0.000000	0.680272	0.000000	0.696864	0.446429	1.185771
P-BE	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
D	0.000000	0.364964	0.000000	0.340136	0.000000	0.000000	0.000000	0.395257
F	0.000000	0.000000	0.000000	0.340136	0.000000	1.393728	0.000000	0.790514
TF-C	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
P	0.000000	0.364964	0.000000	0.340136	0.000000	0.000000	0.000000	0.000000
M-B	0.000000	0.000000	0.000000	0.340136	0.000000	0.000000	0.000000	0.000000
TF	0.000000	0.000000	0.000000	0.000000	0.000000	0.348432	0.000000	0.000000

has fallen in patient group, the percentage of sector 1, 3 and 4 is less in left hand patient group and sector 1 and 2 in hand right patient group has less percentage. In competition bifurcations (B), all sectors in left hand of healthy women have a higher percentage. The percentage of bifurcations (B) in sector 1 and 3 in right

hand, 1, 2 and 4 in left men, 3 and 4 in left hand women are more in healthy people than in patients. By contrast to pattern of (BR) the percentage of sector 4 in left hand women and right hand men and all sectors in left hand men increase in patients (Fig. 6).

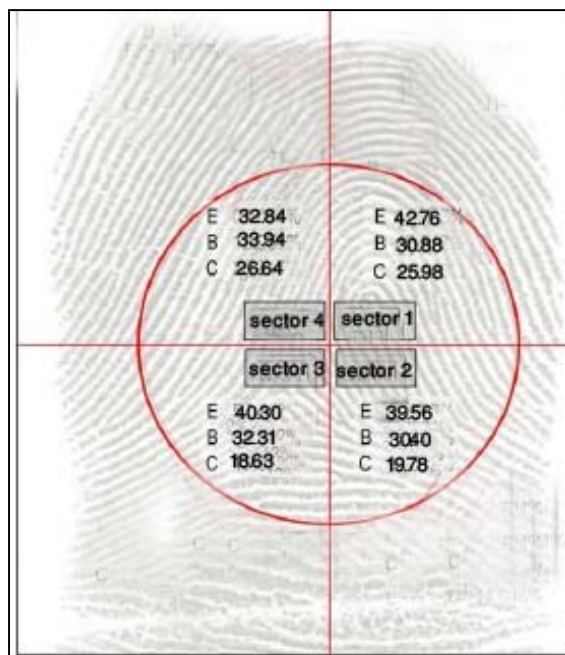


Fig. 6: Distribution of frequency of the minutiae: Ridge ending, bifurcation, convergence, by sector (1, 2, 3 and 4) inside

Table 7: Comparison of type of the minutiae (ridge ending, bifurcations, convergences) in finger 1 (little finger)

Finger 1		Mean				p-value			
Type of minutiae	Hand type group	Female		Man		Female		Man	
		Right hand	Left hand	Right hand	Left hand	Right hand	Left hand	Right hand	Left hand
B	Test	0.857143	0.590909	1.000000	1.800000	0.468510	0.001825	0.227000	0.052512
	Control	0.333333	1.900000	0.636000	1.275862				
c	Test	1.285714	1.368421	1.151515	0.933333	0.403680	0.302700	0.597672	0.889263
	Control	2.000000	0.909091	1.307692	0.969697				
E	Test	1.642857	1.476190	1.718750	2.333333	0.792356	0.246838	0.074023	0.616167
	Control	2.500000	2.200000	2.375000	2.550000				

Table 8: Comparison of type of the minutiae (ridge ending, bifurcations, convergences) in finger 2 (ring finger)

Finger 2		Mean				p-value			
Type of minutiae	Hand type group	Female		Man		Female		Man	
		Right hand	Left hand	Right hand	Left hand	Right hand	Left hand	Right hand	Left hand
B	Test	0.80000	0.90000	0.85000	1.461538	0.15672	0.410684	0.013507	0.13713
	Control	1.357143	1.250000	1.340000	1.122807				
c	Test	1.266667	1.966667	1.254237	1.122449	0.820682	0.000123	0.144566	0.035811
	Control	1.357143	0.529412	1.600000	1.733333				
E	Test	1.533333	1.903226	1.660714	1.737705	0.451435	0.780659	0.005094	0.010609
	Control	1.928571	1.750000	2.638889	2.750000				

Table 9: Comparison of type of the minutiae (ridge ending, bifurcations, convergences) in finger 3 (middle finger)

Finger 3		Mean				p-value			
Type of minutiae	Hand type group	Female		Man		Female		Man	
		Right hand	Left hand	Right hand	Left hand	Right hand	Left hand	Right hand	Left hand
B	Test	0.619048	1.250000	0.550000	1.555556	0.800877	0.200324	0.017254	0.814294
	Control	0.687500	1.722222	1.125000	1.491525				
c	Test	1.217391	0.708333	1.328125	1.000000	0.208225	0.555838	0.168261	0.667282
	Control	1.687500	0.529412	1.675000	1.107143				
E	Test	1.673913	2.304348	2.126984	2.218182	0.260299	0.322903	0.09074	0.112781
	Control	1.250000	2.857143	2.725000	2.900000				

Table 10: Comparison of type of the minutiae (ridge ending, bifurcations, convergences) in finger 4 (index finger)

Finger 4		Mean				p-value			
Type of minutiae	Hand type group	Female		Man		Female		Man	
		Right hand	Left hand	Right hand	Left hand	Right hand	Left hand	Right hand	Left hand
B	Test	0.702128	0.848485	1.000000	1.527778	0.51047	0.156166	0.643561	0.146905
	Control	0.909091	1.473684	1.111111	1.155172				
c	Test	1.333333	1.000000	1.290323	0.903226	0.474616	0.615481	0.810351	0.138516
	Control	1.636364	1.157895	1.361111	1.294118				
E	Test	1.456522	1.914286	1.867647	2.040816	0.05995	0.172181	0.061574	0.108274
	Control	3.000000	2.500000	2.416667	2.615385				

Table 11: Comparison of type of the minutiae (ridge ending, bifurcations, convergences) in finger 5 (thumb finger)

Finger 5		Mean				p-value			
Type of minutiae	Hand type group	Female		Man		Female		Man	
		Right hand	Left hand	Right hand	Left hand	Right hand	Left hand	Right hand	Left hand
B	Test	0.714286	1.26087	0.659574	1.530000	0.60238	0.044773	0.118607	0.783
	Control	0.562500	2.111111	1.000000	1.230000				
c	Test	1.525000	0.739130	1.155556	0.875000	0.835041	0.391368	0.152488	0.059645
	Control	1.437500	0.500000	1.514286	1.400000				
E	Test	1.948718	1.818182	2.152174	1.689655	0.011762	0.182345	0.407726	0.000181
	Control	3.375000	2.615385	2.416667	3.523810				

Table 7 to 11 shows a comparison among fingers of patients and control group of female and male. According to these results there are significant differences in some cases, In contrast to patterns of minutiae about Bifurcation (B) significant difference in left hand women in finger 1(little finger) and finger 5 (thumb finger) is observed and it can also be found in right hand men in finger 2 (ring finger) and finger 3 (middle finger), which P-value is less than 0.05. In comparison of convergences (C) in finger 2 shows p-value is less than 0.05 in left hand women and left hand men. Both of fingers 2 of men show that there is significant difference about the ridge ending (E). Counting of the ridge Ending (E) in finger 5 shows that there is a significant difference between patients and healthy people in right hand women and left hand men.

Also, we compared these patterns without separating gender but the results were different from above results for instance, in contrast to the ridge ending (E), there are significant differences in fingers of both hands for which p-value is less than 0.05 except in two cases, ring (2) finger left hand and middle (3) finger right hand showing a p-value more than 0.05. The comparison of bifurcation (B) showed there is significant difference in some fingers such as finger 1 left hand, finger 2 right hands and finger 3 in both hands and finger 5 left hands. The comparison of convergences (C) did not show any significant difference.

DISCUSSION

Today, significant progress in understanding the relationship between internal disorders and type of insoles line fingers has been achieved. Since the pattern of fingers differs from person to person and also

Essential hypertension disease has hereditary aspects, it is possible to find out relationship between pattern of finger and this disease. Although this disease also is influenced by the environment, but owing to the fact that Finger patterns and lines are formed in a short period, environment can not have a strong in this short period. In conclusion if the genetic marker can be found, by considering environment impact it will be possible to take preventive measure from birth (Mahdavi Shahri *et al.*, 2006; Shamsuddini and Muhammad Abadi, 1981; Sarkar, 2004; Gutié *et al.*, 2007; Okajima, 1970; Stoney and Thornton, 1986).

Some of the most important features of pattern finger and minutiae scrutinized. In two groups of inherited Essential hypertension disease and healthy people were compared as mentioned above to find out significant difference between test group and control group (Reed, 1995).

Our studies of Fingertips showed increased whorl and arch in patients rather than in control groups but whorl showed more differences between the two groups and arch has only slightly few differences. Godfrey *et al.* (1993) learned that higher prevalence of whorls and loops are associated with higher level of blood pressure (Floris and Marini, 1998; Mahdavi *et al.*, 1388), they also concluded in this study that whorls and loops are predominant ridge patterns in hypertensive patients and a deeper examination determined that whorls are higher in incidence on the digit 4 of these patients.

For aspect A-B ridge there was no significant difference. The average A-B ridge counted in male patients falls rather than in normal men but it increases in female patients.

Measuring of ATD angle showed the mean of angle in patient increase rather than in control group

and there was significant difference in left hand women.

Unlike (Champod, 1996), who found no association between the types of minutiae and fingers (the index and middle were the only fingers studied), (Gutiérrez-Redomero *et al.*, 2011) have observed a significant association between the types of minutiae and the different fingers in normal people, a fact also revealed by Okajima (1970), Dankmeijer and Wielenga (1980) and more recently Sarkar (2004). This association reveals a greater frequency of ridge endings in the thumbs and index fingers and of bifurcations and convergences in the middle, ring and little fingers. This allowed us to separate the thumbs and index fingers from the middle, ring and little fingers, based on the distribution of the minutiae and, at the same time, the fingers on the right hand from

Those on the left, Pursuant to result of this study, comparison of two groups showed the ridge ending (E) increase in right hand of healthy people in both male and female groups in sector 2, 3 and 4. It rises in sector 1 and 2 in left hand women and sector 1, 3 and 4 in left hand men. The percentage of the convergences (C) falls in healthy women group, except sector 1 in right hand. But in men group, the percentage of convergences (C) increases except sector 2 in left hand and sector 3 and 4 in right hand. Percentage of the bifurcations (B) in left hand female patients is less. Sector 1 and 3 in right hand women, sector 1, 2 and 4 in left hand men and sector 3 and 4 in right hand men is more in healthy people than in patients. Other types of minutiae have a too small percentage to be compared with more samples.

On the other hand significant difference was found in some cases, bifurcation (B) showed significant difference in left hand woman in finger 1 and 2. And also there were significant differences in right hand men in finger 2 and 3. Comparison of convergences showed significant difference just in finger 2, in left hand men and women. In contrast to the ridge ending (E) significant difference was observed in men group in finger 2, and also right hand women and left hand men in finger 5.

Since the results were completely different when the two groups of men and women were separated, maybe we can say these differences are different are sex-dependent.

According to this study ATD angle for women and some type of minutiae especially bifurcations (B) can be a good indication for the assessment of who might be prone to fall ill with the disease and we wish to be able to prevent this disease from birth.

RECOMMENDATIONS

The researcher would recommend some cases to be done for improved surveys in future:

First raising the number of samples will be useful to compare more accurately. Another suggestion is to take photos by Digital Camera that is special for taking picture of fingers instead of ink so that error of visibility can be reduced. In general, to the best of our knowledge, there has been few studies focused on types of minutiae in diseases. However, we believe that more studies on types of minutiae would prevent from risking of Essential hypertension disease; another survey will help to confirm and complete these evidences.

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