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Research Article

Comparison of Dermatoglyphic Patterns Between Healthy and Hypertensive People

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Abstract: This research aims at examining the characteristics of dermatoglyphic patterns on the palm and the measuring of the symmetry or asymmetry degree, based on palmar dermatoglyphic findings, in patients suffering from high blood pressure with a history of inherited Hypertension. Hypertension or high blood pressure is a chronic medical condition of the heart in which the systolic arterial blood pressure is elevated. This condition is opposite to low blood pressure. Dietary and lifestyle changes and pre-knowledge of family history or of familial genetic diseases can help in the better controlling of blood pressure and in the reducing of the risk of associated health complications. Though drug treatment is necessary in HT patients for whom lifestyle changes prove ineffective or insufficient. Therefore, a prior knowledge of Hypertension is important to the patient and the doctor in controlling the said disease. Today, significant progress has been made in understanding the relationship between internal disorders and dermal ridges on the palm. Moreover, the application of palmar friction ridge analysis as an investigative diagnostic tool has been increasing in medicine and through this, important information has been obtained about the correlation between genetic disorders and ridge patterns. Further, as finger ridge lines create special patterns therefore. This research is an observational, analytical and practical study using a case-control observational approach with simple random sampling and without substitution carried out on two groups of healthy subjects and patients suffering from high blood pressure; people without any other specific genetic diseases which in turn affect dermatoglyphic readings. Palmar prints were taken, then vague and unreadable samples were omitted from the analysis and finally the patient's palmar dermatoglyphic patterns were examined. The experimental group was chosen from healthy people with no history of any kind of genetic diseases or blood disorders and no symptoms of high blood pressure among close relatives. Ridge lines were recorded using clear adhesive tape. This research done on a group of Iranians of Fars race showed that in patients suffering from high blood pressure, loops and arches are the most and the least common patterns, respectively. This research studies the relationship between dermatoglyphic patterns and inherited or familial hypertension and it proves that if genetic features are identified, susceptible people can be recognized before the onset of the disease by special environmental evaluation and then the necessary preventive measures can be undertaken.

Keywords: Blood pressure, dermatoglyphic, fingerprint, inherited essential hypertension disease

INTRODUCTION

Hypertension or high blood pressure is a chronic cardiac medical condition in which the systolic arterial blood pressure is elevated. This condition is opposite of low blood pressure (hypotension).

Hypertension is classified as either primary (essential) hypertension or secondary hypertension; about 90-95% of cases are categorized as primary hypertension, which means high blood pressure with no obvious medical cause. (Brown *et al*., 2001) The remaining 5-10% of cases (secondary hypertension) is caused by other conditions that affect the kidneys, arteries, heart or endocrine system.

Persistent hypertension is one of the risk factors for stroke, myocardial infarction, heart failure and arterial aneurysm. Moderate elevation of arterial blood pressure leads to shortened life expectancy. Changes in diet and lifestyle can improve blood pressure control and decrease the risk of associated health complications though drug treatment may prove necessary in patients for whom lifestyle changes prove ineffective or insufficient. Brown *et al*. (2001) and Aziz *et al*. (2008) Dermatoglyphics which has been around for more than 70 years is a branch of science in which patterns present

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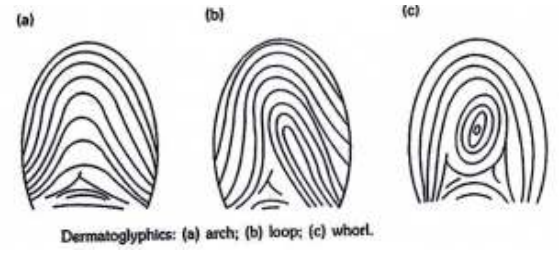

Fig. 1: Illustration of the different finger prints

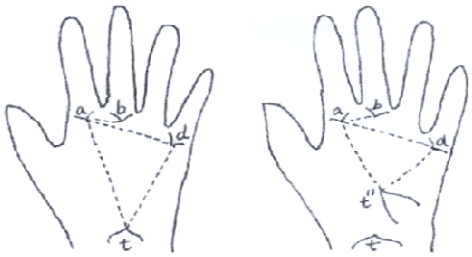

Fig. 2: ATD angle

Fig. 3: The A-B ridg

on the palm and fingers are studied systematically Jaajv andi *et al*. (2006). Palmar and plantar patterns are formed at the end of the 4th fetal month that is the important and critical period of growth and development of the brain and other octodermal derivatives. There is a lot of evidence supporting a hereditary basis for ridge patterns formation and the effects of teratogens in their development. Babler (1991) Today significant progress has been made in underst anding the relationship between internal disorders and dermal palmar ridges; and the application of palmar friction ridge analysis as an investigative diagnostic tool has been increasing in medicine. Moreover, important information has been obtained about the correlation between lots of genetic disorders and ridge patterns. The study of dermatoglyphic patterns in etiology of mental disorders has culminated in many purposeful discoveries for example there has been a lot of research proving the presence of special dermatoglyphic patterns in many diseases such as mental disorders, schizophrenia, epilepsy and different dermal diseases, for example, the presence of asymmetric characteristics in both hands of patients suffering from schizophrenia. (Jaajv Andi *et al*., 2006).

Finger ridge lines create special shapes classified in three categories:

- Arch
- Loop
- Whorl

As can be seen in Fig. 1, there are also three different areas which are important from the dermatoglyphic point of view in the palm of the h and. The main purpose of this research study is the examination of the characteristics of palmar dermatoglyphic patterns and the measurment of the symmetry or asymmetry degree based on palmar dermatoglyphic findings.

The patterns of the palm: To examine the dermatoglyphic patterns of the palm, it must be divided into six configurated areas, including: the thenar area under the thumb, the hypothenar area under the little finger and the inter-digital areas, or the areas between fingers numbered from 1 to 4.

One to 4 inter-digital areas: Inter-digital areas are found on the top of the palm in the region of the head of the metacarpal bones. Each inter-digital area is limited by a triradius from sides. There are four triradii in the base of the fingers, excepting in the thumb, called a, b. c and d from the index to the little finger as Fig. 2 and 3 illustrate.

History: Mahdavi Shahri (2009), in a study, examined the differences of sweat pore ducts occurring in the position of triradii between two populations of healthy people and people with hypertension and realized that there is a meaningful difference in average number of sweat pores present in the triradii positions between the control and the HT or sample group. Mahdavi Shahri (2009) Ethel and Kahkarin discovered in their studies that the increase in TFRC and ATD angle can be considered as a marker of hypertension risk. Godfrey *et al*. (1993) that whorls on the right h and are more strongly associated with higher systolic pressure than whorls on the left (around 2.2 mm Hg). People with long h ands and a narrow palmar angle also have higher systolic pressure (Rising by 49-50 mm Hg for each degree decrease in palmar angle on the right h and Godfrey *et al*. (1993)). Furthermore, it was also observed by Floris and Marini (1998) that planar creases in hypertensive patients are more of transverse type and the Total Ridge Count (TRC) is asymmetrical, both of these features being direct consequences of arterial blood pressure changes before birth (Floris and Marini, 1998). In another research done by Palyzove *et al*. (1990), it was proved that ulnar loops and whorls are predominant and capillary patterns are more observed in people with HT. Comparing the percentage of arches, loops and whorls, Shabanizadeh *et al*. (2006) observed a meaningful difference of dermatoglyphic

patterns between their experimental and control groups. Endeavors by Mahdavi *et al*. (1388) for finding a correlation between fingerprint patterns, especially, with regards to sweat pores and hypertension led to some achievements.

MATERIALS AND METHODS

This research is an observational, analytical and practical study carried out in 2010 using a case-control observational approach with non-substitutional, simple random sampling on two groups of healthy subjects and patients suffering from high blood pressure (both Iranians of the Fars Race).

The experimental group consisted of people suffering from high blood pressure without any other special genetic disease that could affect their dermatoglyphic patterns. Palm and finger prints were made and vague and unreadable samples were omitted from the analysis, finally the recorded dermatoglyphic patterns of patients' palms were examined. The control group was chosen from healthy people with no history of any kind of genetic disease or inherited blood disorder and no symptoms of high blood pressure among close relatives. Recording of the ridge patterns was done using clear adhesive tape and based on Book's inkless printing method.

The simplest method for printing ridge lines is the ink printing method. To take prints using this method the following tools are needed: a small fabric ink pad, a glass plate, an ink tube and a white sheet of study or cardboard. First a few drops of ink are poured on the ink pad and then the ink pad is softly rolled on the glass plate until the ink uniformly spreads over its surface. Next from the little finger to thumb, all fingertips are inked in sequence on the ink pad and finally each inked-fingertip is separately placed and rolled on the printing study from side to side to create an imprint of all finger ridges. Then after printing all five fingers, the palm is completely inked using the ink pad and imprinted on the center of the said study or cardboard. In order to record all palm friction ridge details with clarity, light pressure is applied on the back of the hand. The palmar impression of one h and must be recorded on one side of the study and the impression of the other h and on the backs of the same. Bio data including name, age and gender of the person whose fingerprints are being recorded should also be written in the corner of the page (Kamali, Year).

RESULTS

Considering the Table 1 and Fig. 4, 18 (40%) of samples with HT were males and 27 (60%) were female.

Table 1: Frequency of hypertension by gender

Gender	Frequency	(%)
Male	18	40
Female	27	60
Total	45	45

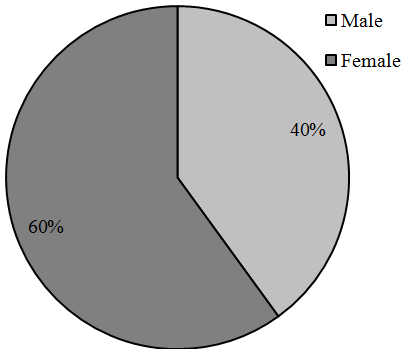

Fig. 4: Frequency of hypertension by gender

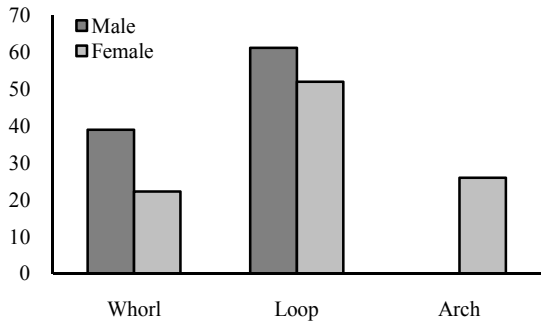

Fig. 5: Comparison of the frequency of distribution of patterns on left digit IV between genders

Data in the Table 2 and Fig. 5 show that loops were the most common patterns on left digits in all patients (males and females). From a statistical point of view, there is a meaningful difference in frequency of different patterns on the left digit 4 ($p = 0.05$) between sexes but other left digits showed no statistically significant difference.

On the right digits (Table 3), loops were higher in incidence in both genders but no significant statistical difference was observed between genders for frequency of different patterns on right digits ($p<0.05$).

The Table 4 indicates a higher incidence of whorls on digit II and of loops on other digits. The table also indicates no significant difference in the frequency of the patterns between two hands ($p<0.05$).

As Table 5 illustrates, frequency in distributions of loops were 70 and 58.8% for the left hand and 63.3 and 66.7%, for the right hand in males and females, respectively. The difference between frequencies of patterns was not statistically significant on any of the two h ands in both sexes-neither the right, nor the left nor both. ($p = 0.02$, $p = 0.03$, $p = 0.002$) as these

Table 2: Comparison of frequency distribution of different patterns on left digits between genders

		Arch		Loop		Whorl		
Fingers	Gender	(%)	Number	(%)	Number	(%)	Number	Meaningful level
Finger 1	Male	0	0	77.8	17	22.2	4	$x = 00.0^2$
	Female	0	0	77.8	21	22.2	6	df = 1
	Total	0	0	77.8	35	22.2	10	p = 1.00
Finger 2	Male	0	0	55.6	10	44.4	8	df =2
	Female	11.1	3	25.9	7	63.0	17	p = 0.008
	Total	6.7	3	37.8	17	55.6	25	
Finger 3	Male	0	0	77.8	14	22.2	4	$x = 00.0^2$
	Female	0	0	77.8	21	22.2	6	df = 1
	Total	0	0	77.8	35	22.2	10	p = 1.00
Finger 4	Male	0	0	61.1	11	38.9	7	$x = 5.78^2$
	Female	25.9	7	51.9	14	22.2	6	df = 2
	Total	15.6	7	55.6	25	28.9	13	p = 0.005
Finger 5	Male	0	0	77.8	14	22.2	4	$x = 2.33^2$
	Female	0	0	55.6	15	44.4	12	df = 1
	Total	0	0	64.4	29	35.6	16	p = 0.13

Table 3: Comparison of the frequency of patterns on right digits between genders

		Arch		Loop		Whorl		
Fingers	Gender	(%)	Number	(%)	Number	(%)	Number	Meaningful level
Finger 1	Male	0	0	72.2	13	27.8	5	$x = 1.13^2$
	Female	0	0	85.2	23	14.8	4	df = 1
	Total	0	0	80.0	36	20.0	9	p = 0.29
Finger 2	Male	0	0	55.6	10	44.4	8	$x = 0.06^2$
	Female	0	0	51.9	14	48.1	13	df = 1
	Total	0	0	53.3	24	46.7	21	p = 0.81
Finger 3	Male	0	0	66.7	12	33.3	6	$x = 3.75^2$
	Female	11.1	3	74.1	20	14.8	4	df = 1
	Total	6.7	3	71.1	32	22.2	10	p = 0.15
Finger 4	Male	0	0	50.0	9	50.0	9	$x = 4.09^2$
	Female	18.5	5	48.1	13	33.3	9	df = 2
	Total	11.1	1	48.9	22	40.0	18	p = 0.13
Finger 5	Male	0	0	72.2	13	27.8	5	$x = 0.02^2$
	Female	0	0	74.1	20	25.9	7	df = 2
	Total	0	0	73.3	33	26.7	12	p = 0.89

Table 4: Comparison of the frequency of different patterns between left and right hands

		Arch		Loop		Whorl		
Fingers	Hand	(%)	Number	(%)	Number	(%)	Number	Meaningful level
Finger 1	Left	0	0	77.8	35	23.2	10	$x = 0.07^2$
	Right	0	0	80.0	36	20.0	9	df = 1
	Total	0	0	78.9	71	21.1	19	p = 0.80
Finger 2	Left	6.7	3	37.8	17	55.6	25	$x = 4.54^2$
	Right	0	0	53.3	24	46.7	21	df = 2
	Total	3.3	3	45.6	41	51.1	46	p = 0.10
Finger 3	Left	0	0	77.8	35	22.2	10	$x = 3.13^2$
	Right	6.7	3	71.1	32	22.2	10	df = 2
	Total	3.3	3	74.1	67	22.2	20	p = 0.21
Finger 4	Left	15.6	7	55.6	25	28.9	13	$x = 1.33^2$
	Right	11.1	5	48.9	22	40.0	18	df = 2
	Total	13.3	12	52.2	47	34.4	31	p = 0.51
Finger 5	Left	0	0	64.4	29	35.6	16	$x = 1.83^2$
	Right	0	0	73.3	33	26.7	12	df = 2
	Total	0	0	68.9	62	31.1	28	p = 0.36

Table 5: Comparison of the frequency of fingerprint patterns between genders

		Arch		Loop		Whorl		
Hand	Gender	(%)	Number	(%)	Number	(%)	Number	Meaningful level
Left hand	Male	0	0	70.0	63	30.0	27	$x = 8.34^2$
	Female	7.4	10	57.8	78	34.8	47	df = 2
	Total	4.4	10	62.7	141	32.9	74	p = 0.02
Right hand	Male	0	0	63.3	57	36.7	33	$x = 6.91^2$
	Female	5.9	8	66.7	90	27.4	37	df = 2
	Total	3.6	8	65.3	147	31.1	70	p = 0.03
Total	Male	0	0	66.7	120	33.3	60	$x = 12.50^2$
	Female	6.7	18	62.2	168	31.1	84	df = 2
	Total	4	18	64.0	288	32.0	144	p = 0.002

Table 6: Comparison of the frequency of the fingerprint patterns in both hands (gender-wise)

		Arch		Loop		Whorl		
Gender	Hand	(%)	Number	(%)	Number	(%)	Number	Meaningful level
Male	Left	0	0	70.0	63	30.0	27	$x = 0.90^2$
	Right	0	0	63.3	57	36.7	33	df = 1
	Total	0	0	66.7	120	33.3	60	p = 0.34
Female	Left	7.4	10	57.8	78	34.8	47	$x = 2.27^2$
	Right	5.9	8	66.7	90	27.4	37	df = 1
	Total	6.7	18	62.2	168	31.1	84	p = 0.32
Total	Left	4.4	10	62.7	141	32.9	74	$x = 0.46^2$
	Right	3.6	8	65.3	147	31.1	70	df = 2
	Total	4	18	64.0	288	32.0	144	p = 0.80

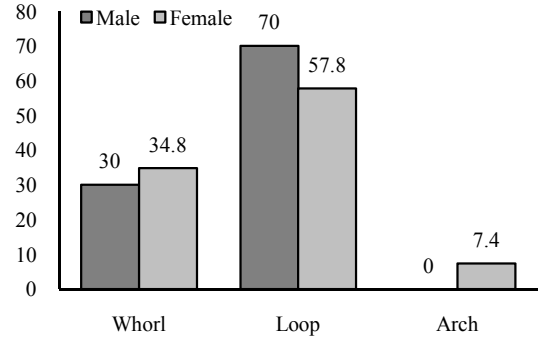

Fig. 6: Comparison of the frequency of the patterns on left digits between genders

Fig. 7: Comparison of the frequency of the patterns on right digits between genders

Fig. 6 and 7 show comparison of the frequency of the Patterns on the right hand and left hand separately while Fig. 8 compares frequency of the pattern both of hands between genders.

As the Table 6 shows, frequency of loops on the left and the right digits were 70-63.3% in males and 57.8-66.7% in females, respectively. The difference between frequencies of the patterns was not statistically significant on both hands of both sexes.

The data shows that the frequency distributions of whorls in the control and sample (hypertensive) group were 75 and 63% on the right hand and 79 and 70% on the left hand of males, respectively (Table 7). No statistically significant difference was observed between frequency distribution of patterns on both hands of males in both groups (p = 0.04, p = 0.02).

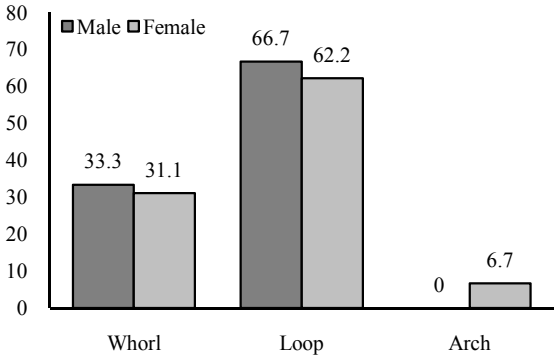

Fig. 8: Comparison of the distribution of fingerprint patterns between genders

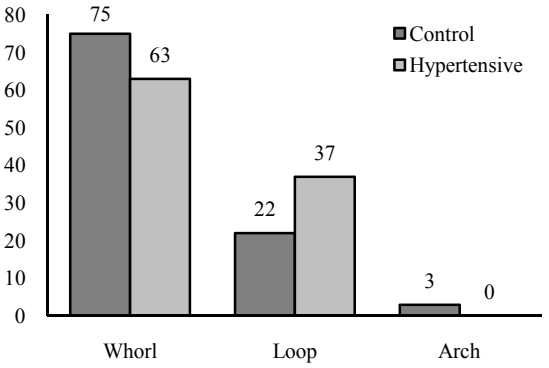

Fig. 9: Comparison of the frequency of the fingerprint patterns on the right hand of the males between the control (healthy subjects) and the hypertensive group

According to the Fig. 9 and 10, percentage of Whorl and Arch is more in control group than in patient group while the percentage of Loop is more in patient group than healthy group in both genders.

Table 8 and Fig. 11 indicate that the percent distribution of whorls on digits of males was as high as 77 and 66.5% in the control and the hypertensive group, respectively. There has been no statistically significant difference between two groups for frequency of patterns on digits in males

The difference in frequency distribution of patterns on digits of females was not high.

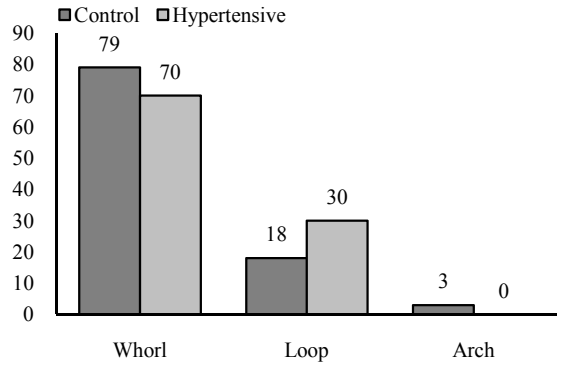

Fig. 10: Comparison of the frequency of the fingerprint patterns on the left hand of the males between two groups: control and sample

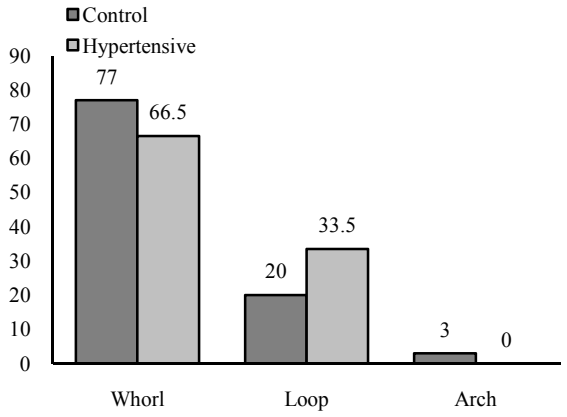

Fig. 11: Comparison of the frequency distribution of the fingerprint patterns in males between two groups: control and hypertensive

Table 7: Comparison of the frequency of the fingerprint patterns in males between the control and the sample group

Hand	Group	Arch (%)	Loop (%)	Whorl (%)	Meaningful level
Left hand	Control	3	22	75	$x = 7.86^2$
	Sample	0	37	63	df = 2
	Total	1.5	59	69	p = 0.02
Right hand	Control	3	18	79	$x = 6.54^2$
	Sample	0	30	70	df = 2
	Total	1.5	24	74.5	p = 0.04

Table 8: Comparison of the frequency of the fingerprint patterns in males between two groups (p = 0.001)

	Arch		Loop		Whorl	
Group	(%)	Number	(%)	Number	(%)	Number
Control	3	6	20.0	40	77.0	154
Hypertensive	0	0	33.5	67	66.5	133
Total	1.5	6	26.8	107	71.8	287

The results show that the percentage of whorl digit patterns in females was 53.7 and 62.5% in the control group and in the hypertensive group, respectively (Table 9 and 10). There has been no statistically significant difference between the two female groups in frequency of patterns on digits.

Table 9: Comparison of the frequency of the fingerprint patterns in females between the control and the hypertensive group

Hand	Group	Arch (%)	Loop (%)	Whorl (%)	Meaningful level
Left hand	Control	4	41	55	$x = 4.46^2$
	Hypertensive	6	27	67	df = 2
	Total	7	34	61	p = 0.10
Right hand	Control	7	41	52	$x = 0.80^2$
	Hypertensive	7	35	58	df = 2
	Total	1.5	38	55	p = 0.67

Table 10: Comparison of frequency distribution of the fingerprint patterns in females between the control and in the hypertensive group (p = 0.12)

	Arch		Loop		Whorl	
Group	(%)	Number	(%)	Number	(%)	Number
Control	5.5	11	40.8	82	53.7	108
Hypertensive	6.5	13	31.0	62	62.5	125
Total	6.0	24	35.9	144	58.1	233

DISCUSSION

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. As mentioned before, previous studies have emphasized that whorls are the most common ridge patterns in hypertensive patients although this study indicates that in the population under study (Iranians of Fars Race) loops are of higher prevalence. Based on Hirsch's reports there is a correlation between genetic disorders and dermatoglyphic patterns. Brain disorders, congenital heart defects, growth and mental retardation and child psychological disorders have been widely examined in order to observe the differences in dermatoglyphic patterns between the control and the experimental group (Stevenson *et al*., 1997). For example, the dermatoglyphic patterns of obese patients were studied by Regoly and colleagues (http://soltaadasi,blogfa.com) Belkan and Milton (Ravindranath, 1995) reported the dermatoglyphic patterns of autosomal trisomies [trisomy 21 (down's syndrome), trisomy 13-18 and trisomy 8], losemi and sex chromosome disorders. There is, in addition, a wide variety of dermatoglyphic patterns among different tribes and these patterns can be considered as a diagnostic feature in some tribes (Ravindranath, 1995). Thomas reported an increase in loops and arches with an increase in whorls on the left hand of diabetic patients (Bakari and Onyemelukwe, 2005) and the results of the present study showed an increase in frequency of loops on the left hand of aforementioned people.

There seems to be a probable relationship between increased frequency of loops in diabetic and hypertensive patients. It has also been proven that obesity is more common in women than in men (Schaumann and Alter, 1976). Hence the main result

obtained in this research is that females are more susceptible to hypertension than males (Table 1). Arches are the most and the least common patterns in patients with breast cancer and high blood pressure, respectively (Oladipo *et al*., 2009). Decreased ATD angle has been reported in patients with prostate cancer (Shabanizadeh *et al*., 2006) whereas the results of this research suggest an increase in ATD angle among hypertensive patients. This is in line with the conclusion made by Jaajv Andi *et al*. (2006) for cleft palate cases. Moreover, Shabanizadeh concluded in a research that the predominant fingerprint patterns in Iranian HT patients are arches and whorls, (Jaajv Andian *et al*., 2008) whereas based on the present study done on Iranians of the Fars Race, loops and arches are the most and the least common ridge prints, respectively.

CONCLUSION

Genetic changes can activate factors which can cause hypertention. Twin and family studies proved that genetic similarity causes some degree of hypertension. In these studies, the genetic influence on blood pressure is estimated to be 30 to 60%. Undoubtedly, environmental factors play an important role in causing hypertension as well. Another hypothesis suggests that hypertension can be attributable to interaction between the environmental and genetic factors.

ACKNOWLEDGMENT

On the whole, in the general population, environmental factors influence hypertension although blood pressure levels are determined by genetics. If genetic features are identified, susceptible people can be recognized before the onset of the disease by special environmental evaluation and necessary preventive measures can be undertaken.

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