RELATIONSHIP BETWEEN PATTERN OF FINGERPRINTS AND OBESITY

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Abstract: The goal was to research the pattern of fingerprints in all the fingers of both hands and to study the association between obesity and fingerprint among university students in different faculties of Koya University with statistical analysis. Dactylography or the fingerprint system relies on the study of stratum ridges and their configurations [dermatoglyphic (derma = skin+ glyph = carving)] in the fingers, palms, and soles. Estimates that probabilities are about one in sixty-four thousand million for two individuals with similar finger impressions. Arbitrate heredity and environment in combination affect the pattern of ridges. We have conducted a study with 120 individual (30 males and 30 females normal and obesity) having the different weight of (normal and obesity), this study was carried out in different faculties in Koya University. All the 10 fingerprint patterns were divided into loop, whorl, and arch. The fingerprint was taken with the help of a stamp pad imprinting the fingerprint ridges over A4 size white paper.
The general distribution of the pattern of fingerprint showed high frequency (58.41%) of the loop, whereas whorls were moderate (37.83%) and arches were least (3.75%) in frequency. Loops are dominated in both normal and obesity for both individual males and females. The study suggests an association between fingerprint pattern and obesity (whorls in left hand of male and female, and arches in different finger of right and left hand of male, also whorls in different finger of right and left hand of female, and arches in different finger of right hand of female) but there is no association between fingerprint pattern and obesity in (loops, whorls, arches, among subject normal and obesity male right hand, loops, and arches among subject normal and obesity of male in left hand, also there is no association between loops, whorls, arches among subject normal and obesity of female right hand, and loops and arches among subjects normal and obesity of female in left hand, also loops and whorls in different finger of right and left hand of male, then loops in different finger of right hand of female, and also loops and arches in different finger of left hand of female) based on statistical analysis of chi-square test when results combined between both genders.

INTRODUCTION

Obesity is a disorder characterized by the extra adiposity tissue, which is a major supply of morbidity and mortality due to a variety of complications linked to weight (Smail 2019). The biological basis of this problem has been explored from evolutionary and mechanistic perspectives (Lizar 2005). The conventional clinical cut-offs for diagnosis involve body mass index calculation (BMI; body weight in kg/height in m). A BMI of 25–29.9 kg/m is considered overweight, 30–34.9 kg/m is obese, and ≥35 kg/m is morbid obesity (Wijnhoven *et al.,* 2015).
There are more than 430 chromosomic regions with gene variants involved in body weight regulation and obesity development (Ochoa *et al.,* 2004). Peroxisome proliferator-activated receptor gamma and, potentially, INSIG2 acting in adipogenesis; the adrenoreceptors beta 2 and 3, as well as hormone-sensitive lipase acting on lipolysis; uncoupling protein 2 acting in mitochondria energy expenditure; and among secreted molecules the cytokine tumor necrosis factor alpha and the hormone leptin (Dahlman and Arner 2007). Major obesity genes are located on chromosomes 2, 10, 11 and 20. Studies of candidate genes indicate that the minor obesity genes control important functions of adipose tissue, and that structural variance in these genes may alter adipose tissue function in a way that promotes obesity (Arner 2000).
Dactylography or the fingerprint system relies on the study of stratum ridges and their configurations (Dermatoglyphics (Derma = skin + Glyph = carving) in the fingers, palms and soles. Estimates that probably there are chances of two people with identical finger impressions are about one in sixty-four thousand million. Heredity and environment arbitrate in combination effects the pattern of ridges (Smail *et al.,* 2019). It has been known for a long time that there is a connection between the ridge pattern and anatomical structures, called volar pads (Cummins, 1929). Volar pads are temporary eminences of the volar skin that form at about the 7th week at the fingertips (apical pads), on the distal part of the palm between the digits (interdigital pads) and in the thenar and hypothenar region (thenar and hypothenar pads). The volar pads become less prominent at around the 10th week and then disappear in human embryos (Kücken and Newell 2005).

The study of fingerprints has been useful in the investigation and identification of certain disorders and syndromes based on the variation of fingerprint patterns and total finger ridge count. In recent years, interest in the medical application of

dermatoglyphic analysis has increased among the clinicians (Smail *et al.,* 2019). Patterns of epidermal ridges have a role in diagnosing and delineating certain syndromes of congenital malformation as well as in establishing twin zygosity in anthropologic surveys and in population genetics (Bhardwaj *et al.,* 2015).

MATERIAL AND METHODS

2:1 MATERIALS

The research was conducted at Koya University between November 2019 and December 2019, on students. A maximum of 120 students (30 normal weight females and 30 obese females and 30 normal weight males and 30 obese males) who belonged to the 18-25 year old age group were randomly selected for study.

white paper divided into four sections, labeled right and left hand for both male and female normal and obese, and further divided into five columns for the thumb-, index-, middle-, and fingerprinting. the horse company's stamp pad of size 45x35 mm is used. The fingerprint was to take away the dirty material absolutely after wiping of hands with tissue paper. Each right and left hand-rolled and plane print was taken for both normal hand and male and female obesity. The fingerprint design (loop, whorl, arch). For this analysis, all persons gathered weight and length to determine the standard and obesity for each individual who then took the fingerprint. Considering normal and obesity according to national health institutes(NIH):

BMI=length×length/weight. A- BMI between 18.5-24.9 is ideal B- BMI over 30 is obesity (Berrington *et al.,* 2010).

2:2 PROCEDURE: (Rastogi *et al.,* 2010):

1-Each subject was asked to wash his hand throughly with soap and water and dry them using a towel.

2-Press his fingertip on the stamp pad and then to the paper to transfer the fingerprint impression. The same method was repeated for all the finger of both hand.

3-The plain fingerprint of all the ten digits were taken separately on the respective block on the same sheet of paper.

4- Care was taken to stop finger slipping to prevent the print from smudging.

5-Results are recorded for determining cases of fingerprints from both normal and obesity

2:3 STATISTICAL ANALYSIS:

The chi-square was applied to examine the relationship between fingerprint and obesity for both right and left hand of male and female (normal and obese). P-values < 0.05 were considered to be statistically significant.

RESULTS

Table 3:1 Distribution of cases based on the sex, normal and obese

sex	Normal	Obesity	Total
Male	30	30	60
Female	30	30	60
Total	60	60	120

Table 3:2 General distributions of primary fingerprint patterns in all fingers of both hands for both sexes.

Types of fingerprints	Total	Percentage
Loops	701	58.41%
Whorls	454	37.83%
Arches	45	3.75%
Total	1200	100%

Table 3:3Distribution of fingerprints pattern among normal and obese man subjects in right hands

Types of fingerprints	Normal	Obese	Total	Chi-square Value:	P value:
Loops	95(63.33%)	78(52%)	173(57.66%)	1.67	0.19
Whorls	51(34%)	64(42.66%)	115(38.33%)	1.46	0.22
Arches	4(2.66%)	8(2.66%)	12(4%)	1.33	0.24
Total	150(100%)	150(100%)	300(100%).		

Table 3:4 Distribution of fingerprints pattern among normal and obese man subjects in left hands

Types of fingerprints	Normal	Obese	Total	Chi-square Value:	P value:
Loops	98(65.33%)	77(51.33%)	175(58.33%)	2.52	0.11

Whorls	42(28%)	62(41.33%)	104(34.66%)	3.84	0.04
Arches	10(6.66%)	11(7.33%)	21(7%)	0.04	0.82
Total	150(100%)	150(100%)	300(100%).		

Table 3:5 Distribution of fingerprints pattern among normal and obese woman subjects in right hands

Types of fingerprints	**Normal**	**Obesity**	**Total**	**Chi-square Value**	**P value**
Loops	84(56%)	96(64%)	180(60%)	0.8	0.37
Whorls	63(42%)	51(34%)	114(38%)	1.26	0.26
Arches	3(2%)	3(2%)	6(2%)	0	1
Total	150(100%)	150(100%)	300(100%)		

Table 3:6 Distribution of fingerprints pattern among normal and obese woman subjects in left hands

Types of fingerprints	**Normal**	**Obesity**	**Total**	**Chi-square Value**	**P value**
Loops	76(50.66%)	97(64.66%)	173(57.66%)	2.54	0.11
Whorls	72(48%)	48(32%)	120(40%)	4.8	0.02
Arches	2(1.33%)	5(3.33%)	7(2.33%)	1.28	0.25
Total	150(100%)	150(100%)	300(100%)		

Table 3:7Distribution of fingerprints pattern in different fingers among normal and obese man subjects in right hands

Fingers	**Thumb**	**Thumb**	**Index**	**Index**	**Middle**	**Middle**	**Ring**	**Ring**	**Little**	**Little**	**Chi-square Value**	**P value:**
	Normal	**Obesity**	**Normal**	**Obesity**	**Normal**	**Obesity**	**Normal**	**Obesity**	**Normal**	**Obesity**		
Loops	18(60%)	15(50%)	16(53.33%)	13(43.33%)	27(90%)	13(43.33%)	19(63.33%)	18(60%)	23(76.66%)	19(63.33%)	9.44	0.39
Whorls	12(40%)	15(50%)	11(36.66%)	13(43.33%)	3(10%)	17(56.66%)	11(36.66%)	9(30%)	7(23.33%)	10(33.33%)	13.11	0.15
Arches	0(0%)	0(0%)	3(10%)	4(13.33%)	0(0%)	0(0%)	0(0%)	3(10%)	0(0%)	1(3.33%)	20.81	0.01
Total	30(100%)	30(100%)	30(100%)	30(100%)	30(100%)	30(100%)	30(100%)	30(100%)	30(100%)	30(100%)		

Table 3:8 Distribution of fingerprints pattern in different fingers among normal and obese man subjects in left hands

Fingers	**Thumb**	**Thumb**	**Index**	**Index**	**Middle**	**Middle**	**Ring**	**Ring**	**Little**	**Little**	**Chi-square Value**	**P value:**
	Normal	**Obesity**	**Normal**	**Obesity**	**Normal**	**Obesity**	**Normal**	**Obesity**	**Normal**	**Obesity**		

Loops	21(70%)	18(60%)	13(43.33%)	10 (33.33%)	21(70%)	17(56.66%)	19(63.33%)	17(56.66%)	24(80%)	19(63.33%)	8.20	0.51
Whorls	8(26.66%)	12(40%)	12(40%)	13(43.33%)	5(16.66%)	11(36.66%)	11(36.66%)	13(43.33%)	6(20%)	9(30%)	7.4	0.59
Arches	1(3.33%)	0(0%)	5(16.66%)	7(23.33%)	4(13.33%)	2(6.66%)	0(0%)	0(0%)	0(0%0	2(6.66%)	26.14	0.00
Total	30(100%0	30(100%)	30(100%)	30(100%)	30(100%)	30(100%)	30(100%)	30(100%)	30(100%)	30(100%)		

Table 3:9Distribution of fingerprints pattern in different fingers among normal and obese woman subjects in right hands

Fingers	**Thumb**	**Thumb**	**Index**	**Index**	**Middle**	**Middle**	**Ring**	**Ring**	**Little**	**Little**	**Chi-square Value**	**P value:**
	Normal	**Obesity**	**Normal**	**Obesity**	**Normal**	**Obesity**	**Normal**	**Obesity**	**Normal**	**Obesity**		
Loops	18(60%)	16(53.33%)	14(46.66%)	16(53.33%)	21(70%)	24(80%)	12(40%)	14(46.66%)	20(66.66%)	26(86.66%)	10.43	0.31
Whorls	12(40%)	14(46.66%)	16(53.33%)	12(40%)	6(20%)	5(16.66%)	18(60%)	16(53.33%)	10(33.33%)	4(13.33%)	19.47	0.02
Arches	0(0%)	0(0%)	0(0%)	2(6.66%)	3(10%)	1(3.33%)	0(0%)	0(0%)	0(0%)	0(0%)	17.33	0.04
Total	30(100%)	30(100%)	30(100%)	30(100%)	30(100)	30(100%)	30(100)	30(100%)	30(100%)	30(100%)		

able 3:10 Distribution of fingerprints pattern in different fingers among normal and obese woman subjects in left hands

Fingers	**Thumb**	**Thumb**	**Index**	**Index**	**Middle**	**Middle**	**Ring**	**Ring**	**Little**	**Little**	**Chi-square Value**	**P value:**
	Normal	**Obesity**	**Normal**	**Obesity**	**Normal**	**Obesity**	**Normal**	**Obesity**	**Normal**	**Obesity**		
Loops	17(56.66%)	18(60%)	12(40%)	13(43.33%)	17(56.66%)	23(76.66%)	11(36.66%)	16(53.33%)	19(63.33%)	27(90%)	12.60	0.18
Whorls	12(40%)	12(40%)	18(60%)	14(46.66%)	12(40%)	6(20%)	19(63.33%)	13(43.33%)	11(36.66%)	3(10%)	17.33	0.04
Arches	1(3.33%)	0(0%)	0(0%)	3(10%)	1(3.33%)	1(3.33%)	0(0%)	1(3.33%)	0(0%)	0(0%)	11.57	0.2
Total	30(100%)	30(100%)	30(100%)	30(100%)	30(100%)	30(100%)	30(100%)	30(100%)	30(100%)	30(100%)		

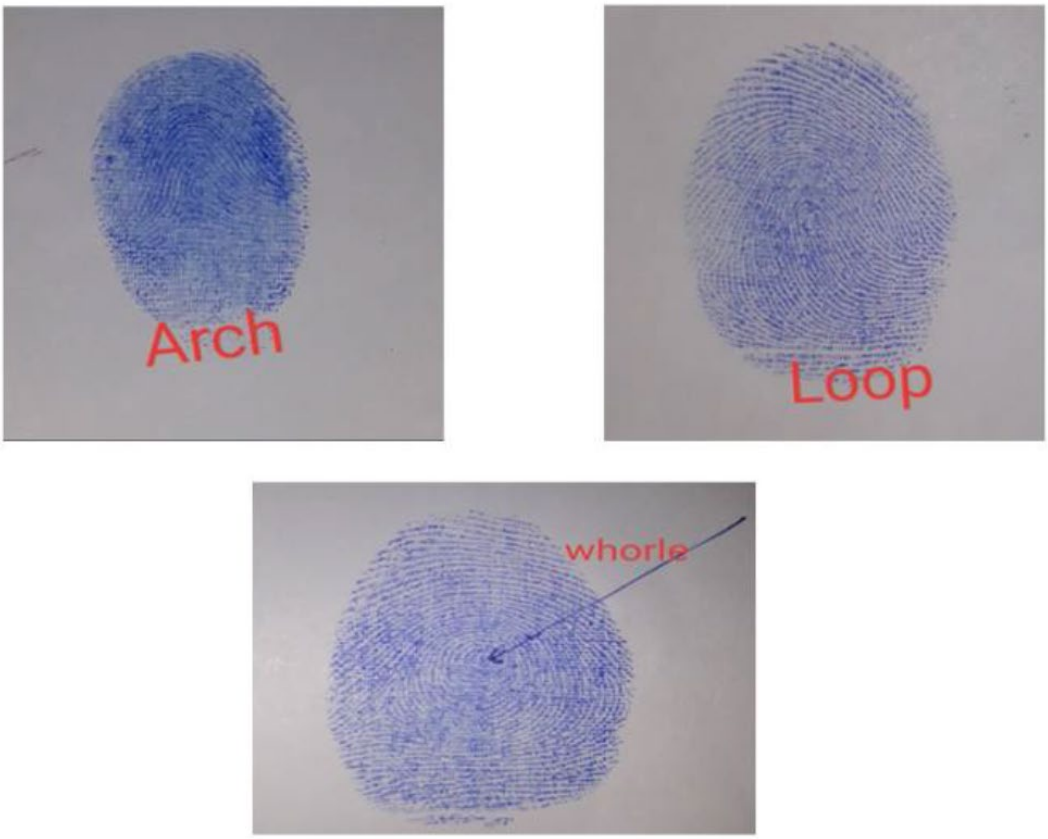

Figure 3:1 Pattern of the primary fingerprints.

DISCUSSION

This study reveals the relation between the distribution of dermatoglyph (dactylography, fingerprint), obesity and gender. A total of 120 subjects randomly chosen from Koya University, among 120 subjects 60 male (30 normal, 30 obese) and 60 females (30 normal, 30 obese). General distribution of primary fingerprint patterns for both genders in all fingers on both hands According to the fingerprint loop types has a greater number than other types (whorl and arch) (Tables 1 and 2).

Loop are the most common types of fingerprints, accounts about 65%. when one or more than one ridge from one side of the pattern and recurve to exist from the same side of point of entry it forms a loop while The whorls fingerprint pattern may be spiral, oval, circular or any variety of a circle and account for approximately 30%. On the other hand, Arch are simplest pattern but rare (about 5%). The fingerprint pattern has ridges running from one side to the other side of the print without having any re-curve (Azhagiri *et al.,* 2018).

According to the type of fingerprint loops average in normal male was (63.33%) and in obese male (52%) and whorl in normal male were (34%) while in obese male (42.66%) and arch in both types were (2.66%). According to the type of fingerprint loops average in normal male and female were

(65.33%) and in obesity were (51.33%) and whorl type in normal were (28%) while in obesity (41.33%) and arch in normal was (6.66%) while in obesity (7.33%) according to the P-value there is relation between fingerprint and obesity in (whorl type) which is (0.04) (table 3 and 4).
According to the type of fingerprint, the loop has a larger average than the other types and there is no relationship between variables. Depending on the type of fingerprint loops in normal were (50.66%) while in obesity (64.66%) and whorl in normal were (48%) and in obesity (32%), arch in normal was (1.33%) and in obesity (3.33%) regarding to P-value there is relation between variable in whorl .loop in normal has larger average number than in obesity in thumb finger, while in normal index finger average number is larger than in obesity, and in middle finger, the normal has larger average number than in obesity, also in little and ring finger normal has larger average number than in obesity, according to P-value there is no relation between variables (fingerprint and obesity) (table 5 and 6).
Whorl in obesity has a larger average number than normal in the thumb finger, a larger number also in the index and middle obesity than usual, and a larger average number in the finger than in obesity, a larger average number in small finger obesity than usual, and no relation between variables. Arch in normal and obesity is equal which is (0 percent) in thumb, and an index, obesity has a greater average number than regular, even in the middle average number is equal which is (0 percent), and ring and tiny the average number in obesity is greater than in obesity, according to P-value the arch is (0.01) meaning there is a relationship between fingerprint and obesity (table 7)
Loop average number in all fingers the normal has a larger range than in obesity Whorl average number in all fingers the obesity has a larger number than in normal Arch in thumb the normal has larger rang than in obesity, in index the obesity has larger range than in normal and in middle, the obesity has smaller ranger than in obesity, the range is equal in ring finger and in little the obesity has larger rang than in normal according to the P-value, arch were (0.00) this mean that there is pure relation between fingerprint and obesity (table 8).
Loop type in thumb the normal has a larger range than in obesity, and in other fingers (index, middle, ring, little) the normal has a smaller range than in obesity. Whorl type in thumb the normal has smaller range than in obesity, and in other fingers (index, middle, ring, little) the normal has larger range than in obesity Arch in thumb, ring and little the average number is equal which is (0%) and in index normal has (0%) and in obesity (6.66%), while in middle the normal has (10%) and obesity (3.33%), depending on the P-value in whorl and arch the variables has relation between them (table 9).
Loop in all fingers the obesity has larger average number than in normal Whorl in thumb the normal and obesity has equal which is (40%), in other fingers (index, middle, ring, little) the obesity has smaller range than in normal Arch in thumb the normal has larger range than obesity and in index, the normal was (0%) while in obesity (10%), in middle there is equal range of normal and obesity, and ring normal were (0%) while obesity (3.33%), in little the range, were equal in normal and obesity, according to the P-value in whorl type the variables has relationship between them (table 10).

CONCLUSION

Conclusively, there was an association between the distribution of fingerprint pattern and obesity of whorl in the left hand of normal and obesity man and woman subjects . on the other hands, there is the relation between Arche patterns from both hands of normal and obese man subjects from

different fingers while only links between arches in right hands of woman subjects among students in Koya university thus it is possible to predict obesity based on the fingerprint.

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