Research Article

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Differences In The Qualitative Features Of Dermatoglyphs Between Persons With Turner And Klinefelter Syndromes And Those With A Normal Karyotype.

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ABSTRACT

Background: Individuals with numerical abnormalities in the X and Y chromosomes are ideal candidates for studying the impact of these chromosomes on the development of specific dermatoglyphic characteristics in humans. The aim of this study is to identify differences in the qualitative features of dermatoglyphs in the Albanian population of Kosovo between women with Turner syndrome and women with a normal karyotype, as well as between men with Klinefelter syndrome and men with a normal karyotype.

Methods and Results: We analyzed the qualitative features of the dermatoglyphs in 15 cases with Klinefelter's syndrome, 17 cases with Turner's syndrome, and 201 men and 202 women with normal karyotype. We used the methods according to Cummins and Midlo to take dermatoglyphic prints and analyze qualitative features. We compared the qualitative features of the dermatoglyphs between the investigated cases using the X-test and Fisher's exact test. During the study of the qualitative features of the dermatoglyphs, it was observed that women with Turner syndrome had a higher frequency of ulnar loops (71.76%) than women in the control group (62.67%), and a lower frequency of whorls (21.77%) than women in the control group (25.64%). People with Klinefelter's syndrome showed differences in the frequency of ulnar loops and whorls that were opposite to those seen in Turner's syndrome.

Patients with Klinefelter's syndrome had a lower frequency of ulnar loops (42%), compared to men in the control group (56.47%), and a higher frequency of whorls (36%), compared to men in the control group (30%).

Conclusion: The frequency of ulnar loops and whorls in fingerprint patterns is a distinctive trait of Turner's syndrome and Klinefelter's syndrome. This should be taken into account when developing screening protocols for these two syndromes.

Keywords : dermatoglyphics pattern, sex chromosomes, Turner's syndrome, Klinefelter's syndrome.

INTRODUCTION

The epidermal ridges on the fingers and palms of the hands tend to extend parallel and continuously. However, various

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factors during embryonic development and growth cause them to become discontinuous, resulting in different patterns of dermatoglyphs on the fingers and palms of the hands. These patterns include ulnar loops, radial loops, whorls, arches, tented arches, accidental whorls, and triradius (1,2,3). Once the distinct patterns of dermatoglyphs are formed, they often remain unchanged throughout a person's lifetime, serving as unique identifying marks for each individual. Dermatoglyphs have proven to be highly significant in the identification of individuals, the study of monozygotic and dizygotic twins, the investigation of human populations, and various other biomedical research endeavors (4,5,6,7,8).

The palms of the hands have digital triradi at the base of the second, third, fourth, and fifth fingers. These triradi are labeled with little letters of the alphabet a, b, c, and d (9). A digital triradi consists of three radiants. The two distale radiaants of the digital triradius encircle the bottom of the finger, while the proximal radiant of the digital triradius extends and signifies the palmar main lines. The capital letters of the alphabets A, B, C, D, and T designate the principal lines of the palm of the hand. This naming convention is based on their origin points, which are the digital triradii a, b, c, and d, as well as the axial triradius t (10.11). The main lines have start points and end points. The starting points for main lines are digital triradii, while ending points of these lines are area-positions that are unique to each line. The positions for line A are 1, 2, 3, 4, 5', 5", and 7. For line B, the positions are 5', 5", 6, 7, 8, and 9. Line C has positions 5', 5", 6, 7, 8, 9, 10, 11, X, x, and 0. Line D has positions 7, 8, 9, 10, 11, and 13'. The T line has positions 11, 12, 13', and 13".

The letter t marks the axial triradius in the proximal part of the hand. Depending on the width of the atd angle, the position of the triradius t in the palm of the hand can also be determined. The angle atd with a width of up to 45^{o}C corresponds to the axial triradius t. The atd corner with a width of 46^{o}C - 55^{o}C corresponds to the axial triradius t'. The axial triradius t" corresponds to the angle atd wider than 56^{o}C. Researchers most often use this classification to study dermatoglyphs (12). In the palms of the hands, there are 5 topographic regions: thenar, with the first interdigital area Th/I; region II; III; IV; interdigital area II; III; IV; and hypothenar. In the interdigital regions, in the thenar and in the hypothenar, the loops are usually present, but whorls, arches, and vestiges can also be found (9,13). The presence of only one transversal crease that extends from one end to the other end of the palm of the hand is called a four-finger crease or simian crease. This crease is more often present in people with chromosomal aberrations (14).

Qualitative feature analysis of dermatoglyphs can be accomplished by performing the feature analysis of dermatoglyphs described above. These tests can be done on the fingers and palms of the hands. These analyses determine the frequency of dermatoglyphic patterns on both the right and left hand's fingers. In the slaps of the hands, the analysis of these qualitative features of the dermatoglyphs is mainly performed: determination of the frequency of dermatoglyphic patterns in the hypothenar and interdigital regions (Th/I, II, III, and IV), determination of the frequency of the axial triradius (t,t', t"), determining of the frequency of the termination of palmar main lines (A, B, C, D, and T), as well as determining the frequency of the four finger crease in the palms of the hands (9,12,13,14). In the normal population, the ulnar loop is the pattern with the highest frequency in the fingers (66.33%), followed by the whorl (26.33%), the plain arches (6%), the radial loop (1%), and tented arch (0.33%). (15).

Multiple studies conducted by various researchers have demonstrated that individuals with sex chromosomal abnormalities may exhibit alterations in the qualitative characteristics of dermatoglyphics. Shionos et al. (1977) found that males with Klinefelter's syndrome had a higher frequency of arches in all fingers (6.1%) compared to males in the control group (1.8%). Additionally, the frequency of whorls in individuals with Klinefelter's syndrome is higher (53.4%) compared to men in the control group (47.7%). Individuals with Klinefelter's syndrome exhibit a decrease in the occurrence of ulnar loops and radial loops (39.3% and 1.1%) compared to the control group (47.2% and 3.3%) (16). However, according to this author, patients with Klinefelter's syndrome have a higher number of loops in the third interdigital area compared to men in the control group. Furthermore, termination of C main lines at position 0 (zero) on the left hand was more frequent in patients with Klinefelter's syndrome (7.1%) compared to men in the control group (5.8%). Similarly, the differences were even more pronounced in patients with Klinefelter's syndrome (17.9%) compared to cases in the control group (3.2%) on the right hand.

Researchers have found different results in the qualitative features of dermatoglyphs in people with sex chromosomal abnormalities like Turner's syndrome and Klinefelter's syndrome from various populations around the world. Hold and Linsten (1964) found that 68.1% of individuals with Turner's syndrome had ulnar loops in all fingers (17). Bhalla et al. (2005) found that people with Turner's syndrome had a decreased frequency of ulnar loops (61.3%) in all fingers of their hands (18). Additionally, different authors reported varying frequencies of whorls in patients with Turner disease. Kobyliansky et al. (1997) discovered that 33.9% of patients with Turner's syndrome had whorls in the fingers of both hands (19). Bhalla et al. (2005) found that the frequency of whorls in both hands' fingers was 24.4%, which was lower than the other research on dermatoglyphs (18). Various researchers have reported variations in the frequency of ulnar loops and whorls, which they attribute to the fact that the individuals studied belong to distinct populations.

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Our goal is to determine the degree to which X and Y chromosomes influence the variability in the frequency of dermatoglyphic patterns. We aim to investigate the qualitative characteristics of the dermatoglyphs in patients with aberrations of the sex chromosomes in the Albanian population of Kosovo. Specifically, we examine the patterns in the fingers, palms, axial triradius, the frequency of termination of palmar main lines, and four finger creases in the palms. This research is unique, as no other authors have conducted similar studies on this population.

STUDY AIM

The study's aim is to assess the influence of sex chromosomal abnormalities by comparing the qualitative characteristics of the dermatoglyphs in Turner syndrome patients and females in the control group, as well as in Klinefelter syndrome patients and males in the control group, to examine the qualitative characteristics of dermatoglyphs in people with Turner's syndrome and Klinefelter's syndrome, as well as identify the specific dermatoglyph variables associated with these two diseases.

MATERIAL AND METHODS

We conducted a qualitative analysis of dermatoglyphs on a sample of 32 individuals with sex chromosomal abnormalities from the Albanian community of Kosovo. Out of these, 17 individuals had Turner's syndrome, and 15 individuals had Klinefelter's syndrome. We analyzed the qualitative characteristics of the dermatoglyphs of 403 individuals from the Albanian community of Kosovo who did not exhibit any chromosomal abnormalities. This group consisted of 202 women and 201 men. We used Cummins and Midlo's (20) approach to collect and analyze dermatoglyphic prints. We realized the karyotype analysis of individuals diagnosed with Turner syndrome and Klinefelter syndrome using the modified Moorhead method and the Seabright method (21).

In this study, we analyzed the qualitative characteristics of the fingerprints on the fingers and palms of the hands. The frequency of dermatoglyphic patterns (arch, tented arch, ulnar loop, radial loop, whorl, and accident whorl) has been assessed on the fingers. The frequency of dermatoglyphic patterns in the palms was assessed, including the thenar region, the interdigital spaces (I, II, III, and IV), and the hypothenar region. In the palms of the hands, we also determined the frequency of distinct forms of axial triradi (t, t', t''), the occurrence rate of the four-finger crease, and the analysis of the termination of palmar main lines (A, B, C, D, and T).

The qualitative features of the dermatoglyphs in cases with aberrations of sex chromosomes were compared to those in the control group using either the X^2 test or Fisher's exact test. P value less than 0.05 ($p<0.05$) was considered statistically significant.

RESULTS

We analyzed the qualitative characteristics of digitopalmar dermatoglyphs in two groups. The first group consisted of 32 individuals with sex chromosomal abnormalities, comprising 17 cases of Turner's syndrome and 15 cases of Klinefelter's syndrome. The second group (i.e., the control group) consisted of 201 men and 202 women who did not have any chromosomal abnormalities.

Table 1 displays the variations in the frequency of dermatoglyphic patterns on the fingers of women with Turner syndrome compared to women with a normal karyotype. Women with Turner syndrome had a lower frequency of arches (0.59%) compared to women in the control group (5.05%). These differences were found to be statistically significant (Fisher test; P = 0.0143*). Ulnar loops were more frequent in women with Turner's syndrome (71.76%) compared to women in the control group (62.67%), and these differences were statistically significant ($X^2 = 5.19$; P = 0.022*). Accidental whorls were in higher frequency in women with Turner syndrome (2.35%) compared to control women (0.40%), and this difference was statistically significant ($X^2=7.72$; p = 0.0055**). Women with Turner's syndrome had a lower frequency of whorls (21.77%) compared to control women (25.64%), but, these differences did not reach statistical significance ($p > 0.05$). The prevalence of radial loops in individuals with Turner's syndrome (3.53%) was comparable to that observed in women in the control group (3.91%).

Figure 1 displays the differences in the frequency of dermatoglyphic patterns on the palm areas of women with Turner syndrome compared to those in the control group. The percentage of woman with Turner's syndrome who had dermatoglyphic patterns in the thenar and first interdigital areas (Th/1) was about 3.85%, which is about the same as the percentage of women in the control group (4.35 %). In individuals diagnosed with Turner's syndrome, dermatoglyphic patterns were absent in the II interdigital region. Of note, women in the control group exhibited dermatoglyphic patterns in this region, occurring at a frequency of 1.29%.

The frequency of dermatoglyphic patterns in the III interdigital region was found to be 34.61% in patients with Turner's syndrome, which was comparable to the frequency of dermatoglyphic patterns in women in the control group, which was 34.94%. In the IV interdigital region, the occurrence of dermatoglyphic patterns in patients with Turner's syndrome was found to be lower (26.92%) compared to women in the control group (36.71%). However, these differences were not statistically significant ($p > 0.05$). In the hypothenar region,

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patients diagnosed with Turner's syndrome had a higher frequency of dermatoglyphic patterns (34.62%) compared to women in the control group (22.71%) in both hands.However, this disparity did not reach statistical significance ($p > 0.05$).

Table 1. Differences in the frequency of dermatoglyphic patterns of fingers on females with Turner syndrome compared to those in the control group.

Dermatoglyphic patterns	Female with Turner syndrome (n=17) %	Females of the control group (n=202) %	Chi-square test	p-value
Arch	0.59	5.05	Fisher test	P= 0.0143*
Tented arch	0.00	2.33	X2=3.0	P=0.0827
Ulnar loop	71.76	62.67	X2=5.19	P=0.022*
Radial loop	3.53	3.91	X2=0.0016	P=0.967
Whorl	21.77	25.64	X2=1.05	P=0.305
Accidental whorl	2.35	0.40	X2=7.72	P=0.0055**
Total	100%	100%		

*p<0.05; **p<0.01; ***p<0.001

Figure 1

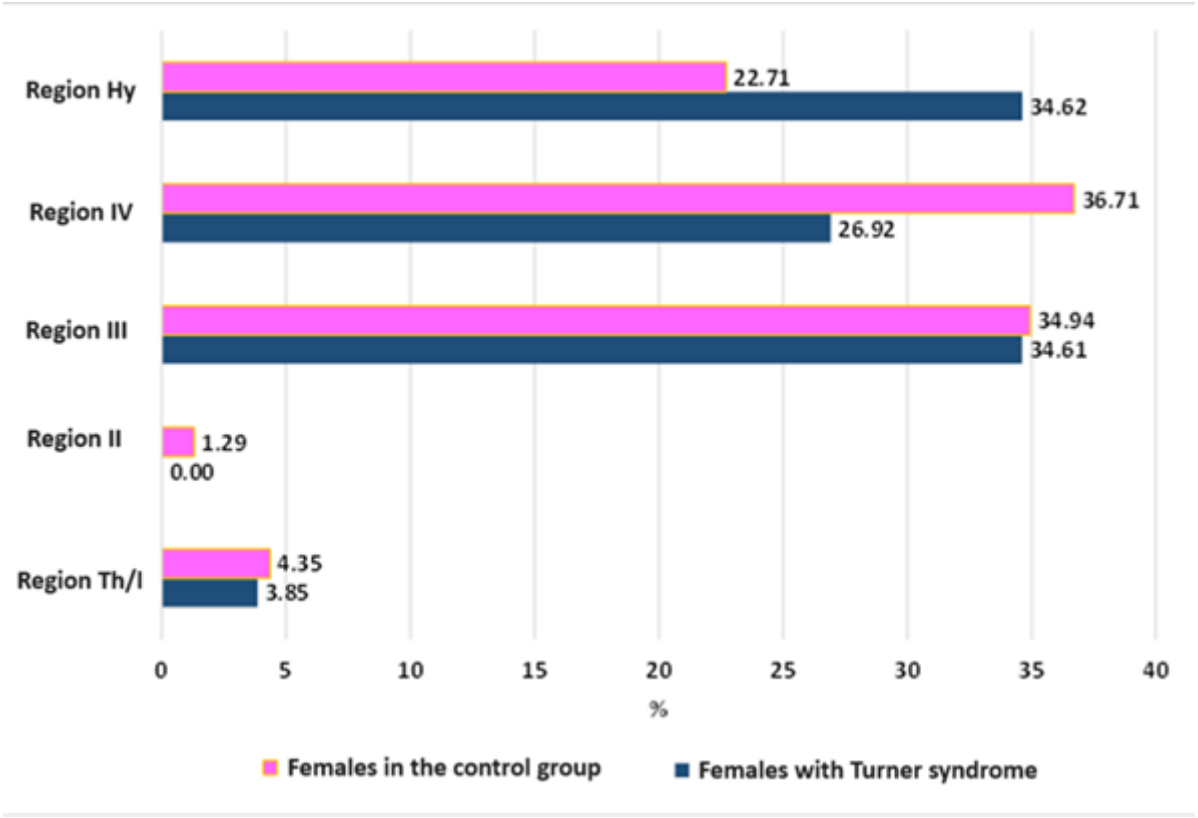


Figure 1. Variations in the frequency of dermatoglyphic patterns on the palm areas of females with Turner syndrome compared to those in the control group.

Figure 2 shows the variations in the frequency of position of axial triradi (t, t', and t") between women diagnosed with Turner's syndrome and women belonging to the control group. In women with Turner's syndrome, the occurrence of axial triradius t was less frequent (35.29%) compared to women in the control group (51.73%), but this difference did not reach statistical

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significance (p > 0.05). The triradius t' frequency in women with Turner's syndrome (38.24%) was similar to that of women in the control group (35.4%). The frequency of triradius t" in women with Turner's syndrome was higher (26.47%) compared to women in the control group (12.87%), although this difference did not reach statistical significance (p > 0.05).

Figure 2

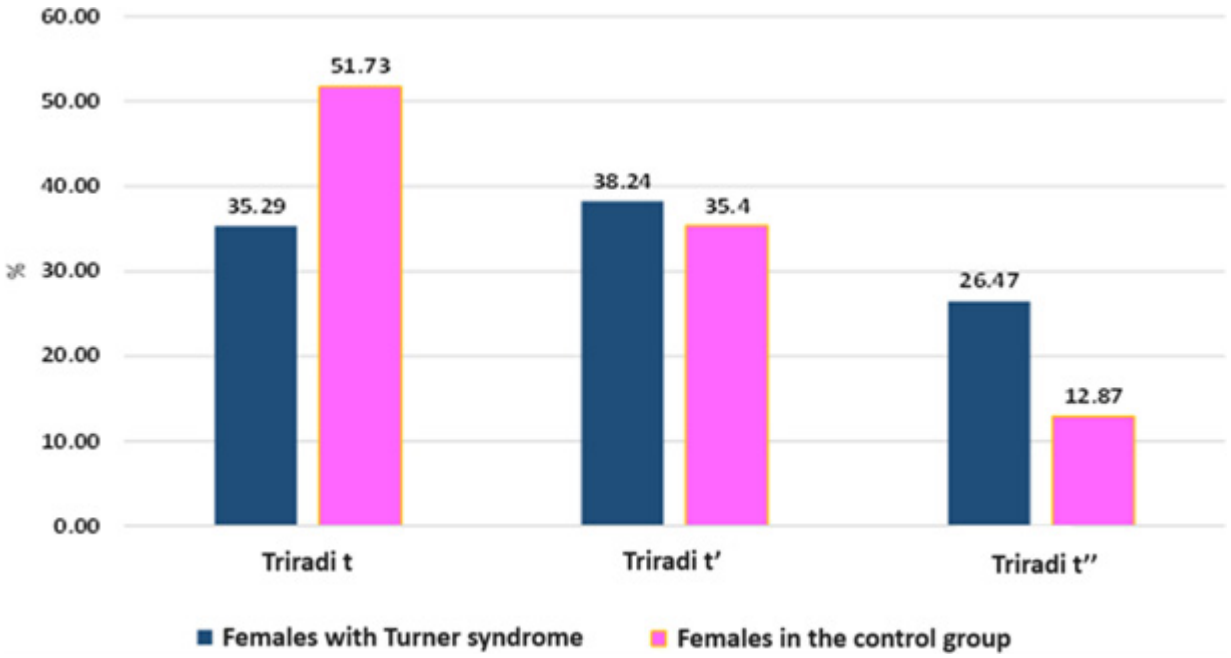


Figure 2. Variations in the frequency of position of axial triradi t, t', and t" among females diagnosed with Turner's syndrome compared to those in the control group.

Table 2 displays the differences in frequency of the four-finger crease (simian crease) on the palms of females with Turner syndrome compared to females in the control group. The frequency rate of the four-finger crease was significantly higher (Fisher test; p < 0.0001***) in females with Turner's syndrome (35.29%) compared to women in the control group (0.99%). Moreover, the frequency rate of the four-finger crease only on one hand was significantly higher (Fisher test; p=0.0015**) in women diagnosed with Turner's syndrome (23.53%) compared to women in the control group (1.98%). In women with Turner's syndrome (41.18%), the absence of the four-finger crease in the palms of the hands was significantly less frequent (Fisher test; p < 0.0001***) compared to women in the control group (97.03%).

Table 2. Differences in the frequency of the four-finger crease (simian crease), in the palms of female with Turner syndrome compared to the control group.

Four finger crease	Females with Turner syndrome n =17 (%)	Females in the control group n=202 (%)	Fisher's exact test	P-value
The occurrence of a four-finger crease on both hands	6 (35.29)	2 (0.99)	Fisher test	P<0.0001***
The occurrence of a four-finger crease in just one hand	4 (23.53)	4 (1.98)	Fisher test	P=0.0015**
The absence of a four-finger crease on both hands	7 (41.18)	196 (97.03)	Fisher test	P<0.0001***
Total	17 (100%)	202 (100%)	202 (100%)	

*p<0.05 ; **p<0.01; ***p<0.001

Table 3 displays a comparison of the frequencies of termination of palmar main lines A, B, C, D, and T between women with Turner syndrome and women in the control group. The comparison was conducted by determining the location of the

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termination of palmar main lines in two claps of hands using statistical tests such as the X^2 test and Fisher's exact test. The results of the statistical tests, specifically the X^2 test and Fisher's test, showed significant differences between women with Turner syndrome and control women for various positions on the main lines A, C, and T. These positions include the position 2 of main line A (Fisher test; $p < 0.0001$***), position 3 of main line A ($X^2 = 6.629$; $p = 0.01$*), position 5' of the main line A (Fisher test; $p = 0.0049$**), position 0 of the main line C (Fisher test; $p = 0.035$*), position 11 of the main line T ($X^2 = 38.1$; $p < 0.0001$***), and position 13' of the main line T ($X^2 = 26.4$; $p < 0.0001$***).

Table 3. Comparison of the frequencies of termination of palmar main lines A, B, C, D, and T between females with Turner syndrome and those in the control group.

Main line	Area of termination	Females with Turner syndrome	Females in the control group	Chi-square test or Fisher's exact test	P-value
		(n=17) %	(n=202) %		
A	1	2 (5.88)	9 (2.23)	Fisher test	P=0.2072
	2	6 (17.65)	5 (1.24)	Fisher test	P<0.0001***
	3	11(32.35)	57 (14.11)	X2=6.629	P=0.01*
	4	9 (26.47)	162 (40.09)	X2=1.908	P=0.167
	5'	5 (14.71)	158 (39.11)	Fisher test	P=0.0049**
	5"	1 (2.94)	13 (3.22)	Fisher test	P=0.999
	7	0 (0.00)	0 (0.00)	-	-
		34 (100%)	404 (100%)		
B	5'	9 (26.47)	62 (15.35)	X2=2.097	P=0.1476
	5"	8 (23.53)	138 (34.16)	X2=1.152	P=0.2831
	6	0 (0.00)	0 (0.00)	-	-
	7	17 (50.00)	198 (49.00)	X2=0.005	P=0.946
	8	0 (0.00)	0 (0.00)	-	-
	9	0 (0.00)	6 (1.49)	Fisher test	P=1.000
		34 (100%)	404 (100%)		
C	5'	0 (0.00)	5 (1.24)	Fisher test	P=1.000
	5"	6 (17.65)	46 (11.39)	X2=0.653	P=0.419
	6	0 (0.00)	0 (0.00)	-	-
	7	9 (26.47)	133 (32.92)	X2=0.337	P=0.561
	8	0 (0.00)	0 (0.00)	-	-
	9	16 (47.06)	174 (43.07)	X2=0.073	P=0.787
	10	0 (0.00)	0 (0.00)	-	-
	11	0 (0.00)	6 (1.49)	Fisher test	P=1.000
	X	0 (0.00)	27 (6.68)	Fisher test	P=0.252
	X	0 (0.00)	6 (1.49)	Fisher test	P=1.000
	0	3 (8.82)	7 (1.73)	Fisher test	P=0.035*
		34 (100%)	404 (100%)		
D	7	6 (17.65)	72 (17.82)	X2=0.043	P=0.835
	8	0 (0.00)	0 (0.00)	-	-
	9	10 (29.41)	134 (33.17)	X2=0.066	P=0.797
	10	0 (0.00)	0 (0.00)	-	-
	11	18 (52.94)	198 (49.01)	X2=0.068	P=0.793
	13'	0 (0.00)	0 (0.00)	-	-
		34 (100%)	404 (100%)		

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T	11	10 (29.41)	13 (3.22)	X2=38.1	P<0.0001***
	12	0 (0.00)	0 (0.00)	-	-
	13'	20 (58.82)	365 (90.35)	X2=26.4	P<0.0001***
	13"	4 (11.77)	26 (6.44)	Fisher test	P=0.276
		34 (100%)	404 (100%)		

*p<0.05; **p<0.01; ***p<0.001

Table 4 shows the differences in the frequency of dermatoglyphic patterns on the fingers between males diagnosed with Klinefelter's syndrome and those in the control group. The frequency of arches in individuals with Klinefelter's syndrome was significantly (X^2=21.3; p < 0.0001***) higher (13.33%) compared to the frequency of arches in males in the control group (4.43%). The frequency of ulnar loop was significantly (X^2 = 11.3; p = 0.0008***) less frequent in males with Klinfelter's syndrome (42%), compared to men in the control group, where the occurrence of ulnar loop was higher (56.47%). In individuals with Klinefelter's syndrome, the frequency of whorls was not significantly higher (p > 0.05) but more frequent (36%) compared to men in the control group (30.05%). The frequency of radial loops was lower, but not significant (p > 0.05), in patients diagnosed with Klinefelter's syndrome (2%) compared to men in the control group (5.12%).

Table 4. Differences in the frequency of dermatoglyphic patterns on the fingers of the hands between males with Klinefelter's syndrome and males in the control group.

Dermatoglyphic patterns	**Males with Klinefelter syndrome (n=15)%**	**Males in the control group (n=201)%**	**Chi-square test or Fisher's exact test**	**P-value**
Arch	13.33	4.43	X^2=21.3	P<0.0001***
Tented arch	6.00	3.53	X^2=1.742	P = 0.187
Ulnar loop	42.00	56.47	X^2=11.3	P=0.0008***
Radial loop	2.00	5.12	Fisher test	P=0.094
Whorl	36.00	30.05	X^2=2.06	P=0.151
Accidental whorl	0.67	0.40	Fisher test	P=0.477
Total	100 %	100 %		

*p<0.05; **p<0.01; ***p<0.001

Figure 3 illustrates the differences in the frequency of dermatoglyphic patterns in the palm regions of individuals with Klinefelter's syndrome compared to those with a normal karyotype. A higher but non significant (p > 0.05) percentage of dermatoglyphic patterns were found in the Th/I region in man with Klinefelter's syndrome (8.16%) than in men in the control group (4.85%). Patients with Klinefelter's syndrome had an absence of dermatoglyphic patterns in the II interdigital region, whereas men in the control group displayed dermatoglyphic patterns in this region with a frequency of 2.28%.

Dermatoglyphic patterns were found just as often in people with Klinefelter's syndrome as they were in the control group in the III and IV interdigital regions. The percentages were 32.66% and 34.69% for people with Klinefelter's syndrome and 34.45% and 31.11% for people in the control group. Patients with Klinefelter's syndrome had a reduced frequency of dermatoglyphic patterns (24.49%) in the hypothenar area compared to men in the control group (27.31%). However, this difference did not reach statistical significance (p > 0.05).

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Figure 3

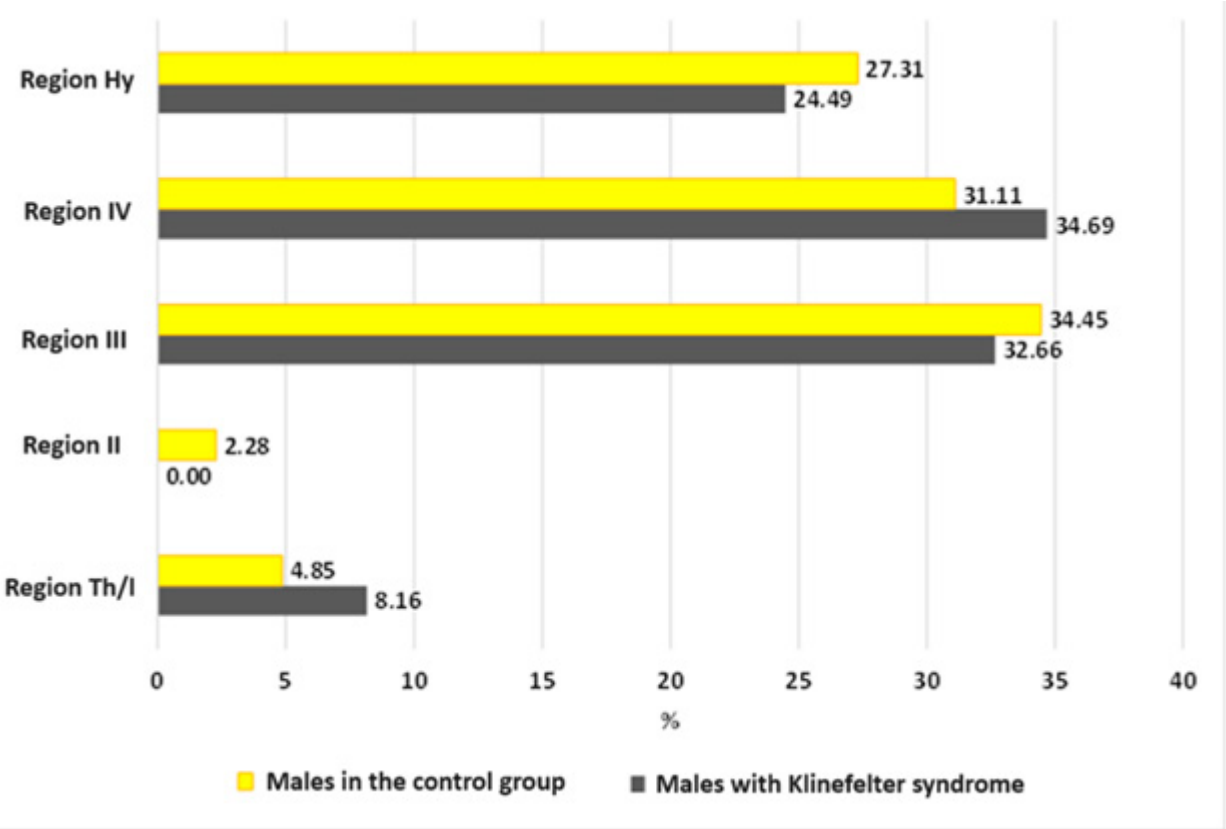


Figure 3. Differences in the frequency of dermatoglyphic patterns in the palm regions of the hands between males with Klinefelter's syndrome and those in the control group.

Figure 4 shows the differences in the frequency of the position of the axial triradius (t, t', t") between males with Klinefelter's syndrome and males in the control group. The frequency rates of axial triradii t, t', and t" in individuals with Klinefelter's syndrome were similar to those in men in the control group, with frequencies of around 60%, 26.67%, and 13.33% compared to 61%, 26.87%, and 11.44%, respectively. While several patients with Turner's syndrome exhibited four finger creases, none of the individuals with Klinefelter's syndrome displayed this characteristic.

There were no statistically significant differences between the control group and the men with Klinefelter's syndrome when it came to the termination frequencies of palmar main lines A, B, C, D, and T (Table 5). The comparison was conducted by determining the location of the termination of the palmar main lines in the two hand slaps in the investigated people using the X^2 test and Fisher's exact test.

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Figure 4

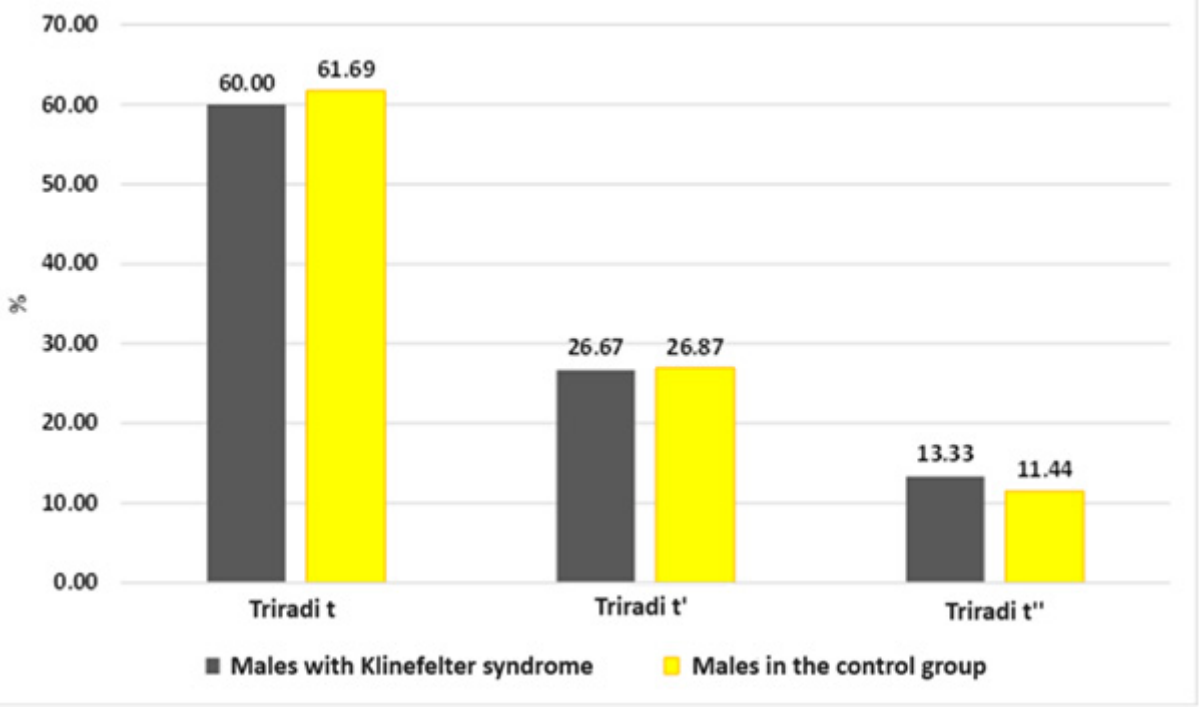


Figure 4. Differences in the frequency of the position of axial triradi t, t', and t'' between males with Klinefelter's syndrome and those in the control group.

DISCCUSSION

Individuals with variations in the number of X chromosomes serve as an appropriate model for studying the impact of the X chromosome and the genes it contains on the development of dermatoglyphics' qualitative and quantitative characteristics (22). Sex chromosomal aberrations can lead to alterations in the frequency of dermatoglyphic patterns on the fingers and palms of the hands. We studied the dermatoglyphs of the fingers and found that patients with Turner's syndrome had a higher frequency of ulnar loops (71.76%) compared to women in the control group (62.67%). Additionally, they had a lower frequency of arches (0.59%) than women in the control group (5.05%), and a lower frequency of whorls (21.77%) than women in the control group (25.64%) (table 1).

Individuals with Klinefelter's syndrome exhibit contrasting variations in terms of the occurrence of arches, ulnar loops, and whorls in the fingers of their hands compared to those with Turner's syndrome. Our study found that patients with Klinefelter's syndrome had a significantly higher frequency of arches (13.33%) compared to the control group of men (4.43%). Additionally, they had a lower frequency of ulnar loops (42%), compared to the control group (56.47%), and a higher frequency of whorls (36%), compared to the males in the control group (30.05%) (table 4). The varied numbers of X chromosomes present in the karyotype of these patients may account for the varying frequencies of arches, ulnar loops, and whorls. Individuals with Turner syndrome have a karyotype (45, X) that is characterized by the presence of a single X chromosome, whereas those with Klinefelter syndrome have a karyotype (47, XXY) that is characterized by the presence of two X chromosomes. Therefore, we can deduce that the genes located on the X chromosome are responsible for the development of dermatoglyphic patterns on the hand's fingers.

Our investigation on dermatoglyphs in women with Turner's disease closely aligned with the data reported by Pfeiffer (1968) (23). In women with Turner syndrome, ulnar loops were observed in 71.76% of cases (Pfeiffer's study reported 68.2%), radial loops in 3.53% of cases (Pfeiffer's research reported 3.5%), and whorls in 21.77% of cases (Pfeiffer's study reported 23.3%). Our study's frequency rate of arches was less frequent (0.59%) than Pfeiffer's (4.9%).

Our study on the frequency of dermatoglyphic patterns in the fingers among patients with Turner's disease frequently revealed discrepancies when compared to other researchers' findings. Bhalla et al. (2005) observed ulnar loops in the fingers of 61.3% of individuals diagnosed with Turner's syndrome. Similarly, Kobyliansky et al. (1997) reported ulnar loops in 61.9% of patients with this illness, while Forbes (1964) identified ulnar loops in 65.6% of patients with Turner's syndrome (18, 19, 24). In our study,

the frequency of ulnar loops in the fingers of patients with Turner's syndrome was higher (71.76%), compared to the findings reported by the aforementioned authors. Patients with Turner syndrome also exhibit variations in the frequency of whorls. In their study, Bhalla et al. (2005) reported the presence of toe whorls in 24.4% of individuals diagnosed with Turner syndrome. Kobyliansky et al. (1997) found whorls in 33.9% of patients, while Forbes (1964) reported it in 25.8% of patients (18, 19, 24). In our study, the frequency rate of whorls in the fingers of patients with Turner syndrome was lower (21.77%) compared to the findings reported by the aforementioned authors. Notably, the individuals studied belong to distinct groups, which may explain the variations in the frequency of ulnar loops and whorls reported by different authors.

Our research and others' research show that patients with Turner's syndrome have a higher frequency of having ulnar loops in all of their fingers (68.10%) than females in the control group (61.60%). The frequency of arches was lower in Turner syndromes (2.04%) than in the control group (7.20%). Similarly, the frequency of radial loops was lower (4.09%) compared to the control group's frequency of 6.40% (17).

In our study of patients with Turner's syndrome, we found that the palm regions rank as follows in terms of the frequency of dermatoglyphic patterns: hypothenar (34.62%) > third interdigital area (34.61%) > fourth interdigital area (26.92%) > thenar and first interdigital area (3.85%) > second interdigital area, which lacks dermatoglyphic patterns (Figure 1). The women in the control group ranked the regions of the palms of their hands based on the frequency of dermatoglyphic patterns as follows: fourth interdigital area (36.71%) > third interdigital area (34.94%) > hypothenar (22.71%) > thenar and first interdigital area (4.35%) > second interdigital area (1.29%) (figure 1). The data indicate that among individuals with Turner's syndrome, the hypothenar region (34.62%) and the third interdigital area (34.61%) of the hands have the highest concentration of dermatoglyphic patterns. In the control group, the fourth interdigital area (36.71%) and the third interdigital area (34.94%) are the regions of the hands with the highest of dermatoglyphic patterns in women.

When studying women with Turner syndrome, we observed that the occurrence of axial triradius t" is higher (26.47%) compared to women in the control group (12.87%). On the other hand, the frequency of triradius t is lower (35.29%) in women with Turner syndrome compared to women in the control group (51.73%) (Figure 2). Other authirs have also documented the heightened frequency of the axial triradius t" in individuals with Turner's syndrome (18, 25).

Our investigation of women with Turner's syndrome revealed a higher frequency of fourth finger creases in both hands among these women (35.29%), compared to the control group (0.99%).Furthermore, fourth finger creases of just one hand were more prevalent in women with Turner's syndrome (23.53%) compared to women in the control group (1.98%) (table 2). Other authors have also reported fourth-finger creases in females diagnosed with Turner's disease (23, 24). We observed statistically significant differences in the frequency of termination of palmar main lines between women with Turner's syndrome and those in the control group. Specifically, three positions of main line A, one position of main line C, and two positions of main line T showed significant differences (as shown in table 3).

Our findings strongly support the selection of qualitative dermatoglyphic variables that are indicative of Turner's syndrome, such as an increased frequency of ulnar loops than in the control group, a decreased frequency of arches and radial loops than in the control group, a lack of dermatoglyphic patterns in the second interdigital area, and an increased frequency of the axial triradius t" and fourth finger crease than in the control group. These variables should be considered while developing a screening approach that can distinguish patients with Turner's syndrome from normal women. By considering the quantitative characteristics of dermatoglyphs specific to Turner's syndrome, it becomes more probable to differentiate patients with Turner's syndrome from normal women. This distinction holds greater practical significance for diagnosing individuals with Turner's syndrome. This method produces a screening approach that is valuable for diagnosing Turner's syndrome.

Our study's findings on the prevalence of dermatoglyphic patterns in the fingers of people with Klinefelter's disease were similar to those reported by Hunter (1968) (26). 13.33% of patients with Klinefelter's syndrome had arches in their fingers (compared to 12.60% in the Hunter group), 42% had ulnar loops (compared to 39.50% in the Hunter group), and 36% had whorls (compared to 39.50% in the Hunter group). In our study, the occurrence of radial loops was less frequent (2%) compared to Hunter's research (8.40%).

Our research on the occurrence of dermatoglyphic patterns in the fingers of patients with Klinefelter's syndrome revealed some discrepancies with other authors' findings. However, like those authors, we also observed a higher frequency of arches in all fingers (6.1%) compared to the control group of men (1.8%). Additionally, we found a higher frequency of whorls (53.4%) compared to the control group (47.7%), a lower frequency of ulnar loops (39.3%) compared to the control group (47.2%), and a reduced frequency of radial loops (1.1%) compared to the control group (3.3%) (16). Nazarabadi et al. (2007) found that the frequency of arches in individuals with Klinefelter's syndrome can serve as a screening test for diagnosing the condition with an 80% reliability rate (27).

In our study, we observed that the frequency of dermatoglyphic patterns in patients with Klinefelter's syndrome varied across different palm regions. The order of palm regions, based on

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the size of these frequencies, was as follows: fourth interdigital area (34.69%) > third interdigital area (32.66%) > hypothenar (24.49%) > thenar and first interdigital area (8.16%) > second interdigital area, which did not exhibit any dermatoglyphic patterns (figure 3). The men in the control group ranked the regions of the palms of their hands based on the frequency of dermatoglyphic patterns as follows: third interdigital area (34.45%) > fourth interdigital area (31.11%) > hypothenar > (27.31%) > thenar and first interdigital area (4.85%) > second interdigital area (2.28%) (see figure 3). The fourth interdigital area (34.69%) and the third interdigital area (32.66%) have the highest concentration of dermatoglyphic patterns in males diagnosed with Klinefelter's syndrome. In the male control group, the third interdigital area (34.45%) and the fourth interdigital area (31.11%) exhibit the highest concentration of dermatoglyphic patterns on the hands.

Several investigators have reported variations in the frequency of the axial triradii (t, t', and t") between individuals with Klinefelter's syndrome and those in the control group (24, 27). The frequencies of axial triradius t, t', and t" in people with Klinefelter's syndrome (60%, 26.67%, and 13.33%) were the same as those in the control group (61%, 26.87%, and 11.44%) (Figure 4). Our study observed the lack of four finger creases in the palms of patients with Klinefelter's disease. Our study findings are consistent with reports from other authors (24, 27). We observed no statistically significant differences in the frequencies of termination of palmar main lines between men with Klinefelter's syndrome and those with a normal karyotype. This applies to the termination of palmar main lines A, B, C, D, and T positions, as shown in Table 5.

Table 5. Comparison of frequencies of termination of palmar main lines A, B, C, D, and T between males with Klinefelter's syndrome and those in the control group.

Main line	Area of termination	Males with Klinefelter syndrome	Males in the control group	Chi-square test or Fisher's exact test	P-value
		(n=15) %	(n=201) %		
A	1	1 (3.33)	16 (3.98)	Fisher test	P=1.000
	2	2 (6.67)	5 (1.24)	Fisher test	P=0.079
	3	7 (23.34)	72 (17.91)	X^2=0.25	P=0.619
	4	10 (33.33)	160 (39.80)	X^2=0.26	P=0.613
	5'	10 (33.33)	127 (31.59)	X^2=0.04	P=0.843
	5"	0 (0.00)	20 (4.98)	Fisher test	P=0.383
	7	0 (0.00)	2 (0.50)	Fisher test	P=1.000
		30 (100%)	402 (100%)		
B	5'	5 (16.67)	61 (15.17)	Fisher test	P=0.794
	5"	5 (16.67)	114 (28.36)	Fisher test	P=0.206
	6	0 (0.00)	0 (0.00)	-	-
	7	18 (60.00)	215 (53.48)	X^2=0.251	P=0.616
	8	0 (0.00)	0 (0.00)	-	-
	9	2 (6.66)	12 (2.99)	Fisher test	P=0.253
		30 (100%)	402 (100%)		
C	5'	0 (0.00)	8 (1.99)	Fisher test	P=1.000
	5"	2 (6.67)	46 (11.44)	Fisher test	P=0.558
	6	0 (0.00)	1 (0.25)	Fisher test	P=1.000
	7	10 (33.33)	129 (32.09)	Fisher test	P=1.000
	8	0 (0.00)	0 (0.00)	-	-
	9	14 (46.67)	190 (47.26)	Fisher test	P=1.000
	10	0 (0.00)	0 (0.00)	-	-
	11	2 (6.67)	8 (1.99)	Fisher test	P=0.148
	X	1 (3.33)	16 (3.98)	Fisher test	P=1.000
	x	0 (0.00)	2 (0.50)	Fisher test	P=1.000
	0	1 (3.33)	2 (0.50)	Fisher test	P=1.000
		30 (100%)	402 (100%)		

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D	7	6 (20.00)	62 (15.42)	Fisher test	P=0.446
	8	0 (0.00)	1 (0.25)	Fisher test	P=1.000
	9	5 (16.67)	124 (30.84)	Fisher test	P=0.146
	10	0 (0.00)	3 (0.75)	Fisher test	P=1.000
	11	19 (63.33)	211 (52.49)	X^2=0.92	P=0.337
	13’	0 (0.00)	1 (0.25)	Fisher test	P=1.000
		30 (100%)	402 (100%)		
T	11	2 (6.67)	18 (4.47)	Fisher test	P=0.641
	12	0 (0.00)	0 (0.00)	-	-
	13’	19 (63.33)	310 (77.12)	Fisher test	P=0.117
	13”	9 (30.00)	74 (18.41)	Fisher test	P=0.146
		30 (100%)	402 (100%)		

*p<0.05; **p<0.01; ***p<0.001

Our findings, along with those of other researchers, indicate a distinct correlation between dermatoglyphics and certain sex chromosomal disorders. Thus, we strongly emphasize the need to identify the specific qualitative characteristics of dermatoglyphs that are indicative of Klinefelter’s syndrome. These include an increased frequency of arches and whorls, a decreased frequency of ulnar loops and radial loops, and an absence of dermatoglyphic patterns in the second interdigital area. These criteria should be considered while developing a screening strategy to distinguish patients with Klinefelter’s syndrome from healthy men. Therefore, we can regard dermatoglyphs as a reliable initial diagnostic measure for probable cases of Klinefelter’s syndrome.

We observed a shared characteristic between patients with Turner’s syndrome and those with Klinefelter’s syndrome in our study. We specifically noted the absence of dermatoglyphic patterns in the second interdigital area of the hands’ palms. This was in contrast to the presence of dermatoglyphic patterns in the same region for women in the control group and men in the control group (Figures 1 and 3). In this regard, several other authors have reported the absence of dermatoglyphic patterns in the second interdigital area (16, 18, 28) of patients with Turner’s syndrome and Klinefelter’s syndrome.

Therefore, the absence of dermatoglyphic patterns in the second interdigital area could be considered a unique characteristic of Turner’s syndrome and Klinefelter’s syndrome among the Albanian population in Kosovo. This study provides an initial investigation into the qualitative characteristics of dermatoglyphs in individuals with Turner’s syndrome and Klinefelter’s syndrome in the Albanian population of Kosova.

CONCLUSION

When comparing the qualitative characteristics of dermatoglyphs between individuals with abnormalities in their sex chromosomes and those in the control group, we reached the following conclusions:

Females with Turner’s syndrome had a higher frequency of ulnar loops (71.76%) compared to those in the control group (62.67%). Conversely, arches were less frequent in females with Turner’s syndrome (0.59%) compared to the control group (5.05%), and whorls were also less frequent in females with Turner’s syndrome (21.77%) compared to the control group (25.64%).

The frequency of arches, ulnar loops, and whorls in Klinefelter’s syndrome exhibited contrasting patterns compared to those found in Turner’s syndrome. Males with Klinefelter’s syndrome exhibited a higher frequency of arches (13.33%) compared to the control group (4.43%). Additionally, there was a higher frequency of whorls (36%) compared to the control group (56.47%), and a lower frequency of ulnar loops (42%), compared to the control group (56.47%).

Females with Turner’s syndrome exhibited a higher frequency of four finger creases in both hands (35.29%) compared to those in the control group (0.99%). In addition, the frequency rate of the four- finger crease in a single hand was higher among females with Turner’s syndrome (23.53%) compared to females in the control group (1.98%).

Patients with Turner’s syndrome and Klinefelter’s syndrome did not exhibit any dermatoglyphic pattern in the II interdigital region, whereas females and males in the control group had dermatoglyphic patterns in these regions.

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