Coll. Antropol. **33** (2009) 4: 1001–1005
Original scientific paper

Comparative Analysis of Dermatoglyphic Traits in Albanian and Turkish Population Living in Kosovo

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A B S T R A C T

The aim of the study was to compare quantitative dermatoglyphic traits of two ethnic groups with different origin and customs, living on the same territory. The dermatoglyphic prints were collected from 800 inhabitants of the Dukagjin valley in southwest Kosovo, of Albanian (400) and Turkish (400) ethnic origin. The quantitative analysis comprised the number of ridges and triradii on the fingers, and the number of ridges in the interdigital areas on the palm (a-b, b-c, and c-d) as well as the size of the atd angle. The statistical analysis showed significant differences between the Albanian and the Turkish males for two fingers and pattern intensity index left, and on palms for a-b rc and c-d rc on both hands and b-c rc on the left hand, and between females for six fingers and almost all palmar traits. Significant inter-population variations were observed for most palmar areas in both sexes but more pronouncedly in females. The differences found between the examined population groups show that admixture between Albanian and Turkish population in Kosovo has been small, and the Turks have retained their ethnic identity for several centuries.

Key words: *dermatoglyphics, population structure, sex differences, Kosovo*

Introduction

Dermatoglyphics are individual-specific, but highly heritable traits. Even today, dermatoglyphic traits play an important role in medical genetic and human biology research as well as in population studies. In the latter, the dermatoglyphic traits are used as an easily applied and not expensive tool for estimating the genetic distances between populations. Differences between numerous population groups haves been studied so far, e.g.: the dermatoglyphics of American Caucasians by Plato[1]; a multivariate approach to fingerprint variation in Papua New Guinea by Froehlich and Giles[2]; the dermatoglyphics of the URSS peoples by Heet[3]; sexual dimorphism in the Chuvashian population of Russia by Karmakar et al.[4]; the dermatoglyphic variation among indigenous New Guinea groups by Lin et al.[5]; the diversity in palmar pattern ridge counts among 12 Iranian populations by Kamali et al.[6]. Blangero[7] performed a population structure analysis using various polygenetic traits; Chakraborty[8] studied the quantitative dermatoglyphic traits in relation to population structure; Kamali and Mavalwala[9] the diversity of palmar ridge count in Iranian populations; Crawford and Duggirala[10] the digital dermatoglyphic in Eskimo and Amerindian populations; Jantz et al.[11] the dermatoglyphic variation among Finno-Ugric speaking populations; Jantz et al.[12] the quantitative traits in the population of Lapps; Arrieta et al.[13] the dermatoglyphic variation in Spanish Basque populations; Karmakar et al.[14] the dermatoglyphic traits in five endogamous populations of West Bengal, and all authors found population variability for dermatoglyphic traits. Although the traits and methods used in the above-mentioned studies varied among investigators, they are providing extensive evidence that the dermatoglyphic traits are a useful tool for estimating distances between populations.

The aim of this work is to study the possible differences between two ethnic groups living in the southwest

Received for publication January 10, 2009

Kosovo in Dukagjin valley using quantitative dermatoglyphics traits. Several studies using new prints from the same population have documented some differences in the results varying among analytical approaches and among observers[15,16]. The advantage of the present study lie in the fact that all data were collected and analyzed by the same observer, since such methodological variation may produce results that cannot be appropriately compared with each other.

Albanians are an autochthonous population of the southwest Balkan Peninsula that speaks a language with characteristics very distinct from those of the surrounding populations. The Albanian language is an extreme case of a relict language that has survived through thousand of years of continuous linguistic turmoil in the neighboring regions[17]. The Albanians perceive themselves as direct descendents of the first known inhabitants of this region – the Illyrians – a group of tribes that inhabited the Western Balkan during classical antiquity. Kosovo was inhabited by Illyrian tribe called Dardanet, so the land inhabited by the Dardans was called Dardania[18,19]. The Turkish population originates from Asia, and at the time of Ottoman expansion, they migrated to the Balkans in 14th and 15th centuries[20]. The proportion of Turks in the population of this region is approximately 6.1% and their population size was estimated to be between 7.929 and 10.911[21]. By current customs, the Albanians and Turkish people do not get married between them; while endogamy is common in the Turkish population, it is not so pronounced in the Albanian population.

The aim of the study is to compare the quantitative dermatoglyphic traits in Albanian and Turkish populations living in southwest Kosovo. We expect that this analysis will demonstrate if the two populations have retained their genetic distinctiveness after 6 centuries of living in tight geographic proximity, i.e. if the process of genetic separation or the one of admixture was the predominate tendency for the two ethnic groups with different origin and customs, occupying the same territory.

Material and Methods

Finger and palmar dermatoglyphic prints were collected from 800 inhabitants of the Dukagjin valley, near the city of Prizren, in south-west Kosovo. The sample consisted of 200 males and 200 females of Albanian and 200 males and 200 females of Turkish ethnicity, all aged between 14 and 20. The dermatoglyphic prints were collected and analyzed by a single observer (G. Temaj) using a method developed by Cummins and Midlo[22].

The studied traits on the fingers were: ridge counts for each finger on the left (FRL1-5) and right (FRR1-5) hand, and total ridge count (TFRC). We also studied pattern intensity index for each finger for the left (PRL) and right (PRR) hand, and total pattern intensity index (TPII)[23]. Total finger ridge count was carried out by calculating the sum of ridge counts of individual fingers using only the single maximum count for each finger (in whorls only the highest counts were used). On palms we studied: ridge counts between digital triradius a, b, c and d (a-b, b-c, and c-d ridge counts), total palmar ridge count (TPRC), and the atd angle left and right, and total atd angle for both hands (atd-t). The t-test analysis were applied to examine the inter-population relationship and to find if there are any differences between the two population groups. The data for males and females were treated separately.

Results

The results of descriptive statistic of quantitative dermatoglyphic traits for each finger of left and right hands are presented on Table 1 for females and on Table 2 for males of Albanian and Turkish population separately.

In both sexes the numerous significant differences were found between the examined population groups. The results of t-test (Table 1) reveal significant differences between Albanian and Turkish populations in females for the first ($t=2.76$, $p<0.01$), second ($t=2.17$, $p<0.01$), and third finger ($t=11.41$, $p<0.001$) right, and on the left hand for the fourth finger ($t=2.64$, $p<0.01$).

Total finger ridge count (TFRC) in Albanian females was 104.92 and in Turkish females 91.84 and the t-test revealed significant differences between Albanian and Turkish female populations ($t=3.26$, $p<0.01$).

On palms, a-b rc and c-d rc on the right hand show significant differences between Albanian and Turkish female populations ($t=5.62$, $p<0.01$; $t=6.70$, $p<0.01$), and on the left hand the differences are found for a-b rc, b-c rc, c-d rc ($t=5.46$, $p<0.01$; $t=4.12$, $p<0.01$; $t=6.22$, $p<0.01$). For total palmar ridge count (TPRC) between digital triradii a, b, c, and d, which vary from 174.80 in Albanian females to 157.71 in Turkish females, t-test shows significant differences between the examined female groups ($t=5.08$, $p<0.01$)

The sum of atd angles right and left (atd-t) also vary from 94.22 in Albanian females to 87.41 in Turkish females. The results of t-test reveal significant differences between Albanian and Turkish populations in females ($t=5.08$, $p<0.01$).

Total pattern intensity index (TPII) in females was 12.87 in Albanian females, and 10.84 in Turkish females. The results of the t-test reveal significant differences between females ($t=6.34$, $p<0.01$).

In males, we only found significant differences on fingers of the right hand for the first ($t=3.30$, $p<0.01$), and second finger right ($t=3.40$, $p<0.01$). TFRC in Albanian males was 105.32, and in Turkish males 105.54, and they were not statistically different (Table 2).

On palms the differences were found for ridge count in a-b rc ($t=6.37$; $p<0.01$), and c-d rc ($t=5.66$, $p<0.01$) of the right hand, and for a-b rc ($t=5.65$, $p<0.01$), b-c rc ($t=2.44$, $p<0.02$), and c-d (rc on the left hand $t=4.69$, $p<0.01$). For total palmar ridge count (TPRC) between triradii a, b, c, and d, in males from Albanian population was 179.32, and in Turkish males TPRC=165.97 and the difference was significant ($t=6.07$, $p<0.01$). For TPII in

TABLE 1
DESCRIPTIVE STATISTICS OF QUANTITATIVE DERMATOGLYPHIC TRAITS IN FEMALES. DIFFERENCES BETWEEN ALBANIAN AND TURKISH POPULATION GROUPS ARE TESTED BY MEANS OF T-TEST

Variable	N	Albanian females		Turkish females		t-test
		$\overline{X}$	SD	$\overline{X}$	SD	
FRR-1	200	13.41	5.36	14.79	4.70	2.76*
FRR-2	200	9.51	5.74	8.27	5.80	2.17*
FRR-3	200	13.41	4.47	8.16	4.80	11.41*
FRR-4	200	9.51	5.33	10.32	5.20	1.53
FRR-5	200	8.93	4.46	9.10	4.50	0.17
FRL-1	200	11.81	5.03	11.74	5.20	0.13
FRL-2	200	8.62	6.43	8.46	6.40	0.27
FRL-3	200	9.27	5.48	9.01	5.80	0.46
FRL-4	200	11.55	5.55	10.15	5.20	2.64*
FRL-5	200	9.87	5.23	9.00	5.20	1.64
TFRR	200	53.81	20.71	48.64	19.70	2.59*
TFRL	200	51.12	22.50	43.22	19.60	1.78
TFRC	200	104.92	42.07	91.84	38.10	3.26*
atd-R	200	46.87	9.01	43.36	5.00	4.18*
atd-L	200	47.36	8.48	44.18	5.40	4.48*
atd -t	200	94.22	16.59	87.41	9.10	5.08*
a-b rc R	200	34.48	6.17	31.22	5.40	5.62*
b-c rc R	200	22.75	5.89	21.59	6.10	1.93
c-d rc R	200	22.84	8.40	27.53	5.30	6.70*
TPRR	200	87.68	8.40	80.15	12.03	6.84*
a-b rc L	200	34.78	6.18	31.45	6.00	5.46*
b-c rc L	200	22.26	5.88	19.79	6.10	4.12*
c-d rc L	200	30.08	6.05	26.47	5.60	6.22*
TPRL	200	87.12	8.37	77.59	11.40	9.53*
TPRC	200	174.80	5.08	157.71	24.6	5.08*
TPIR	200	6.47	1.41	5.83	1.70	4.57*
TPIL	200	6.47	1.49	5.02	1.90	8.53*
TPII	200	12.87	2.71	10.84	3.40	6.34*

* $p<0.01$; ** $p<0.001$

males from Albanian (TPII=13.22), and Turkish (TPII=12.17) populations significant variability ($t=3.30$ $p<0.01$) was found.

Discussion and Conclusion

The study of the quantitative dermatoglyphic traits in Albanian and Turkish populations living in the south--west Kosovo in the vicinity of the city of Prizren in Dukagjin valley was carried out to determine if differences separating those two populations could be found. Although they share the same territory, they have a different origin and customs, and the marriages connecting the two communities are extremely rare.

Previous studies indicated that the quantitative dermatoglyphic traits change more slowly than do the qualitative traits[24–27]. A statistical comparison showed significant differences between the Albanian and Turkish populations for two fingers and pattern intensity index left, and on palms for a-b rc and c-d rc on both hands and b-c rc on the left hand in males, and on the six fingers and almost all palmar traits in females. In environmentally stressful areas where all local populations are subjected to the same pressures Relethford et al.[25] expected that male and female measures of differentiation would be smaller than in other areas, but we found that the differentiation between sexes suggest that females are less responsive to environmental and developmental influences, and show a greater correspondence to genetic relationship. According to this the differences found in females, in the analysis of dermatoglyphic traits suggest a differences between those two populations.

The results of the investigations of Jantz and Chopra[28], Kamali et al.[29], Reddy et al.[30,31], Demarchi et al.[32],

TABLE 2
DESCRIPTIVE STATISTICS OF QUANTITATIVE DERMATOGLYPHIC TRAITS IN MALES. DIFFERENCES BETWEEN ALBANIAN AND TURKISH POPULATION GROUPS ARE TESTED BY MEANS OF T-TEST

Variable	N	Albanian males		Turkish males		t-test
		$\overline{X}$	SD	$\overline{X}$	SD	
FRR-1	200	13.41	5.11	15.06	5.02	3.30*
FRR-2	200	8.29	5.39	10.91	9.60	3.40*
FRR-3	200	9.12	4.69	8.97	5.10	0.31
FRR-4	200	11.88	5.14	11.20	5.20	1.33
FRR-5	200	10.03	4.32	9.72	4.10	0.76
FRL-1	200	13.06	5.30	13.11	5.20	0.09
FRL-2	200	7.43	5.44	8.43	5.90	1.75
FRL-3	200	8.62	4.92	9.34	5.90	1.60
FRL-4	200	11.79	5.16	11.29	5.10	0.01
FRL-5	200	9.89	3.88	9.84	4.90	0.11
TFRR	200	54.55	18.7	54.27	21.00	0.14
TFRL	200	50.78	19.02	51.26	23.10	0.23
TFRC	200	105.32	36.54	105.54	42.80	0.06
atd-R	200	46.06	7.98	45.53	6.60	0.73
atd-L	200	45.93	7.5	45.38	7.50	0.73
atd-R+L	200	91.85	14.83	90.27	13.80	1.10
a-b rc R	200	35.04	5.98	31.60	4.60	6.37*
b-c rc R	200	23.13	5.39	22.20	4.60	1.82
c-d rc R	200	31.35	5.91	28.01	6.00	5.66*
TPRR	200	89.51	12.32	84.71	10.60	4.17*
a-b rc L	200	36.66	7.33	33.27	4.30	5.65*
b-c rc L	200	22.75	5.30	21.41	5.60	2.44**
c-d rc L	200	30.41	6.00	28.44	5.90	4.69*
TPRL	200	89.81	13.38	81.86	9.50	6.85*
TPRC	200	179.32	24.53	165.97	18.20	6.07*
TPIR	200	6.73	1.56	6.17	2.20	1.24
TPIL	200	6.50	1.55	5.97	2.30	2.65*
TPII	200	13.22	2.94	12.17	4.30	1.13

* $p<0.01$; ** $p<0.001$

Nagy[33] suggest that palmar traits are better indicators of distances between populations than finger traits. The same conclusion was also supported by our observations. Our results showed statistical differences in a higher number of palmar traits than in finger traits, and the differences in the former were statistically more significant. In males as suggested Arrieta et al.[34] the c-d ridge count is more genetically influenced. For females Arrieta et al.[34] found that all palmar variables are under the strong genetic component, and the highest heritability is found for a-b ridge count.

In conclusion, the Albanian and Turkish populations, as we expected, show differences in most dermatoglyphic variables. Dermatoglyphics, as complex, polygenic traits, are not very sensitive to evolutionary forces[35,36], thus these traits reflect the differences between the populations of different origins over long time periods. The differences found between the two populations show that admixture between Albanian and Turkish population living in Kosovo has been small, and that Turkish population has retained its genetic identity for several centuries.

Acknowledgements

This study was supported by the Ministry of Science, Education and Sports of the Republic of Croatia (projects: 196-1962766-2747; 196-1962766-2736) and by the Ministry of Science of Kosovo.

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USPOREDBA KVANTITATIVNIH SVOJSTAVA DERMATOGLIFA IZMEĐU POPULACIJE ALBANACA I TURAKA NA KOSOVU

SAŽETAK

Sakupljeno je 800 otisaka dermatoglifa stanovnika albanskog i turskog porijekla koji žive u području Dukagjin doline na jugozapadnom dijelu Kosova. Ove dvije etničke skupine su različitog porijekla, ali i običaja, a žive na istom području. Zbog toga se kvantitativnom analizom dermatoglifa pokušalo utvrditi postoje li razlike među populacijama u broju grebena i triradijusa na prstima i u broju grebena u interdigitalnim područjima dlana (a-b, b-c i c-d) kao i u veličini atd kuta. Statistička analiza je pokazala značajne razlike između populacija kod muškaraca albanske i turske populacije za dva prsta i PII na lijevoj ruci te na dlanu za a-b rc i c-d rc na obje ruke i b-c rc samo na lijevoj ruci. Kod žena je nađeno više razlika, i to na šest prstiju te za gotovo sve varijable dlana. Značajna je interpopulacijska varijabilnost opažena za varijable dlana u oba spola ali naročito kod žena. Te razlike nam ukazuju da je miješenje dvaju populacijskih skupina Albanaca i Turaka bilo malo, te da je turska populacija zadržala svoj genetički identitet kroz stoljeća.