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Genetic studies in Medzev, a village in South-Eastern Slovakia. 3. Morphogenetic traits

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With 6 tables in the text

Summary: Eleven anthropometric traits, five indices and eight anthroposcopic and behavioural traits have been studied in the population of Medzev, which is located in the region Spiš in South-Eastern Slovakia. An attempt has been made to compare the results of the present study with other population groups in Slovakia, particularly with an ethnogenetically related population from North-Eastern Slovakia (Chmel'nica). Barring zygomatic breadth in males, bigonial breadth in females, biacromial breadth und jugomandibular index in both sexes, hair pigmentation, ear lobe attachment and arm folding, the remaining traits show no significant differences between the Medzev and Chmel'nica population. On the whole, these two populations are closer to each other than to any other Slovakian group.

Zusammenfassung: Elf anthropometrische Merkmale, fünf Indices sowie acht anthroposkopische und Verhaltensmerkmale wurden an der Bevölkerung von Medzev in der Region Spiš (südöstliche Slowakei) untersucht. Die Ergebnisse dieser Untersuchung wurden mit denen an anderen slowakischen Bevölkerungsgruppen gewonnenen verglichen, insbesondere mit einer ethnogenetisch verwandten Bevölkerung aus Chmel'nica in der nordöstlichen Slowakei. Abgesehen von der Jochbeinbreite bei Männern, der Unterkieferwinkelbreite bei Frauen, der Biakromialbreite und dem Jugomandibularindex bei beiden Geschlechtern, der Haarpigmentierung, dem Verwachsungsgrad der Ohrläppchen sowie dem Armekreuzen fanden sich keine signifikanten Unterschiede zwischen Medzev und Chmel'nica. Insgesamt sind diese beiden Bevölkerungen einander ähnlicher als jeweils im Vergleich zu anderen slowakischen Bevölkerungsgruppen.

Introduction

This paper is the third in the series of genetic studies in Medzev. History, demography and marriage pattern of this population have been reported by Siváková & Walter (1996). The distribution patterns of 14 blood group genetic markers have been examined by Siváková et al. (1997). This paper deals with some anthropometric (11 measurements and 5 indices), and anthroposcopic traits (hair and iris pigmentation, ear lobe attachment, midphalangeal hair, PTC taste sensitivity, hand clasping, arm folding and tongue rolling). The frequency distribution of these characters will be compared with that one observed in the Chmel'nica population, having similar ethnohistoric background and residing regions Spiš in North-

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Eastern Slovakia, as well as with other appropriate data from Slovakia. Thus the results obtained, will be discussed with respect to possible effects of changes in the mating structure on the anthropological constitution of the Medzev population.

Material and methods

The sample comprises 53 males and 71 females. Only for hair pigmentation and tongue rolling evaluations the sample sizes differ a little (Table 5). The Fischer-Saller chart was used to determine hair colour and the Martin-Schulz chart was used for iris colour evaluation. The types of ear lobe attachment have been classified in two ways: free and attached. Mid-phalangeal hair pilosity was distinguished between present and absent. The ability to taste PTC was determined by a solution containing. 1.3 g/l. Boiled tapwater was used as a control. For hand clasping and arm folding the subjects were classified as R(right) and L(left) depending on how they clasp their hands and fold their arms in a natural way. For tongue rolling the subjects were asked to roll the tongue, and all the categories of rolling have been classified as positive. For intergender and intersample comparison, Kruskal-Wallis H test, Student t-test and Chi-square test were used.

Results and discussion

Table 1 shows that there is no significant difference in the mean age for gender.

Anthropometric traits

From the means and standard deviations for the anthropological measurements and indices (Table 2) it is evident that stature, weight and all length and breadth dimensions are significantly larger with males. Among the indices only differences in the total facial index are significant. Table 3 demonstrates the distribution of stature and some indices within our sample. It is seen, that except of the total facial index, the frequency of particular categories is homogeneously distributed among males and females from Medzev. Comparisons of the mean values to the Chmel'nica population and the Slovak population are given in Table 4. At the first glance one can see that males and females from Medzev differ less from the population of Chmel'nica than from the compared Slovakian sample. The males from Medzev tend to have higher bizygomatic breadth than the females from Chmel'nica. The same is valid for jugomandibular index. In both populations broad category of this index prevailes. However, no narrow category has been observed in Chmel'nica (Siváková et al. 1995), which makes it a considerable fact to be recognised.

Males together with females from Medzev differ significantly in 10 out of 16 parameters from the Slovakian sample (Table 4), which is based on IBP data (Kroupová 1976, 1977), except for body mass index (BMI) (Smolková 1994). Males from Medzev are significantly taller and heavier than the other Slovakian males. From the head and face measurements some differences are of particular interest. Both gender from Medzev have a significantly lower cephalic index. On the other hand, highly significant differences in bigonial breadth have led to the significantly higher differences in the jugomandibular index. Regarding nasal

Table 1. Distribution by sex and age in Medzev.

Sex	N	Mean	S.D.	Kruskal-Wallis H
Males	53	48.18	14.84	1.17
Females	71	50.73	15.61	d.f. 1 < p > 0.05

Table 2. Statistics of anthropological measurements (in cm) and indices in Medzev.

Parameters	Males n = 53		Females n = 71		Kruskal Wallis H
	Mean	S.D.	Mean	S.D.	
Stature (b-v)	172.34	6.33	159.03	6.68	68.00***
Weight (kg)	79.57	12.51	69.55	13.28	15.67***
Head length (g-op)	18.70	0.78	17.68	0.56	47.21***
Head breadth (eu-eu)	15.60	0.56	14.87	0.61	36.09***
Bizygomatic breadth (zy-zy)	13.93	0.78	13.25	0.66	25.06***
Bigonial breadth (go-go)	11.39	0.91	10.80	0.71	13.42***
Nasal height (n-sn)	5.50	0.39	5.24	0.40	14.00***
Nasal breadth (al-al)	3.39	0.33	3.16	0.39	16.00***
Total facial height (n-gn)	12.06	0.92	10.95	0.72	39.80***
Biacromial breadth (a-a)	39.37	1.59	34.83	2.09	75.24***
Mouth breadth (ch-ch)	5.08	0.37	4.74	0.37	25.69***
Cephalic index	83.52	3.79	84.16	3.82	0.95
Total facial index	86.75	7.14	82.81	6.40	9.12**
Jugomandibular index	81.84	5.38	81.58	4.37	0.07
Nasal index	62.03	7.53	60.73	9.04	1.48
Body mass index (BMI)	2.68	0.41	2.76	0.53	0.25

* $0.05 > p > 0.01$ ** $0.01 > p > 0.001$ *** $p > 0.001$

height, Medzev population has higher values, especially the females, than the Slovak sample. Contrary to the nasal height, nasal breadth is significantly lower among both gender in Medzev resulting in significantly lower nasal index. The other significant differences are apparent from the table.

Males and females from Medzev show an increase in the BMI values in comparison with the Slovak sample of machinery occupation (males: 2.53 ± 0.36, females: 2.49 ± 0.45). In addition they are actually similar to those working in agriculture (males: 2.70 ± 0.43, females: 2.78 ± 0.53). It is worth noting, that the population of Medzev yields similar differences in the measurements and indices from the compared Slovakian sample as the ethnogenetically related population from Chmel'nica (Siváková et al. 1995).

As far as the cephalic index is concerned, females from Medzev are also characterised with lower values than another female population from Slovakia aged 45–68 (Cvíčelová 1993). The corresponding mean value of the cephalic index in that study is 85.6 ± 0.033.

Table 3. Distribution of stature and indices (in %) in Medzev.

	Males n=53	Females n=71	χ^2
Stature			
Short	37.74	42.25	0.27
Medium	43.39	39.44	d.f. 2
Tall	18.88	18.31	$p > 0.05$
Cephalic index			
dolichocephal	1.89	4.23	1.56
mesocephal	16.98	23.94	d.f. 2
brachycephal	81.13	71.83	$p>0.05$
Total facial index			
euryprosopic	26.42	42.26	8.39*
mesoprosopic	43.30	19.72	d.f. 2
leptoprosopic	30.19	38.02	$0.05 > p > 0.01$
Jugomandibular index			
narrow	11.32	2.81	5.35
medium	24.52	16.90	d.f. 2
broad	64.15	80.29	$p > 0.05$
Nasal index			
leptorrhine	86.79	85.92	1.52
mesorrhine	11.32	14.08	d.f. 2
platyrrhine	1.89	0.00	$p > 0.05$
Body mass index (BMI)#			
obese	15.09	29.58	3.99
robust	54.72	40.85	d.f. 3
appropriate	15.09	14.08	$p > 0.05$
slender	15.09	15.49	
thin	0.00	0.00	

categories follow Čechovský (1989).

Body height of our sample in comparison with some recent Slovakian data (Smolková 1994), shows differences favouring the so-called present Slovak population. The corresponding figures in the compared sample are: males 173.80 ± 7.26; females 160.60 ± 5.90. This shows differences of 1.46 cm and 1.57 cm, respectively.

Unfortunately, no other complete data on the adult Slovak population have been published in the last years.

Among the striking differences observed in the anthropometric traits in the Medzev population, mainly two of them, body height and cephalic index, are open to more discussion. There is no doubt that these important anthropologic characters contain a considerable genetic component. Therefore their secular changes may well be due to the factors influencing the genetic composition of the population. Regarding the cephalic index e. g. Hulse (1957) observed among Swiss adult males a decrease due to exogamy and an increase due to endogamy. In the rural population of Slovakia, the cephalic index was shown depending on the type of mating in the proceeding generation: endogamous parents tend to produce

Table 4. Student – t test comparisons between Medzev, Chmel'nica and the Slovak population in the measurements and indices.

Parameters	Slovak population[1]		Chmel'nica population	
	males	females	males	females
Stature (b-v)	2.71**	1.93	0.29	0.51
Weight (kg)	4.42***	1.34	0.73	–0.68
Head length (g-op)	1.64	–0.14	1.23	–0.77
Head breadth (eu-eu)	–3.13**	–4.61**	0.68	0.85
Bizygomatic breadth (zy-zy)	1.59	0.39	2.03*	0.32
Bigonial breadth (go-go)	4.02***	6.71***	–0.57	–2.51*
Nasal height (n-sn)	0.89	6.67***	–0.58	–1.46
Nasal breadth (al-al)	–4.04***	–2.29*	0.48	–0.76
Total facial height (n-gn)	–0.62	–1.56	0.76	–0.98
Biacromial breadth (a-a)	0.65	–6.08***	–2.40*	–3.38***
Mouth breadth (ch-ch)	–2.26*	–2.55**	0.55	0.16
Cephalic index	3.69***	–6.78***	–0.43	1.34
Total facial index	1.03	2.69**	–0.76	–0.97
Jugomandibular index	6.92***	11.54***	–2.64*	–3.37***
Nasal index	–5.60***	–3.43***	0.72	0.28
Body mass index (BMI)[2]	–0.51(A) 2.22* (M)	–0.28(A) 3.60** (M)	0.53	–0.89

*0.05 > p > 0.01 **0.01 > p > 0.001 ***p > 0.001
(A) – agriculturist, (M) – machinery
[1] IBP Kroupová (1976, 1977)
[2] Smolková (1994)

more brachycephalic children, and vice versa (Ferák & Lichardová 1969). At this point, the results on temporal changes of breeding structure in the population of Nižný Medzev (Siváková & Walter 1996), could contribute to the explanation of the depressed mean value of the cephalic index, that signifies to the observed dolichocephalisation. Adult probands in our study, being on average 48–51 years old in the time of data collection, were born from parents that entered into marriage at the "breakdown of isolates" period. This period is attributable to the increase of exogamy followed by the average increase of heterozygozity in the population. From the first part of Medzev studies (Siváková & Walter 1996) it is known, that percentage of exogamy started to increase continuously in Medzev from the time span 1926–1930 onward, and reached 44 % in 1936–1940 time span. Also according to Ferák & Lichardová (1968) in most regions of Slovakia the percentage of exogamy started to increase considerably during or shortly after World War II. Therefore, the post-war rural population of Slovakia provides research field for detecting the heterosis effect. If we identify ourselves with this assumption, it follows, that our probands having exogamous parents are more dolichocephalic than those having endogamous parents. In our study it would be difficult to prove heterosis, because the sample is too small to allow us to demonstrate an effect of the mating system between parents on the cephalic index. The obtained results are in agreement with the observation of Ferák & Lichardová

(1969) and Siváková et al. (1995) on the Slovak population, along with the results of the other authors examined the effect of endo- or exogamy on metric characteristics (Hulse 1957, Henke 1974, Schmidt 1991) in Central Europe.

It is essential to mention that we could use the same deduction to explain the differences in stature (Table 4). The connection between the secular increase in stature and the breakup of population isolates in Europe is well known. From some studies of this kind, it is self-evident that inbreeding diminishes body height and that outbreeding, following previous inbreeding leads to an increase in body height, so heterosis may provide an alternative or complementary explanation for the secular increase in stature. However, Schreider (1967), Shull (1962) and some others have found "inbreeding depression" on stature.

Ferák et al. (1968) have given evidence that in the regions of Slovakia where endogamy prevailed the stature of adults was generally smaller than in regions or villages where exogamy was dominant. They reported mean value for men: endogamous 174.2 ± 0.62, exogamous 176.2 ± 0.32; for women: endogamous 161.4 ± 0.64, exogamous 162.9 ± 0.32, respectively. If we compare body height from Medzev with the findings of the above mentioned study, it is clear that both gender from Medzev attain even smaller stature than men and women of endogamous parents in that study. We are aware of that secular changes in the cephalic index and the stature depend not only on the amount of inbreeding or endogamy-exogamy relation in the given population, but also on separation from the gene pool and the environmental conditions. For all these, we are not able to explain satisfyingly discrepancies in the stature found in our sample and to take up a standpoint from the foregoing factors which might more influence anthropological constitution of this population. It is possible that at least a part of the observed differences is not attributable to an effect of heterosis or "inbreeding depression" but to a bias in sampling procedure.

Anthroposcopic traits

Table 5 shows distribution of some anthroposcopic and behavioural traits and its significance among males and females from Medzev. It is to be seen that no intergender differences in the distribution of investigated traits have been observed. However, the expected value lower than five (hair pigmentation) must be considered.

Table 6 demonstrates comparison of anthroposcopic and behavioural traits between Medzev and Chmel'nica populations. It is worthwhile noting, that both samples are close in the mean values of age and that in the both studies the same methodology, the hair and eye charts, respectively, have been used (Siváková et al. 1995). The table also shows that significant differences are observed in hair pigmentation, ear lobe attachement and arm folding. Further these differences are discussed.

Hair pigmentation

Although dark hairs prevaile in both populations, in Medzev blond and temporary hair colours are less frequent. Apart from this, in one case ginger colour (red hairs) was recorded in Medzev. The comparison with other Slovakian or former Czecho-

Table 5. Distribution of some genetical and behavioural traits in Medzev.

Trait	Males		Females		
	N	%	N	%	χ^2
Hair pigmentation					
blond (A–K)*	0	0.00	2	3.13	0.23
temporary (L-P)*	3	5.66	3	4.68	d.f. 2
dark (Q–Y)*	49	92.45	59	92.19	$p > 0.05$
Total	52		64		
Iris pigmentation					
dark (1–4)**	5	9.43	12	16.90	2.26
temporary (5–10)**	27	50.95	28	39.44	d.f. 2
fair (11–16)**	21	39.62	31	43.66	$p > 0.05$
Total	53		71		
Ear lobe attachment					
attached	7	13.21	9	12.68	0.01
free	46	86.79	62	87.32	d.f. 1
Total	53		71		$p > 0.05$
Mid phalangeal hair					
absent	62	58.49	91	64.08	0.80
present	44	41.51	51	35.92	d.f. 1
Total (pairs)	106		142		$p > 0.05$
P.T.C. testing					
tasters	39	73.58	51	71.83	0.05
non-tasters	14	26.42	20	28.17	d.f. 1
Total	53		71		$p > 0.05$
Hand clasping					
R (Right)	24	45.28	33	46.48	0.02
L (Left)	29	54.72	38	53.52	d.f. 1
Total	53		71		$p > 0.05$
Arm folding					
R (Right)	19	35.85	37	52.11	3.24
L (Left)	34	64.15	34	47.89	d.f. 1
Total	53		71		$p > 0.05$
Tongue rolling					
positive	39	75.00	47	67.14	0.89
negative	13	25.00	23	32.86	d.f. 1
Total	52		70		$p > 0.05$

* Fischer-Saller chart
** Martin-Schulz chart

slovakian data is questionable due to different methods of sample collection, categories created on the basis of hair chart and age categories. From appropriate data, for example Drobná (1964) observed among 18–20 years old girls following frequencies: 6.1 % blond hairs, 32.2 % of temporary and 58.1 % dark hairs. Regarding our sample, differences in temporary ($t = 7.58$, $p < 0.001$) and dark categories ($t = 8{,}00$, $p < 0.001$) achieve statistical significance. Pooled data, irrespective gender,

Table 6. Comparison of eight anthroposcopic and behavioural traits between the Medzev and Chmel'nica samples and chi-square values for differences

Trait	Medzev		Cheml'nica		
	N	%	N	%	χ^2
Hair pigmentation					
blond (A–K)*	2	1.71	7	11.87	26.12***
temporary (L-P)*	6	5.13	15	25.43	d.f. 3
dark (Q–Y)*	108	92.31	37	62.71	$p < 0.001$
ginger (I-IV)*	1	0.85	0	0.00	
Total	117		59		
Iris pigmentation					
dark (1–4)**	17	13.71	9	12.50	4.68
temporary (5–10)**	55	44.35	43	59.72	d.f. 2
fair (11–16)**	52	41.94	20	27.78	$0.1 > p > 0.05$
Total	124		72		
Ear lobe attachment					
attached	16	12.90	20	27.78	6.72*
free	108	87.10	52	72.22	d.f. 1
Total	124		72		$0.05 > p > 0.01$
Mid phalangeal hair					
absent	153	61.69	78	54.17	2.13
present	95	38.31	66	45.83	d.f. 1
Total (pairs)	248		144		$0.3 > p > 0.1$
P.T.C. testing					
tasters	90	72.58	54	75.00	0.14
non-tasters	34	27.42	18	25.00	d.f. 1
Total	124		72		$0.9 > p > 0.7$
Hand clasping					
R (Right)	57	45.97	40	55.56	1.68
L (Left)	67	54.03	32	44.44	d.f. 1
Total	124		72		$0.3 > p > 0.1$
Arm folding					
R (Right)	56	45.16	12	16.67	16.32***
L (Left)	68	54.84	60	83.33	d.f. 1
Total	124		72		$p < 0.001$
Tongue rolling					
positive	86	70.49	54	75.00	0.46
negative	36	29.51	18	25.00	d.f. 1
Total	122		72		$0.5 > p > 0.3$

* Fischer-Saller chart
** Martin-Schulz chart

for the Medzev population are: 1.71 % blond, 5.13 % temporary, 92.31 % dark hair color. These frequencies differ highly from those ones reported by Hrubcová (1961) to be 14.5 %, 61.4 %, 20.3 %, respectively, for the Czech population, based on family studies ($t = 9.21$, $p < 0.001$ for blond; $t = 24.77$, $p < 0.001$ temporary, $t = 27.84$, $p < 0.001$ for dark hairs).

Ear lobe attachment

In this trait free lobes are prevailing in both compared populations, however, in Medzev incidence of attached ear lobes is lower than in Chmel'nica. This decrease in frequency is not exceptional because even lower frequency of the attached ear lobes (4.54 %) has been found by Siváková (1977) in a study based on family data. On the other hand, Jiránková (1970) reported frequency of 25.67 % in the Slovakian population. From the frequency variation obtained for this trait an indication followes that the population of Medzev is not atypical in its frequency of the attached ear lobe and falls within the range of the Slovakian population.

Arm folding

Although in both samples left type (L) of arm folding is prominent, quite low frequency of right (R) type in Chmel'nica contributes probably of statistically significant differences. Trangelová (1980) recorded among students aged from 17 to 18 years frequencies close to present study. The corresponding figures are: L-type 56.7 % males, 54.4 % females; R-type 43.3 % males, 45.6 % females. Our data do not differ significantly from these, in both folding type and sexes (L-type males $t = 0.81$, $0.5 > P > 0.25$; females L-type $t = 0.73$, $0.5 > P > 0.25$). The data available on the other Slovakian samples are too scarce for critical assessment of the variability in Slovakia.

Summing up this discussion, it emerges that a statistical significance from the population of Cheml'nica is seen only in regard to bizygomatic breadth by males, bigonial breadth by females, biacromial breadth and jugomandibular index by both genders, and to some anthroposcopic traits, viz. hair pigmentation, ear lobe attachment and arm folding. These two ethnogenetically related populations are closer to each other than to the compared Slovakian sample and both show similar trend in deviation from the Slovak population, particularly in the anthropometric traits.

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