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TRAIT VARIATIONS IN CHILDREN AS INDICATORS. PRELIMINARY DATA OF A RESEARCH PROJECT

M. PAP, GY. SZABÓ, and T. GÖNCZI-SZABÓ*

Department of Human Biology , L.Kossuth University, Debrecen H-4010, P.O.B. 6 , Hungary;
**Bessenyei Teachers' Training College, Department of Biology, Nyiregyháza H-4401 P.O.B. 166, Hungary*

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Abstract

The study reports some preliminary results within the research project "Population biological criteria of human populations and the various environmental impacts" from examinations on children in the Bódva valley (North Hungary, Borsod-Abauj-Zemplén County). It documents the physical development of 340 Hungarian and Gypsy children aged 7-15 years from the Bódva microregion, which is regarded as relatively homogeneous from a human ecological point of view.

Key words: metrical character variations of children, Bódva microregion, Hungarian and Gypsy samples, interpopulational analysis.

Introduction

Determination and control of the changes in the sociodemographic, genetic structures and the biological status of human populations are indispensable in an exploration of the factors influencing the state of health of the various populations. A whole series of examinations prove that the life style, the dwelling place, the place of work and the natural and social environment considerably influence the health and biological status of the population.

The notoriously unfavourable health state of the Hungarian population is overwhelmingly due to widespread, non-infectious, degenerative diseases, accidents and somatic, psychic and social states, underlying which are new types of causes, risk factors and numerous other problems (KERTAI, 1993; BOJÁN et al., 1993).

A population-biologically oriented approach to the changes in the sociodemographic structure and the genetic stock of human populations requires new scientific results (HARRISON and BOYCE, 1972; WALTER and NEMESKÉRI, 1972; FREIRE-MAIA, 1974; PAP, 1979, 1986; CRAWFORD et al., 1987), which are indispensable for a complex interpretation of urbanization, social restratification, transformation of life style and the changes caused by the natural and social environment for the preservation of the population's health and fitness for work.

Theoretically, our point of departure is the basic statement that individuals (as "unique information carriers") consistently differ from one another in their geno- and phenotypes, and hence in their responses to environmental impacts. Furthermore, we presume that the properties of the individuals, and the quantitative and qualitative variations of their traits are reflected in selected samples, and can be well interpreted at the individual, age group, population and microregion levels (PAP, 1984; PAP et al., 1996).

We plan an exploration of the causal and background variables underlying the characteristic biological, sociodemographic criteria observed and the expression of the complex phenomena with quantitative variables, as well as the establishment of a new database.

Our research project and the results are intended to provide further information for a nationwide monitoring of the biological status of the various populations (GYENIS and SZERÉNYINÉ, 1984; BODZSÁR, 1984; EIBEN and PANTÓ, 1986; FARKAS, 1986).

Here, we present an account of investigations carried out within the above research project, of some variations of traits in children, based on an intrapopulational analysis.

Material and method

A study was made of the physical development, biological state and sociodemographic status of children living in the populations of a North-Hungarian microregion (the Bódva valley), the given natural and social environment being taken into account. Eight metrical characters of 340 children were selected [stature (M.1), weight (M.71), biacromial diameter (M.35), bicristal width (M.40), iliac spine height (M.13), shoulder height (M.8), sitting height (M 23) and transverse chest breadth (M.36)], and analyses were carried out on these data. In the course of the examinations, MARTIN's prescriptions (MARTIN and SALLER, 1957-66) were followed, and consideration was given to the IBP recommendations (TANNER et al., 1969). The number of subjects involved in the three samples: Hungarians at Bódvaszilas 104 persons (50 boys and 54 girls), Hungarians at Szalonna 93 persons (41 boys and 52 girls), and Gypsy children at Bódvaszilas + Szalonna 143 persons (76 boys and 67 girls). The three samples account for 35 % of the children in this age group /7-15 yr/ in the Bódva microregion (1990 census). For the comparative analysis, 4 combined age groups were formed: 1) 7-8 yr, 2) 9-11 yr, 3) 12-13 yr and 4) 14-15 yr. Data processing and the analyses were performed with the SPSS/PC$^+$ program packet.

Results and discussion

The preliminary results of these monitoring examinations will be used primarily to test the concept of our research, with regard to the fact that the children were examined as unique information carriers in the given population and microregion. Prominence was therefore given to the procedures that help reveal the individual properties and parameters at any time and by which the specificities can be well studied. The set of information manifested at the individual, population and microregion levels can be interpreted within further relations (e.g. obesity or goiter disease).

The microregion classification of the cadastral survey of the small landscapes of Hungary (MAROSI and SOMOGYI, 1990) made sampling and hence the reliability of the material used in the study more consistent. We have succeeded in solving the problem

caused by the small number of 7-15- yr olds in the Bódva valley "small populations". With an examination method considering the whole of the microregion, the migration effects can be treated as well. This is an especially important circumstance as concerns the Gypsy children.

The distribution of the variables was analysed in several steps. Comparisons of the absolute metrical characters by sex, age groups and populations are presented in Tables 1-4. As regards the analyses with the t-test (LEVENE's test) included in these Tables, for reasons of space we report only on the age groups for which the sex distribution of the traits differed significantly. First, we give the results for the various age groups of the Hungarian children. In the first age group, a significant difference was not found in any case, while in the second age group there was a difference only in transverse chest breadth. On the other hand, in the third age group (12-13 yr) the differences between the mean values were significant in five traits. The length and weight values for the girls showed considerable increase (Table 1).

Table 1. Descriptive statistics on body measurements of Hungarian boys and girls in the Bódva valley (age group III).

Variables	Sex	Mean	SD	SE of mean	Mean differ.	LEVENE's test	T-value	2-Tail sig.
Stature	Boys	152.6933	10.428	2.692	-6.9686	F=2.166	-2.37	0.024
	Girls	159.6619	7.424	1.580		P= .150		
Weight	Boys	39.6000	7.590	1.960	-9.1619	F= .252	-3.23	0.003
	Girls	48.7619	8.902	1.943		P= .619		
Biiliocrist diameter	Boys	24.1333	2.270	0.586	-2.4095	F= .202	-3.26	0.003
	Girls	26.5429	2.124	0.463		P= .656		
Sitting height	Boys	78.8733	5.448	1.407	-4.3171	F= .791	-2.80	0.008
	Girls	83.1905	3.834	0.837		P= .380		
Shoulder height	Boys	122.8333	8.648	2.233	-6.3333	F= .555	-2.41	0.021
	Girls	129.1667	7.079	1.545		P= .461		

Table 2. Descriptive statistics on body measurements of Hungarian boys and girls in the Bódva valley (age-group IV).

Variables	Sex	Mean	SD	SE of mean	Mean differ.	LEVENE's test	T-value	2-Tail sig.
Stature	Boys	168.8471	10.051	2.438	6.8179	F=3.050	2.63	0.012
	Girls	162.0292	6.591	1.345		P= .089		
Weight	Boys	53.4118	9.790	2.375	3.6409	F=1.214	1.33	0.192
	Girls	49.7708	7.752	1.582		P= .277		
Biacromial diameter	Boys	35.6647	3.032	0.735	1.6355	F=2.115	2.17	0.036
	Girls	34.0292	1.793	0.366		P= .154		
Iliac sp. height	Boys	97.8059	5.893	1.429	6.9225	F= .162	3.54	0.001
	Girls	90.8833	6.363	1.299		P= .689		
Shoulder height	Boys	138.2588	8.600	2.086	6.4672	F=3.108	2.98	0.005
	Girls	131.7917	5.308	1.083		P= .086		
Transverse chest	Boys	26.1059	4.077	0.989	1.9392	F=1.805	2.08	0.044
	Girls	24.1667	1.774	0.362		P= .187		

In the fourth age group (Table 2) the differences between the sexes were similarly demonstrable: significant differences were found in the mean values of stature,

biacromial diameter, iliac spine height, shoulder height and transverse chest breadth. However, as compared with the third age group, the metrical characters were larger for the boys; thus, the situation was just the reverse.

In the various age groups of the Hungarian and Gypsy children, the tendencies prevailing in the distribution of the trait variations were examined in the comparison of the sexes (Tables 3 and 4.). In the first age group of the boys, there were no significant differences between the mean values, while in the second age group, the differences were significant ($p<0.05$) in two cases (stature and sitting height). In the third age group, there was no difference, whereas in the fourth group, significant differences were found in four length characters (Table 3). The mean values for the Hungarian boys were higher.

Table 3. Descriptive statistics on body measurements of Hungarian and Gypsy boys in the Bódva valley (age group IV).

Variables	Population	Mean	SD	SE of mean	Mean differ.	LEVENE's test	T-value	2-Tail sig.
Stature	Hungarian	168.8471	10.051	2.438	8.4371	F= .031	2.14	0.042
	Gypsy	160.4100	9.551	3.020		P= .861		
Weight	Hungairan	53.4118	9.790	2.375	4.5618	F= .090	1.15	0.261
	Gypsy	48.8500	10.236	3.237		P= .766		
Iliac sp. height	Hungarian	97.8059	5.893	1.429	7.2259	F= .000	3.03	0.006
	Gypsy	90.5800	6.135	1.940		P= .986		
Shoulder height	Hungarian	138.2588	8.600	2.086	8.0688	F= .000	2.38	0.025
	Gypsy	130.1900	8.291	2.622		P= .999		

Table 4. Descriptive statistics on body measurements of Hungarian and Gypsy girls in the Bódva valley (age-group III).

Variables	Population	Mean	SD	SE of mean	Mean differ.	LEVENE's test	T-value	2-Tail sig.
Stature	Hungarian	159.6619	7.242	1.580	8.4369	F= .049	3.62	.001
	Gypsy	151.2250	6.743	1.686		P= .827		
Sitting. height	Hungarian	83.1905	3.834	.837	5.2530	F= .411	4.34	.000
	Gypsy	77.9375	3.387	.847		P= .526		
Iliac sp. height	Hungarian	91.4429	5.201	1.135	4.8241	F= .019	2.95	.006
	Gypsy	86.6187	4.532	1.133		P= .891		
Shoulder height	Hungarian	129.1667	7.079	1.545	6.8417	F= .114	3.10	.004
	Gypsy	122.3250	6.010	1.503		P= .738		

Conversely, demonstrable differences were found between the trait variations of Hungarian and Gypsy girls in all four age groups. Significant differences were observed in the first age group in stature and shoulder height ($p<0.05$ for both), in the second age group in stature and sitting height ($p<0.01$ for both), and in the third age group in stature, sitting height, shoulder height and iliac spine height ($p<0.01$ for all). This descriptive statistical result is presented in Table 4. Finally, in the fourth age group, considerable differences between the traits of the Hungarian and Gypsy girls were demonstrated in the distribution of three traits: stature, shoulder height and sitting

height ($p<0.01$). The higher mean values, as for the boys, were found for the Hungarian girls.

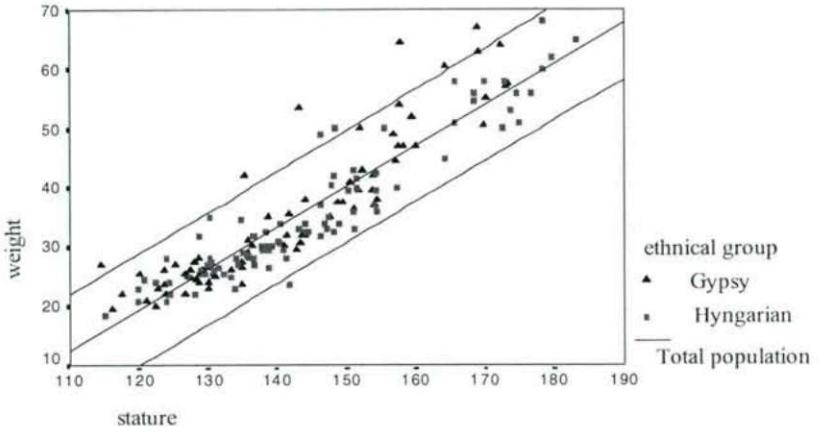

Fig. 1. Linear regression of stature vs. weight for boys in the Bódva valley (all age groups).

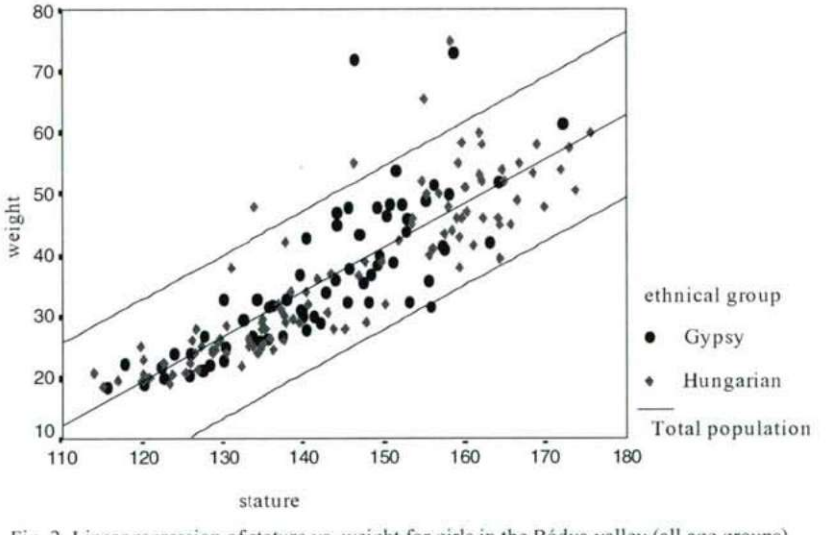

Fig. 2. Linear regression of stature vs. weight for girls in the Bódva valley (all age groups).

Correlating the above results and following BLOM's method (see program packet), the stature vs. weight linear regression is presented for all age groups of boys (Fig. 1) and girls (Fig. 2) in the three samples from the Bódva valley. The relationships and the dispersion of the traits of Hungarian and Gypsy boys and girls can be surveyed together. The linear regression analysis reveals that the gradients of the lines are

positive in every case, i.e. the regression coefficient is positive. The gradient differs significantly from zero. There is a close connection between the two variables (Table 5 and 6). Attention is drawn to the cases outside the 95% confidence interval zone, in which a considerable excess weight was found (Figs 1 and 2). Since the program packet permits inclusion of the individuals' code numbers, the relation of the quantitative and qualitative variables at the level of the individuals can be learnt. In this way, we have increased opportunities to identify the background variables and the cause vs. effect relations.

Table 5. Regression analyis of some body measurements versus stature for boys (Hungarians=1; Gypsies=2; Y'= mx + b).

Body measurements		m	b	r	R
Bicristal width	1	0.15	0.93	0.923	0.852
	2	0.15	1.84	0.753	0.567
Iliac spine height	1	0.66	-15.30	0.947	0.897
	2	0.64	-10.78	0.966	0.933
Shoulder height	1	0.89	-13.92	0.993	0.985
	2	0.87	-9.74	0.983	0.967
Transverse chest breadth	1	0.16	-1.66	0.777	0.603
	2	0.16	-0.20	0.795	0.632
Biacromial diameter	1	0.21	0.61	0.903	0.815
	2	0.22	0.51	0.894	0.799
Sitting height	1	0.44	11.14	0.968	0.936
	2	0.46	9.27	0.964	0.929
Weight	1	0.64	-61.68	0.936	0.876
	2	0.73	-68.19	0.909	0.826

Table 6. Regression analyis of some body measurements versus stature for girls (Hungarians=1; Gypsies=2; Y'= mx + b).

Body measurements		m	b	r	R
Bicristal width	1	0.19	-4.69	0.866	0.751
	2	0.21	-6.70	0.816	0.665
Iliac spine height	1	0.63	-9.31	0.971	0.942
	2	0.66	-14.26	0.917	0.840
Shoulder height	1	0.89	-13.74	0.978	0.957
	2	0.85	-6.88	0.988	0.977
Transverse chest breadth	1	0.16	0.51	0.830	0.689
	2	0.18	-4.44	0.789	0.623
Biacromial diameter	1	0.20	2.31	0.886	0.786
	2	0.25	-3.81	0.878	0.772
Sitting height	1	0.48	5.41	0.963	0.927
	2	0.45	9.94	0.950	0.903
Weight	1	0.71	-65.57	0.877	0.769
	2	0.77	-73.88	0.793	0.629

For further determination of the distributions, we made use of the indices relating to the central point and standard deviation of the samples. The localization of the sample is characterized by the median and its dispersion, with the interquartile range. The median is the resistant measure of the sample's centre and is suitable for characterizing the central point of asymmetric distributions. In our opinion the quartile (boxplot) figure can be successfully applied to the parametric tests too. A detailed

presentation of our analysis would go beyond the scope of this study. We confine ourselves here to an analysis of the distribution of stature on the basis of the data for the Hungarian children in the Bódva valley (Fig. 3). This procedure allows a selection on the basis of various traits, of the cases outside the interquartile region, i.e. the extreme occurrences. Thus, the result obtained by linear regression was confirmed with a different method.

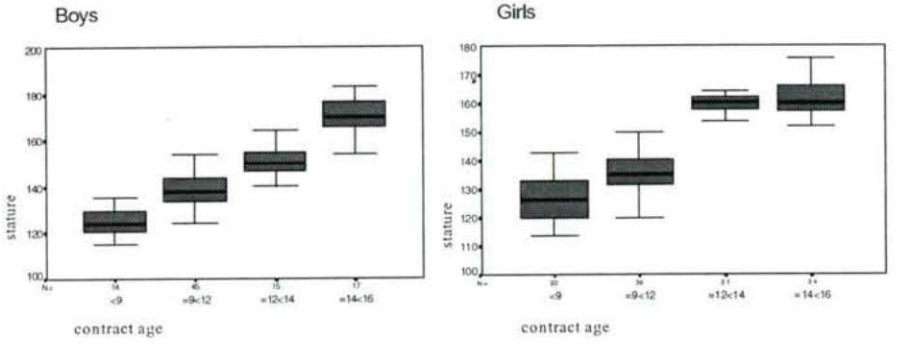

Fig. 3. Changes in stature of Hungarian children (boxplot).

Conclusions

The population-biological approach to changes in the sociodemographic structure and the genetic stock of human populations requires new scientific results, which are indispensable for a complex interpretation of the changes caused by the natural and social environment, for the conservation of the health and fitness for work of the population. Our new data (database) obtained through the human biological examination of 7-15-yr-old children may serve as an important part of a nationwide monitoring research. We have presented some important elements of the concept of our research, awaiting confirmation, complementation or refutation. Our working hypothesis is: that the Bódva microregion provides a relatively homogeneous ecological system of conditions, where well-definable natural factors affect the human populations and, within this frame, the children in the 7-15-yr age group. These factors influence the development of the biological state of the children. The trait variations of the children were analysed in several steps. Analysis by age groups and sexes can well demonstrate the characteristics of prepuberty– puberty and also the developmental differences of the members of the different ethnic groups.

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References

BODZSÁR, É. B. (1984): Gyermekek szomatokonstrukciója és ökológiai összefüggésük közép-dunántúli falvakban. - ELTE, Budapest (CSc. thesis).

BOJÁN, F., MCKEE, M. and OSTBY, T. (1993): A népességtan oktatásának fejlesztése Magyarországon. Tempus project structúrája. - Népegészségügy *74*, 93-99.

CRAWFORD, M., PAP, M., and KOERTVELYESSY, T. (1987): Hungarian family expedition briefing. - Earthwatch, Boston *1*, 140 pp.

EIBEN, O. G. and PANTÓ, E. (1986): The Hungarian national growth standards. - Anthrop. Közl. *30*, 5-23.

FARKAS, GY. (1986): Délalföldi 10-18 évesek testi fejlettsége és a leányok menarchekora. - Budapest (DSc. thesis).

FREIRE-MAIA, N. (1974): Populations genetics and demography. - Human Heredity *24*, 105-113.

GYENIS, GY. and SZERÉNYINÉ PÁSZTOR, ZS. (1984): Érd'79. Az érdi iskolásgyermekek testi fejlettsége. - Humanbiol. Budapest. Suppl. *2*, 143 pp.

HARRISON, G. A. and BOYCE, A.J. (1972): The structure of human populations. - Clarendon Press, Oxford.

KERTAI, P. (1993): A népegészségügy prioritásai Magyarországon az ezredfordulóig. - Népegészségügy *74*, 133-156.

KOERTVELYESSY, T., PAP, M. and SZILÁGYI, K. (1987): The mating structure of four agriculturalist villages in NE Hungary. - American J. Physical Anthrop. *72*, 220.

MAROSI, S. and SOMOGYI, S. (eds) (1990): Magyarország kistájainak katasztere II. - MTA Földrajztudományi Kutató Intézet, Budapest.

PAP, M. (1984): A humán populációgenetikai kutatás néhány aspektusa a magyarországi vizsgálatok tükrében. - Anthrop. Közl. *28*, 84-89.

PAP, M. (1979): Some aspects of populations structure and genetic variability in the Tiszamogyorós population in Hungary. - Acta Biol. Debr. Suppl. *1*, 1-103.

PAP, M. (1986): Polymorphism of red cell enzymes, heterozygosity and population structure. - Coll. Anthrop. *10*, 49-52.

PAP, M.T., SZABÓ, GY. and GÖNCZY-SZABÓ, T. (1996): Populationbiological feature of human populations, physical development of children and environmental effects. - 10th Congress of the European Anthropological Association, Brüssels, Program Abstracts 54 pp.

TANNER, J. M., HIERNAUX, J. and JARMAN, S. (1969): Growth and physique studies. In: WEINER, J. S. and LOURIE, J. (eds): Human biology. A guide to field methods. - IBP Handbook. Blackwell Sci. Publ. Oxford, Edinburgh. No. 9. 76 pp.

WALTER, H. and NEMESKÉRI, J. (1972): Population genetic investigations in the Bodrogköz area of NE Hungary. In: TÖRŐ, J., SZABADY, E., NEMESKÉRI, J. and EIBEN, O. G. (eds): Advances in the biology of human populations. - Akadémiai Kiadó, Budapest, 329-343 pp.

1990. évi Népszámlálás (1992): Borsod-Abaúj-Zemplén megye adatai. - Központi Statisztikai Hivatal 7., Budapest.