The European Proceedings of
Social & Behavioural Sciences
EpSBS

Future Academy

ISSN: 2357-1330

http://dx.doi.org/10.15405/epsbs.2018.03.1

ICPESK 2017
International Congress of Physical Education, Sport and Kinetotherapy

SECULAR TREND OF STUDENTS' SOMATIC DEVELOPMENT FROM DIFFERENT ROMANIAN GEOGRAPHICAL REGIONS

Monica Stănescu (a)*, Marius Stoicescu (b), Lucian Bogdan Bejan (c)
*Corresponding author

(a) National University of Physical Education and Sports, 140 Constantin Noica Street, Bucharest, Romania, monica_iulia@yahoo.com
(b) National University of Physical Education and Sports, 140 Constantin Noica Street, Bucharest, Romania, marius_stoicescu@yahoo.com
(c) Universidade Federal Rural de Pernambuco, Av. Dom Manoel de Medeiros s/n, Recife, Pernambuco, Brazil, lucianbb@gmail.com

Abstract

In Romania, the secular trend enjoys a constant interest from the specialists in this field, given its importance for the health of the population and for the selection potential that it has for the performance sport. The aim of this paper is to highlight the level of manifestation of the height and weight indices in different geographical areas of Romania - mountains, hills, plains, based on the data obtained within the project "Evaluation of somatic, functional and motor potential of the Romanian school population" (2011-2012, MCTS, UNEFS). The values of the development indices were compared with values from the previous national assessments, back in the 70s, 80s and 90s. According to the results obtained from the comparative analysis, we found insignificantly different values from one geographic area to another, but significantly different from generation to generation. The conclusions highlight a number of factors that can be held accountable for the results obtained, and are also launching new hypotheses for future studies. We believe that it is necessary to continue the comparative analysis of the data that will be constantly obtained from different socio-economic and geographic regions of Romania in order to identify certain disorders in the process of child growth and development, but also those areas that can offer solutions for the selection of children for practicing certain sports.

Keywords: Secular trend, height, weight, children.

http://dx.doi.org/10.15405/epsbs.2018.03.1
Corresponding Author: Monica Stănescu
Selection and peer-review under responsibility of the Organizing Committee of the conference
eISSN: 2357-1330

1. Introduction

The secular trend concept refers to the tendency to increase the dimensions of the human body compared to previous generations, a tendency highlighted by researchers since the 1800s, especially in men (Tanner, 1986; Cole, 2003; Danubio & Sanna, 2008).

The secular trend among children registers different values from one stage of development to another. At each age, there are certain peculiarities of growth in height, expressed both by the size of the growth and its rhythm (Cole, 2003).

Studies have shown that the postnatal growth and development process is determined by a series of hereditary and environmental factors that act constantly on the child. The constellation of these factors consists of prenatal, psychosocial, climatic, socio-economic factors, nutrition, urbanization and physical activity (Delemarre van Haal, 1993; Pietiläinen, Maija, Rissanen, & Rose, 2002). Each individual has in his/her genetic baggage a growth potential that is modulated by these environmental factors, both in the intrauterine and postnatal life. This explains why optimal growth is achieved when all factors act in harmony.

Under the action of environmental factors, there may be differences in the manifestation of the genetic potential. For this reason, van Wieringen (1986) stressed that it is more correct to talk about secular changes, a syntagm that involves variations between generations or populations in different geographic and socio-economic areas.

2. Problem Statement

Under the influence of environmental factors, the European population - from the middle of the nineteenth century (Komlos, 1985; Floud, 1989) - recorded an increase in the average height of children compared to their parents (Cole, 2003; Webb et al, 2008). The main explanation is that this situation is due to improved living conditions and optimized health. On the other hand, during the wars, this secular tendency is slower and even minimal (Sparen et al., 2004).

In the 1990s, several researchers in Central and Eastern Europe drew attention to the pollution and its consequences on children's health (Fitzgerald et al., 1998). Their studies were based on conclusions formulated more than 100 years ago, showing that child growth and development patterns are an indicator of how sound is the environment in which they develop.

In Romania, Cucu, Lupeanu, Nicorici, lonescu and Sandu (1994) pointed out that, in those decades, the children were living in unfavorable conditions as a result of their exposure to waste not properly stored. These negative influences also affected the height increase.

The contributions of genetic and environmental effects are very difficult to spot. However, it is obvious that environmental differences can modulate the manifestation of the genetic potential (Proos, 1993). The influence of heredity on growth and development increases from birth to adolescence. At birth, the effects of the genes are 36% of the length variation in boys, and 5% in girls. In 16-year-olds, the genes become responsible for 78% (boys) and 77% (girls) of the final height (Jelenkovic et al., 2011).

To highlight the effects of the environment on the growth process, a series of studies on twins have been carried out to show the contribution of genetic and environmental effects on the physical and

http://dx.doi.org/10.15405/epsbs.2018.03.1
Corresponding Author: Monica Stănescu
Selection and peer-review under responsibility of the Organizing Committee of the conference
eISSN: 2357-1330

behavioural phenotypes (Evans & Martin, 2000). Their conclusions did not capture the net relationship between gene interaction with common and individual environmental factors. However, the influence of the latter was minimal in all investigated cases. The authors estimate that 84-88% of the height of 5-year-olds is genetically determined, while in the adult age, the heredity is 70% (Eaves, Eysenck, & Martin, 1989). Consequently, more studies are needed in order to show the relationship between genes and the environment, in caloric intake, basal metabolism and caloric consumption.

Other authors (Weber, Seidler, Wilfing & Hauser, 1995) did not identify in Austria significant differences in terms of environment (urban, rural), but in terms of the level of studies pursued by the subjects.

In Romania, studies show significant economic differences between the eight development regions of the country (Lefter & Constantin, 2009), as well as between urban and rural areas (Dachin, 2008). With regard to the height of the students, the synthetic averages obtained in 2012, compared to the previous assessments (70s, 80s and 90s), highlight the trend of population growth, the city students being higher than those from the villages. At the same time, the average values of weight highlight that the city students are heavier than those in rural areas (Stănescu, Ciolcă, & Stoicescu, 2016).

The biomotor potential assessment of the 70s highlights for pre-school students, at 4-5 years of age, height and weight values that are higher for girls and boys in the countryside, in flat areas (Focșăneanu, Paraschiv, & Nicu, 1979).

In the primary cycle, values of higher heights are recorded in the cities and villages, compared to the ones in the hills and mountains. The highest values were recorded in lowland towns, and the smallest ones in mountain villages, for both girls and boys. The conclusions of the assessment of the biomotor potential of students in grades I-IV (7-11-year-olds) and V-VIII (11-14-year-olds), in 1970, emphasise that both socio-economic and geographical conditions influence the somatic development of children.

In the same edition of the assessment, but in high school students, it is noted that at the age of 14-15, city boys are taller and have more body weight than the ones in the villages, the advantage being preserved mainly in the case of those in lowlands and hill areas. Subsequently, between the ages of 15 and 18, although the height and weight are higher for urban students, there are cases where students from hill or mountain towns have better results than those in the countryside. (CNEFS, 1975)

As for the height of the girls, the differences between the two types of localities (urban, rural) from different geographical areas are not significant. In the case of weight, it is noticed that 14-16-year-old girls in hill areas, rural and urban localities, have higher values than in other areas, while in 17-18-year-olds, the advantage is in favor of girls in the mountain areas. (CNEFS, 1975) Since the 1970s, boys have been considered to be more sensitive to socio-economic and geographical influences than girls.

The advantage of higher heights and weights is maintained for girls and boys (11-14-year-olds) in the urban area for the 80s and 90s assessment editions, too (Nicu, Focșăneanu, Loghin, Paraschiv, & Negoiță, 1981). The data from the previous editions of biomotor potential assessment show that the conclusions regarding the values of the somatic indices remain valid both for girls and boys, who are taller in the urban plain area than in the urban areas, in hill or mountain localities and in rural areas (Paraschiv & Șintie, 1992).

http://dx.doi.org/10.15405/epsbs.2018.03.1
Corresponding Author: Monica Stănescu
Selection and peer-review under responsibility of the Organizing Committee of the conference
eISSN: 2357-1330

3. Research Questions

In this context, the question arises whether the environmental, socioeconomic and natural influences exerted on children from different geographic areas of Romania can determine the same significant differences in the height and weight values, at different ages, just as in the previous editions of biomotor potential assessments.

4. Purpose of the Study

This paper intends to verify the hypothesis according to which there are significant differences between the height and weight of children in different geographical areas of Romania - plain, hill, mountain, due to socio-economic (urban, rural) and climatic conditions in those areas.

5. Research Methods

In order to verify the hypothesis, we compared the height and weight results of children aged 6/7 years, 10/11 years, 14/15 years and 18/19 years, from different geographic areas of Romania (mountain, hill, plain), obtained in the project "Evaluation of somatic, functional and motor potential of the Romanian school population" (2011-2012, MCTS, UNEFS). 146,758 results were analysed, from 72,188 girls and 74,540 boys.

In this theoretical study, we used the bibliographic study method that helped us extract data from national reports, descriptive and hypothesis tests to compare the data, and the graphical method to illustrate the comparisons. In terms of methodology, statistical data processing and analysis were mostly done using the indicators of central tendency, with reference to the average.

For the comparison purpose, hypothesis tests were performed (significance level $\alpha = 0.05$). All the corresponding difference values were coloured in the summary tables below.

6. Findings

The data were compared between the plain and hill areas, hills and mountains, mountains and plains, between rural and urban school population, girls and boys. Applying the significance tests between the identified differences is centralized in Table 01.

Table 01. [Differences in the mean values of school population for height (cm) and weight (kg) (male – M, female – F), in urban – U and rural – R areas, between different landform regions (flat – S, hill – D, mountain – M)]

		S-D				D-M				M-S			
		U		R		U		R		U		R	
		M	F	M	F	M	F	M	F	M	F	M	F
Height (cm)	I	-0.22	0.02	0.00	0.21	0.22	-0.81	-0.32	-0.15	0.00	0.79	0.32	-0.05
	V	0.66	1.05	0.17	0.13	0.40	-0.35	-0.05	-0.66	-1.05	-0.70	-0.12	0.53
	IX	0.49	0.64	-1.19	0.72	0.78	-1.13	-0.71	-2.36	-1.27	0.49	1.90	1.64
	XII	0.46	0.65	-1.35	-0.49	0.16	-0.01	-1.71	0.66	-0.62	-0.65	3.06	-0.16
Weight (kg)	I	0.55	0.44	0.92	0.47	-0.48	-0.32	-0.65	0.00	-0.07	-0.12	-0.27	-0.47
	V	1.44	1.31	0.98	1.22	-0.22	0.69	-0.31	-0.30	-1.22	-2.00	-0.67	-0.92

http://dx.doi.org/10.15405/epsbs.2018.03.1
Corresponding Author: Monica Stănescu
Selection and peer-review under responsibility of the Organizing Committee of the conference
eISSN: 2357-1330

	IX	0.97	0.02	0.43	-0.15	0.08	-0.95	0.35	-1.04	-1.04	0.93	-0.77	1.19
	XII	0.39	-0.55	-1.06	0.43	0.48	0.56	-0.20	1.13	-0.87	-0.01	1.27	-1.57

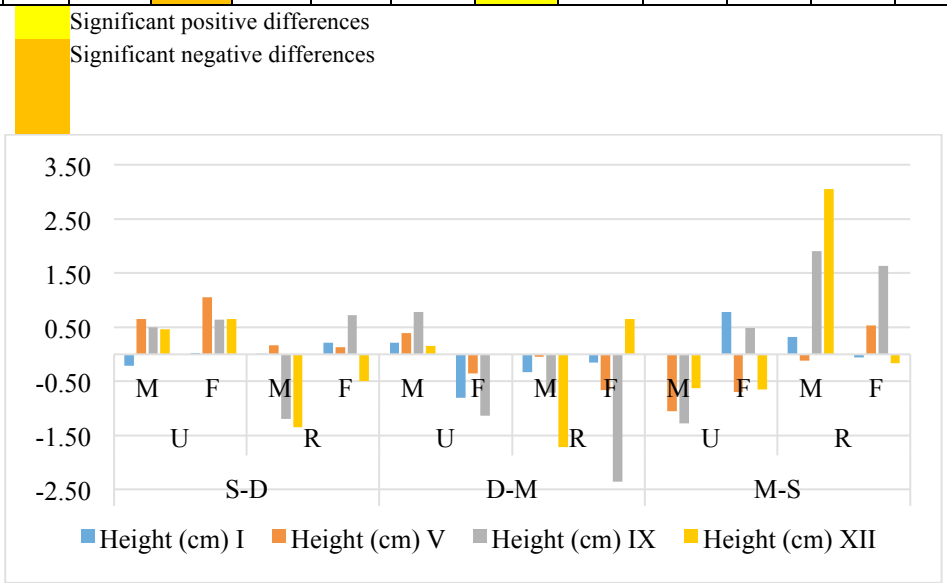

Figure 01. [Differences in the mean values of school population for height (cm) (male – M, female – F), in urban – U and rural – R areas, between different landform regions (flat – S, hill – D, mountain – M)]

The obtained results highlight the following aspects regarding height (Figure 01):

a) For the first grade school population, 6-7-year-old children, the differences are generally not significant and not influenced by the environmental conditions; the average values recorded for girls are an exception, being significantly higher in mountain areas (127.36 cm) compared to hills and plains, for the urban area. For rural areas, there are no significant differences;

b) Among 10-11-year-olds, fifth grade, girls and boys in the urban lowland area, as well as girls in mountainous rural areas, show significantly higher values in height than other children of the same age but from other areas. There are no significant differences for boys in rural areas;

c) The most numerous significant differences were identified in 14-15-year-old girls, 9th graders. In this age group, we have found that the height of children in rural mountain areas (163.84 cm girls and 170.31 cm boys) tends to be significantly higher than those in lowland and hill areas. The same aspect is found in urban mountain areas only in girls (164.76 cm), while in boys, the dominant height occurs in the plain areas (170.99 cm);

d) In the 12th grade, both the girls (165.84 cm) and boys (175.23 cm) from the urban low area and the boys (176.36 cm) from the mountainous rural area tend to be taller than those from other geographic areas.

With regard to the weight (Figure 02):

a) For the first grade children aged 6-7 years, significantly lower values are recorded in hill urban areas (26.19 kg, girls and 27.12 kg boys) than in other geographic regions, and significantly higher values in rural plain areas (25.46 kg girls and 26.57 kg boys) than in other geographic regions;

http://dx.doi.org/10.15405/epsbs.2018.03.1
Corresponding Author: Monica Stănescu
Selection and peer-review under responsibility of the Organizing Committee of the conference
eISSN: 2357-1330

b) The 10-11-year-olds, fifth grade, girls and boys in the plain areas, regardless of the environmental conditions, exhibit significantly higher weight values than other children of the same age and from other geographical areas;

c) At the age of 14-15 years, in the ninth grade students, it is found that, in urban areas, the weight of the boys in the plain areas (62.30 kg) is significantly higher, while for the girls, the mountain values (55.64 kg) are predominant. For rural areas, there are no significant differences;

d) In the 12th grade, significant differences are found only in the urban areas where the weight of the boys in the plain areas (68.96 kg) is significantly higher, while for the girls, the hill values (57.37 kg) are predominant. For rural areas, there are no significant differences.

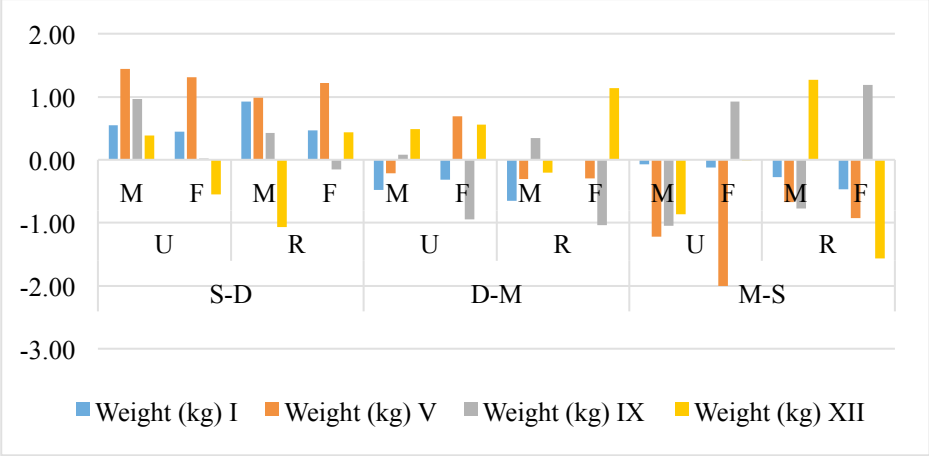

Figure 02. [Differences in the mean values of school population for weight (kg) (male – M, female – F), in urban – U and rural – R areas, between different landform regions (flat – S, hill – D, mountain – M)]

7. Conclusion

The above results have revealed that, at the age of 6-7 years, children from the rural plain areas tend to register higher values of height and weight than in the urban environment. This is in agreement with the information from the Romanian literature, which has signaled this aspect since the 1970s (Focşăneau et al., 1979). On the other hand, the conclusions that highlight an increasing influence of the environmental factors on the growth process from the first years of life to adolescence are confirmed (Eaves et al., 1989; Jelenkovic et al., 2011). This explains why the differences in the early years are in favor of children in the countryside, in plain areas, while, as they grow and develop, the values of height and weight are in favor of children in the urban plain areas.

If the height of 6-7-year-old children is not significantly different, regardless of the socio-economic or geographic environment, their weight is in favor of those living in the rural plain areas. This situation can be attributed to the quality of food, but also to the lesser conditions for practicing physical exercise. Shobha, Asawari, Smita and Jayshree (2012) saw a similar phenomenon in rural areas in India. Although the differences in the secular trend for height are insignificant, the weight difference highlights the need for better information of mothers in rural areas regarding healthy eating in order to reduce the risk of overweight in children, even in the respective environment.

Unlike previous editions of the biomotor potential assessment, it is noted that the height of children aged 14 to 15 years in rural mountain areas tends to be higher than for children from plain areas, although in the case of the boys, the body weight of those in the plain cities remains significantly higher. This signals the risk of overweight, especially for boys in urban plain areas. Differences can also be associated with a cleaner, less polluted natural environment, with fewer noxious influences on boys, in particular (Cucu et al., 1994).

The 17-18-year-olds, boys in the urban plain area, as well as those in the mountainous rural area, have the highest values of the height. The tallest girls are found in the urban plain areas, but the highest weight is found among the girls in hill urban areas. This finding confirms the earlier data (CNEFS, 1975), which put these differences at the expense of certain diet patterns and concerns regarding overweight.

This research confirms some of the information from the literature, but also draws attention to the modification of the relationship between the morphological indices of children, indices which, unlike other editions, are more pronounced in the mountain areas at the age of 14-15.

Given these results, we believe it is necessary to continue the comparative analysis of the data that will be constantly obtained from different socio-economic and geographic regions of Romania in order to identify certain disorders in the process of child growth and development, but also those areas that can offer solutions for the selection of children to practice certain sports.

Acknowledgments

The research was conducted based on the main data obtained within the project "Evaluation of somatic, functional and motor potential of Romanian school population" (UNEFS - MENCS, 2012). The author Lucian Bejan thanks the Universidade Federal Rural de Pernambuco, Recife, Brazil, for his postdoctoral leave..

References

CNEFS. (1975). *Potențialul biometric al populației școlare din anii I-IV de liceu (cls. IX-XII) și învățământul profesional*. București.

Cole, T. J. (2003). The secular trend in human physical growth: A biological view. *Econ. Hum. Biol., 1*, 161-168.

Cucu, M., Lupeanu, M., Nicorici, M., lonescu, L., & Sandu, S. (1994). The dangerous wastes and health risks in Romania: National report. *Cent Eur J Public Health, 2*(Suppl), 41-43.

Dachin, A. (2008). Rural development - A basic condition for narrowing regional disparities in Romania. *Rom J of Reg. Sci., 2*(2), 106-117.

Danubio, M. E., & Sanna, E. (2008). Secular changes in human biological variables in Western countries: An updated review and synthesis. *J Anthropol Sci., 86*, 91-112.

Delemarre van Waal, H. A. (1993). Environmental factors influencing growth and pubertal development. *Environ Health Perspect Supplements, 101*(Suppl 2), 39-44.

Evans, D. M., & Martin, N. G. (2000). The validity of twin studies. *GeneScreen, 1*, 77-79.

Eaves, L. J., Eysenck, H. J., & Martin, N. G. (1989). *Genes, culture, and personality: An empirical approach*. London: Academic Press.

Fitzgerald, E. F., Schell, L. M., Marshall, E. G., Carpenter, D. O., Suk, W. A., & Zejda, J. E. (1998). Environmental factors influencing growth and pubertal development. *Environ Health Perspect., 106*, 307-311.

Floud, R. (1989). Measuring European inequality, the use of height data. In: A. J. Fox (Ed.), *Health inequalities in European countries*. Aldershot: Gower.

Focşăneanu, A., Paraschiv, V., & Nicu, A. (1979). *Potenţialul biomotric al preşcolarilor*. Bucureşti: CNEFS-MEI.

Jelenkovic, A., Ortega-Alonso, A., Rose, R. J., Kaprio, J., Rebato, E., & Silvetoinen, K. (2011). Genetic and environmental influences on growth from late childhood to adulthood: A longitudinal study of two Finnish twin cohorts. *Am J Hum Biol., 23*(6), 764-773.

Komlos, J. (1985). Stature and nutrition in the Habsburg Monarchy: The standard of living and economic development in the eighteenth century. *Am Hist Rev., 90*, 1149-1161.

Lefter, C. & Constantin, C. (2009). Economic and social disparities of Romania in regional and county profile. *Management & Marketing, 4*(1), 77-96.

Nicu, A., Focşăneanu, A., Loghin, M. Paraschiv, V., & Negoiţă, D. (1981). *Potenţialul biomotric al elevilor din clasele V-VIII*. Bucureşti: MEI - CNEFS.

Paraschiv, V., & Şintie, A. M. (1992). *Studiu comparativ al potenţialului biometric al elevilor din clasele I-IV la a treia ediţie a evaluării*. Bucureşti: MTS - MIS.

Pietiläinen, K. H., Maija, K., Rissanen, A., & Rose, R. J. (2002). Genetic and environmental influences on the tracking of body size from birth to early adulthood. *Obesity Research, 10*(9), 875-884.

Proos, L. A. (1993). Anthropometry in adolescence - secular trends, adoption, ethnic and environmental differences. *Horm Res., 39*(Suppl 3), 18-24.

Shobha, R., Asawari, N. K., Smita, B. J., & Jayshree, S. S. (2012). Secular trends in growth of preschool children from rural Maharashtra. *India J Health Popul Nutr., 30*(4), 420-430.

Sparen, P., Vagero, D., Shestov, D., Plavinskaja, S., Parfenova, N., Hoptiar, V., Paturot, D., & Galanti, M. R. (2004). Long term mortality after severe starvation during the siege of Leningrad: Prospective cohort study. *Br Med J.,* 328:11. Doi: https://doi.org/10.1136/bmj.37942.603970.9A

Stănescu, M., Ciolcă, C., & Stoicescu, M. (2016). *Comparative analysis of the biological and motor potential of school population from Romania (urban and rural environments)*. World LUMEN Congress (pp. 922-934). Iasi & Suceava, April 12-17, 2016.

Tanner, J. M. (1986). Growth as a mirror of condition of society: Secular trends and class distinctions. In A. Demirjan (Ed.), *Human growth - A multidisciplinary review* (pp. 3-34). London: Taylor & Francis.

Van Wieringen, J. V. (1986). Secular growth changes. In F. Falkner & J. M. Tanner (Eds.), *Human growth* (Vol. 3, Methodology, ecological, genetic and nutritional effects on growth, pp. 307-331). New York: Plenum Press.

Webb, E. A., Kuh, D., Pajak, A., Kubinova, R., Malyutina, S., & Bobak, M. (2008). Estimation of secular trends in adult height, and childhood socioeconomic circumstances in three Eastern European populations. *Econ Hum Biol., 6*, 228-236.

Weber, G., Seidler, H., Wilfing, H., & Hauser, G. (1995). Secular change in height in Austria: An effect of population stratification? *Ann Hum Biol., 22*(4), 277-288.