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MILOŠ HITKA, MILOŠ GEJDOŠ

DECREASE OF THE SECULAR TREND LONG-TERM DEVELOPMENT BASED ON SELECTED ANTHROPOMETRIC MEASURES OF THE SLOVAK ADULT POPULATION

ABSTRACT: The work aims to compare selected anthropometric characteristics of the adult Slovak population represented by a sample of Slovak university students from the years 2000–2006 with data obtained using the same measurement methodology on a sample of university students in the years 2018–2023. The statistical analysis of selected antrophometric measures of Slovak population has been done. Selected antropometric attributes are important for proposals of optimal workplace arrangement and at making of optimal work environment. Slovak population was represented by sample of students studying at Universities in Slovakia within the years 2000–2006 and 2018–2023. A total of 25 anthropometric measures were selected, which are important from the point of view of the design of the working environment and its functional elements. Standard descriptive statistics of size and variability (arithmetic mean and standard deviation) for all selected antrophometric measures were calculated and compared. The statistical testing showed that the sizes and variability of selected anthropometric attributes in two decades are comparable, although a slight tendency to greater variability exists in selected anthropometric measures. We evaluated significant differences in the location and variability of selected anthropometric characteristics of the adult population in productive age. The result is a decrease in the secular trend of Slovakia's adult population. The results of the research on the anthropometric dimensions of the adult population of Slovakia in the span of two decades showed that the adult population of young people changes statistically significantly only in the parameter of body weight.

KEY WORDS: Antrophometria – Population – Quantiles – Statistical test – Long-term development

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INTRODUCTION

In the production of ergonomically correct work tools, machines, and furniture, a person must be taken into account as a primary factor with his dimensions and strength abilities. Therefore, the design of an optimal workplace (furniture, work tools, aids) is always based on measurements of the target interest group of people, which are compared with the data of the entire population living in a certain area, usually divided into men and women. The anthropometric characteristics of a certain population can change especially over longer periods due to the action of several factors, such as changes in the standard of living and lifestyle of the population, changes in nutrition, genetic factors, etc. Therefore, it is necessary to periodically update data on population anthropometric characteristics. The updated data reflect the real situation and make it possible to design an optimal layout of the workplace, or they will allow the creation of an optimal working environment necessary for achieving the maximum performance of workers while observing all principles of work safety and hygiene. Population data are mostly determined on selected samples at a certain point in time and for various reasons (such as the population's diet, lifestyle, etc.) they can change in a trend over a longer period of time (Dorlencourt *et al.* 2000). In addition to changes in time, important anthropometric features can also vary in space, which is related to the characteristics of the human population inhabiting a certain living space. Changes in the anthropometric characteristics of the population over time are becoming an increasingly important factor directly affecting the production and business strategy of companies trying to establish themselves on the market.

The history of the human population is made up of the history of each individual and represents a barometer of all the changes to which these individuals have contributed. They are a reflection of how much power and will each individual has to be able to spread this idea and transform it into tangible artifacts left on our planet by each population. Each group of individuals originating from the same species and occurring at a given time in a certain place can be understood as a population, according to its tangible and biological remains, which is called habitus. This term can be explained according to appearance, formability, appearance, or even character. However, the fact that it is something biological tells us that we can find a connection between the processes that describe living organisms. On the basis of these characteristics, we can create a detailed and, above all, comprehensive survey of a specific individual, from whom we have certain remains that have been preserved. Thus, it is a grouping of certain metric and external signs that adapt to the surrounding environment on the basis of various hereditary properties. Due to the fact that the settlement of one population followed the settlement of another population, and by the fact that they adopted each other's material culture and their customs, the definition of the population from the point of view of anthropology is fulfilled and it is necessary that it forms part of all studies that create an image of the habits of a given ethnic group. It is conditioned by the fact that all ethnic groups that participated in the formation of a certain population left a biological and genetic trace there (Kolena, Vondráková 2013).

The fact that a person has been developing physically over the past millennia is mainly indicated by the brittleness of the skull, dentition, and the postcranial skeleton, by reducing body weight and the volume of the brain. "From the Neolithic period until today, Europeans are subject to the so-called conformation-heterogenization trend" (Kolena, Vondráková 2013). This trend manifests itself in the imitation of various body features among Europeans. Intrapopulation heterogenization indicates that differences in body dimensions within the same population group are increasing. A large number of signs are polyfactorial and polygenic. That is why the environment also has a significant influence on these changes. Research in the field of anthropology shows that the dimensions of a person's body, such as their average body height, change and develop due to the influence of the time factor. Body dimensions in the adult population have increased compared to the past – a secular trend (Maranho *et al.* 2023, Stloukal *et al.* 1999). In the history of man's development, his body dimensions have always been, and still are, a determining criterion for his conscious creation of the objects he used, as well as the surrounding environment, i.e. architecture. Man has been concerned with the dimensions of the human body since time immemorial. It has obvious and obvious since the construction of the first buildings. European civilization has been dealing with the dimensions of the human body and its proportions since ancient times, and the effort to define the proportions of the human body is known from this area, especially for the needs of sculpture. All this was related to a very careful observation of the dimensions of the human body. The knowledge of ergonomics began to be used by industrial designer Henry Dreyfuss from America. In the work

"De-signing for people" he described what the ideal configuration of objects should look like. Nowadays, anthropometry and the data obtained thanks to it are applied and used more and more regularly and more often (Woodruff, Duffield 2002). Measurements and research have shown that the body height of both women and men has changed significantly over time. All these changes have a significant impact on the determination of objects of daily use. So if it happens that the needs of daily use are proposed for the future, we have to take into account the time factor and the fact that those dimensions change due to constant development. Thus, if we want to create some standardized and optimized products, we have to stick to the knowledge and understanding of statistical measures for the population for which the given products are created and which will use these products.

In general, the secular trend is an indicator of health, well-being, improved nutrition, and health care (Knutsen 2002). In addition to health and nutrition, growth rates also reflect overall hygienic conditions (Bogin 1999, Schell 1989). This phenomenon has been documented in many European countries in the last two centuries, including Norway, Denmark, Sweden, the Czech Republic, and Germany (Morkovsky 2019). Height is an indicator of the country's economic development, but also of an individual's standard of living. Temporal analysis can reveal both short-term changes and the timing and structure of the secular trend (Danubio *et al.* 2003, Komlos, Kriwy 2002, Padez 2002, Silventoinen *et al.* 2001). The secular trend has already taken on a global character, and its origin can be attributed to a total change in lifestyle, improvement of health care, mass mixing of national and ethnic groups, but also psycho-social changes. Thus, the secular trend shows a similar pattern everywhere in the world, only differing in speed and timing. Also in Asia, there are records confirming an increase in body dimensions (Chuan *et al.* 2010, Iseri, Arslan 2009). The essence of the measurements are points on the upper and lower limbs, head and trunk, and indices – BMI index, thanks to which we can assess the appropriateness of body weight to body height (Čuta *et al.* 2019). These are very simple and effective measurements (Haghravan *et al.* 2016, Chen *et al.* 2016).

Economic growth caused the intensification of the globalization of the market together with a higher overall standard of living, better availability of food, sedentary work and thus significantly influenced the diet and overall lifestyle of people, which also caused a significant increase in the body weight of the population worldwide (Gomula *et al.* 2015, Stevens *et al.* 2012, Freedman *et al.* 2010). "The rising prevalence of overweight and obesity" has been labeled as a global pandemic in many countries of the world (Stevens *et al.* 2012, Wang *et al.* 2007). Finucane *et al.* (2011) used data from 369 national surveys and 591 smaller local surveys in their research to map trends in BMI change in the world between 1980 and 2008. Other authors (De Onis *et al.* 2010) processed 450 national surveys, to determine the trend of childhood overweight and obesity from 1990 to 2020. Data from both studies, as well as others, point to an excessive, almost global, increase in overweight and obesity in recent decades, despite analyses from some countries suggesting, that some populations have stabilized (Flegal *et al.* 2010, Rockholm *et al.* 2010, Stamatakis *et al.* 2010). Data from several studies from the US even indicate that the continued increase in obesity may lead to a decrease in the average life expectancy in the future. (Olhansky *et al.* 2005). The fact that these trends are already appearing in developing countries only confirms the growing global epidemic of overweight and obesity (Thang, Popkin 2003, Thankappan 2001). Many studies show that the dangerous trend of increasing overweight and obesity already occurs at a very young age (Durankova *et al.* 2020, Bielecki *et al.* 2012, Smpokos *et al.* 2011, Cardoso, Padez 2008, Cardoso, Caninas 2010). This trend is subsequently exacerbated among young adults, who experience a very rapid increase in body weight (Parvez 2022, Thompson 2008). Some studies look at the problem from the opposite side, i.e. in what way is it possible to maintain an unchanged weight? It turns out that for women, exercise was associated with successfully maintaining a stable weight, but for women who have two or more children, they often drink sugary drinks, eat irregularly, have tried unhealthy diets in the past, and are not satisfied with his life there was an increase in weight. In men, weight gain is associated with irregular eating, unhealthy diets, and smoking, as shown by the authors' research (Kärkkäinena *et al.* 2018, Susanne 1984).

In recent decades, however, there have been not only weight changes in the population but also changes in growth. Secular trends have been documented in many countries of the world since the 19th century (Fudvoye, Parent 2017, Komlos, Lauderdale 2007, Leitao *et al.* 2013). While there is a worldwide increase in population weight in the case of weight, the situation is different in the case of growth changes. Research in the territory of the Czech Republic shows that in the Czech population, as well as in the Slovak population, there has been a significant increase in body dimensions, especially

body height and weight. The beginnings of Czech anthropometry date back to 1895, when under the leadership of Dr. Matiegka conducted research in the area of measuring children and youth. Almost 100 thousand children participated in this research. Another important research was the research of V. Fetter, which in the Czech Republic can be considered as the first national anthropometric research of youth. Based on these results, the growth characteristics of children and youth were determined. Subsequently, further research continued under the leadership of Bláha, Prokopec and others. One of the researches, organized between 1970 and 2011, found that there was an increase in height of 6.1 cm for men, 4 cm for women, an increase of 7.4 kg for men, and 5 kg for women between 1985 and 2011. It is interesting that body height and weight in the Czech Republic are not growing in proportion at the present time. Especially in men, weight increases more significantly than body height. Jirkovský (2003) also studied the anthropometric measurement of men aged 18-25 in the Czech Republic in the second half of the 20th century. The results of the research are comparable to the results of Jirkovský, states that since the second half of the 1980s, growth acceleration has gradually slowed down and body weight has increased. This means that the significant secular trend that took place after World War II slowed down at the end of the last century. Despite this, there is a slight increase in the body height and weight of the male population from the Czech Republic.

The issue of secular growth of the adult population of Slovakia is addressed by a minimum of researchers in the scientific sphere. This literature review identified a research gap that is addressed in this research. Sufficient information is not available on secular population growth and selected body dimensions. For this reason, the aim of the presented work is to compare selected anthropometric characteristics of the adult Slovak population represented by a sample of Slovak university students from the years 2000–2006 with data obtained using the same measurement methodology on a sample of university students in the years 2018–2023. In this work, we will evaluate significant differences in position and variability in selected anthropometric features of the adult population in productive age.

Empirical material and work methodology

In the anthropometric literature, a whole series of standardized dimensions and features of the human body are defined, which can be determined exactly. Based on our experience and analysis of the literature, we present a set of 25 dimensions and features that can be used in hygienic and ergonomic practice, especially when designing the optimal spatial arrangement of the workplace and creating an optimal working environment. The list of interesting characters together with the connected units of measurement is contained in tab. 1. and 2 located in the results section. Exact definitions of the individual signs and the method of their measurement can be found in the publication by Strelka (1978), however, due to the scope of the contribution, they will not be presented in this work.

Empirical measurements of the values of selected anthropometric characteristics of the current population in Slovakia were made in the years 2000–06 on a sample consisting of 289 men and 270 women, students aged 20–24 from the entire territory of Slovakia, and in the years 2018–2023 on a sample adult students from the entire territory of Slovakia, which consisted of 1,966 men and 1,496 women.

The measured sample data were collectively described by common characteristics of location and variability – arithmetic means $\bar{x}$ and standard deviations s_x characterizing the size and fluctuation of individual measured values. For both characteristics of each observed character, their relative differences *dif %* were calculated according to the formula:

$$dif\ \% = \frac{\bar{x}_1 - \bar{x}_2}{\frac{\bar{x}_1 + \bar{x}_2}{2}} \quad \text{resp.} \quad dif\ \% = \frac{s_{x1} - s_{x2}}{\frac{s_{x1} + s_{x2}}{2}}$$

In addition to a simple comparison of the values of the descriptive characteristics, due to the selective nature of the measured data, the work proceeded to test the agreement of the arithmetic means and standard deviations of the selected characters for 2 monitored basic files – from the years 2000–2006 and 2018–2023.

As part of the tests, it is basically a check of the statistical significance of the differences in the sample arithmetic means and standard deviations of the individual considered anthropometric features so that at the selected level of significance it can be ruled out that the detected differences in the sample descriptive characteristics were not caused exclusively by an error from the representation.

When verifying the agreement of the arithmetic means of the 2 basic sets, we test the null hypothesis H0: $\mu_1 = \mu_2$ according to which we claim that the arithmetic means of the anthropometric features of the 2 basic sets are equal. Testing the agreement of the

arithmetic means under the conditions that the selections from the basic sets are independent and the variability of the monitored characters in the basic sets is assumed to be different is done using the classical test criterion:

$$t = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{s^2_{x1}}{n_1} + \frac{s^2_{x1}}{n_2}}}$$

which is compared with the critical value of the Student's t distribution $t_{\alpha/2(f)}$ with the number of freedom degrees $f = n_1 + n_2 - 2$, where n_1 and n_2 are the sample sizes from the 1st and 2nd basic sets. The null hypothesis H0: $\mu_1 = \mu_2$ is accepted at the selected level of significance α if $|t| \leq t_{\alpha/2(f)}$, and vice versa, it is rejected if we find that $|t| > t_{\alpha/2(f)}$. If the null hypothesis is not rejected, we can equivalently claim that the difference of the sample means $\bar{x}_1 - \bar{x}_2$ is so small that it can only be caused by the randomness of the selection, and conversely, if H0 is rejected, we know at the chosen level of significance that the difference of the sample means $\bar{x}_1 - \bar{x}_2$ is already too large to be solely attributable to the randomness of selection.

Within the framework of our work, with our range of sample sizes, the critical value $t_{\alpha/2(f)}$ for the selected level of significance and the number of degrees of freedom f = (289 + 1966) - 2 = 2253 for men aquires the value $t_{0,025(2253)} = 1.9682$ and for women the number of degrees of freedom f = (270 + 1496) - 2 = 1764 value $t_{0,025(1764)} = 1.9688$.

Similarly, we can also test the null hypothesis H0: $\delta_1^2 = \delta_2^2$ about the agreement of standard deviations (or variances), i.e. the variability of the values of the observed characters in the tested basic sets. The test is again done using sample variances s_1^2 and s_2^2 and is based on Fisher's F distribution. The test criterion F is calculated as a proportion:

$$F = \frac{s_1^2}{s_2^2}$$

In order to simplify the conclusion of the test, the larger of the 2 sample variances is usually placed in the numerator of the test criterion F, therefore the indices 1 and 2 for the symbol s must be considered formal. The conclusion of the test itself is then made on the basis of a comparison of the value of the calculated test criterion F with the critical value F distribution $F_{1-\alpha/2(f_1,f_2)}$ for two numbers of degrees of freedom $f_1 = n_1 - 1$ and $f_2 = n_2 - 1$ and it holds that if $F > F_{1-\alpha/2(f_1,f_2)}$ the null hypothesis H0: $\delta_1^2 = \delta_2^2$ about the agreement of the variability of the values of the monitored anthropometric feature in the Slovak and Czech populations is rejected.

The critical F value of the distribution for the level of significance α = *5%* is for men in cases where the variance of the first sample is greater $F_{0.95(289,1966)} = 1.3545$ and in the case that the second sample of the period 2018–2023 the sample shows a greater variance $F_{0.95(1966,289)} = 1.3307$. For women, in cases where the first sample shows a larger variance $F_{0.95\,(270,1496)} = 1.3366$ and in the case of a larger variance of the second sample of the period 2018–2023 $F_{0.95(1496,270)} = 1.3290$.

RESULTS

Information about the main results of the work is contained in tab. 1. and 2. From tab.1 for the female part of the population, we see that the size of the monitored features, i.e. the anthropometric dimensions of the population in two different periods do not differ significantly. The average relative difference of the arithmetic means of all observed features is almost not different from 0, the individual relative differences are very small (most of them are within ± 2.5%) and their signs fluctuate randomly. The only exception is body weight, where it was found that the female population in the period 2018–2023 already has a significantly greater weight by approximately 8% than the female population in the period 2000–2006. This finding is quite interesting, especially in connection with the fact that the body height of both population samples is practically the same.

The situation is different when comparing the variability of the measured values of selected anthropometric characteristics. Here we see that the variability of the values in the second sample (2018–2023) is greater in most cases. It is partly related to the fact that the range of the sample size was larger. The average relative difference of the compared standard deviations for all 25 monitored features is -32.8%, which means that the variability of the data in the second sample from the period 2018–2023 is approximately 33% greater. This fact is also confirmed in 18 cases by the significance test of the sample difference s_x, while in up to 17 characters the significant difference has a negative sign, i.e. indicative of greater data variability in the second sample population of populations. Likewise, for signs where the difference s_x was not confirmed as significant, most of the signs are negative.

TABLE 1: Basic characteristics of the size and variability of anthropometric features of the Slovak population – women. * highlighted test criteria are significant at the significance level a = 5 %

Anthropometric features	Mean 2000–2006	Mean 2018–23	Dif. 2000–2023	t - test	Std. deviations 2000–2006	Std. deviations 2018–2023	Dif. v %	F - test
1. body weight in kg	59.2	64.2	**-8.0**	-8.72	7.7	12.51	-47.6	**2.64**
2. stature height	168.85	166.7	1.3	5.19	6.35	6.20	2.4	1.05
3. height of the nose root (standing)	157.6	156.3	0.8	2.83	6.55	6.45	1.5	1.03
4. standing shoulder height	142	139.6	1.7	4.90	7.4	6.43	14.0	**1.32**
5. standing elbow height	108.6	106.4	2.0	5.38	5.75	6.37	-10.3	1.23
6. height of the 3rd finger tip (standing)	67.8	66.2	2.3	4.09	5.4	6.33	-15.8	**1.37**
7. arm's reach while standing	210.1	206.7	1.6	5.32	9.5	10.75	-12.4	1.28
8. shoulder (bi-deltoid) breadth	41.65	41.6	0.1	0.14	3.5	4.56	-26.3	**1.70**
9. lateral chest diameter	33	32.7	1.0	0.68	5.95	10.59	-56.1	**3.17**
10. arm's forearm reach (standing)	78.65	77.6	1.4	2.60	5.35	7.85	-37.9	**2.15**
11. arm span while standing	165.45	164.6	0.5	1.51	8.35	9.08	-8.4	1.18
12. body height while sitting	89.1	89.1	0.0	-0.06	7.75	12.65	-48.1	**2.67**
13. height of the nose root (sitting)	77.15	79.2	-2.7	-4.31	4.95	12.24	-84.8	**6.11**
14. sitting elbow height	25.75	26.2	-1.8	-1.38	3.75	7.84	-70.6	**4.37**
15. upper arm flexed at the elbow	34.9	35.0	-0.3	-0.37	2.6	5.74	-75.3	**4.87**
16. knee height while sitting	53.1	51.4	3.2	6.56	3.6	4.02	-11.0	1.25
17. arms reach (sitting)	128.55	128.1	0.4	0.77	7.15	12.55	-54.9	**3.08**
18. forearm+hand (bent at the elbow)	43.9	42.9	2.3	4.59	2.55	4.87	-62.5	**3.64**
19. the length of the thigh (bemt knee)	56.2	54.8	2.6	4.48	4.35	5.73	-27.5	**1.74**
20. leg length when sitting forward	101.7	99.4	2.3	5.41	6.35	7.49	-16.5	**1.39**
21. arm's forearm reach (sitting)	78.3	77.1	1.6	3.15	5.45	6.29	-14.2	**1.33**
22. palm width	9.6	9.6	0.2	0.28	1.05	1.32	-23.1	**1.59**
23. palm length	18	17.8	1.3	1.36	1.3	4.67	-112.9	**12.90**
24. foot width	9.5	9.4	1.0	1.26	1.1	1.26	-13.7	**1.32**
25. foot length	24.4	24.1	1.1	2.14	1.75	1.90	-8.3	1.18
			0.6		**Av. diference:**		**-32.8**	

This finding is quite important because it indicates that the quantiles of the empirical distribution of the values of the two population samples widely used in ergonomic and hygiene practice will differ and therefore need to be determined separately for the current population. In addition, in further research, it will be necessary to verify whether the individual populations and selected samples do not also differ in the shape of the distribution of values and whether they have the expected shape of a normal random distribution.

The analysis of the characteristics in the male part of the population showed very similar results – the dimensional parameters of both population samples do not differ significantly (with the exception of body weight and one other less important characteristic – sitting elbow height), however, the variability of the monitored characteristics, similar to that of women, is in the second the population sample is significantly larger. The average relative difference of standard deviations for all observed characteristics (-26%) is 6% lower than in the female

TABLE 2: Basic characteristics of the size and variability of anthropometric features of the Slovak population – men. * highlighted test criteria are significant at the significance level a = 5 %

Anthropometric features	Mean	Mean	Dif.	t - test	Std. deviations		Dif.	F - test
	2000 2006	2018-23	2000-2023		2000-2006	2018-2023	v %	
1. body weight in kg	77.4	81.5	**-5.1**	-5.97	10.25	14.24	-32.6	**1.93**
2. stature height	181.35	180.7	0.4	1.63	6.7	7.05	-5.1	1.11
3. height of the nose root (standing)	169.9	169.4	0.3	1.21	6.85	7.43	-8.1	1.18
4. standing shoulder height	152.5	151.9	0.4	1.33	6.95	7.29	-4.8	1.10
5. standing elbow height	116.2	114.9	1.2	3.42	5.9	7.02	-17.3	**1.42**
6. height of the 3rd finger tip (standing)	70.45	71.1	-0.9	-1.82	5.05	6.86	-30.4	**1.85**
7. arm's reach while standing	228.7	225.9	1.2	4.08	9.95	15.73	-45.0	**2.50**
8. shoulder (bi-deltoid) breadth	49.05	48.1	1.9	3.10	4.45	5.84	-27.0	**1.72**
9. lateral chest diameter	36.6	35.4	3.4	3.30	5.3	7.28	-31.5	**1.89**
10. arm's forearm reach (standing)	86.45	85.0	1.7	2.74	8.6	7.34	15.8	0.73
11. arm span while standing	181.65	180.7	0.5	1.63	8.65	10.37	-18.1	**1.44**
12. body height while sitting	95.3	96.2	-1.0	-1.52	9.25	13.30	-35.9	**2.07**
13. height of the nose root (sitting)	82.85	84.8	-2.4	-3.70	7.2	12.69	-55.2	**3.11**
14. sitting elbow height	25.7	29.4	**-13.6**	-8.25	5.35	12.34	-79.0	**5.32**
15. upper arm flexed at the elbow	38.95	38.3	1.6	2.05	4.4	6.40	-37.0	**2.12**
16. knee height while sitting	57.4	56.4	1.7	3.96	3.6	4.94	-31.4	**1.88**
17. arms reach (sitting)	138.8	139.1	-0.2	-0.42	8.15	14.19	-54.0	**3.03**
18. forearm+hand (bent at the elbow)	48.9	47.2	3.6	6.22	3.9	5.87	-40.4	**2.27**
19. the length of the thigh (bemt knee)	59.55	58.2	2.3	4.04	4.8	6.39	-28.5	**1.77**
20. leg length when sitting forward	109.65	107.4	2.1	5.00	7.05	8.42	-17.8	**1.43**
21. arm's forearm reach (sitting)	86.55	84.6	2.3	4.50	6.55	7.55	-14.2	**1.33**
22. palm width	11.1	11.1	-0.1	-0.21	1.1	1.60	-36.8	**2.10**
23. palm length	19.2	19.3	-0.6	-0.82	2.1	1.83	14.0	1.32
24. foot width	10.55	10.6	-0.3	-0.37	1.15	1.44	-22.7	**1.58**
25. foot length	27.5	27.0	1.8	3.36	2.2	2.34	-6.4	1.14
			0.1		**AV. diference:**		**-26.0**	

part of the population, the number of significantly different features is 19 and all have a negative sign.

DISCUSSION

Secular trends were documented in many countries since the 19th century (Fudvoye, Parent 2017, Leittao *et al.* 2013, Komlos, Lauderdale 2007). Height increases were registered in southern Europe (Schmidt *et al.* 1995). Hauspie *et al.* (1997) found secular trends in Europe during the last decades of the 20th century ranging from 3 mm/decade in Scandinavia to 30 mm/decade in parts of Southern and Eastern Europe. The existence of secular trends can be considered as a global phenomenon (Jirkovský 2003, Cole 2003, Bolstadt *et al.* 2001). Comparing the results of our research with the results of other researches is difficult for a variety of reasons, such as the different sample sizes, specific measurement methods, demographic coverage, ethnic mix or health

status of the participants. However, anthropometric research does not stop only at the general dimensions of the human body. Research by Rodriguez *et al.* (2022), for example, deals in detail with the characteristics of the head from the point of view of populations. The authors Maranhi *et al.* (2023) deal with a selected part of the human skeleton. Several authors are also engaged in anthropometric research on the child and adolescent population (Jenčová *et al.* 2022, Rodríguez *et al.* 2022, Durankova *et al.* 2022, Langová *et al.* 2021, Leitao *et al.* 2013, Woodruff, Duffield 2002, Dorlencourt *et al.* 1993). Research similar to ours was also carried out by Parvez *et al.* (2022).

The results of the development of the anthropometric dimensions of the adult population of Slovakia in the span of two decades showed that the adult population of young people changes statistically significantly only in the parameter of body weight. This trend is more pronounced, especially in the female population. It can be characterized as a negative trend, especially from the point of view of the development of food quality in relation to eating habits. In the future, this will have a negative impact on the general health situation of the population and workforce in productive age, which will secondarily affect the setting of the processes of the economic production sphere and ergonomic standards. The higher variability of anthropometric dimensions in the sample from 2018–23 can be attributed to the larger selection of the population sample that was available in this period and exact conclusions cannot be drawn from it. This indicates the slowing down of the secular trend of the Slovak population. Similar results are also stated by the authors Jirkovský (2003) in the Czech population, Bolstad *et al.* (2001) in the Norwegian population, and Cole (2003).

Some indications about the contemporary slowdown or stagnation of secular trends in heights (similar to the mentioned Romanian study) were reported for some regions and populations (Schönbeck *et al.* 2013, Subramanian *et al.* 2011, Bolstad *et al.* 2001, Malina 2004), the positive secular trend in central and eastern Europe probably still prevails.

CONCLUSION

Knowledge of the basic anthropometric parameters of the adult population is a necessary condition for the creation of the correct layout of the workplace, both from the point of view of optimal employee performance, as well as from the point of view of work safety and hygiene. Creation of an optimal workplace, construction of machines, work tools, furniture, etc. it is always based on a comparison of the anthropometric data found. The anthropometric characteristics of a certain population can change especially over longer periods of time due to the action of a number of factors, such as changes in the standard of living and lifestyle of the population, changes in nutrition, genetic factors, etc., change significantly. Therefore, it is necessary to periodically update data on population anthropometric characteristics, especially after longer periods. In the thesis, we investigated the comparability of the size and variability of the values of selected anthropometric data of the Slovak population over two decades. Research has shown that the dimensional parameters of the Slovak population do not differ in their size, but they differ in their variability. It follows that when calculating the quantiles of the distribution of individual characteristics important for ergonomic and hygienic practice, we can combine both samples into one file.

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Miloš Hitka*
Department of Economics,
Management and Business
Faculty of Wood Sciences and Technology,
Technical University in Zvolen,
T. G. Masaryka 24, 96001 Zvolen,
Slovakia
E-mail: hitka@tuzvo.sk
Miloš Gejdoš
Department of Forest Harvesting,
Logistics and Ameliorations
Faculty of Forestry
Technical University in Zvolen,
T.G. Masaryka 24, 960 01 Zvolen,
Slovakia
E-mail: gejdos@tuzvo.sk

* Corresponding author.