

EVALUATION OF THE SELECTED MARKERS OF PHYSICAL DEVELOPMENT OF STUDENTS AT THE TECHNICAL UNIVERSITY OF KOSICE

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Key words:

- university population,
- parameters of physical development,
- body fat,
- body mass index,
- active body mass.

Abstract:

The article in question deals with selected markers of physical development among students of Technical University in Kosice. It compares the parameters of body height and weight, body mass index (BMI), quantity of body fat, muscles and visceral fat with the results of different studies.

Entry (pre) measurements were taken in 1042 students of Technical university in Kosice (n1=1042, 512 females and 530 males, september 2012), exit (post) measurements in 670 students (n2=670, 302 females, 368 males, may 2013) where the average age was $21,1 \pm 1,4$ years. The paper also presents the entry data collected at the Pavol Jozef Safarik University in Kosice in (n=951, 672 females and 279 males, average age $=21,5 \pm 3,5$ years, september 2012).

The primary goal of this study was to gain insight and evaluate the impact of the changing living conditions on physical development of college students. The assessment of body weight, BMI, body composition – proportion of body fat and active body mass (muscles) is part of health state valuation. Higher values of the above-mentioned parameters represent a significant risk factor related to a whole number of health disorders.

INTRODUCTION

Statistics in Slovakia show that only 40% of males and 56% of females at the age of up to 35 years have weight in proportion to their height. The aim of the survey carried out in the years 1992 – 2007 among 4590 undergraduate students was to find out the mean BMI values in this group of population. 22% of males and 8% of females were diagnosed as being above the ideal weight. The increasing BMI values over the course of years were found in males in particular [4]. The study performed between the years 2007 – 2011 at the University of Nebraska with more than 2530 participants revealed overweight in more than 30,5% of probands [6]. The reasons for the increased number of overweight individuals were associated with the change of their lifestyle towards the increasingly hypokinetic way of life. To tackle the challenges of university studies undergraduates are required to devote more time to learning which leads to a gradual shift to a sedentary way of life. Most of them leave their families and for a certain period of time are exposed to a new environment where they live and study. This is closely related to the change in their daily routine and eating habits. Irregularity and changes in schedules make them unable to keep their regular eating patterns. The primary goal of this study was to gain insight and evaluate the impact of the changing living conditions on physical development of college students. The assessment of body weight, BMI, body composition – proportion of body fat and active body mass (muscles) is

part of health state valuation. Higher values of the above-mentioned parameters represent a significant risk factor related to a whole number of health disorders. It leads to an increased probability of cardiovascular diseases, diabetes, provides a precondition for a decreased mobility as well as life span thus deteriorating the quality of life.

The following study was carried out as part of the VEGA project No 1/1343/12 „ Selected risk factors of obesity and preventive measures for mobility „

METHODS

The study of the selected parameters of the physical development was performed in students of the 1st – 5th year of the Technical university of Kosice (TUKE). In September 2012 the entry (pre) and in May 2013 the exit (post) diagnostics of the followings parameters was carried out: body height, body mass index (BMI), body composition – amount of body fat and active body mass (muscles).

The professional OMRON Body Composition Monitor BF511 was used for the diagnostics of the physical development; body weight was measured using a stadiometer to the nearest 0,5cm. Entry (pre) measurements were taken in 1042 students (n1=1042, 512 females and 530 males), exit (post) measurements in 670 students (n2=670, 302 females, 368 males) where the average age was 21,1±1,4 years. The paper also presents the entry data collected at the Pavol Jozef Safarik University in Kosice in September 2012 (n=951, 672 females and 279 males, average age =21,5±3,5 years).

The results of the survey obtained were statistically weighted and subjected to classified and logical analysis. The arithmetic mean (\bar{x}) from the statistical characteristics of the position and the standard deviation from the characteristics of the variability rate were used to compare the values with the results of similar surveys. The normality of data distribution was assessed using the Pearson's chi-square test for goodness-of-fit. To determine the homogeneity of variances necessary for statistical evaluation, an F-test for independent groups was used. The statistical significance of differences was tested at the level of significance 0,05. Statistical calculations were performed using Matlab and Microsoft Excel.

RESULTS AND DISCUSSION

All the data measured in individual groups were assessed using the Pearson's chi-square test, the results of which disproved the hypothesis of normality for distribution of frequency. The paired t-test could not be used for the statistical analysis due to the different sample of probands in the entry (pre) and exit (post) measurements. The assessment of changes of individual parameters in the TUKE students using t-tests for independent groups showed significant differences in measurements taken in September 2012 and May 2013 only in the BMI parameter in the female group ($T=0,005$). The mean BMI value of females decreased by 1,2 kg/m². Comparison of the average values of other parameters showed that males' weight in the exit (post) measurement was higher by 1,2 kg which appears as the most significant change along with the decrease in the proportion of body fat in females from 30,6%±7,1 to 27,4%±7,1 and the increase in active body mass (muscles) from 28,4%±3,0 to 30,2%±3,0. Based on the data of the study from the years 1992 – 2007, the changes in the average BMI values [4] were expected to show an increase. This 15-year study revealed the trend of increasing BMI over the years, especially in males. (Fig.1). No significant changes were observed between the entry (pre) and exit (post) measurements at the TUKE due to a short (only 8 months) time interval between them.

Table 1. Average values of body height, weight, BMI, proportion of fat and active body mass (muscles) found in the TUKE students with respect to the time interval and t-tests results

Parameter Date	Height (cm)			Weight (kg)			BMI (kg/m ²)			Proportion of fat (%)			Active body mass (%) muscles		
	F	M	total	F	M	total	F	M	total	F	M	total	F	M	total
nF=302 nM=368															
x(9/2012) nF=512 nM=530 nTotal=1042	166,6 ±6,0	179,0 ±6,8	172,9 ±8,9	60,6 ±10,8	76,7 ±6,8	68,9 ±15,0	21,9 ±3,8	23,9 ±3,9	22,9 ±4,0	30,6 ±7,1	19,5 ±8,0	27,3 ±9,1	28,4 ±3,0	40,0 ±13,3	34,5 ±7,0
x(May 2013) nF=302 nM=368 nTotal=670	167,9 ±6,2	179,6 ±6,3	173,9 ±8,0	59,2 ±10,8	77,9 ±12,0	73,4 ±14,1	20,7 ±3,8	24,2 ±3,7	23,4 ±3,8	27,4 ±7,1	19,1 ±7,1	21,0 ±7,8	30,2 ±3,0	40,5 ±4,3	38,0 ±6,0
T values of t-test p=(0,05)	0,09	0,2	1,2	0,08	0,2	2,2	0,005	0,4	0,1	8,9	0,5	1,5	2,32	0,3	3,8

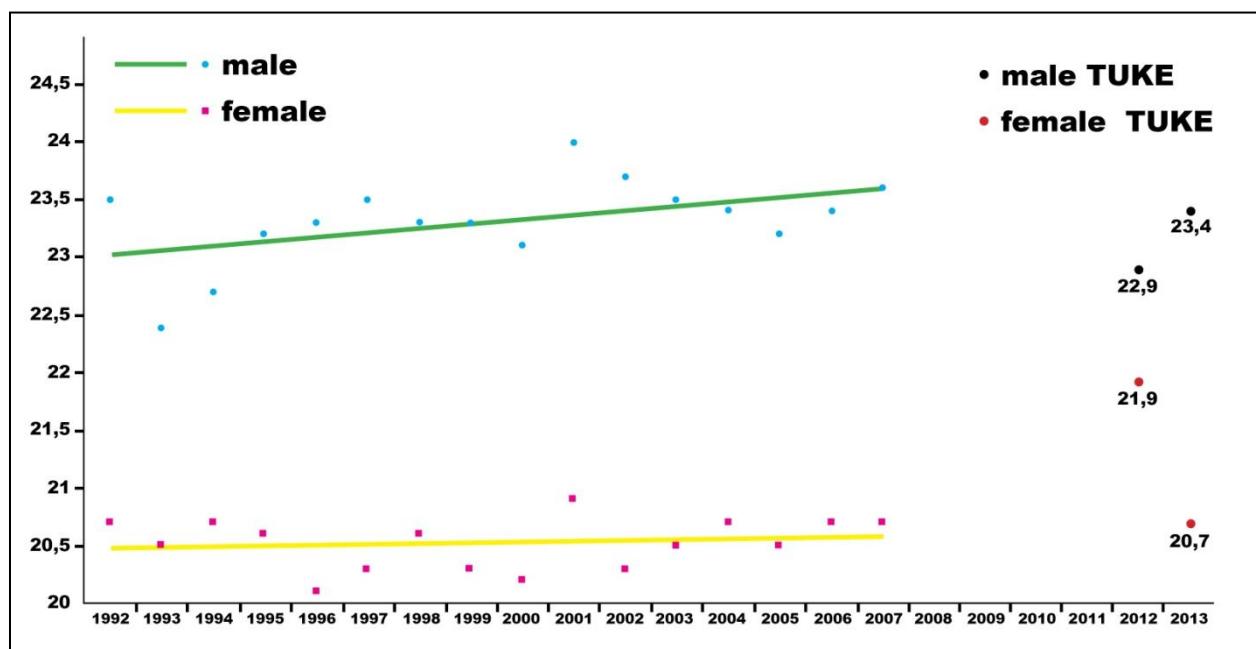


Fig. 1. Changes in BMI over the years 1992 – 2007 [4]. Completed with the values found in the students of the Technical university of Kosice (kg/m²).

The results of t-tests showed a significant difference between the TUKE students and UPJS students in the BMI parameter, namely in the mixed group (males and females together, $T=0,0002$) and in the proportion of body fat in the female group ($T=0,02$). The mean BMI value was $22,9\pm3,0$ kg/m² for the TUKE students (females $21,9\pm3,8$ kg/m² and males $23,9\pm3,9$ kg/m²) and $22,3\pm3,7$ kg/m² for the UPJS students (females $21,7\pm3,7$ kg/m² and males $23,6\pm3,8$ kg/m²). These findings correspond with the results of Jurkovičová [4] from the year 2007 who found that the mean BMI was $21,6\pm2,5$ kg/m² (females $20,5\pm2,3$ kg/m² and males $23,4\pm2,7$ kg/m²). Moravec [8] reported the mean BMI values for females in general population at the level of $20,2$ kg/m². In 2008 the mean BMI values were investigated in the female students of the Faculty of Economics of the Matej Bel University which were then found at the level of $21,1$ kg/m² [3]. A survey of 220 students at a university in Lebanon showed that the mean BMI values were at the level of as much as $23,6$ kg/m²

[10]. When testing all other parameters the resultant value of the t-test exceeded the value 0,05.

Table 2. Comparison of the mean values of body height, weight BMI, proportion of fat and active body mass (muscles) in the TUKE a UPJŠ students

Parameter Date	Height (cm)			Weight (kg)			BMI (kg/m ²)			Proportion of fat (%)			Active body mass (%) muscles		
	F	M	total	F	M	total	F	M	total	F	M	total	F	M	total
x(TUKE) nF=512 nM=530	166,6 ±6,0	179,0 ±6,8	172,9±8,9	60,6 ±10,8	76,7 ±6,8	68,9 ±15,0	21,9 ±3,8	23,9 ±3,9	22,9 ±4,0	30,6 ±7,1	19,5 ±8,0	27,3 ±9,1	28,4 ±3,0	40,0 ±13,3	34,5 ±7,0
x(UPJŠ) nF=302 nM=368	166,0 ±6,0	179,2 ±6,4	169,8 ±8,7	60,0 ±10,8	75,5 ±12,8	64,7 ±13,4	21,7 ±3,7	23,6 ±3,8	22,3 ±3,7	29,5 ±7,2	19,8 ±7,8	26,7 ±8,9	29,6 ±3,0	39,7 ±4,9	32,5 ±13,4
T values of t-test p=(0,05)	0,07	0,6	1,2	0,3	0,2	1,0	0,4	0,2	0,0002	0,02	0,7	2,3	6,2	0,4	1,9

Determination and comparison of the mean BMI values does not provide a sufficient overview of the number of students who exceed the ideal weight. Therefore, the percentage of BMI values in individual groups was analyzed according to the assessment scale.

Table 3. Comparison of BMI values between the TUKE and the UPJS in the assessment scale applicable for European population

	Malnutrition	Ideal and healthy weight	Moderate overweight	Obesity	Moderate overweight a and obesity
(scale)	<18,5	18,6 - 25,0	25,1 - 30,0	30,1 - 40,0	>25,1
F TUKE (n=512)	10,5%	72%	13,7%	3,8%	17,5%
F UPJŠ (n=302)	12,3%	73%	11,2%	3,5%	14,7%
M TUKE (n=530)	3,8%	65%	25,5%	5,7%	31,2%
M UPJŠ (n=368)	4,3%	64,2%	25,4%	6,1%	31,5%
TUKE total	7%	68%	20%	5,0%	25,0%
UPJŠ total	10%	70,5%	15,3%	4,2%	19,5%

68% of the TUKE students and 70,5% of the UPJS students were within the range of their ideal weight. In the year 2007 during the survey of 4590 students as many as 85% of them were in the range of their ideal weight , 77,9% of males and 92,2% of females [4]. Thus, it can be supposed that the number of college students who exceed their ideal weight is increasing. This assumption is proved by the fact that as many as 17,5% of females and 31,2% of males at the TUKE had BMI values exceeding 25,1 kg/m². BMI values over kg/m² were also found in 31,9% of medical students in Crete [2], likewise also in 31,2% of students at The Lebanese American University [10], [9]. The study between the years 2007 – 2011 at the University of Nebraska that surveyed more than 2530 students found the exceeding ideal weight in more than 30,5% of probands [6]. These results do not correspond with the values found in the TUKE students (25%), and there was an even more significant difference found in the students of the UPJS (only 19,5%).

CONCLUSIONS AND RECOMMENDATIONS

The results of t-tests showed a significant difference between the TUKE and UPJS students in the BMI parameter, namely in the mixed group (males and females together) and in the proportion of body fat in the female group. The mean BMI value of the TUKE students

was $22,9 \pm 3,0 \text{ kg/m}^2$ (females $21,9 \pm 3,8 \text{ kg/m}^2$ and males $23,9 \pm 3,9 \text{ kg/m}^2$) and of the UPJS students $22,3 \text{ kg/m}^2$ (females $21,7 \text{ kg/m}^2$ and males $23,6 \text{ kg/m}^2$). The t-test confirmed the significant difference in values of the TUKE students between the entry (pre) and exit (post) measurements only in the BMI parameter in the female group, where the mean value decreased by $1,2 \text{ kg/m}^2$. This finding is in contradiction with the findings of Jurkovičová [4] as well as with the results of similar studies which reported increasing BMI values over the years [6]. Almost 25% of the TUKE students, however, exceeded their ideal body weight, which in comparison with the Jurkovičová's findings [4] represents an increase by 3%. The increasing values of these parameters only confirm the findings of the World Health Organization about the ever increasing number of people with overweight and obesity. Therefore, this issue requires further research and more detailed analysis.

REFERENCES

1. ABDULLAH, Y. 2007. Overweight and Obesity among university students, Riyadh, Saudi Arabia, College of medicine, King Saud University. *Middle east journal of family medicine*. 2007 [online]. 2013 [cit.13.6.2013]. Dostupné na internete: <http://www.mejfm.com/journal/March2007/Overweight.htm>. ISSN148-4196
2. BERTSIAS, G., KAFATOS, A. MAMMAS, I., LINARDAKIS, M. 2003. Overweight and obesity in relation to cardiovascular disease risk factors among medical students in Crete, Greece. M. *BMC Public Health*. 2003 [online]. 2013 [cit.13.6.2013]. Dostupné na internete: <http://www.biomedcentral.com/1471-2458/3/3>. ISBN (DOI) 10.1186/1471-2458-3-3
3. IZÁKOVÁ, A. HRUŠOVSKÁ, K. 2009. Šport a zdravie v hodnotovej orientácii vysokoškolákov, In: *Zborník z vedeckej konferencie k 90. Výročiu založenia UK a 90. Výročiu vzniku Univerziténeho športu na Slovensku*, 2009. Bratislava: FMFI UK. ISBN 978-80-223-2706-0. s. 45 – 49.
4. JURKOVIČOVÁ, J., ŠTEFÁNIKOVÁ, Z., SOBOTOVÁ, Ľ., ŠEVČÍKOVÁ, Ľ. 2010. Prevalencia a trendy vývoja rizikových faktorov kardiovaskulárnych chorôb u vysokoškolákov, In: *Životné podmienky a zdravie*. Bratislava: Úrad verejného zdravotníctva SR, 2010. ISBN: 978-80-7159-176-4. s. 142 – 151.
5. LYNN, A. 2012. Body mass index trends and nutrition goals of college Students between 2007-2011. A thesis. Lincoln, Nebraska. Dostupné na internete: <http://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=1038&context=nutritiondis> s.
6. KOMPÁN, J. 2003. *Vplyv cvičení v posilňovni na telesnú zdatnosť vysokoškolákov*. Banská Bystrica: Univerzita Mateja Bela, 2003 [online]. 2013 [cit.13.6.2013]. Dostupné na internete: www.fhv.umb.sk/app/accountPropertiesAttachment.php?...2342.
7. MORAVEC, R., KAMPMILLER, T., SEDLÁČEK, J. a kol. 1996. *Eurofit: Telesný rozvoj a pohybová výkonnosť školskej populácie na Slovensku*. Bratislava: SVSTVŠ, 1996, s. 23. ISBN 80-967487-1-8.
8. SPARLING, P. 2007. Obesity on campus. 2007. *Prev Chronic Dis.*, 2007 [online]. 2013 [cit.13.6.2013]. Dostupné na internete: <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1955391/>. PMID PMC1955391
9. YAHIA, N., ACHKAR, A., ABDALLAH, A., RIZK, S. 2008. Eating habits and obesity among Lebanese university students. *Nutrition Journal*, 2008 [online]. 2013 [cit.13.6.2013]. Dostupné na internete: <http://www.nutritionj.com/content/7/1/32>. ISBN (DOI) 10.1186/1475-2891-7-32.