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Effects of lifestyle on physical health in Slovak university students

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ABSTRACT: Overweight and obesity in childhood and young people represent a large global health problem. Therefore, the main aim of the study was to assess the prevalence of overweight/obesity by body mass index (BMI) and its associated lifestyle factors among university students in Slovakia. The BMI index was examined in relation to nine life factors for both sexes, respectively, in a sample of 200 (108 men and 92 women) young university students from Slovakia. The data were obtained using anthropometric measurements and by means of a questionnaire. The results for BMI values confirmed that both sexes were classified into the "about right" weight category. Analysis of the BMI values and questionnaire data showed different results for both sexes. While the type of daily activity and type of physical activity were associated with greater obesity for men, in women, tobacco intake was an important.

KEY WORDS: BMI, anthropometry, standardized questionnaire, Slovakia

Introduction

In recent decades, overweight and obesity in childhood and young people have become large global health problems. They represent a multifactorial chronic disease in which fat mass increases as a result of a positive energy balance (WHO 2004; Cunningham et al. 2014; Gortmaker and Taveras 2014).

University students belong to a risk group, as they are highly exposed to unhealthy eating habits which lead to bodyweight gain (Huang et al. 2003). One of the major causes of obesity has been the change in diet in terms of both quantity and quality, such as the rapid spreading of unhealthy food consumption in the past decades (Banwell et al. 2009; Al-Rethaiaa et al. 2010; Alfawaz 2012). Other factors include higher stress (Wahed and Hassan 2017), lack of sleep (Vargas et al. 2014) and mainly a lack of physical activity (Desai et al. 2008; Banwell et

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al. 2009; Deng et al. 2011; Khalaf et al. 2013; Pengpid and Peltzer 2015; Peltzer et al. 2014; Zaccagni et al. 2014; Pengpid et al. 2015; Sofková and Přídalová 2015; Yahia et al. 2016; Buková et al. 2019).

In general, according to the above-listed studies, the following five factors may affect the overall health of university students and/or young adults: (i) Sociodemographic factors (mainly male gender, older age and higher socioeconomic status); (ii) Social factors (lack of social support, capital and lack of religiousness); (iii) Dietary behaviour (intake of fibre, consumption of red meat, skipping breakfast more often, a high number of meals, snacking behaviour); (iv) Health risk behaviour (physical inactivity, frequent alcohol and tobacco intake); and (v) Mental health and childhood abuse (poor mental health, e.g. depression, anxiety, childhood physical abuse, sexual and verbal abuse).

The authors assume that physical activity is a major contributor to controlling body weight. Studies have confirmed the trend of reduced energy expenditure through physical activity caused by a sedentary lifestyle and the decreased emphasis on physical activities in schools. Physical activity in early childhood correlates positively with attainment of overall body size, increased physical fitness, improved psychosocial health and reduced adiposity (Carson et al. 2017). However, many adolescents are above the recommended BMI values (Galaviz et al. 2016; Carson et al. 2017); therefore, increasing physical activity should be a public health priority. Sofková and Přídalová (2015) showed the importance of physical activity in the overall health status of young adolescents. They presented different results for women who were active or inactive in terms of physical activity. Obese and overweight women with a higher level of physical activity had lower levels of body fat (body fat mass, body fat percentage) and less visceral fat in both age groups. These findings were in contrast with results for women with at the inactive level of physical activity, who similarly recorded an increase in fat-free body mass. The authors believe that the relative risk of damage to health as measured by somatic indices (e.g. body mass index, body fat mass index) is high in women irrespective of the level of physical activity attained. Therefore, these relationships might be useful in strategies aimed at maintaining and developing a healthy lifestyle.

On the other hand, Frankenfield et al. (2001) noted obesity in terms of adiposity rather than the relation of body weight to height. In turn, body composition became a more desirable determinant of obesity than BMI. For example, the Stodden model offers a better explanation, because it explains in a visual way the relation between physical and structural status (Stodden et al. 2008, 2014). According to this model, perceived competence and fitness are situated as mediators within this model. The main idea is that one can either develop a positive cyclical trajectory that results in a healthy weight status or a negative trajectory resulting in an unhealthy weight status.

However, food intake and correct energy balance in the diet (Zimmerman and Snow 2012; Kohl and Cook 2013) should also be taken into account based on the energy requirements for individual activities (Institute of Medicine 2003). Smoking and alcohol intake are among the other important factors in regard to body weight. The use of tobacco products has been confirmed in more than 4.7 million high school and university

students, most of whom started smoking during their early teens (Walker and Loprinzi 2014; Singh 2016). The use of tobacco by adolescents has decreased significantly over the past 40 years, and nearly one in 20 young people of high school age smoke every day (Johnston et al. 2018). Smoking accelerates metabolism and reduces food intake, while excess alcohol intake causes energy from the diet to be transformed and stored in the form of adipose tissue (Institute of Medicine 2004). Several authors have confirmed this association between gaining or losing body weight and smoking (Twardella et al. 2006; Sneve and Jorde 2008; Plurphanswat and Rodu 2014; Patel et al. 2017; Tan et al. 2018). Twardella et al. (2006) showed that for men overweight/obesity is associated with increased smoking cessation, possibly related to increased health concerns. In women, low weight was associated with decreased smoking cessation, possibly related to an increased fear of weight gain. Plurphanswat and Rodu (2014) noted that compared to non-smokers, male and female current smokers had a lower BMI and a lower probability of obesity. In contrast, only female former smokers had an elevated BMI and an increased probability of obesity. They also confirmed the different effects on BMI in men and women in relation to age, education and marital status.

The aim of our study was to assess the prevalence of overweight/obesity by body mass index (BMI) and its associated lifestyle among university students in Slovakia (Central Europe).

Material and Methods

A total of 200 students (108 men and 92 women with the mean age 22.45 years for men and 22.46 years for women) from Slovakia attending the University of Presov participated in the study. The procedure of research sample selection was based on random selection and solely on the voluntary decision of students to participate in the study. All students were divided according to sex. Then body mass index (BMI kg/m^2) was evaluated as the ratio of body height (cm) and body weight (kg). We also worked with nine questions, mostly associated with lifestyle. Data on lifestyle were collected from participants using a questionnaire, which was part of a study designed for the purposes of the research. Students were asked to complete a questionnaire containing questions related to their demographics (site, age, sex), dietary behaviours and knowledge of nutrition (healthy or unhealthy foods), physical activity (daily activity, type of activity and amount of physical activity), alcohol and tobacco intake, amount of sleep and stress, and they were divided into parts (Table 1). The questionnaire was adopted and modified as recommended and used by several authors (e.g. Al-Rethaiaa et al. 2010; Yahia et al. 2016). All responses were categorized and coded in ranked scales as shown in Table 1.

Body weight and body height were measured according to the recommendations of the International Standards for Anthropometric Assessment (Kopecký et al. 2013). We then evaluated the BMI index as a one of the predictors for estimating the risk of overweight-related diseases, and the relationship to age and sex (Sobal and Marquart 1994; Gahagan et al. 2011) was also calculated according to Pastucha et al. (2014). The data were evaluated in regard to dependent variables (body height and body weight) and independent variables (lifestyle factors).

Table 1. Life factors obtained from standardized questionnaire coded in quantitative or ranked scales

Questions Asked	Answer levels	Total N (%)
Q1 – Where do you live, in the city or in the countryside?	A – city	37 (18.50)
	B – village	71 (35.50)
Q2 – What kind of eating is typical for you?	A – healthy diet	7 (3.50)
	B – unhealthy diet	39 (19.50)
	C – more or less combination	62 (31.00)
Q3 – What kind of daily life prevails in you?	A – physical activity	32 (16.00)
	B – sedentary activity	10 (5.00)
	C – more or less combination	66 (33.00)
Q4 – How much time do you spend on physical activity per day?	A – less than 45 minutes	17 (8.50)
	B – between 45-60 minutes	30 (15.00)
	C – more than 60 minutes	61 (30.50)
Q5 – What type of physical activity is prevalent in you?	A – aerobic activity	23 (11.50)
	B – anaerobic activity	18 (9.00)
	C – more or less combination	67 (33.50)
Q6 – Are you an alcohol user?	A – alcohol user	42 (21.00)
	B – abstinent	16 (8.00)
	C – occasionally user	50 (25.00)
Q7 – Are you a cigarette user?	A – smoker	33 (16.50)
	B – non-smoker	64 (32.00)
	C – occasionally smoker	11 (5.50)
Q8 – Are you often exposed to stressful situations?	A – rather yes	53 (26.50)
	B – rather no	55 (27.50)
Q9 – How many hours per day do you sleep?	A – less than 7-8 hours	53 (26.50)
	B – between 7-8 hours	47 (23.50)
	C – more than 7-8 hours	8 (4.00)

Normal distribution was tested using the D'Agostino-Pearson omnibus K^2 test and the Shapiro-Wilk normality test. Morphometric variation was initially examined by means of univariate non-parametric tests (Mann-Whitney U test and Kruskal-Wallis H test) to test the differences between factor categories for both sexes, respectively. The effects of all factors on BMI were also evaluated using multivariate analysis of variance by use of principal component analysis (PCA). All descriptive analyses and tests were evaluated using the statistical software OriginPro8.6 (Microral Software Inc., Northampton, USA).

Results

The results of the univariate non-parametric tests for BMI values divided by lifestyle are shown in the Table 2a for men and 2b for women, for both sexes, respectively. Our findings showed different effects in men and women. For men, the BMI values were influenced mainly by the type of daily activity together with the type of physical activity. In contrast, for women tobacco intake played a significant role in overall BMI values and obesity. These differences were also confirmed by the different impacts of lifestyle.

Table 2a. BMI values of the young Caucasian university students from Slovakia based on nine life factors (Q1–Q9) for young men. Statistics given are: Sample size (N), percentage of (%); Mean±standard deviation (M±SD), Confidence interval (CI). Differences are shown with the significant levels

Sex	Lifestyle questions		N	%	M±SD	95% CI	Mann-Whitney U test / Kruskal-Wallis H test	p
men	Q1	city	37	18.50	23.72±3.87	22.43/26.10	U = 975.00	0.03
		village	71	35.50	25.24±3.63	24.34/26.10		
	Q2	healthy diet	7	3.50	23.33±4.14	19.50/27.15	H = 1.77	0.41
		unhealthy diet	39	19.50	25.20±4.20	23.84/26.57		
		Combination	62	31.00	24.57±3.45	23.70/25.45		
	Q3	physical activity	32	16.00	23.56 ± 3.25	22.39/24.73	H = 5.99 between daily activity and combination	0.05
		Sedentary	10	5.00	25.14±4.98	21.57/28.71		
		Combination	66	33.00	25.22±3.74	24.30/26.14		
	Q4	less than 45 minutes	17	8.50	25.94±4.39	23.69/28.19	H = 2.91	0.23
		between 45–60 minutes	30	15.00	25.22±4.34	23.60/26.84		
		more than 60 minutes	61	30.50	21.14±3.20	23.32/24.95		
	F5	Aerobic	23	11.50	23.59±2.59	22.47/24.72	H = 6.59 between aerobic and anaerobic physical activity	0.04
		Anaerobic	18	9.00	26.41±4.03	24.40/28.41		
		Combination	67	33.50	24.65±3.92	23.70/25.61		
	Q6	alcohol user	42	21.00	25.04±4.08	23.77/26.31	H = 0.47	0.79
		Abstinent	16	8.00	25.24±4.22	22.99/27.49		
		occasionally user	50	25.00	24.29±3.37	23.33/25.24		
	Q7	Smoker	33	16.50	25.40±4.12	23.94/26.86	H = 1.86	0.40
		non-smoker	64	32.00	24.31±3.62	23.40/25.21		
		occasionally user	11	5.50	25.09±3.51	22.73/27.44		
	Q8	rather yes	53	26.50	24.75±3.64	23.75/25.75	U = 1399.00	0.72
		rather no	55	27.50	24.69±3.92	23.63/25.75		
	Q9	less than 7–8 hours	53	26.50	24.90±3.61	23.91/25.90	H = 0.62	0.73
		between 7–8 hours	47	23.50	24.67±4.07	23.47/25.87		
		more than 7–8 hours	8	4.00	23.81±3.20	21.13/26.49		

Notes: life factors: Q1 – site; Q2 – food; Q3 – daily activity; Q4 – amount physical activity; Q5 – type physical activity; Q6 – alcohol intake; Q7 – tobacco intake; Q8 – stress; Q9 – sleeping.

Table 2b. BMI values of the young Caucasian university students from Slovakia based on nine life factors (Q1–Q9) for young women. Statistics given are: Sample size (N), percentage of (%); Mean±standard deviation (M±SD), Confidence interval (CI). Differences are shown with the significant levels

Sex	Factor	Factor type	N	%	M±SD	95% CI	Mann-Whitney U test / Kruskal-Wallis H test	p
women	Q1	city	40	20.00	22.79±4.92	21.22 / 24.37	U = 1000.00	0.76
		village	52	26.00	22.09 ±3.93	20.99 / 23.18		
	Q2	healthy diet	21	10.50	22.90±3.42	21.34 / 24.46	H = 4.70	0.10
		unhealthy diet	26	13.00	21.67±5.41	19.48 / 23.85		
		combination	45	22.50	22.58 ±4.15	21.33 / 23.83		
	Q3	physical activity	12	6.00	20.79±2.52	19.19 / 22.39	H = 1.71	0.43
		sedentary	14	7.00	24.71±6.75	20.81 / 28.60		
		combination	66	33.00	22.20±3.87	21.25 /23.15		
	Q4	less than 45 minutes	31	15.50	22.07±4.56	20.39 / 23.74	H = 0.43	0.81
		between 45–60 minutes	23	11.50	22.43±4.32	20.56 /24.30		
		more than 60 minutes	28	14.00	22.64±4.36	21.21 / 24.07		
	Q5	aerobic	27	13.50	21.82±4.15	20.18 / 23.46	H = 3.29	0.19
		anaerobic	12	6.00	20.85±3.12	18.87 / 22.84		
		combination	53	26.50	23.04±4.64	21.75 / 24.32		
	Q6	alcohol user	14	7.00	21.54±3.48	19.53 / 23.55	H = 2.57	0.28
		abstinent	19	9.50	21.38±3.78	19.56 / 23.20		
		occasionally user	59	29.50	22.92±4.70	21.70 / 24.15		
	Q7	smoker	19	9.50	25.93±6.16	22.96 / 28.90	H = 11.70 between smoker and non-smoker	0.002
		non-smoker	65	32.50	21.21±2.90	20.48 / 21.94		
		occasionally user	8	4.00	23.66 ±4.88	19.58 / 27.74		
	Q8	rather yes	59	29.50	22.76±4.83	21.50 / 24.02	U = 904	0.57
		rather no	33	16.50	21.74±3.40	20.54 / 22.95		
	Q9	less than 7–8 hours	37	18.50	22.02±3.55	20.83 / 23.20	H = 0.52	0.77
		between 7–8 hours	45	22.50	22.61±4.416	21.28 / 23.94		
		more than 7–8 hours	10	5.00	22.83±6.865	17.92 / 27.74		

Notes: life factors: Q1 – site; Q2 – food; Q3 – daily activity; Q4 – amount physical activity; Q5 – type physical activity; Q6 – alcohol intake; Q7 – tobacco intake; Q8 – stress; Q9 – sleeping.

The BMI values for men correlated slightly with daily activity and site (Table 3), but only the correlations between BMI and site (F1) were statistically significant ($p < 0.05$). The relationships between lifestyle were also confirmed, particularly in relation to food intake and alcohol intake. The relationships between the type of physical activity and potential stress and amount of sleep were confirmed as well. For women, a negative relationship between BMI and smoking was confirmed (Table 3). In contrast, we confirmed stronger relationships between the type of food and daily activity as well as between the amount and type of physical activity. Moreover, the overall contribution of life factors to the variation in BMI values was also confirmed by PCA analysis.

The results of PCA for young men from Slovakia showed that the first five principal components (PC1-PC5) explained 64.5% (16.7%. 13.6%. 12.3%. 11.3 % and 10.6%) of the variation based on nine lifestyle questions which were important for overall obesity (Table 4, Figure 1a). The first axis (PC1) correlated positively with the amount physical activity (correlation coefficient r = 0.48), stress (0.40) and alcohol (0.34) and correlated negatively with daily activity (–0.38) and BMI (–0.33). The second axis (PC2), which still explains a high proportion of the variation, correlated positively with sleeping (0.58), daily activity (0.39) and type of physical activity (0.36) and correlated negatively with the amount of physical activity (–0.37) and the site (–0.36).

Different results of PCA were shown for young women in that the first five principal components (PC1-PC5) explained 63.7% (16.2%, 13.7%, 13.0%, 11.0 % and 9.8%) of the variation (Table 4, Figure 1b). PC1 correlated positively with the amount of physical activity (r = 0.45), type of physical activity (0.45) and BMI (0.39) and correlated negatively with the site (–0.39). PC2 correlated positively with sleeping (0.60) and stress (0.47), and in contrast, it correlated negatively with tobacco intake (–0.20) and with amount of physical activity (–0.18).

Table 3. Spearman's correlations (r_s) for body mass index (BMI) and nine lifestyle questions (Q1–Q9) of Caucasian university students from Slovakia. Correlation values for young men are showed below the diagonal and young women above the diagonal with significant values ($p < 0.05$) emboldened.

		women									
		BMI	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9
men	BMI		−0.03	0.01	0.02	0.06	0.16	0.15	**−0.23**	−0.06	−0.02
	Q1	0.21		0.00	−0.07	**−0.22**	−0.06	0.08	0.13	0.06	0.06
	Q2	0.01	−0.05		**0.23**	0.07	0.17	0.01	−0.13	0.08	0.03
	Q3	0.23	−0.04	0.01		−0.01	0.09	−0.05	0.01	0.10	0.02
	Q4	−0.16	0.11	0.18	**−0.25**		**0.25**	0.06	−0.09	−0.04	−0.05
	Q5	0.03	−0.05	0.11	0.07	0.15		−0.08	−0.07	−0.02	−0.05
	Q6	−0.05	0.04	**0.24**	−0.14	0.00	0.07		0.00	0.07	0.17
	Q7	−0.07	0.04	0.00	−0.04	−0.09	0.01	0.04		0.05	−0.09
	Q8	−0.03	−0.16	0.08	−0.13	0.16	**0.19**	0.05	0.07		0.20
	Q9	−0.07	−0.10	0.02	0.04	−0.15	**0.19**	0.12	0.11	0.10	

Notes: life factors: Q1 – site; Q2 – food, Q3 – daily activity; Q4 – amount physical activity; Q5 – type physical activity; Q6 – alcohol intake; Q7 – tobacco intake; Q8 – stress; Q9 – sleeping.

Table 4. Loading values of principal component analysis (PCA) of the young Caucasian university students from Slovakia based on BMI (body mass index) and nine lifestylequestions (Q1–Q9); their eigenvalues, percentage (variability %) and cumulative percentage (cumulative %) expressions

	Men					Women				
	PC1	PC2	PC3	PC4	PC5	PC1	PC2	PC3	PC4	PC5
BMI	−0.33	0.10	0.58	0.00	0.28	0.39	0.15	−0.40	−0.31	0.21
Q1	−0.16	−0.34	0.30	0.48	0.46	−0.39	0.13	−0.01	−0.02	0.77
Q2	0.30	−0.03	0.45	0.18	−0.48	0.31	0.32	0.44	−0.02	0.25
Q3	−0.38	0.39	0.28	−0.11	−0.28	0.08	0.31	0.50	−0.23	−0.21
Q4	0.48	−0.37	0.13	−0.20	0.16	0.45	−0.18	−0.07	0.55	−0.12
Q5	0.31	0.36	0.39	−0.16	0.26	0.45	−0.10	0.24	0.28	0.45
Q6	0.34	0.05	0.12	0.57	−0.30	−0.01	0.30	−0.47	0.37	0.07
Q7	0.03	0.26	−0.29	0.47	0.32	−0.42	−0.20	0.21	0.42	0.02
Q8	0.40	0.23	0.04	−0.27	0.31	−0.14	0.47	0.18	0.39	−0.12
Q9	0.14	0.58	−0.15	0.18	0.08	−0.04	0.60	−0.21	0.07	−0.13
Eigenvalue	1.67	1.36	1.23	1.13	1.06	1.62	1.37	1.31	1.10	0.98
Percentage (%)	16.70	13.60	12.30	11.30	10.60	16.20	13.70	13.00	11.00	9.80
Cumulative (%)	16.70	30.30	42.60	53.90	64.50	16.20	29.90	42.90	53.90	63.70

Notes: life factors: Q1 – site; Q2 – food; Q3 – daily activity; Q4 – amount physical activity; Q5 – type physical activity; Q6 – alcohol intake; Q7 – tobacco intake; Q8 – stress; Q9 – sleeping.

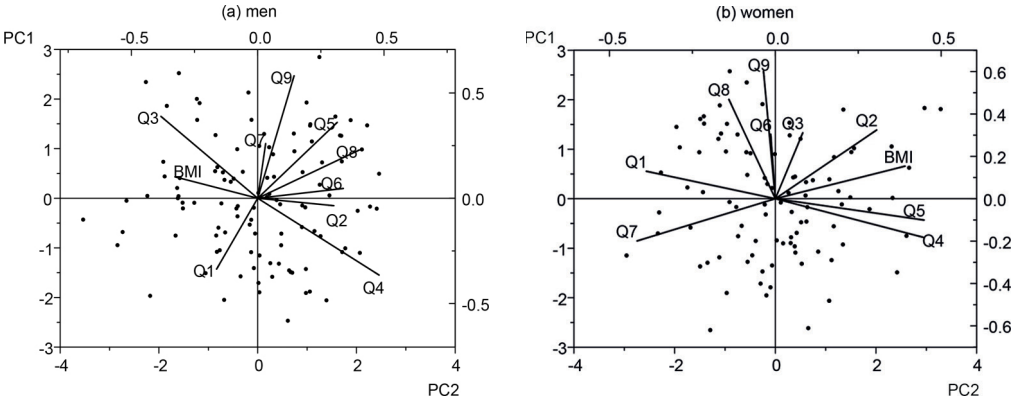

Fig. 1. Biplot of values calculated for body mass index (BMI) and nine life factors (F1–F9) of Caucasian university students from Slovakia for young men (a) and young women (b)
Notes: life factors: Q1 – site; Q2 – food; Q3 – activity; Q4 – amount physical activity; Q5 – type physical activity; Q6 – alcohol intake; Q7 – tobacco intake; Q8 – stress; Q9 – sleeping.

For both genders it was found that the first major component (PC1) was influenced mainly by physical activity, the second (PC2) could be interpreted as a contrast between physical activity and stressful lifestyle.

Discussion

Several authors have previously dealt with the BMI index (Wardle and Johnson 2002; Wardle et al. 2006; Flegal et al. 2012; Lim et al. 2018). Wardle et al.

(2006) in their study summarized previous findings obtained from 22 countries, comparing two anthropometric measurements (body mass and body height) as well BMI. By comparing the data we obtained in this study with data from study by Wardle et al. (2006), higher body mass values and BMI were confirmed for young people from Slovakia. Our BMI values for Caucasian students also divided by lifestyle fit into the "about right" weight category and were in accordance with findings shown by (Wardle and Johnson 2002; Wardle et al. 2006).

Upon evaluating the BMI values and questionnaire from the study participants, the results obtained indicated different patterns in both sexes. Our findings revealed that physical inactivity and tobacco intake were associated with overweight/obesity. These results were in accordance with previous studies (Banwell et al. 2009; Deng et al. 2011; Khalaf et al. 2013; Pengpid and Peltzer 2015; Peltzer et al. 2014; Zaccagni et al. 2014; Pengpid et al. 2015; Sofková and Přídalová 2015; Yahia et al. 2016). For men, we found that the type of daily activity and type of physical activity were associated with higher obesity, while in women, tobacco intake was very important. Peltzer et al. (2014) showed that male students had a higher mean frequency of physical activity than females, and physical inactivity was related to overweight/obesity among males but not among females. In contrast, Arroyo et al. (2000) found no link between physical inactivity and overweight/obesity for both sexes. Nevertheless, they showed that men were more likely to engage in physical exercise in their free time. Moreover, Goméz et al. (2009) confirmed a relationship between BMI and physical activity only for men. Despite these differences, Peltzer et al. (2014) believe that the link between obesity and a sedentary lifestyle has been established. Similarly, Zaccagni et al. (2014) showed the importance of physical activity and its significant role in body composition parameters for Italian university students. The most active males had the least amount of fat mass, and the most active females had the greatest amount of fat-free mass. Body mass index (BMI) and Waist-to-Stature Ratio (WSR) were not shown to be accurate indices of adiposity in young adults.

Our findings revealed the importance of stress and time sleeping in relation to overweight/obesity. Temporary sleep loss and stress, which were connected with the more stressful conditions in students, were also confirmed by several authors (Vargas et al. 2014; Wahed and Hassan 2017; Schwarz, 2018). Von Bothmer et al. (2005) revealed differences in health habits and in motivation for a healthy lifestyle among Swedish university students based on sex. They showed and discussed sex differences in relation to the impact of stress on female students' health, and the risk of male students having unhealthy nutritional habits in combination with being physically inactive and drinking too much alcohol. Denton et al. (2004) suggested that women's health was more influenced by structural and psychosocial determinants, such as stress, lower levels of self-esteem, mastery and a sense of coherence. In contrast, men's health was more affected by health behaviours, such as smoking, drinking and physical activity. These findings may partly explain our results, in which males were also overweight and obese.

Several studies have confirmed that smokers weigh less (also had lower BMI values) than non-smokers, and that former smokers are not heavier than non-smokers (Kvaavik et al. 2004; Jessen et al. 2005; Twardella et al. 2006; Sneve and Jorde 2008; Munafò et al. 2009; Flegal et al. 2009; Fang et al. 2009; Walker and Loprinzi 2014; Plurphanswat and Rodu 2014; Patel et al. 2017; Tan et al. 2018). Despite the significant reduction in cigarette smoking, the overall incidence of obesity was only slightly affected (Eisenberg and Quinn 2006). This can be explained by the fact that nicotine has mild metabolic effects and also suppresses the appetite (Kvaavik et al. 2004). Long-term studies have shown that continuing smokers had a lesser increase in BMI than those who stopped smoking (Munafò et al. 2009; Bushet et al. 2016; Plurphanswat and Rodu 2014; Patel et al. 2017; Tan et al. 2018).

Our findings showed that young smokers or occasional smokers had higher BMI values than non-smokers and were therefore in contrast with the above-mentioned studies. These different results in BMI values between smokers and non-smokers may be explained by the relatively lower weight gain among smokers over time. Nevertheless, Munafò et al. (2009) found that smokers had a lower BMI than non-smokers, but over time, former smokers eventually reverted back to BMI levels similar to non-smokers. For those who stopped smoking, there was a significant positive relationship between the number of cigarettes and the consequent increase in BMI. Although smoking correlates with lower BMI in adults, this trend was not observed in younger smokers, i.e. students between 16–24 years old (Mackay et al. 2013).

In conclusion, we confirmed that BMI values were variable between both sexes and may be affected by different lifestyle. For men, the type of daily activity and type of physical activity were shown to have an influence on obesity. In women, tobacco intake was an important. Our sample size was too small to make a final conclusion, but the findings still reflect differences in the obesity problems among young adults. Nevertheless, further studies are needed in the future to confirm these findings.

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Authors' contributions

Silvia Duranková – writing text, data collection and participation in graphical evaluation of results (69%); Alexander Csanády – statistical evaluation of data, inspection of manuscript as recomended by the Guidelines for authors (20%); Anna Ždiľová – data collection (1%); Jarmila Bernasovská – final reading and commented of the text after writing and after editing from the reviewer's instructions (5%); Alena Buková – final reading and commented of the text after writing and after editing from the reviewer's instructions (5%).

Conflict of interest

The authors declare that there is no conflict of interest.

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