ORIGINAL ARTICLE

Gender differences in Body Mass Index and physical activity of students of the University of Tuzla

Authors' Contribution:
A – Study Design
B – Data Collection
C – Statistical Analysis
D – Data Interpretation
E – Manuscript Preparation
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Abstract

Background: This study was carried out among undergraduate students at the University of Tuzla (Bosna and Herzegovina) with the objective of examining gender differences in the body mass index (BMI) and the level of Physical Activity (PA) among respondents.

Material/Methods: This study was conducted to: determine the body mass index (BMI) and the average weekly number of hours of sport activity in the last six months (PA). A research sample was made of female students (n = 330) in the chronological age of 19.3+1.5 yrs, 60.7%, and of male students (n = 213) in the chronological age of 20.0+1.8 yrs, 39.2%.

Results: On average, the students (both female and male) spend 5.60 (5.03) hours on physical activity per week. Female students spend 4.05 (4.32) hours, while male students dedicate 8.11 (5.30) hours to physical activities. It can be concluded that in principle the students practice physical activities and recreation, but still 1/5 of all students are inactive. The obtained results for the BMI show that the majority of students are in the zone of normal values: female – 278 (84.2%); male – 157 (73.7%). Correlations between BMI and PA amount to (R = .214; p < 0.01) and (R^2 = .046; p < 0.01). The results of the T-test show a more significant statistical variable of differences between female and male students at the level of p < 0.05. In comparison to female students, male students have 2.35 kg/m^2 higher BMI, and they are more active in physical activities for 4.06 hours in comparison to women.

Conclusions: The focus should be directed to the education of young people, because they can easily adopt healthy habits that should be maintained for life. These results point out the necessity of an integrated approach to prevention and control of risk factors, particularly among youth.

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Introduction

Overweight and obesity, and insufficient physical activity are related to a number of chronic, non-contagious diseases, but also to shorter life expectancy [1]. The World Health Organization (WHO) estimates that 2.8 million people die each year due to overweight and obesity, while 3.2 million deaths annually are attributed to physical inactivity [2]. Therefore, maintaining ideal weight and improving and increasing different physical activities present important goals of public health policy of the majority of developed countries in the world. The problem of overweight and obesity has gained sufficient attention on the global level only in the last ten years. Moreover, the growing obesity occurrence is one of the major health problems of this time, at least when speaking about the developed countries. Namely, the number of obese adults has tripled in the USA and doubled in the UK over the past twenty years [3].The International Obesity Task Force (IOTF) estimations show that there is about 1.1 billion overweight and about 300 million [4] obese people in the world. Obesity is even more alarming when it comes to children and adolescents. Namely, over the past two decades, the obesity prevalence for children and adolescents has grown at a rate of 0.5-1% per year [5]. According to the data from 2003, the prevalence of overweight adults in Croatia was (38%) for men and (34%) for women, while the obesity prevalence was the same for both genders in the range of about (20%) [6]. Rather similar prevalence is noted in other central European and Mediterranean countries [7]. Furthermore, the ratio of overweight or obese Croatian children and adolescents reached (26%) and (20%), which is similar to the situation in other Mediterranean countries, but higher than in central or northern Europe [8].

The Body Mass Index (BMI) is currently the most often used parameter for evaluation of the nutritive status. The body mass index (BMI), or the Quetelet index, is a heuristic proxy for estimating human body fat based on an individual's weight and height. Body mass index is defined as the individual's body mass divided by the square of his or her height (kg/m^2) [9]. Normal values for adults range between 18.5 and 25 (kg/m^2) [10]. Values under 18.5 (kg/m^2) indicate malnutrition, and values higher than 25 (kg/m^2) and up to 30 (kg/m^2) indicate overweight, while BMI higher than 30 (kg/m^2) indicates obesity [10]. Although it was intended for the total world population, it was seen that the Asian population has a larger fat mass for the given BMI [11], thus the initial WHO's scale went through a smaller modification and a smaller lower border was set for weight and obesity for Asian population; 23 (kg/m^2) for overweight and 25 (kg/m^2) for obesity [12]. The border values for malnutrition, overweight and obesity for children and adolescents differ from those for adults, and are gender and age specific [13, 14]. Although it is moderately related to the amount of body fat, the body mass index cannot evaluate the constitution of the body, i.e. the amount of fat in the body, but only the nutritive status [15]. On the other hand, the obesity is defined as an abnormal situation of the body in which there is an extensive accumulation of fat, resulting in a negative impact on health and shortening of life expectancy [16].

Physical activity [17] is defined as any body movement resulting in a significant increase in energy consumption, above the level of consumption in standstill. Physical activity is seen in many forms and contexts, and it is under a strong influence of cultural heritage. The total amount of physical activity is calculated from its frequency, duration and intensity. Leisure-time physical activity is understood as a wide range of activities an individual can do during his/her free time. Such activities can be organised (e.g. different fitness programmes) or free (e.g. walking, bicycle riding, dancing, etc.). Physical exercise is understood as planned, structured and recurring activity, whose aim is to improve functional abilities of the body or to maintain health [18]. For the majority of students of first and other years of study, the course "Physical Education and Sport" presents the only form of physical activity. The complexity of some study programmes causes a number of forms of psycho-emotional stress, and lack of leisure time, thus the lack of time for physical activities. It is very important to emphasise that young people should be encouraged to undertake physical activity, and thus they should be provided with space for recreation and organised sport activities in their schools. Namely, students spend a lot of time sitting at their computers and desks, working on different programmes, and the amount of time they spend on physical activities has significantly decreased. The WHO estimates that approximately 60% of the world population is currently insufficiently physically active [2]. The level of physical activity starts to significantly decrease during ado-

lescence, and the period of life in which the turn from adolescence into adulthood happens is very important for the research of changes indicating the nutrition status and the functional ability of the cardio-respiratory system [19].

This study was conducted to: 1) determine the Body Mass Index (BMI), and Physical Activity (PA) of a sample of college-aged students and so assess the prevalence of underweight, overweight and obesity; 2) evaluate physical activity of all study participants, and 3) determine the relationship between male and female students participating in the study.

Material and methods

Design and sample

Enrolment in the study was on a voluntary basis and it involved 543 students from the University of Tuzla. A research sample was made of female students (n=330) at the chronological age of 19.3+1.5 yrs, 60.7%, and of male students (n=213) at the chronological age of 20.0+1.8 yrs, 39.2%. The inclusion criteria were to be healthy subjects, free of any disorders or any chronic diseases. The research data were collected by means of a questionnaire. The questionnaire form was composed of two sections: general and anthropometric information and physical activity. After approval by the University of Tuzla Research Ethics Committee (No. 02/11-10071/12-12), questionnaires were administered during free time. Answering the questionnaires took an average of 10 minutes. Measurements were carried out in the morning shift from 9-12 o'clock, in the months of March, April and May 2012, the academic year. The order of measurement was always the same. All students who participated in this study were subjected to testing under the same conditions. Measurements were performed in small groups of 13 to 15 students each. One secretary was measured at each workplace.

The sample of variable.

The survey contained the following questions: year of birth – AGE, gender – G, body weight – BW (kg), body height – BH (cm), body mass index – BMI (kg/m^2) and questions about physical activity (average hours per week of physical activity – hrs). Body height was measured using Martin's anthropometer with precision of 0.1 cm, BMI was measured using a Tanita TBF-300A Pro Body Composition analyser scales with precision of 0.1 kg (Tanita Corp., Tokyo, Japan). Students were barefooted during measurements. With a physical activity questionnaires we tried to measure the physical functioning through two questions: Level of physical activity: I) I do not practice sport regularly, II) I practice sport occasionally but not on a regular basis, III) I take part in sport at a recreational level and regularly, IV) I train one or more sports regularly and I take part in competitions); and Hours of physical activity spent on average per week in the last six months: I) 0-5 hours, II) 6-10 hours, III) 11-15 hours, IV) 16-20 hours, V) 21-30 hours.

Data analysis

Data analysis was done using the Statistical Package for Social Sciences (SPSS, Version 20, IBM, Chicago, Illinois, USA). We calculated basic descriptive statistics for all variables: n, number of study participants; %, percentages of study participants; MIN, minimum; MAX, maximum; M, mean; SD, standard deviation; K-S test, Kolmogorov-Smirnov test for normality of distributions with (p<0.01); R, Pearson correlation and T-test for the difference between male and female students in the two variables.

Results

It is visible from the implemented analysis (Tab. 1) and (Fig. 1-2) that 244 of the questioned students (44.9%) answered: "I practice sport occasionally but not on a regular basis". Another 118 students (21.7%) answered: "I take part in sport at a recreational level and regularly", and 113 students (20.8%) answered: "I do not practice sport regularly". Finally, 68 students (12.5%) answered "I train one or more sports regularly and I take part in competitions". The results of answers to the question: „Hours of sport spend on average per week in the last six months" are presented in Table 1. Overall, the largest number of answers was in the values between 0-5 hours, 338 answers

(62.2%), 6-10 hours – 134 answers (24.6%), 11-15 hours – 48 answers (8.8%), 21-30 hours – 12 answers (2.2%), and finally, 16-20 hours – 11 answers (2.0%).

Table 1. Engagement in physical activities and body mass index for the study samples

Activities	n (%)		
	F, n=330 (60.7%)	M, n=213 (39.2%)	T, n=543 (100%)
Level of sport activity			
I: I do not practice sport regularly	93 (28.2)	20 (9.4)	113 (20.8)
II: I practice sport occasionally but not on a regular basis	173 (52.4)	71 (33.3)	244 (44.9)
III: I take part in sport at a recreational level and regularly	47 (14.2)	71 (33.3)	118 (21.7)
IV: I train in one or more sports regularly and I take part in competitions	17 (5.2)	51 (23.9)	68 (12.5)
Hours of sport spend on average per week in the last six months			
I: 0-5 hours	259 (78.4)	79 (37.0)	338 (62.2)
II: 6-10 hours	48 (14.5)	86 (40.3)	134 (24.6)
III: 11-15 hours	14 (4.2)	34 (15.9)	48 (8.8)
IV: 16-20 hours	2 (.6)	9 (4.2)	11 (2.0)
V: 21-30 hours	7 (2.1)	5 (2.3)	12 (2.2)
Body Mass Index – BMI (kg/m^2)			
I: < 18.5	31 (9.39)	5 (2.34)	Underweight
II: 18.5 – 24.9	278 (84.24)	157 (73.70)	Normal weight
III: 25.0 – 29.9	21 (6.36)	47 (22.06)	Overweight
IV: 30.0 – 34.9	-	4 (1.87)	Obese Class I

Abbreviations: n, number of study participants; %, percentage; F, female; M, male; T, total
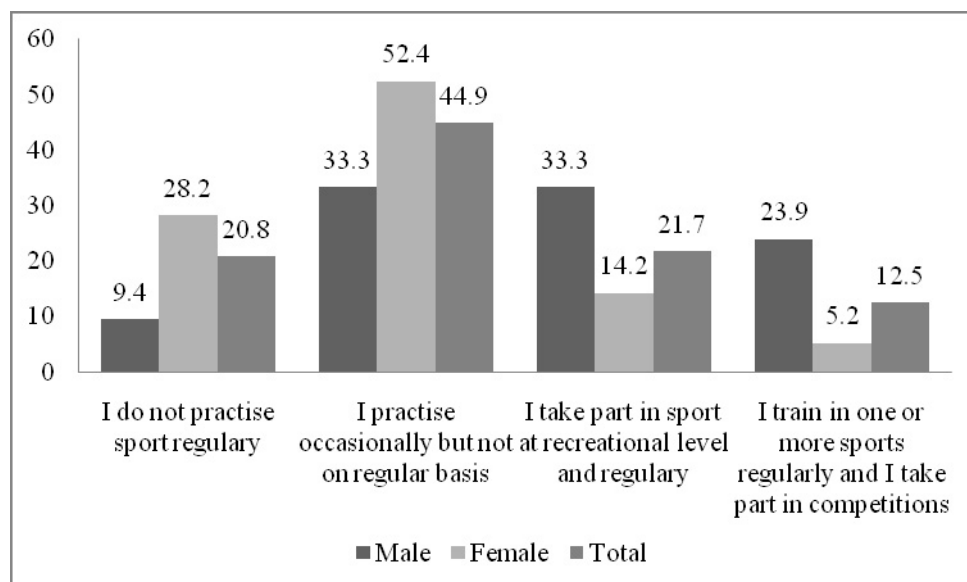

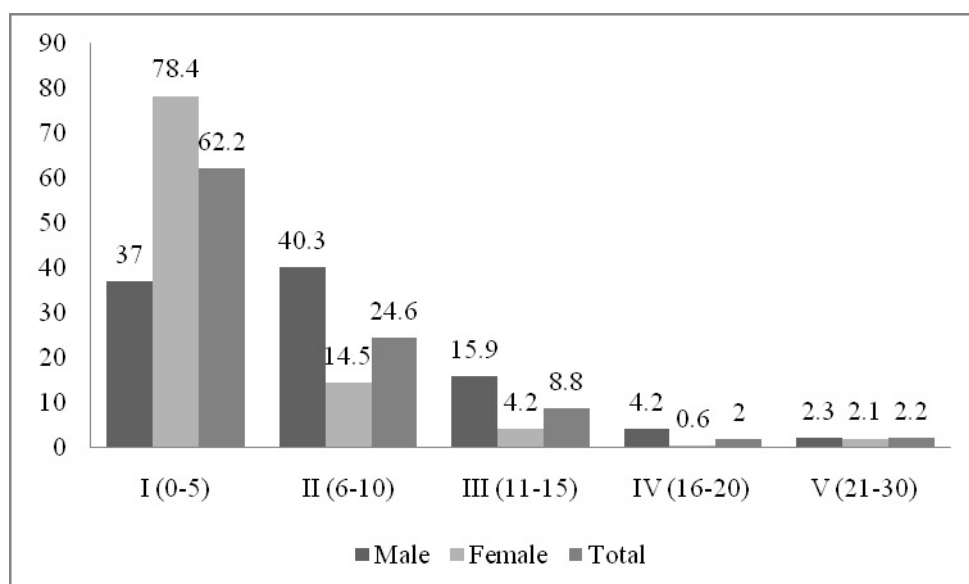Fig. 1. Taking part in physical activity during last 6 months

Fig. 2. Hours spend for sport on average/week during last 6 months

As for the calculated BMI (Tab. 1), 157 (73.7%) of the male students who participated in the re-search have normal BMI, 5 (2.3%) students are underfed, 47 (22.0%) have excessive body mass, and 4 (1.8%) are obese, 1st level. Female students predominantly have normal body mass –278 (84.2%) in comparison to those with excessive body mass – 21 (6.3%). The number of underfed female students was somewhat higher, 31 (9.39%). Female students showed a higher tendency towards excessive thinness, with 9.39% of female students, in comparison to 2.34% of male stu-dents, whose BMI showed underfeed. On the other hand, 6.3% of female and 23.8% of male stu-dents were obese. Taking into account the results, we can conclude that male students have more members with excess body mass and obesity, while female students show more interest in lean-ness.

Table 2. Descriptive statistics and Kolmogorov Smirnov test normality of the distribution results for the study samples

Variables	n		MIM		MAX		X		SD		K-S test (p-value)	
	M	F	M	F	M	F	M	F	M	F	M	F
AGE	213	330	18	17	35	32	20.05	19.38	1.89	1.58	3.30 (.00*)	6.84 (.00*)
BH	213	330	167	146	198	185	182.54	167.95	6.20	6.09	.918 (.36)	1.32 (.61)
BW	213	330	56	41	114	95	77.86	59.25	10.33	7.06	1.30 (.06)	2.04 (.00*)
BMI	213	330	16.5	16.0	34.0	27.8	23.34	20.99	2.66	2.17	1.02 (.24)	1.30 (.06)
HW	213	330	0	1	28	24	8.11	4.05	5.30	4.32	1.97 (.00*)	4.37 (.00*)

*Abbreviations: AGE, years; BH, body height; BW, body weight; BMI, body mass index; HW, hours spend for sport on average/week during last 6 months; F, female; M, male; X, mean; SD, standard deviation K-S test, Kolmogorov Smirnov test normality of the distribution; Significance at the (*p<0.05) level (2-tailed).*
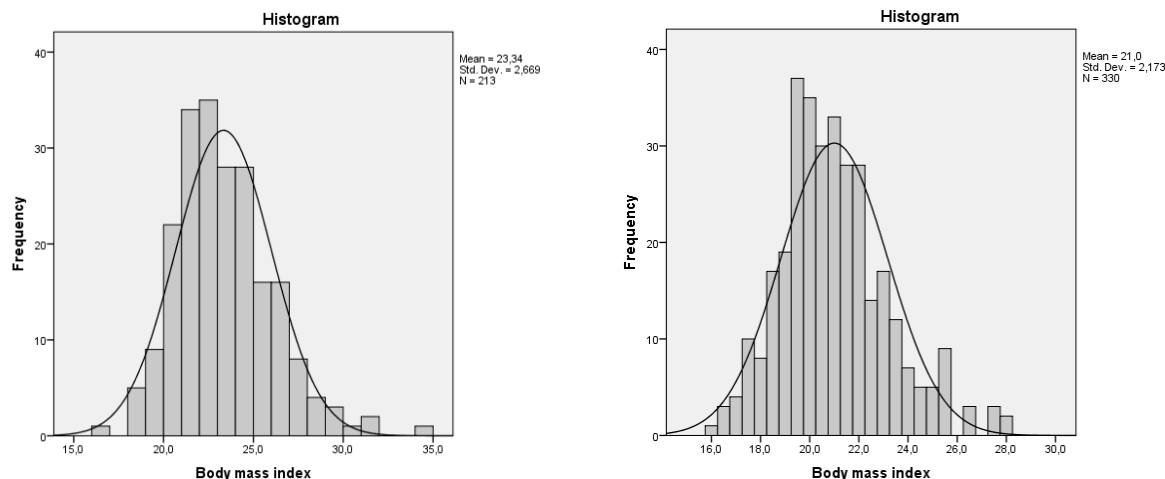
Fig. 3. Body mass index (BMI) (kg/m^2) for female (n=330) and male (n=213) students

Table 3 shows that mean BMI was 23.33 (2.66) kg/m^2 in male and 20.99 (2.17) kg/m^2 in female students. BMI for male students was in the range of 16.5-34.0 kg/m^2. For female students, the BMI was in the range between 16.0 and 27.8 kg/m^2. Table 3 shows that the most time on physical activity is spent by male students – 10.7 hours and female students – 9.5 hours from the Faculty of Physical Education and Sports, while the least amount of time on physical activity is spent by students from the Faculty of Law – males 2.5 hours and female students from the Faculty of Pharmacy 1.3 hours. On average, students (both male and female) spend an average of 5.60 (5.03) hours on physical activity. Female students spend 4.05 (4.32) hours, and male students spend 8.11 (5.30) hours on physical activities.

Table 3. Measures of central tendency for body mass index (BMI) and physical activity (PA) according to gender and study program

Faculties and high schools	Female (n=330)					Male (n=213)				
	n (%)	BMI (kg/m^2)		PA (hrs)		n (%)	BMI (kg/m^2)		PA (hrs)	
		X	SD	X	SD		X	SD	X	SD
Faculty of law	14 (4.24)	21.478	2.681	2.50	1.16	6 (2.81)	22.983	2.733	2.50	1.04
Faculty of philosophy	57 (17.27)	21.028	2.259	3.71	5.23	9 (4.22)	24.388	2.283	6.33	5.97
Faculty of medicine	64 (19.39)	20.884	2.256	3.67	4.18	31 (14.55)	22.993	2.989	5.87	5.97
Faculty of mechanical engineering	4 (1.21)	21.300	3.653	3.50	2.08	12 (5.63)	22.375	4.450	5.75	2.41
Academy of drama	n/a	n/a	n/a	n/a	n/a	1 (0.46)	22.300	0	8.00	0.00
Faculty of mining, geology and civil engineering	13 (3.93)	22.085	2.765	2.84	1.57	16 (7.51)	23.293	2.763	7.56	5.66
Faculty of technology	29 (8.78)	21.358	2.024	3.48	3.57	4 (1.87)	23.000	1.921	8.75	4.78
Faculty of education and rehabilitation	53 (16.06)	21.054	2.301	4.09	3.89	4 (1.87)	22.725	1.662	6.50	6.19
Faculty of electrical engineering	28 (8.48)	20.685	2.141	2.46	1.42	16 (7.51)	23.700	2.855	5.43	3.68
Faculty of pharmacy	3 (0.90)	21.100	0.707	1.33	0.57	n/a	n/a	n/a	n/a	n/a
Medical school	40 (12.12)	20.477	2.738	4.32	3.79	29 (13.61)	23.424	2.960	6.62	3.86
Faculty of physical education and sport	25 (7.57)	21.116	3.094	9.52	5.70	85 (39.90)	23.481	2.248	10.76	4.38

Abbreviations: n, number of study participants; %, percentage; X, mean; SD, standard deviation BMI, body mass index; PA, physical activity

A significant positive correlation between BMI and PA exists in hours spend on sport on average/week during last 6 months. Correlations between BMI and HW, as Figure 4 shows, amount to (R=.214; p<0.01) and (R^2=.046; p<0.01). At the univariant level of the data analysis aiming to define differences between men and women, we used the T-test for independent samples. The re-

sults of the T-test show that the differences between men and women in variables are statistically significant at the level of ($p<0.05$). This statement is confirmed by the results from Table 2, where male BMI is higher in comparison to women's 2.35 kg/m^2, while, at the same time, men are more active in sports by 4.06 hours on average per week in comparison to women.

Table 4. Independent samples t – test between female and male students for body mass index and hours spend for sport on average/week during last 6 months

Variables	Levene's Test for Equality of Variances		t-test for Equality of Means						95% CI	
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference		Lower	Upper
BMI	9.570	.002	11.193	541	.000	2.340	.209		1.929	2.751
HW	22.256	.000	9.700	541	.000	3.969	.409		3.165	4.772

Abbreviations: BMI, body mass index; HW, hours of sport spend on average per week in the last six months
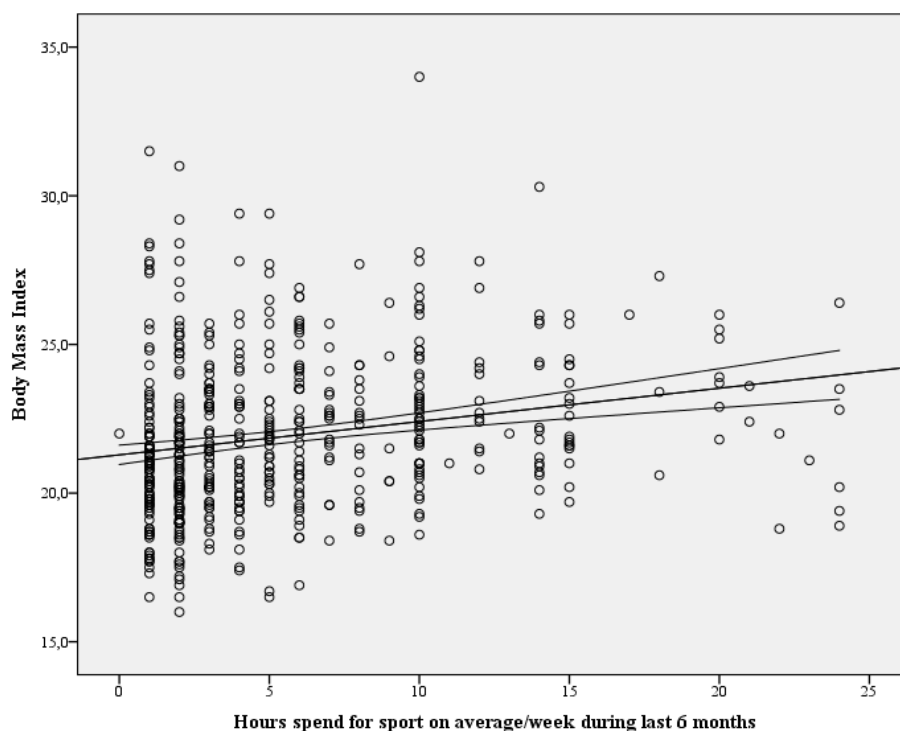

Fig. 4. Correlation between PA and BMI. Correlation between hours spend for sport on average/week during last 6 months and category of BMI is positive and statistically significant
(R=0.214; P=0.01, R^2=0.046; P=0.01)

Discussion

The classes in physical and health education at the University of Tuzla are obligatory for students of 1st and 2nd year of integrated and expert study. Higher years do not have an organised from of education; there are no electoral courses or optional courses in PE. Considering the fact that this type of education in higher education is the final, obligatory and organised form of physical activity, it is of utmost importance to develop the awareness of the need of everyday exercising and of its positive impacts on the health status of human organisms. Thus, students should be enabled to undertake individual physical exercises. This is one of the goals of education within the course titled Physical and Health education in higher education. Courses at universities should educate young people on healthy nutrition and the need for physical activity with the purpose of preventing different health problems.

Looking at differences between the genders, it can be stated that female students, 93 (28.2%), are less active than males, 20 (9.4%). If we take another look at the differences between answers from male and female students to the question "I train one or more sports regularly and I take part in competitions", we can see that there are more male students, 51 (23.9%), involved in regular sport activities, such as regular training, than female ones, 17 (5.2%). The results are identical on the level of leisure time, involving 220 (66.6%) female students and 142 (66.6%) male ones. Having in mind that the questionnaire did not include the reasons for physical inactivity, we can guess that it largely lays in school and house related commitments. Considering the fact that the questionnaire did not include the reasons for physical inactivity, we are guessing that the reasons lay in a large number of study related duties, both at school and at home. Namely, students spend a large portion of time sitting behind a computer or a desk, working on different projects, and the time available for physical activities has decreased.

It can be concluded that students practice physical activities and recreation in principle, but still 1/5 of all students are inactive, i.e. they do not spend any of their time on sports and recreation. Modern life understands a significant time spent sitting. The majority of people work in offices and behind computers. Cars have replaced walking and the most common relaxation is watching television or playing games. When meeting with friends, the time will usually be spent sitting in a coffee bar or a restaurant. All of this has negative implications on BMI.

The results of research conducted by various authors [20] show that (44.5%) of students spend their free time on some type of sport or recreational activity, and the most frequently stated activities are walking, swimming, jogging, bicycle riding, roller-skating, as well as aerobic and fitness programmes and other sport activities. The remaining (55.5%) students do not undertake any physical activity and their key reasons listed are a lack of habit, company or will. Preferences of activities are the same as for students who undertake physical activity. Results obtained by other authors come to similar data [21]; a sample of (n=2681) students show only 8.7% of female and 16% of male students of the Faculty of Philosophy to undertake regular exercises at least twice a week, which is devastating. A paper from other authors [22] shows that most of the male students (65.38%) said that as leisure recreation they engaged in physical activity, which involved about two weeks of practicing a physical activity. 26.92% of the male students were actively involved in sports (at least five times a week) while 7.69% did not engage in physical activity during leisure time. The situation of female students is slightly worse. As many as 42.86% did not engage in physical activity, while 48.41% said they engaged in recreational sport about twice a week. If we look at total engagement in physical activity in leisure time of Medical students, we conclude that more than half of the surveyed first-year students of the faculty (51%) engaged in recreational sports, and many other students (36.84%) did not engage in sports in their free time. The results from a research from the authors [23] show that male students are more frequently involved in physical activity than female students. The worrying fact is the percentage of female students who do not do any physical activity at all amounts to 13.9% or those who do is several times a year to 11.3%. One of the reasons for such behaviour is lack of free time, visible from the responses to the question: "Do you have enough free time", to which as many as 32.2% of the female students responded negatively, in comparison to the male students with 4.4% of such responses. On average, students have 3.2 hours for sport and recreational activities, of which 1.7 hours is spent on studying. Out of 22 offered sport and recreational activities, the students mostly undertake (three to four times a week or more) walking (48.9%), jogging (10.6%), dance (9.5%). Those who undertake activities once or twice a week are also mostly involved in walking (32.9%) and jogging (26.5%), but also bicycle riding (20.2%) and roller-skating (10.6%). A few times during a month or in a year, the majority of them go swimming (67.0%), play volleyball (48.9%), do jogging (47.8%) and play pool (46.8%), while they never did any horse riding (94.6%), boccie (93.6%), hunting (93.6%), mountain hiking (87.2%), Pilates (87.2%) or fishing (80.2%). The given results are objective considering the fact that the city of Vukovar does not offer a sufficient number of sport and recreational activities. From the results obtained by authors [24], it is visible that as many as 56% of the interviewed students do not dedicate any of their time to sports and recreational activities.

The received results for the BMI show that the majority of students are in the zone of normal values. The start of the student life is an important period in the life of each individual. It represents the start of the period with increased responsibility and independence, but, at the same time, it results in a poorer health status, involving worse nutrition and nutritive habits, and rapid reduction of physical activities. The results are similar to those reached by the authors [25] taking into the account the BMIs for students who participated in the research; 5.0% students were underfeed, 30.0% overweight, and 6.0% obese. Female students were largely within the normal range (76.0%) in comparison to those with excess body weight (11.0%). A recent report [31] on the prevalence of BMI in the female students population shows overweight or obesity (5.9%) and underweight (4.73%) among all (n=1394) students [31]. This differs for male students, where there are 43.0% of students with normal fat and 48.0% with excess body weight. Female students showed a larger tendency towards thinness with 9.0% of those who were considered underfeed, based on their BMI. On the other hand, 4.0% of female students and 7.0% of male students were obese. According to the results of a study among students of the University of Novi Sad [26], the mean body mass index for male students was 23.92 (kg/m^2), female students 20.43 (kg/m^2) and overall 23.18 (kg/m^2). The prevalence of obesity similar to the results of this study with a higher prevalence in males is found in European countries, like Italy [8] where the prevalence of overweight in male and female students (BMI ≥ to 25) was 20.5% and 10%, respectively, in Spain 28.1% and 18.4%, in Bulgaria (2004) 21.2% and 11.3%, and in the Czech Republic (2008) 30.5% and 15.2% [26-29], respectively. Physically inactive people suffer from cardiovascular diseases twice more than physically active ones. A sedentary way of life occurs in mostly young population, since more than 3 hours a day of physical activity is carried out only by 39.2% of adolescents [30].

Conclusion

Our findings were similar to other studies [26-29], but statistically significant differences were found for gender and the level of physical activity. The focus should be directed to the education of young people, because they can easily adopt healthy habits that they should maintain for life. These results point out the necessity of an integrated approach to prevention and control of risk factors, particularly among youth.

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