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Original research article

INTERRELATIONS BETWEEN BODY MASS INDEX, PERCENTAGE OF BODY FAT, AND WAIST-TO-HIP RATIO AMONG DIFFERENT GROUPS OF STUDENTS AT THE UNIVERSITY OF BANJA LUKA

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Abstract. *Overweight and obesity prevalence has been reported in all age groups worldwide, including college students, while numerous researchers have pointed out that the critical period for weight gain are the freshman years. The first aim of this study was to measure body weight and prevalence of overweight and obesity among students at the University of Banja Luka by using three independent measurement methods. The second aim of the present study was to determine whether there were any statistically significant differences across groups in terms of gender, field of study (faculty), and year of study. A total of 210 students from the University of Banja Luka participated in the study, with a mean age of 21.94 ± 2.73 years. The set of measurements included: the Body Mass Index, Body Fat Percentage, and Waist-to-Hip Ratio. In terms of the Body Mass Index, a total of 22.40% of students were reported to be overweight, while 2.40% of them were obese. A higher percentage of overweight and obesity was reported among male students. The other two measurement methods, Body Fat Percentage and Waist-to-Hip Ratio, showed somewhat different results primarily with respect to fewer numbers of students classified either as overweight or obese, which raised questions as to whether the Body Mass Index was a reliable method when it came to measuring certain population groups, particularly young people. Differences across groups were reported when gender and, to a certain extent, field of study was taken into account, whereas the difference between freshman and senior years students was not statistically significant. The results from this study call for an extensive, detailed and prompt response to the issue of overweight and obesity, and its treatment among university students.*

Key words: *BF%, BMI, obesity, overweight, student, WHR*

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INTRODUCTION

Globally, overweight and obesity are considered one of the burning public health problems (Doak, Wijnhoven, Schokker, Visscher, &Seidell, 2012; Ogden, Carroll, Kit, & Flegal, 2014; Rolland-Cachera, 2011), and the estimate is that some 1.9 billion people (39% of the global population) older than 18 are overweight, out of which 600,000,000 (13% of the total global population) are obese (World Health Organization-WHO, 2014a). Haidar and Cosman (2011) have argued that both developed and developing country are facing the issue of overweight and obesity, with significant differences recorded across and within the countries (Davar, 2015). The rising prevalence of overweight and obesity across the globe is becoming the number one public health issue (Adeboye, Bermano, & Rolland, 2012; Ng et al, 2014); the correlation between overweight and obesity with various diseases (Roger et al., 2012) is seen as a global challenge (Ogden et al., 2014), or even described as a widespread pandemic (Ng et al., 2014; Popkin, Adair, & Ng, 2012; Roth, Qiang, Marbán, Redelt, & Lowell, 2004; Swinburn et al., 2011). Various researches have confirmed that around 6% of the total public health expenditure worldwide is related to physical inactivity, and overweight and obesity (WHO, 2003) - the direct and indirect costs of overweight and obesity in the USA in 2002 were 92.6 billion $ or 9.1% of the total amount of money spent on health care (Rosamond et al., 2008). Overweight and obesity has been estimated as the fifth leading cause of death among adult people (James et al., 2004), resulting in 3.4 deaths annually, while the disability-adjusted life year (DALY) has recorded 3.9% of the global population deaths and a 3.8% disability rate caused by overweight and obesity (Lim et al., 2012).

The overweight and obesity epidemic takes its toll on the health of adults and children alike (Ogden et al., 2014), including college students as well (Harring, Montgomery, & Hardin, 2010; Mendez Hernandez et al., 2010). In the study of global, regional, and national prevalence of overweight and obesity in children and adults during 1980–2013, Ng et al. (2014) have come to the conclusion that obesity reaches its maximum values among the middle- and old-age population, but they also report an increase in the prevalence among the young population.

Based on the results of two studies, "Behavioral Risk Factor Surveillance System" and "The Spread of the Obesity Epidemic in the Unites States, 1991-1998", the most substantial gain in weight was reported in the period between 18 and 29 years of age among both men and women (Mokdad et al., 1999).Weight and body-composition change was found to be critical during college freshman year among students (Crombie, Liu, Ormsbee, & Ilich, 2012; Racette, Deusinger, Strube, Highstein, & Deusinger, 2008; Vella-Zarb, & Elgar, 2009). The reason lies in the fact that students experience a certain number of transitional changes when they transfer from secondary school to the college environment (Dyson & Renk, 2006; Von Ah, Ebert, Ngamvitroj, Park, & Kang, 2004). In case they do not manage to adapt successfully, their attitude towards health gets impaired, e.g. weight gain prevalence increases. This period of life is reported to be very critical in young people's health due to a tendency to gain weight and adopt poor dietary and exercise habits (Vadeboncoeur, Townsend, & Foster, 2015). Many other studies give evidence of freshmen years as the period of young adulthood, which is the key risk time for weight gain. (Blondin et al., 2016; Crombie et al., 2012; Girz et al., 2013; Gunes, Bekiroglu, Imeryuz, &Agirbasli, 2012; Kapinos, Yakusheva, & Eisenberg, 2014; Nies, Sun, Kazemi, Carriker, & Dmochowski, 2012; Smith-Jackson & Reel, 2012; Wansink, Cao, Saini, Shimizu, & Just, 2012). Some also claim that first-year university students were reported to have

more inappropriate weight gain compared to young people of their age who did not enter into tertiary level education (Anderson, Shapiro, & Lundgren, 2003; Butler, Black, Blue, & Gretebeck, 2004). European authors have provided plentiful evidence themselves to support similar claims (Deliens, Clarys, De Bourdeaudhuij, & Deforche, 2013; de Vos et al., 2015; Finlayson, Cecil, Higgs, Hill, & Hetherington, 2012). Hunag at al. (2016), based on a diverse set of research findings, claim that the underlying reason for massive weight gain should be looked for in poor dietary habits and prevalence of physical inactivity among the student population.

The World Health Organization (1995, 1998) defines overweight for adults as a Body Mass Index [BMI] values from 25 to 30 kg/m2. Although the BMI method has a widespread use due to its simple nature, there are certain limitations which need to be taken into account. Luke at al. (1997), and other researchers (Deurenberg, Yap, & van Staveren, 1998; Deurenberg, Yap, Schmidt, van Staveren, & Deurenberg, 2000), found that such measuring leave space for speculations as the values of BMI and Percent Body Fat [BF%] ratio vary across different subgroups of the population. The BF% increase is in a direct relation to BMI values, especially among children and adolescents (Krebs et al., 2007); however, there are certain studies that have found some deviations in body composition values in that respect (Crnobrnja, Srdić, Stokić, Dujmović, & Andrejić, 2012). The BMI takes into account both body fat and muscles, so it can sometimes be a very misleading indicator of overweight and obesity, particularly among people who have a normal or relatively low level of BF% (Bray, DeLany, Volaufova, Harsha, & Champagne, 2002; Freedman & Sherry, 2009), e.g. the population of athletes (Crnobrnja et al., 2012). Therefore, the Body Fat Percentage stands in a better correlation to overweight and obesity assessment than BMI (Freedman, Ogden, & Kit, 2015). This is particularly true for the young population whose BMI values serve as a less reliable predictor of overweight and obesity compared to middle-age people (Dagan, Segev, Novikov, & Dankner, 2013). The Waist-to-Hip Ratio [WHR] is also much more reliable for fat distribution assessment, though it is used much less for that purpose than the BMI (Brown, 2009; Dagan et al., 2013).

There are many studies which have dealt with the issue of the increase in body mass among students, particularly in freshman college students. Some of the studies focused on sophomore students (Culnan, Kloss, &Grandner, 2013; Gropper, Simmons, Connell, & Ulrich, 2012; Hull, Morrow, Dinger, Han, & Fields, 2007; Lloyd-Richardson, Bailey, Fava, & Wing, 2009; Racette, Deusinger, Strube, Highstein, &Deusinger, 2005, Racette et al., 2008), and on fourth-year students (Racete et al., 2008). Racette et al. (2005) compared the basic parameters between freshman and sophomore year students, while Gropper et al. (2012) and Ren et al. (2015) reported on changes in weight, composition, and shape of the body in a 4 yearlong study of college students. Peltzer et al. (2014) addressed the prevalence of overweight/obesity and its associated factors among university students from 22 countries.

The aim of this study was to investigate not only the level of BMI, but also to examine the prevalence of overweight and obesity in students of the University of Banja Luka. The present study is concerned specifically with the aspects of statistical significance in terms of their relevance to the gender of the tested students, different age groups (year of study), and field of study (faculty attended). It is also concerned with the statistical significance among the three different measurement methods used herein.

METHODS

As a cross-sectional study which involves data collection at a defined time, this study included a total of 210 students; first- and third-year students from the Faculty of Physical Education and Sport [FPES], and Faculty of Economics [FE] – 30 students per each faculty and year of study (a total of 120 students), and 90 students from the Faculty of Medicine [FM], first-, third-, and fifth-year students (30 students per each year of study). The gender structure of the tested students was balanced among the Faculty of Medicine students, whereas the gender structured at the two other Faculties, due to the very nature of the male to female student ratio, was imbalanced. So the total gender structure of the tested students consisted of 108 male students (51.40%), and 102 female students (48.60%). Students were recruited on a voluntary basis, and informed consent was obtained from the students prior to their participation. This study was carried out in accordance with the highest ethical principles set out in the Declaration of Helsinki, and it was compliant with similar legislation concerning human participants in Bosnia and Herzegovina.

The measurements were performed at the Institute of Sport of the Faculty of Physical Education and Sport, during the months of May and June 2015. The students were measured according to the following parameters: Body Mass [BM], Body Height [BH], Waist Circumference [WC], Hip Circumference [HC], Biceps Skinfold [BS], Triceps Skinfold [TS], Subscapular Skinfold [SSS], and Suprailiac Skinfold [SIS].

Anthropometric measurements were performed in accordance with the recommendations of the International Biological Program [IBP] and WHO. BM (kg) was measured in kilograms using medical weighing scales with a precision of 0.1 kg; BH was taken barefoot in centimeters by using the Martin anthropometer, and it was recorded with a precision of 0.1 cm; WC (cm) and HC (cm) were recorded by using measuring tape with a precision of 0.1 cm. WC was measured at the midpoint between the lowest point of the rib cage and the highest point of femoral crest of the pelvic bone, whereas HC was measured at the widest point while at level with the trochanter. Skinfold measurement was obtained using John Bull Calipers with 0.2 mm precision and standard pressure of 0.01 Pa on 1 mm2 of skin. BS was measured on the anterior side of the middle of the forearm just above m. biceps, while TS was measured on the dorsal side of the middle of the forearm just above m. biceps. SSS was measured below the lower edge of the scapula, and SIS was measured 1 cm above and 2 cm medially from the anterior superior iliac spine (ASIS) - spinailiaca anterior superior.

We calculated the BMI by dividing body weight in kilograms by height in meters squared (kg/m2). According to the WHO overweight and obesity factsheet (2014b), BMI values were determined as follows: ≤18.5 underweight, between 18.5 and 24.9 normal (healthy) weight, 25.0–29.9 overweight, and ≥30 obese. WHR values were classified according to the WHO recommendations (2008), and with respect to gender dimorphism – females: <0.75 excellent, 0.75–0.79 good, 0.80–0.86 average and >0.86 at risk, and males: <0.85 excellent, 0.85-0.89 good, 0.90–0.95 average and >0.95 at risk. The calculation of BF% was based on the formula developed by Durin & Womersley(1974), with predicted values for 17–29 year old people expressed as logs of the total four skinfold types. The classification of the obtained values was performed in accordance with Bray (2004, p. 18) again with respect to gender dimorphism – females: 20–30% physiological (normal) values, 30–33% borderline overweight, >33 overweight (obese); males: 12–20% physiological (normal) values, 20–25% borderline overweight, >25% overweight (obese).

The data were coded and entered into a database. We used simple descriptive statistics to provide basic information about the overall characteristics of the sample, and to obtain a frequency distribution expressed as percentages, while the difference between the tested subgroups were obtained through variance analysis and canonical correlation. Statistical analyses were carried out using the IBM SPSS Statistics program, version 21.0.

RESULTS

The data obtained from the studied variables among the tested students from the University of Banja Luka, revealed the following average values for males: WHR (M = .84, SD = .52), BF% (M = 15.47, SD = 3.50), and BMI (M = 24.36, SD = 2.59); and for females: WHR (M = .72, SD = .04), BF% (M = 25.14, SD = 3.59) and BMI (M = 21.54, SD = 2.46). The means of the descriptive statistical analysis according to the field of study (faculty) and gender are shown in Figure 1. The highest values for WHR (for male students) were recorded among students of the Faculty of Medicine (M = .85, SD = .05), and lowest among FPES students (M = .82, SD = .06), while among female students the highest values were recorded among the FPES students (M = .74, SD = .03), and the lowest among the students of the Faculty of Medicine (M = .71, SD = .04). The smallest difference by gender was observed among the students of the FPES. The highest BF% values were reported among the male students of Medicine (M = 16.98, SD = 3.14), followed by the students of Economics (M = 15.20, SD = 3.09), whereas the lowest values were observed among the FPES students (M = 13.92, SD = 3.45). In female students, the highest values were reported among the FE students (M = 25.67, SD = 3.42), FPES students had slightly lower reported values (M = 25.47, SD = 3.75), while the lowest observed values were recorded among the students of Medicine (M = 24.56, SD = 3.64). From the studied data, it was observed that according to BMI classification of males, FE students were at the top of the list (M = 24.54, SD = 2.70), while FPES (M = 24.32, SD = 2.66) and FM (M = 24.31, SD = 2.54) students had almost identical observed values. In females, the highest BMI values were recorded among FPES students (M = 21.91, SD = 2.66), followed by FE students (M = 21.58, SD = 2.76), and FM students (M = 21.34, SD = 2.12). Again, the smallest difference by gender was observed in FPES students, while the smallest values in BF% were among the students of Medicine.

Distribution of frequency (Figure 2) showed that the WHR variable reported that 98.10% of male students and 87.9% of female students have excellent and good values. Only 1.90% of the male students had with average values, whereas the female students fared a bit worse (11.20% average and 1.00% at risk). In terms of BF% variable distribution, 84.50% of the male students and 88.80% of the female students were within or under the range of physiological values [PV], while 15.50% of the male and 11.20% of the female students were observed as overweight. None of the students were recorded to have BF% values indicating obesity. The BMI results showed 70.90% of the total number of students with values within the PV range, 22.40% of them were overweight, and 2.40% were obese.

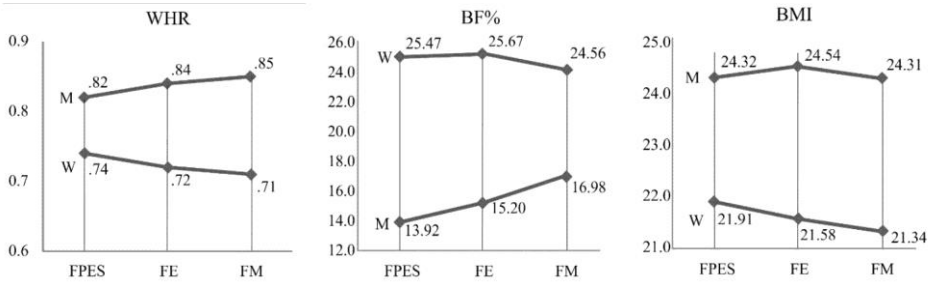

Fig. 1 Mean values of descriptive statistics of studied variables by field of study (faculty) and gender
Legend: WHR – Waist-to-Hip Ratio; BF% – Body Fat Percentage; BMI – Body Mass Index; FPES – Faculty of Physical Education and Sport; FE – Faculty of Economics; FM – Faculty of Medicine; M – Men; W – Women.

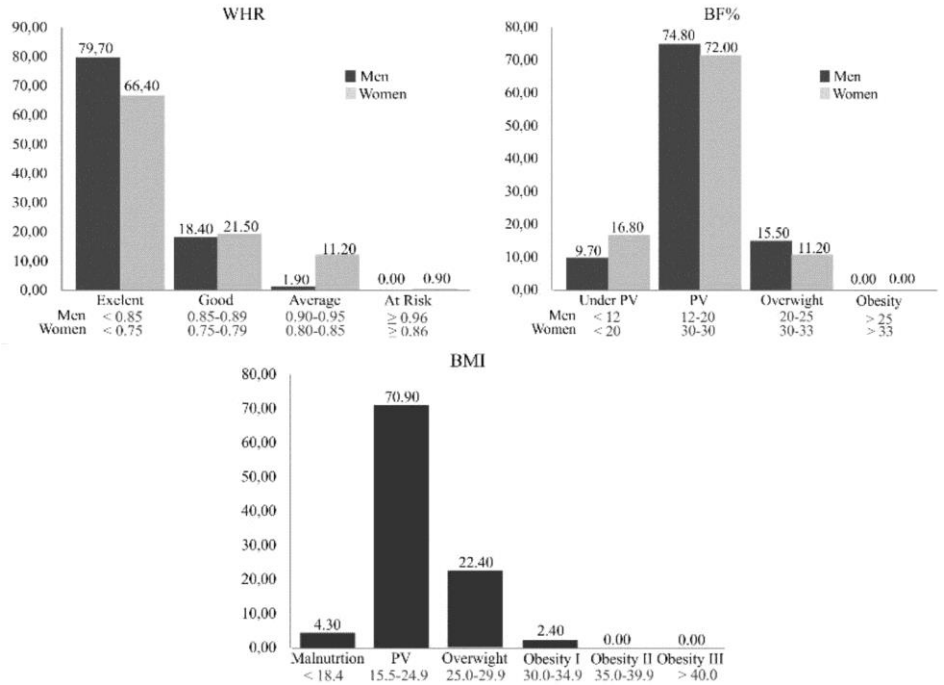

Fig. 2 Distribution of frequency of observed variables among the tested students of the University of Banja Luka (as percentages)
Legend: WHR – Waist-to-Hip Ratio; BF% – Body Fat Percentage; BMI – Body Mass Index; PV – Physiological Values.

As for the differences pertaining to gender, field of study (faculty) and different year of study, the obtained results shown in Table 1 indicate the existence of differences in mean values of the studied variables between male and female students. In all three

studied variables a statistically significant difference at the p≤.01 level was found between male and female students. A canonical correlation, with a high value of R = .92, showed the highest difference in the BF% variable (Wilks Λ = .35, F(1, 208) = 391.00, p = .00), followed by a relatively lower value of the WHR variable (Wilks Λ = .36, = .35 F(1, 208) = 365.51, p = .00), while the lowest value was recorded for the BMI variable (Wilks Λ = .76, F(1, 208) = 65.31, p = .00).

Table 1 Differences in observed variables between male and female students (ANOVA)

Measurement	Source	df	SS	MS	F	p
WHR	Between groups	1	.76	.76		
	Within groups	208	.43	.00		
	Total	209	1.19		365.51	**.00**
BF%	Between groups	1	4910.07	4910.07		
	Within groups	208	2612.00	12.56		
	Total	209	7522.06		391.00	**.00**
BMI	Between groups	1	417.91	417.91		
	Within groups	208	1330.94	6.40		
	Total	209	1748.85		65.31	**.00**

Legend: WHR – Waist-to-Hip Ratio; BF% – Body Fat Percentage; BMI – Body Mass Index; *df* – Degrees of freedom; *SS* – Sum of squares; *MS* – Mean square; *F* – Fisher's F ratio; *p* – Probability.

The obtained result differences of the studied variables, classified by field of study – faculty, (Table 2) showed a statistical significance at the p≤.01 level only for the BF% variable (Wilks Λ = .93, F(1, 207) = 8.06, p = .00), while the remaining two variables, namely WHR (Wilks Λ = .36, F(1, 207) = 1.97, p = .14) and BMI (Wilks Λ = .76, F(1, 207) = 1.52, p = .22), exhibited no statistically significant differences between student groups from different faculties.

Table 2 Differencesbetween studied variables between faculties (faculties attended) - ANOVA

Measurement	Source	df	SS	MS	F	p
WHR	Between groups	2	.02	.11		
	Within groups	207	1.17	.01		
	Total	209	1.19		1.97	.14
BF%	Between groups	2	543.72	271.86		
	Within groups	207	6978.34	33.71		
	Total	209	7522.06		8.06	.00
BMI	Between groups	2	25.38	12.69		
	Within groups	207	1723.46	8.33		
	Total	209	1748.85		1.52	.22

Legend: WHR – Waist-to-Hip Ratio; BF% – Body Fat Percentage; BMI – Body Mass Index; *df* – Degrees of freedom; *SS* – Sum of squares; *MS* – Mean square; *F* – Fisher's F ratio; *p* – Probability.

The obtained differences between the studied variables, classified by year of study, (Table 3) showed that there was no statistically significant difference between freshman students and senior students across the entire set of the observed variables: WHR (Wilks

Λ = .99, F(1, 208) = 2.17, p = .14), BF% (Wilks Λ = 1.00, F(1, 208) = .33, p = .57), and BMI (Wilks Λ = 1.00, F(1, 208) = .30, p = .58)

Table 3 Differences between studied variables between freshman and senior year students (ANOVA)

Measurement	Source	df	SS	MS	F	p
WHR	Between groups	1	.01	.01		
	Within groups	208	1.18	.00		
	Total	209	1.19		2.17	.14
BF%	Between groups	1	12.02	12.02		
	Within groups	208	7510.04	36.11		
	Total	209	7522.06		.33	.57
BMI	Between groups	1	2.52	2.52		
	Within groups	208	1746.32	8.40		
	Total	209	1748.85		.30	.58

Legend: WHR – Waist-to-Hip Ratio; BF% – Body Fat Percentage; BMI – Body Mass Index; *df* – Degrees of freedom; *SS* – Sum of squares; *MS* – Mean square; *F* – Fisher's F ratio; *p* – Probability.

Table 4 shows the results for the canonical discriminant analysis of the studied variables, and clearly points to the three following facts: (1) statistically significant differences between male and female students were observed at the p≤.01 level, with a high correlation quotient; (2) 85% of the total variance accounting for the differences between fields of study (faculty) was statistically significant at the p≤.01 level, and (3) there was no statistical significance observed between freshman and senior students, which confirmed the results obtained through the analysis of variance.

Table 4 Canonical correlation of the studied differences between different groups (subsets) of students

	Eigenvalue	% of variance	R	λ	χ2	df	p
1	5.76	100.0	.92	.15	394.55	3	.00
2	.11	85.3	.31	.89	25.05	6	.00
	.02	14.7	.14	.98	3.82	2	.15
3	.03	100.0	.16	.98	5.09	3	.17

Legend: 1 – difference between male and female students; 2 – difference between faculties (fields of study); 3 – difference between freshman and senior years students; *R* – correlation quotient; λ – Wilks Λ; χ^2 – Chi-square test; *df* – Degrees of freedom; *p* – Probability.

DISCUSSION

Prevalence of overweight/obesity and its associated factors among university students from 22 countries was in the focus of a study carried out by Pelzer et al. (2014), and it revealed a high degree of prevalence of overweight/obesity regardless of the part of the world where it had been conducted. It is noteworthy that Pelzer et al. (2014) applied the same methodology (BMI indicators) as the present study. Distribution of frequencies (%) among men, with BMI (M = 22.50, SD = 4.10), showed that the prevalence of underweight was 10.80%, normal weight 64.40%, overweight 18.90% and obesity 5.80%,

while among women, with BMI (M = 21.90, SD = 4.20), the prevalence of underweight was 17.60%, normal weight 62.10%, overweight 14.10% and obesity 5.20%. As it has been mentioned, the Body Mass Index (BMI) was used to measure the weight status of students from the University of Banja Luka as well. Here the BMI values were higher for both men and women – (M = 24.36, SD = 2.59) for male students, and (M = 22.98, SD = 2.89) for female students. As for the distribution of frequencies (Figure 2), the prevalence of underweight was 4.30%, normal weight 70.90%, overweight 22.40% and obesity 2.40%, which indicates that the total number of tested students from the University of Banja Luka recorded lower percentages of underweight and obese, higher percentage of overweight, and higher number of normal weight students. However, BMI values for students from the University of Banja Luka revealed that 24.80% (or ¼) tend to fall within the overweight and obesity range. No underweight male students were reported at the University of Banja Luka, the majority of them were of normal weight (58.88%), but a considerable number of them (40.19%) had a high prevalence of overweight and obesity (3.74% obese). Women fared much better, 9.62% were underweight, 81.73% normal weight, 7.69% overweight, and 0.96% obese (only one recorded female student in total).

If the results from this study are set against the study conducted by Wardle, Haase, and Steptoe, (2006), in which perceived overweight was explored by using standardized methods in male and female students from 22 countries, it is a compelling fact that male students of the University of Banja Luka fared much worse in comparison to students coming from 16 different European countries (out of 22 countries included in the mentioned international comparisons). Only the perceived overweight prevalence for students from Spain (35%) was categorized as worse. As for women, the obtained results in our study were quite opposite; they were ahead of all other European countries (German female students had the most favorable values in perceived overweight, 23%). Belgium and Ireland (both 59%) were among a large group of European countries with a prevalence of perceived overweight above 50%. The obtained results from our study are inversely proportional to the results presented by Wardle et al. (2006); however, they are quite similar to the results reached by studies conducted in our region. Crnobrnja et al. (2012) used the BMI to gauge the level of overweight/obesity, and found that the total of 22% of students fell into the category of overweight/obese. The prevalence of overweight/obesity was higher in men than in women (overweight: 41.70% vs. 6.10%; obesity: 1.9 vs. 0.50%); the underweight prevalence was 4.58% (total of two students – both female). Simić, Vasić, & Jakonić (2010), in a study conducted at the University of Novi Sad, reached similar results – overweight/obesity prevalence was higher in men than in women (33.50%, vs. 7.5%), underweight prevalence was at 12.42% (for women). In a similar vein, Stojanović, Višnjić, Mitrović, & Stojanović (2009), in a study carried out at the University of Niš, reached the following indicators: overweight – 38.18% men, 7.95% women; obesity – 7.27% men, 132% women. The vast number of studies have made it obvious that almost all countries in our region and wider are facing overweight and obesity issues, although great variations exist between and within countries (Davar, 2015). It is indicated that further research into the characteristics and underlying causes of overweight and obesity between male and female students would be beneficial. It can only be surmised that the similarity of regional distribution of overweight and obesity indicators is due to the lifestyle and dietary patterns of both male and female students. The difference between male and female students from the University of Banja Luka exhibited statistical significance at the $p \leq .01$ level (Table 1). This significance was not only due to the obtained BMI values, though the BMI method

was proven to be least reliable ($F(1, 208) = 65.31$), but it was also perpetuated by BF% and WHR values – WHR ($F(1, 208) = 365.51$), and BF% ($F(1, 208) = 391.00$).

As an index of weight-for-height, the BMI has been regarded as simple but at the same time a method with serious limitations when it comes to body composition analysis (Arroyo et al., 2004; Davar, 2015). Obesity has long been defined not only as a person's total body mass but as his/her total BF%, resulting from an imbalance between calories consumed and calories expended, which may impair the overall health and increase risk of various diseases (WHO, 2000). Crnobrnja et al. (2012) stress that "an increase in body mass may come as the result of increased muscle mass (e.g. bodybuilders and athletes), so the mere fact that a person has an increased body mass value should not therefore be conclusive of overweight and obesity" (p. 133). In contrast, Marques-Vidal et al. (2010) point out that persons with normal weight may have a bigger proportion of body fat at the expense of reduced muscle mass. This condition, low muscle mass accompanied by high fat mass, is known as sarcopenic obesity, and it is more common among women and children (Stokić, Micić, & Jorga, 2004). Gallagher et al. (2000), claim that about 10% of young women suffer from this condition. BF% in our study showed that there were no students within the obesity range, whereas BMI values for the same group of students placed 2.40% (3.94% male and 0.90% female) in the obesity category. The overweight category, as calculated by the BMI, consisted of 36.54% men and 7.69% women, while BF% calculation put 15.50% men and 11.20% women within the same category, which supports the notion of prevalence of sarcopenic obesity in young women (Ibid). In the category of normal weight according to BF%, there were 74.80% male students (as opposed to 58.88% by BMI), and 72.00% female students (81.73% by BMI). There were also significant changes in terms of underweight categorization. The BMI values put none of the male student in this category, whereas BF% put 9.70% of them. As for female students, 16.80% were underweight by BF%, while only 9.62% were underweight by BMI. Other authors came up with similar variations as well. Davar's (2015) distribution of participants on the basis of BMI showed that 2.08% men and 10.06% women were found to be underweight, while on the basis of BF%, 8.96% men and 21.53% of the women were found to be in the underweight category. The same trend continued across other categories – 58.84% of the male students had normal weight by BF% vs. 90.76% by BMI, while 23.07% of the female students had normal weight vs. 42.11% by BMI. For the overweight category, the values were the following: 18.73% vs. 24.26% for the male students (BF% vs. BMI), and 32.33% vs. 24.21% for the female students (BF% vs. BMI). Within the obesity range, men had 13.47% vs. 3.15% (BF% vs. BMI), while women had 23.07% vs. 23.42%. Yahia, Achkar, Abdallah, & Rizk (2008) reached similar results while examining eating habits and obesity among Lebanese university students.

Davra (2015) verified the most evident correlation between BF% and WHR BF% ($r = .90$, $p < .01$), which is congruent with the findings of our study (Table 1). None of the students from the University of Banja Luka were reported to be at risk of overweight/obesity according to the WHR method, which was also in line with the findings reached by the BF% method (Figure 2). This method, though being rather uncomplicated, has not been used much in the exploration of overweight/obesity phenomenon among university students, and it is yet to be verified as a valid one when it comes to measuring the college student population.

In the analysis of the differences among group means, ANOVA (Table 2) performed by the BF% method, a statistically significant difference was observed among male students and across faculties (field of study) at the $p \leq .01$ level, whereas in the female students, the difference was much less evident (Figure 1). The students of FPES recorded lower values

of BF%, probably due to physical activities demanded by the nature of their studies. The male students' of FM high values for BF% came as unexpected, as this population should be well aware of the risks overweight/obesity and excessive fat may have on health. The situation among the female students was reverse. The female students of FM had the lowest recorded BF% values, while a surprisingly high level of BF% was observed among female students of FPES.

When it comes to observing the obtained parameters across different years of study (freshmen vs. senior year students – Table 3), all the three observation methods showed lower measurement values in freshman students: BMI freshman students (M = 22.05, SD = 2.92) vs. BMI senior year students (M = 23.07, SD = 2.88); BF% freshman students (M = 19.94, SD = 5.93) vs. BF% senior year students (M = 20.42, SD = 6.07); and WHR freshman students (M = .77, SD = .07) vs. WHR senior year students (M = .78, SD = .08). Although distinctions across different years of study were more than evident, the analysis of variance did not establish statistically significant differences in the three measurement methods used for that purpose (Table 3). So the findings of this study are in line with many others, which find the freshman year as the critical period for weight gain in university students (Blondin et al., 2016; Crombie et al., 2012; Girz et al., 2013; Gunes et al., 2012; Kapinos et al., 2014; Nies et al., 2012; Smith-Jackson & Reel, 2012; Wansink et al., 2012). Racette et al. (2005) found a statistically significant difference in BMI between freshman and sophomore year students at $p \leq .01$ level, while Gropper et al. (2012) accounted for BMI and BF% statistically significant difference between freshman and senior year students.

The findings obtained by ANOVA in the categories of gender, faculty (field of study), freshman vs. senior year, were further confirmed by a canonical correlation (Table 4), with a statistical significance between male and female students at the $p \leq .01$ level, and a correlation quotient (R = .92) together with the chi-square test results ($\chi 2(3, N = 210) = 394.55$, $p < .01$) exhibiting very high values; 85.30% of the observed variance between faculties (fields of study) showed statistical significance at the $p \leq .01$ level, with an average correlation quotient (R = .31) and chi-square test ($\chi 2(6, N = 210) = 25.05$, $p < .01$), whereas 15% of the variance did not exhibit statistical significance (R = .14; $\chi 2(2, N = 210) = 3.82$, $p = .15$). And finally, there was no recorded statistically significant difference between the groups of freshman and senior year students (R = .16; $\chi 2(3, N = 210) = 5.09$, $p = .17$).

There are certain limitations to this study, and they are primarily related to a relatively small number of different faculties included in the research; however, the guiding principle in the process of selection of faculties has been diversity, so the total sample of tested students has included those that have physical activities as part of their daily routines (FPES), students that should be aware of proper dietary and exercise patterns (FM), and a group of students randomly selected – FE. An additional in-depth look into the population of students from the Faculty of Mechanical Engineering would be most beneficial, as their first year curriculum is the only one which includes physical education as a compulsory course. Recruitment of the eligible participants has also been one of the problems, as students from the University of Banja Luka did not show a high level of motivation to take part in this study. As a cross-sectional study which compares different population groups at a single point in time, this study fails to address the overweight/obesity issue in a longitudinal manner. The findings in this study suggest that an additional concern should be given to the nature of differences between male and female students. A longitudinal research, nested in the cohort study of the same group of students over a longer period of time, is clearly needed to determine the validity of changes among the observed parameters.

CONCLUSION

Almost one quarter of the tested students of the University of Banja Luka (24.80%) were reported being overweight and obesity (22.40% overweight and 2.40% obesity), with male overweight/obesity being more prevalent. Exactly 15.50% of the male students and 11.20% of the female students were categorized as normal weight. A total of 1.90% male students and 12.10% female students were observed to have visceral (abdominal) overweight/obesity. The obtained results urge us to focus attention in the direction of proper diagnostic (measurement) of overweight/obesity, particularly on the issue of body fat and its distribution. The greatest increases in overweight and obesity seem to occur in normal weight population – i.e. young students - which calls for a more detailed and in-depth analysis of the overweight and obesity of university students, together with the proper measurement and treatment of the issue. The findings of the present study indicate that compulsory lessons of physical education should be reintroduced in the curriculum of the first year, across faculties and departments at the University of Banja Luka.

REFERENCES

Adeboye, B., Bermano, G., & Rolland, C. (2012). Obesity and its health impact in Africa: A systematic review. *Cardiovascular Journal of Africa*, 23 (9), 512–521.

Anderson, D. A., Shapiro, J. R., & Lundgren, J. D. (2003). The freshman year of college as a critical period for weight gain: An initial evaluation. *Eating Behaviours*, 4 (4), 363–367.

Arroyo, M., Rocandio, A. M., Ansotegui, L., Herrera, H., Salces, I., &Rebato, E. (2004). Comparison of predicted body fat percentage from anthropometric methods and from impedance in university students. *British Journal of Nutrition*, 92, 827–832. doi: 10.1079/BJN20041273

Blondin, S. A., Mueller, M. P., Bakun, P. J., Choumenkovitch, S. F., Tucker, K. L., &Economos, C. D. (2016). Cross-sectional associations between empirically-derived dietary patterns and indicators of disease risk among university students. *Nutriens*, 8 (1), E3.

Bray, G. A. (2004). Classification and evaluation of the overweight patient. In: G. S. Bray and C. Bouchard (Eds.), Handbook of obesity: Clinical applications-2nd edition, (pp. 1–32). New York, NY: Marcel Dekker, Inc.

Bray, G. A., DeLany, J. P., Volaufova, J., Harsha, D. W., & Champagne, C. (2002). Prediction of body fat in 12-y-old African American and white children: evaluation of methods. *American Journal of Clinical Nutrition.*, 76 (5), 980–990.

Brown, P. (2009). Waist circumference in primary care. *Primary Care Diabetes*, 3 (4), 259–261.

Butler, S. M., Black, D. R., Blue, C. L., &Gretebeck, R. J. (2004), Change in diet, physical activity, and body weight in female college freshman. *American Journal of Health Behaviour*, 28 (1), 24–32.

Crombie, A. P., Liu, P. Y., Ormsbee, M. J., &Ilich, J. Z. (2012). Weight and body-composition change during the college freshman year in male general-population students and army Reserve Officer Training Corps (ROTC) cadets. *International Journal of Sport Nutition and. Exercise Metabolism*, 22 (6), 412–421.

Crnobrnja, V., Srdić, B., Stokić, E., Dujmović, F., & Andrejić, B. (2012). Analysis of obesity prevelances in students from Novi Sad. *Medicinski Pregled*, 65 (3-4), 133–137.

Culnan, E., Kloss, J. D., & Grandner, M. (2013). A prospective study of weight gain associated with chronotype among college freshmen. *Chronobiology International*, 30 (5), 682–690.

Davar, V. (2015). Body composition analysis of university students by anthropometry and bioelectrical impedance analysis. *International Journal of Medical, Health, Biomedical, Bioengineering and Pharmaceutical Engineering*, 9 (6), 492–496.

Dagan, S. S, Segev. S., Novikov; I., & Dankner, R. (2013). Waist circumference vs body mass index in association with cardiorespiratory fitness in healthy men and women: a cross sectional analysis of 403 subjects. *Nutrition Journal*, 12 (12), 1–8.

Deliens, T., Clarys, P., De Bourdeaudhuij, I., & Deforche, B. (2013). Weight, sociodemographics, and health behaviour related correlates of academic performance in first year university students. *Nutritional. Journal*, 12, 162.

Deurenberg, P., Yap, M., & van Staveren, W. A. (1998). Body mass index and percent body fat: a meta-analysis among different ethnic groups. *International Journal of Obesity Related Metabolic Disorders*, 22 (12), 1164–1171.

Deurenberg, P., Yap, M., Schmidt, G., van Staveren, W. A., & Deurenberg, P. (2000). The paradox of low body mass index and high body fat percent among Chinese, Malays and Indians in Singapore. *International Journal of Obesity Related Metabolic Disorders*, 24 (8), 1011–1017.

deVos, P., Hanck, C., Neisingh, M., Prakd, D., Groene, H., & Faas M. M. (2015). Weight gain in freshman college students and perceived health. *Prev Med Rep*, 2, 229–234.

Doak, C. M., Wijnhoven, T. M., Schokker, D. F., Visscher, T. L., & Seidell, J. C. (2012). Age standardization in mapping adult overweight and obesity trends in the WHO European Region. *Obesity. Review*, 13 (2), 174–191.

Durnin, J. V. G. A., & Womersley, J. (1974). Body fat assessed from the total body density and its estimation from skinfold thickness: measurements on 481 men and women aged from 16 to 72 years. *British Journal of Nutrition*, 32 (1), 77–97.

Dyson, R., & Renk, K. (2006). Freshmen adaptation to university life: depressive symptoms, stress, and coping. *Journal of Clinical Psychology*, 62 (10), 1231–1244.

Finlayson, G., Cecil, J., Higgs, S., Hill, A., & Hetherington, M. (2012). Susceptibility to weight gain. Eating behaviour traits and physical activity as predictors of weight gain during the first year of university. *Appetite*, 58 (3), 1091–1098.

Freedman, D. S., Ogden, C. L., & Kit, B. K. (2015). Interrelationships between BMI, skinfold thicknesses, percent body fat, and cardiovascular disease risk factors among U.S. children and adolescents. *BMC Pediatrics*, 15 (188), 1–9.

Freedman, D. S., &Sherry, B. (2009). The validity of BMI as an indicator of body fatness and risk among children. *Pediatrics*, 124 (Suppl 1), S23–34.

Gallagher, D., Heymsfield, S., Hero, M., Jebb, S., Murgatroyd, R., & Sakamoto, Y. (2000). Healthy percentage body fat ranges: An approach for developing based on body mass index. *American Journal of Clinical Nutrition*, 72 (3), 694–701.

Girz, L., Polivy, J., Provencher, V., Wintre, M. G., Pratt, M. W., Pancer, S., et al. (2013). The four undergraduate years. Changes in weight, eating attitudes, and depression. *Appetite*, 69, 145–150.

Gropper, S. S., Simmons, K. P., Connell, L. J., & Ulrich, P. V. (2012). Changes in body weight, composition, and shape: A 4-year study of college students. Appl. Physiol. *Nutrition & Metabolism.*, 37 (6), 1118–1123.

Gunes, F. E., Bekiroglu, N., Imeryuz, N., & Agirbasli, M. (2012). Relation between eating habits and a high bodymass index among freshman students: A cross-sectional study. *The Journal of the American College of Nutrition.*, 31 (3), 167–174.

Haidar, Y. M., & Cosman, B. C. (2011). Obesity epidemiology. *Colon and Rectal Surgery*, 24 (4), 205–210.

Harring, H. A., Montgomery, K., & Hardin, J. (2010). Perceptions of body weight, weight management strategies, and depressive symptoms among US college students. *Journal of American College Health* , 59 (1), 43–50.

Huang, T. T., Harris, K. J., Lee, R. E., Nazir, N., Born, W., & Kaur, H. (2016). Assessing overweight, obesity, diet, and physical activity in college students. *Journal of American College Health*, 52(2), 83–86.

Hull, H. R., Morrow, M. L., Dinger, M. K., Han, J. L., & Fields, D. A. (2007). Characterization of body weight and composition changes during the sophomore year of college. *BMC Womens Health*, 7, 21.

James, W. P. T., Jackson-Leach, R., Ni Mhurchu, C., Kalamara, E., Shayeghi, M, Rigby, N. J., et al. (2004). Overweight and obesity: High body mass index. In: M. Ezzati, A. D. Lopez, A. Rodgers, and C. J. L. Murray (Eds.), *Comparative quantification of health risks: Global and regional burden of disease attribution to selected major risk factors* (vol. 1, pp. 497–596). Geneva, Switzerland: World Health Organization.

Kapinos, K. A., Yakusheva, O., & Eisenberg, D. (2014). Obesogenic environmental influences on young adults: Evidence from college dormitory assignments. *Economics & Human Biology*, 12, 98–109.

Krebs, N. F., Himes, J. H., Jacobson, D., Nicklas, T. A., Guilday, P., & Styne, D. (2007). Assessment of child and adolescent overweight and obesity. *Pediatrics*, 120 (Suppl 4), S193–228.

Lim, S. S., Vos, T., Flaxman, A. D., Danaei, G., Shibuya, K, Adair-Rohani, H., et al. (2012). A comparative risk assessment of burden of disease and injury attributable to 67 risk factors and risk factor clusters in 21 regions, 1990–2010: A systematic analysis for the Global Burden of Disease Study 2010. *Lancet*, 380(9859), 2224–2260.

Lloyd-Richardson, E. E., Bailey, S., Fava, J. L., & Wing, R. (2009). Tobacco etiology research network (TERN): A prospective study of weight gain during the college freshman and sophomore years. Preventive Medicine, 48 (3), 256–261.

Luke, A., Durazo-Arvizu, R., Rotimi, C., Prewitt, T. E., Forrester, T., Wilks, R., et al. (1997). Relation between BMI and body fat in black population samples from Nigeria, Jamaica and the United States. *American Journal of Epidemiology*, 145 (7), 620–628.

Marques-Vidal, P., Pécoud, A., Hayoz, D., Paccaud, F., Mooser, V., Waeber, G., & Vollenweider, P. (2010). Normal weight obesity: Relationship with lipids, glycaemic status, liver enzymes and inflammation. *Nutrition, Metabolism and Cardiovascular Diseases.*, *2*0 (9), 669–675.

Mendez Hernandez, P., Dosamantes Carrasco, D., Lamure, M., Lopez Loyo, P, Hernandez Palafox, C., Pineda Perez, D, et al. (2010). Weightloss strategies among university students in Mexico. *International Journal of Public Health*, 55 (3), 221–225.

Mokdad, A. H, Serdula, M. K, Dietz, W. H., Bowman, B. A., Marks, J. S., &Koplan, J. P. (1999). The spread of the obesity epidemic in the United States, 1991–1998. *JAMA*, 282(16), 1519–1522.

Ng, M., Fleming, T., Robinson, M., Thomson, B., Graetz, N., Margono, C., et al. (2014). Global, regional, and national prevalence of overweight and obesity in children and adults during 1980–2013: a systematic analysis for the Global Burden of Disease Study 2013. *The Lancet*, 384(9945), 766-781.

Nies, M. A., Sun, L., Kazemi, D., Carriker, A., & Dmochowski, J. (2012). Relationship of body mass index to alcohol consumption in college freshmen. *The Scientific World Journal*, 2012, ID849018.

Ogden, C. L., Carroll, M. D., Kit, B. K., & Flegal, K. M. (2014). Prevalence of obesity and trends in body mass index among US children and adolescents, 1999-2010. *Journal of the American Medical Association.*, 307 (5), 483–490.

Peltzer, K., Pengpid, S., Samuels, T. A., Özcan, N. K., Mantilla, C., Rahamefy, O. H., et al. (2014). Prevalence of overweight/obesity and its associated factors among university students from 22 countries. *International Journal of Environmental Research and Public Health*, 11 (7), 7425–7441.

Popkin, B. M., Adair, L. S., & Ng, S. W. (2012). Global nutrition transition and the pandemic of obesity in developing countries. *Nutrition Reviews*, 70 (1), 3–21.

Racette, S. B., Deusinger, S. S., Strube, M. J., Highstein, G. R., & Deusinger, R. H. (2005). Weight changes, exercise, and dietary patterns during freshman and sophomore years of college. *Journal of American College Health*, 53 (6), 245–251. doi:10.3200/JACH.53.6.245-251

Racette, S. B., Deusinger, S. S., Strube, M. J., Highstein, G. R., &Deusinger, R. H. (2008). Changes in weight and health behaviors from freshman through senior year of college. *Journal of Nutrition Education and Behavior*, 40 (1), 39–42.

Ren, X., Chen, J., He, L., Jin, L., Tian, L., Lu, M., et al. (2015). Prevalence of underweight, overweight and obesity in university students from the region of Anhui (China). Nutr Hosp., 31 (3), 1089–1093.

Rolland-Cachera, M. F. (2011). Childhood obesity: Current definitions and recommendations for their use. *International Journal of Pediatric Obesity.*, 6 (5-6), 325–331.

Roger, V. L., Go, A. S, Lloyd-Jones, D. M., Benjamin, E. J., Berry, J. D., Borden, et al. (2012). Executive summary: Heart disease and stroke statistics - 2012 update: A report from the American Heart Association. *Circulation*, 125 (1), 188–197.

Rosamond, W., Flegal, K., Furie, K., Go, A., Greenlund, K., Haase, N, et al. (2008). Heart disease and stroke statistics – 2008 update: a report from the American Heart Association Statistics Committee and Stroke Statistics Subcommittee. *Circulation*, 117 (4), e25–e146.

Roth, J., Qiang, X., Marbán, S. L., Redelt, H., & Lowell, B. C. (2004). The obesity pandemic: Where have we been and where are we going? *Obesity Research*, 12 Suppl 2, 88S–101S.

Simić, S., Vasić, G., & Jakonić, D. (2010). Telesna visina, telesna masa i uhranjenost studenata Univerziteta u Novom Sadu [Body height, body weight and nutritional status in students of the University of Novi Sad]. *Medicina Danas*, 9 (4-6), 141–146. In Serbian

Smith-Jackson, T., & Reel, J. J. (2012). Freshman women and the "Freshman 15": Perspectives on prevalence and causes of college weight gain. *Journal of American College Health*, 60 (1), 14–20.

Stojanović, D., Višnjić, A., Mitrović, V., &Stojanović, M. (2009). Risk factors for the occurrence of cardovascular system diseases in students. *Vojnosanitski Pregled*, 66(6), 453–458.

Stokić, E., Micić, D., &Jorga, J. (2004). Gojaznost je bolestkoja se leči [Obesity is a disease to be treated]. Novi Sad, Serbia: Medicinski fakultet Univerziteta u Novom Sadu. In Serbian

Swinburn, B. A., Sacks, G., Hall, KD, McPherson, K., Finegood, D. T., Moodie, M. L., &Gortmaker, S. L. (2011). The global obesity pandemic: Shaped by global drivers and local environments. *The Lancet*, 378 (9793), 804–814.

Vadeboncoeur, C., Townsend, N., & Foster, C. (2015). A metaanalysis of weight gain in first year university students: is freshman 15 a myth? *BMC Obeity*, 2 (22), 1–9.

Vella-Zarb, R. A., &Elgar, F. J. (2009). The 'freshman 5': a meta-analysis of weight gain in the freshman year of college. *Journal of American College Health*, 58 (2), 161–166.

Von Ah, D., Ebert, S., Ngamvitroj, A., Park, N., & Kang, D. H. (2004). Predictors of health behaviours in college students. *Journal of Advanced Nursing*, 48 (5), 463–474.

Wansink, B., Cao, Y., Saini, P., Shimizu, M., & Just, D. R. (2012). College cafeteria snack food purchases become less healthy with each passing week of the semester. *Public Health and Nutrition*, 16 (7), 1291–1295.
Wardle, J., Haase, A. M., & Steptoe, A. (2006). Body image and weight control in young adults: International comparisons in university students from 22 countries. *International Journal of Obesity*, 30 (4), 644–651.
World Health Organization. (1995). Physical Status: The Use and Interpretation of Anthropometry. Technical Report Series no. 854. Geneva, Switzerland: World Health Organization.
World Health Organization. (1998). Programme of Nutrition, Family and Reproductive Health. Obesity. Preventing and Managing the Global Epidemic. Report of a WHO Consultation on Obesity. Geneva, Switzerland: World Health Organization.
World Health Organization. (2000). Obesity: Preventing and managing the global epidemic. Geneva, Switzerland: World Health Organization.
World Health Organization (2003). The European Health Report 2002. Copenhagen, Denmark: WHO Regional Office for Europe, WHO Regional Publications. Retrieved from: http:/www.who.dk/europeanhealth-report.
World Health Organization. (2008). Waist circumference and Waist-hip ratio, Report of a WHO Expert Consultation. Geneva, Switzerland: World Health Organization.
World Health Organization (2014a). Obesity and overweight (Factsheet). Retrieved from: http://www.who.int/mediacentre/factsheets/fs311/en.
World Health Organization (2014b). The international classification of adult underweight, overweight and obesity according to BMI. Retrieved from: http://apps.who.int/bmi/index.jsp?introPage=intro_3.html.
Yahia, N., Achkar, A., Abdallah, A., &Rizk, S. (2008). Eating habits and obesity among Lebanese university students. *Nutrition Journal*, 7 (32), 1–13.

MEĐUSOBNA POVEZANOST IZMEĐU INDEKSA TELESNE MASE, PROCENTA TELESNE MASNOĆE I ODNOSA OBIMA STRUKA/KUKOVA NA PRIMERU STUDENATA RAZLIČITIH STUDIJSKIH PROGRAMA UNIVERZITETA U BANJOJ LUCI

Epidemija predgojaznosti i gojaznosti uočava se kod svih starosnih grupa uključujući i studente, a u mnogobrojnim istraživanjima identifikovan je brucoški period na univerzitetu kao period od posebno visokog rizika za dobijanje u telesnoj masi. Cilj ovog istraživanja bio je da se utvrdi stepen uhranjenosti i učestalost pojave predgojaznosti i gojaznosti kod studenata Univerziteta u Banjoj Luci korištenjem tri nezavisne metode procene kao i da se ustanovi da li postoje statistički značajne razlike između grupa po polu, fakultetima ili godinama studija. Ispitivanu grupu činilo je ukupno 210 studenata Univerziteta u Banjoj Luci, prosečne starosti 21.94±2.73 godina. Ispitanicima su određeni: Body Mass Index, Percent Body Fat i Waist-to-Hip Ratio. Prema Body Mass Index ukupno 22.40% studenata bilo je predgojazno, dok je 2.40% njih bilo gojazno. Veća učestalost predgojaznosti i gojaznosti nađena je kod ispitanika muškog pola. Druge dve metode, Percent Body Fat i Waist-to-Hip Ratio, pokazale su drugačije rezultate prvenstveno u pravcu smanjenja broja studenata u kategorijama predgojaznosti i gojaznosti štogovori u prilog činjenici da procena uz pomoćBody Mass Index nije pouzdana za pojedine populacione grupe, prvenstveno za populaciju mladih. Razlike među grupama su ustanovljenje po polu i donekle među fakultetima dok razlika između brucoša i studenata viših godina studija nije statistički značajna. Dobijeni rezultati ukazuju na potrebu sveobuhvatnog, detaljnog i pravovremenog proučavanja, dijagnostikovanja i lečenja predgojaznosti i gojaznosti u populaciji studenata.

Ključne reči: *BF%, BMI, predgojaznost, gojaznost, studenti, WHR*