

ANTHROPOMETRIC CHARACTERISTICS, NUTRITIONAL STATUS AND DIETARY HABITS IN A COLLEGE POPULATION

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ANTROPOMETRIJSKE KARAKTERISTIKE, NUTRITIVNI STATUS I NAVIKE U ISHRANI STUDENTSKE POPULACIJE

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ABSTRACT

The college student population is prone to irregular food intake and the excessive intake of carbohydrates and snacks. The aim of this study is to investigate the relationships among anthropometric characteristics, dietary habits and nutritional knowledge in female students attending a healthcare college.

Our investigation enrolled 100 college students at the High Health School of Professional Studies in Belgrade, 19-30 years old, who underwent anthropometric measurements and an investigation by questionnaire of their nutritional knowledge as well as recorded a 7-day food diary. The results were interpreted in relation to their location of nutritional intake.

The majority of students showed good nutritional knowledge. Of the total population, 83% were of normal weight, 11% were overweight, and 5% were underweight. The average Body Mass Index values, as well as body fat percentage, were similar regardless of the type of eating location, but all overweight and obese students were recorded in the groups that ate in the student dining facility and that prepared food and ate by themselves. Students who ate with their families ate significantly fewer fats and proteins but significantly more carbohydrates compared to students in the other two groups. Higher fat intake and snack consumption are significantly related to an increased percentage of body fat. Fruit intake is inversely related to body fat percentage.

Despite the relatively low prevalence of overweight, obesity, and underweight in the investigated population, the given results indicate that students may benefit from health promotion activities, increased knowledge and improved eating habits. This is especially important considering that they are future health professionals.

SAŽETAK

Studentska populacija je sklona nepravilnoj ishrani i prekomernom unosu ugljenih hidrata i grickalica. Cilj studije je da se ispita povezanost između antropometrijskih karakteristika, navika u ishrani i znanja o ishrani i namirnicama u populaciji studentkinja Visoke zdravstvene škole.

Ispitivanjem je obuhvaćeno 100 studentkinja Visoke zdravstvene škole strukovnih studija u Beogradu, uzrasta 19-30 godina. Nakon antropometrijskih merenja, upitnikom je ispitano njihovo znanje o ishrani i namirnicama, a unos namirica je praćen kroz sedmodnevni dnevnik ishrane. Rezultati su tumačeni prema načinu organizacije njihove ishrane.

Većina studentkinja je pokazala dobro znanje o ishrani i namirnicama. Normalno uhranjenih je bilo 83%, sa prekomernom telesnom masom 11%, a pothranjenih 5%. Prosečne vrednosti Indeksa telesne mase, kao i procenta telesne masti bile su slične, bez obzira na način organizacije ishrane, ali su sve studentkinje sa prekomernom telesnom masom i gojaznošću pripadale grupama koje se hrane u studentskoj menzi, ili koje same organizuju ishranu. Studentkinje koje su se hranile u roditeljskom domaćinstvu unosile su značajno manje masti i belančevina, ali značajno više ugljenih hidrata u odnosu na ostale grupe. Ove studentkinje su u isto vreme unosile značajno manje obroka, manje voća i mleka i mlečnih proizvoda. Veći unos masnoća i grickalica pokazuje značajnu pozitivnu povezanost sa povećanim procentom telesne masti, a unos voća negativnu povezanost.

Uprkos relativno maloj prevalenci prekomerne telesne mase, gojaznosti i pothranjenosti u ispitivanoj populaciji, rezultati ukazuju na to da bi studentkinjama koristili preventivni programi usmereni na smanjenje učestalosti gojaznosti, kao i na poboljšanje znanja o ishrani, pogotovo što se školuju za zdravstvene radnike.

Key words: Nutrition, students, anthropometry

Ključne reči: Ishrana, Studenti, Antropometrija



INTRODUCTION

Inadequate nutrition is often related to health problems that lower the quality of life and significantly influence morbidity and total mortality. Food is an everyday necessity. Adequate nutrition has become one of the most important issues of modern society.

Economic development, industrialization and urbanization, together with a sedentary lifestyle, have led to changes in dietary habits in most of the world population. These changes have contributed to an increase in body mass in all age groups, leading to a global crisis with significant consequences for world health (1). Nutrition is related to health, creativity, efficiency, cognitive functioning, and well-being.

Obesity rates are increasing regardless of socioeconomic status but are more pronounced in populations with lower income and lower education (2,3). This observation is expected because the cheapest foods are rich in fat and sugar but poor in nutritive value (4).

According to the World Health Organization, non-communicable chronic diseases are the leading cause of death (60-80%) and disability (70%) in the world, while the leading risk factors are inadequate nutrition and sedentary lifestyle (6).

An analytical health study was conducted in a Serbian population in 2006 (7). The results from the study indicate that more than half of adults in Serbia (54,5%) have a high body mass—36,2% are overweight and 18,3% are obese. The average Body Mass Index (BMI) values are 26,1 kg/m² in men and 25,9 kg/m² in women. In children and adolescents (aged 7-19), there is a significant increase in the percentage of overweight and obese individuals—from 12,6% in 2000 to 18% in 2006. Regular monitoring of nutritional status in Serbia only occurs among school children and partly with older students (8).

Results from the Behavioral Monitoring of Risk Factors questionnaire indicate that the greatest increase in obesity is observed between 18 and 29 years, during the transition from adolescence to adulthood. The transition from high school to college is critical, and the risk of weight gain is significantly higher than during other significant life stages (9,10).

However, this life stage is favourable for the establishment of positive habits in nutrition and physical activity. The youth population represents a group susceptible to dietary interventions through education and the promotion of healthy behaviours and lifestyles, which may influence their future health.

Nutritional knowledge, dietary habits, nutritional status, and physical activity of the student population are the subjects of numerous studies (11-13). The results indicate that insufficient knowledge, poor food choices, increased caloric intake, stress, insufficient physical activity and sleep impairment, among other factors, may contribute to the increase in obesity among students.

During this period, some students leave the parental home and starting to live alone and maintain their own

household, including food preparation, which represents a major challenge.

Obesity, other than being a disease itself, is related to cardiovascular diseases, diabetes, and metabolic impairment (14). The contemporary definition of obesity specifies an increase in fat mass, instead of in total body weight, which leads to health problems and the development of complications as a consequence of the imbalance between energy intake and energy expenditure (1,17).

In most cases, total body weight is directly related to body fat mass, but sometimes sophisticated diagnostic procedures indicate exceptions (16), i.e., individuals with normal body weight may actually have a fat mass above referent values. This type of obesity is known as *normal body weight obesity* or *sarcopenic obesity*, considering the increase in total body weight due to muscle mass reduction (17). This type of obesity is also related to numerous risk factors for the development of mild complications. Sarcopenic obesity is more often present in women and children (16). According to Gallagher, et al., this type of obesity is registered in 10% of young women (18). Obesity at a young age is related to increased risk from early onset of complications, which requires proper diagnostics and treatment (16).

The aim of this study is to investigate the relationship between anthropometric characteristics, dietary habits and nutrition knowledge in a population of female nursing students.

SUBJECTS AND METHODS

This study enrolled 100 female nursing students in Belgrade, aged 19-30 years. The students were divided in three groups according to their eating location and arrangement: the first group (35 students) ate at home with their families, the second group (33 students) ate on their own, while the third group (32 students) ate in the student dining facility. The investigation was conducted in March and April 2014.

Nutritional knowledge was investigated by questionnaire (19), consisting of four groups of questions: questions about experts' recommendations, food classification and categorization, proper combinations of foods, and relationships between diseases and inadequate nutrition. The first group of questions was weighted at 10 points each, while the three other groups were weighted at 30 points each.

The nutritive values of the students' 7-day food intake were calculated from data obtained from the students' 7-day food intake diaries (20). Students recorded every food item and the amount they took *per os* every day of the week. Obesity was categorized according to the World Health Organization Obesity Classification (21). Body composition was determined by bioelectrical impedance analysis (InBody 7200, South Korea). The observed parameters were body height, body weight, BMI, and body fat percentage.

**Table1.** Age structure of the examined students

Age (yrs)	Frequency table	
	Count and %	Cumulative count and %
19	37	37
20	27	64
21	10	74
22	7	81
23	7	88
24	4	92
25	1	93
27	1	94
28	3	97
29	1	98
30	2	100

Data were analysed by regression and correlation. Data were presented as the means \pm standard deviation. The normality of distribution was tested by using the Kolmogorov-Smirnov test. The significance of difference between groups was tested by analysis of variance and the Kruskal-Wallis test. The correlations between parameters were tested by Spearman's correlation analysis. Statistical analyses were performed using the software package Statistica.10, and significance was accepted at $p < 0,05$.

RESULTS

A total of 100 female students were randomly chosen from a larger population of nursing students. They were divided into three groups depending on their eating loca-

tion and arrangement. The groups did not differ regarding body height, age, income and socio-economic characteristics. The analysis of age showed that 93% of students were 25 years old or younger, and most students were between 19 and 20 years old.

According to results from the nutritional knowledge questionnaire, we classified students into three categories by score: 4% of students were categorized as excellent (66-100 points), 91% as good (30-65 points) and 5% as unsatisfactory (less than 30 points). The average number of points in the unsatisfactory group was 21, with very large variations in the number of correct answers, as indicated by a coefficient of variation 31%. The majority of students showed good nutritional knowledge, with the average score of 47 points. The average number of correct answers in the excellent group was 69. The levels of nutritional knowledge were similar in all three investigated groups, regardless of eating location and arrangement.

The anthropometric characteristics of the three groups of students are shown in Tables 2 and 3.

Among all of the students, 83% were of normal weight (BMI between 18,5 and 24,9 kg/m²), 11% were overweight (BMI between 25 and 29,9 kg/m²), 5% were underweight (BMI under 18,5 kg/m²), while one was obese, with a BMI above 30 kg/m².

Average values of body height, body weight, BMI and body fat percentage were similar in all of the investigated groups, regardless of eating location and arrangement ($p > 0,05$). However, all overweight students were registered in the group that eats on their own, and the student classified as obese was registered in the group that eats at the student dining facility. In these two groups, we also registered underweight students. All of the students who ate with their families had normal BMIs.

Body fat percentage, as an anthropometric characteristic, showed much more variability in the investigated population (Table 4).

Table 2. Anthropometric characteristics (means \pm standard deviations) in three group of students

Groups	Body height (cm)	Body weight (kg)	BMI (kg/m ²)	Body fat (%)
I	166,00 \pm 6,94	60,38 \pm 8,02	21,73 \pm 1,87	26,60 \pm 4,74
II	166,00 \pm 6,14	59,50 \pm 10,02	21,56 \pm 3,07	28,73 \pm 6,90
III	166,45 \pm 7,40	58,23 \pm 19,70	22,12 \pm 4,22	29,04 \pm 15,64
Total	166,28 \pm 6,77	59,40 \pm 13,30	21,80 \pm 3,15	27,09 \pm 10,08

I eating with their families

II eating on their own

III eating in student dining facility

Table 2. Statistical BMI data for all three groups

Groups	Mean (kg/m ²)	Interval of variation		SD	Coefficient of variation
		Minimal	Maximal		
I	21,73	18,50	24,70	1,87	8,62
II	21,56	17,50	29,80	3,07	14,26
III	22,12	17,50	38,10	4,22	19,08
Total	21,80	17,10	38,10	3,15	14,23



Table 4 Statistical body fat percentage data for all three groups

Groups	Mean (%)	Interval of variation		SD	Coefficient of variation
		Minimal	Maximal		
I	26,60	16,80	35,00	4,74	17,82
II	28,73	11,40	40,00	6,90	26,83
III	29,04	11,50	49,09	15,64	53,87
Total	27,09	11,40	49,09	10,08	37,22

The average value for body fat percentage among all groups was 27,09% (ranging from 11,40% to 49,09%). The largest average value was registered in group that ate in the student dining facility (29,04%). Statistically, this parameter is the most stable in students who ate with their families, with the lowest SD (4,74) and coefficient of variation (17,82). Stability is three-fold times lower in group that ate at the student dining facility (SD=15,64, CV=53,87). However, the results from the Kruskal-Wallis test showed that the observed differences in average values of body fat percentage between the three groups were not statistically significant ($H=0,4704024$; $p=0,7904$).

The nutritive values of dietary intake were calculated based on students' self-reported 7-day diaries of food intake. Total calories, amounts of fat, carbohydrates, and proteins were calculated. The average nutritive values of each group's daily dietary intake are shown in Table 5.

The average daily intake of fats among all groups was $64,06 \pm 18,1$ g, which represents 27,34% of total daily energy intake. However, when observed separately, the daily intake of fats in students who ate with their families was lower than in the other two groups (by 10 g and 20 g, respectively). The highest intake of fat was recorded in the group that ate at the student dining facility ($73,13 \pm 17,0$ g, or 29,99% of total daily energy intake). Similar trends were observed in daily protein intake as well as in total energy intake. Quite the opposite trend was observed for daily carbohydrate intake: the highest intake was recorded

in the group that ate with their families ($311,27 \pm 43,7$ g, i.e., 62,40%), while the lowest intake was recorded in the group that ate at the student dining facility ($291,77 \pm 30,2$ g, or 52,75%). Students who ate at the student dining facility ate an average of $2206,97 \pm 277,8$ kCal, which is almost 215 kCal higher than the group that ate with their families.

According to the ANOVA results, the differences between groups are statistically significant regarding fat intake ($F=10,3421$; $p=0,000085$), protein intake ($F=42,48007$; $p=0,000000$), and total energy intake ($F=6,327237$; $p=0,002613$). Post-hoc analysis, performed using Fisher's least significant difference (LSD) test, determined that students who ate with their families ate significantly less fat than the other two groups ($p=0,000017$), as well as protein ($p=0,00000$). However, although the ANOVA did not show significant differences between groups regarding carbohydrate intake, the post-hoc LSD test indicated that intake in the group that ate with their families was significantly higher than that of the other two groups ($p=0,028795$). Observed differences in the intake of fats, proteins and carbohydrates generated significant differences in total energy intake, with the lowest average energy intake recorded in students who ate with their families.

In addition to nutritive values, we investigated the number of meals and servings of fruit per week, and the number of days in one week when milk and other dairy products, and snacks were consumed. Average values of the investigated parameters are shown in Table 6.

Table 5. Average nutritive values of daily dietary intake in three investigated groups

Group		Nutritive values			
		Fats	Carbohydrates	Proteins	Total energy value
I	g	54,73 \pm 17,9	311,27 \pm 43,7	63,25 \pm 19,8	
	%	24,91	62,40	12,70	
	kCal	509,56 \pm 166,5	1276,21 \pm 179	259,33 \pm 81,3	1990,67 \pm 297,0
II	g	64,98 \pm 14,7	306,46 \pm 31,6	92,59 \pm 13,3	
	%	26,97	56,06	16,94	
	kCal	604,31 \pm 136,4	1256,49 \pm 129,7	379,62 \pm 54,6	2181,06 \pm 249,9
III	g	73,13 \pm 17	291,77 \pm 30,2	95,42 \pm 13,3	
	%	29,99	52,75	17,25	
	kCal	680,11 \pm 158,3	1196,26 \pm 124	391,22 \pm 55,3	2206,97 \pm 277,8
Total	g	64,06 \pm 18,1	303,44 \pm 36,5	83,23 \pm 21,6	
	%	27,34	57,06	15,65	
	kCal	595,20 \pm 168,4	1244,10 \pm 149,7	341,24 \pm 88,7	2122,71 \pm 288,3



Table 6. Average values of parameters

Groups	Meals (number per week)	Fruit servings (number per week)	Milk and dairy (number of days per week)	Snacks (number of days per week)
I	19	4	3	3
II	20	6	4	2
III	21	6	4	3
Total	20	5	4	2

The Kruskal-Wallis test indicates that the observed differences in number of meals are statistically significant ($H=42,076$; $p=0,0000$), as well as in number of fruit servings, and the number of days per week that milk and dairy products and snacks are consumed, ($H=26,94012$; $p=0,0000$, $H=9,733827$; $p=0,0077$, and $H=6,514935$; $p=0,0385$, respectively). Students who ate with their families consumed significantly fewer meals, fewer servings of fruit, and fewer milk and dairy products than the other two groups.

To investigate the relationship between percentage of body fat and intake of particular foods, Spearman's correlation was tested. The results are shown in Table 7.

The results of the correlation analysis indicate that percentage of body fat significantly correlates to fat intake and consumption of fruits and snacks. Higher fat intake leads to a significant increase in body fat percentage. Greater snack consumption is also directly related to an increase in body fat, and the relationship is even stronger than that with fat consumption. Fruit intake, however, is inversely related to body fat—the more fruit consumed, the lower the percentage of body fat.

DISCUSSION

The results obtained in our study revealed the level of knowledge about nutrition, nutritive status, and nutritional habits in a population of female nursing students.

Regarding their age, the investigated group was homogenous, with the majority (93%) of students aged 19-25 years. The majority of subjects (91%) showed a favourable amount of knowledge about nutrition. The best nutrition questionnaire results were achieved in the categorization of food as well as in recognizing the diseases related to inadequate nutrition. Slightly less knowledge was observed regarding experts' recommendations, and the worst results were achieved in the identification of the proper combinations of foods. These results were expected, considering the type of school the students attend and their previous medical education.

An analysis of the anthropometric parameters indicates that 83% of the students had normal BMI values, while 11% were overweight, 1% was obese, and 5% were underweight. These results are in accordance with the survey conducted by Simic, et al. (22). They found that population of female students in the Faculty of Sports Education had an average BMI value of $21,26 \text{ kg/m}^2$, which is similar to our results ($21,80 \text{ kg/m}^2$). Like our subjects, those students were mostly of normal weight (84,85%), with 9,09% overweight, and 6% underweight. Those students were physically active and also had good knowledge regarding nutrition. A study by Lavery, et al. showed that students with normal weight also had better nutrition and achieved better results in tests investigating knowledge and opinions regarding nutrition (23). In a survey conducted at the University of Novi Sad (24), 78% of female students were of normal weight, which is less than in our investigation. The percentage of overweight and obese students was lower (7,55%), while the percentage of underweight was two-fold higher (12,42%) than in our investigations. Considering the relatively similar population investigated in both studies (student status, same age, and similar socio-economic factors), the observed differences may originate from the methodological limitations of our study.

The average nutrition status varies depending on race, ethnicity and culture. Female students in Thailand (25) have an average BMI of $19,8 \text{ kg/m}^2$, which is lower than in our study. However, according to our results, the nutritional status, presented as BMI, does not depend on the type of eating location or arrangement. However, body fat percentage showed much more variability and instability. The average value of body fat percentage of all investigated students was 27,09%, which is slightly above the upper normal range (15-25%). The group with the highest percentage of body fat was the group that ate at the student dining facility, with an average value was 29,04%. The only obese student belonged to this group, and her body fat percentage was 49,09%. These results are in accordance with the distribution of obesity according to BMI.

Table 7. Spearman's correlation analysis

Pair of variables	Spearman Rank Order Correlation			
	Valid N	Spearman R	T(N-2)	P
Body fat (%) / Fruit servings per week	100	-0,280779	-2,89608	0,00466
Body fat (%) / Days when snacks are consumed	100	0,685910	9,33117	0,00000
Body fat (%) / Fat intake	100	0,539575	6,34432	0,00000



The nutritive and energetic characteristics of the students' 7-day food intake results were calculated on the basis of the Nutrition and food intake plan (20) and the nutritional requirements for the participating population of students. Nutritive value was estimated based on reported content of fats, carbohydrates, proteins and total energetic value in the daily food intake. The average daily intake of fats among all students was 64 g, which is 27,34% of total energy intake. This value is within the recommended range (10-30%). However, when analysed separately for each group, the average daily intake of fats showed great differences—24,91% in the group that ate with their families, 26,97% in group that ate on their own, and 29,99% in group that ate in the student dining facility.

In students who ate at the student dining facility, we observed the greatest intake of fats ($73,33 \pm 17$ g), and the greatest intake of proteins: $95,42 \pm 13,5$ g, i.e., 17,25%, which is more than the recommended percentage of 10-15%. The greatest average value of daily total energy intake was recorded in this group too—2206,97 kCal. The intake of fats in the first group was statistically significantly lower than that of other two groups, which ate similar amounts of fats. The daily menu of students who ate with their families contained 10 g less fat than that of the group that ate by themselves and 20 g less fat than that of the group that ate at the student dining facility.

The average intake of proteins was also lowest in students who ate with their families, with a statistically significant difference compared to the other groups ($p < 0,05$). Protein intake was similar in the other two groups.

We also observed a statistically significant difference in carbohydrate intake between groups. Post-hoc analysis revealed that the difference occurred between students who ate with their families (where we recorded highest carbohydrate intake) and the group that ate at the student dining facility ($p < 0,05$).

The observed differences in the intake of fats, proteins, and carbohydrates between the investigated groups lead to differences in total energy intake. The total energy intake in students who ate with their families was significantly lower than that of the other groups ($p < 0,05$).

Considering the fact that all overweight and obese students were recorded in the groups that ate on their own and at the student dining facility, we may hypothesize that the nutritional style of the investigated population can be assessed by the anthropometric parameters of nutritional status—body weight, BMI, and percentage of body fat.

These results are expected, considering their busy daily schedules with lectures and practical work all day, as well as the lack of time and finances needed for organized physical activity. Leaving the parental home and adjusting to a new environment and obligations may impose substantial stress, which may reflect on eating habits, leading to an increase in body weight (11,12,13). This effect is in accordance with our results given that we recorded overweight and obese students only in groups that lived apart from their families, i.e., came from other towns.

An increase in obesity among the student population has been recorded in numerous investigations all around the world, indicating that the biggest increase is occurring between 18-29 years, during the transition from adolescence to adulthood, which coincides with the attendance of college and university (9,10).

However, the fact that students who ate with their families were not overweight/obese does not mean that they had better nutrition. For example, they tended to eat foods poor in proteins and rich in carbohydrates. Data obtained from their nutritional diaries indicate that they usually ate products from bakeries for breakfast and often for lunch as well. Together with a high intake of snacks and a low intake of fresh fruits, these habits lead to the sarcopenic type of obesity in which the percentage of body fat is increased without an increase in BMI, which is actually present in all three investigated groups of students.

Our results confirmed that insufficient knowledge, insufficient intake of foods with high nutritive value, increased energy intake, stress, and a lack of physical activity, among other factors, may be related to obesity in the student population, which is in accordance with other surveys (11,12,13).

CONCLUSION

Despite the relatively low prevalence of overweight, obesity, and underweight in the investigated population, our results indicate that students may benefit from health promotion activities directed at decreasing the incidence of obesity, as well as increasing the knowledge of and improve eating habits. During the last decade, the Republic of Serbia has been exposed to social and cultural changes related to economic transitions, which has inevitably led to major changes in nutrition, specifically the eating styles present in Western Europe. The consequences of such a nutritional transition are poor knowledge regarding nutrition and making poor food choices, leading to overweight/obesity, which was observed in this study.

Methodological limitations: Limitations in the interpretations of our results are derived from the relatively small number of subjects and the fact that all of the subjects were female.

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