NUTRITIONAL STATUS DISORDERS IN STUDENT POPULATION

Djordje Stevanovic[1,2], Mina Poskurica[1,2], Jovan Jovanovic[2], Miodrag Sreckovic[2], Vladimir Zdravkovic[1,2], Mileta Poskurica[1], Vladimir Miloradovic[1,2] and Nela Djonovic[1]

[1]*University of Kragujevac, Faculty of Medical Sciences, Kragujevac, Serbia*

[2]*Clinic of Cardiology, Clinical Center Kragujevac, Serbia*

POREMEĆAJ STATUSA UHRANJENOSTI U STUDENTSKOJ POPULACIJI

Đorđe Stevanović[1,2], Mina Poskurica[1,2], Jovan Jovanović[2], Miodrag Srećković[2], Vladimir Zdravković[2], Mileta Poskurica[1], Vladimir Miloradović[1,2] i Nela Đonović[1]

[1]*Univerzitet u Kragujevcu, Fakultet medicinskih nauka, Kragujevac, Srbija*

[2]*Klinika za kardiologiju, Klinički Centar Kragujevac, Srbija*

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ABSTRACT

Obesity is a global health problem associated with numerous pathological conditions. Unhealthy eating habits and the lack of regular physical activity are considered the most common cause of disordered nutritional status. The aim of the research was to determine the nutritional status in student population and the predictors which determine this condition. The cross-sectional study was conducted on 262 students of the Faculty of Medical Sciences in Kragujevac (130 males and 132 females). Body weight and height, body mass index (BMI) and visceral fat (VF) were measured. Each respondent completed a specially designed questionnaire considering sociodemographic data, eating habits and physical activity. The majority of students have normal BMI values (75.6%), 5.3% were classified as underweight, 14.9% as overweight and 4.3% as obese. Normal VF values were found in 93.1% of subjects, while high in 5.7% and very high in 1.1%. A statistically significant difference in BMI and VF values was found between male and female gender (24.41 vs. 21.05, Sig = 0.000 and 5.47 vs. 3.07, Sig = 0.000, respectively), as well as between students of the first 4 and the last 2 years of study (Sig = 0.019 and 0.000 respectively). Unhealthy eating habits, such as the consumption of sweets, snacks, fast foods and white bread, and the absence of regular physical activity were statistically more present in overweight/obese respondents. Given the significant presence of pre-obesity/obesity in the examined population, corrective measures should be taken in this population in order to avoid a major health problem in the future.

Keywords: *Obesity, nutrition, student population*

SAŽETAK

Gojaznost predstavlja globalni zdravstveni problem, povezan sa brojnim patološkim stanjima. Nezdrave navike u ishrani i nedostatak redovne fizičke aktivnosti smatraju se najčešćim uzrokom gojaznosti. Cilj istraživanja bio je utvrditi nutritivni status studentske populacije i prediktore koji na njega utiču. Studija preseka sprovedena je na 262 studenta Fakulteta medicinskih nauka u Kragujevcu (130 muškog i 132 ženskog pola), podeljenih u 6 uzrasnih kategorija, shodno godini studija. Ispitanicima su mereni telesna težina i visina, indeks telesne mase (ITM) i zastupljenost visceralnih masti (VM). Svaki ispitanik je popunio specijalno dizajnirani upitnik koji se ticao sociodemografskih podataka, navika u ishrani i fizičke aktivnosti. Većina studenata je imala normalne vrednosti ITM (75,6%), dok je 5,3% klasifikovano kao pothranjeno i 14,9% kao predgojazno, a 4,3% kao gojazno. Normalne vrednosti VM nađene su u 93,1% ispitanika, visoke u 5,7%, a veoma visoke u 1,1%. Statistički značajna razlika u vrednostima ITM i VM nađena je između muškog i ženskog pola (24,41 vs. 21,05, Sig = 0,000; 5,47 vs. 3,07, Sig=0,000), kao i između studenata prve 4 i poslednje 2 godine studija (Sig=0,019, odnosno 0,000). Nezdrave navike u ishrani, poput konzumacije slatkiša, grickalica, brze hrane i belog hleba, kao i odsustvo redovne fizičke aktivnosti, statistički značajno su bili prisutniji među predgojaznim/gojaznim ispitanicima. Obzirom na značajno prisutvo predgojaznosti/gojaznosti u ispitivanoj populaciji, potrebno je preduzeti korektivne mere u ovoj populaciji, kako bi se izbegao veliki zdravstveni problem u budućnosti.

Ključne reči: *gojaznost, ishrana, studentska populacija*

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Corresponding author:
Djordje Stevanovic
University of Kragujevac, Faculty of Medical Sciences, Kragujevac, Serbia
Clinic of Cardiology, Clinical Center Kragujevac, Serbia
Tel.: +381606969077
E-mail: djordje.stevanovic.kg@gmail.com

INTRODUCTION

Proper nutrition and regular physical activity are one of the basic prerequisites for a healthy life. The basic principles of healthy nutrition are moderation, meal regularity and variety in choice of nutrients (expressed through the World Health Organization ("WHO") pyramid), with regular physical activity. Violation of these principles over a longer period of time leads to nutritional status disorders, in the direction of malnutrition or obesity, and, consequently, to potential health disorders. Obesity, a nutritional status disorder significantly more common than malnutrition, is often defined "as an abnormal or excessive fat accumulation in adipose tissue, to the extent that health may be impaired" (1, 2).

In addition to energy imbalance, there are many other reasons that can lead to the development of obesity, such as physiological (pregnancy, menopause), pathological (chromosomal disorders, metabolic diseases, gestational diabetes, some tumors, etc.) and medicamentous (antipsychotics, antidepressants, antiepileptics, etc.) (1-4) are.

The great importance of obesity lies in its prevalence, which is increasing worldwide in alarming rate, in both developed and underdeveloped countries (4). Since 1980 worldwide obesity has more than doubled. In 2014 study more than 1.9 billion adults (39% of global population) were overweight. Of these over 600 million (13% of global population) were obese. In 2014 more than 41 million children under the age of 5 were overweight or obese (3). In study conducted in Serbia in 2006, 55.7% of population was overweight with 19% being obese (5).

The fact that worries is the increase of obesity in the category of young adults and students. Two studies conducted on USA college students have shown that 3 of 10 college students were overweight or obese (6, 7). Aside from America, the high prevalence of obesity in young adults is also present in other countries around the world, more common in male subgroup (8-12). Although it would be expected that obesity is not so much present among medical students, due to better knowledge in terms of harmfulness and consequences of obesity, studies have shown that even this population of students is not an exception, with overweight also being more present in male population (13-17). Obesity is a serious health problem of modern age. The reasons are, beside its omnipresence, serious complications and diseases associated with obesity. It has been shown that obesity is an important risk factor for many diseases: cardiovascular (hypertension, acute coronary syndrome, stroke), respiratory (obstructive sleep apnea), gastrointestinal (fatty liver, gallbladder, gout), metabolic and endocrine disorders (diabetes mellitus type 2, hypercholesterolemia, metabolic syndrome X), some types of carcinoma, negligible and underestimated psychological and self-esteem disorders and many others (2-4, 18, 19). In addition to this, Blackburn GL et al. study has shown that obesity is related with premature mortality (20). For these reasons, adequate classification of obesity is of great importance because it would help us to timely detect obesity, degree of risk and, consequently, give us a better chance to prevent comorbidities. Although there are several obesity classifications, the most commonly used is the one based on Body Mass Index (BMI), proposed by the WHO. Given the ease of performance and satisfactory reliability, BMI can be used as a predictor of the population and large groups (3).

THE AIM OF THE PAPER

The aim of the research was to determine the nutritional status in student population and the predictors which determine this condition.

PATIENTS AND METHODS

Sample

The study was conducted on students of medicine at the Faculty of Medical Sciences in Kragujevac, from September to October 2016, as a descriptive cross-sectional study. The study involved 262 students (130 male and 132 female) from all 6 years of study, with approximately equal gender distribution in each category: 1st year - 30 (14; 16); 2nd year - 47 (23; 24); 3rd year - 37 (19; 18); 4th year - 49 (25; 24); 5th year - 51 (26.25); 6th year - 48 (23; 25). The minimum number of respondents calculated by G-Power software for α err prob = 0.05; power (1-β err prob) = 0.95; was 220. Excluding factors were: pregnancy, spine deformities and conditions that are reliably known to be a limitation for using BMI as a tool of assessing nutritional status.

Measurements

All students were measured:

1. Body height;

2. Body weight;

3. Body Mass Index (BMI);

4. Visceral fats;

1. Body height was measured to the nearest 0.1cm with standard stadiometer.

For items 2-4, the Omron BF511 was used. The device calculated BMI using the entered height and measured weight (measured to the nearest 0.1kg) by the standard outlet BMI formula: Weight[kg]/Squared Height[m^2]. Visceral fats were measured by the bioelectrical impedance method. In order to reduce the possibility of false results, the recommendations were followed by the manufacturers - respondents who were measured barefoot and light clothing. They did not eat 3 hours and did not drink 1 hour before the measurement.

Based on the obtained results, students were classified according to the nutritional status categories, using the already established categorization tables, as following:

1. For BMI:

Underweight - BMI<18.5kg/m^2
Normal weight - BMI 18.5-24.9 kg/m^2
Overweight/Pre obese - BMI of 25-29.9 kg/m^2
Obesity class 1 - BMI 30-34.9 kg/m^2
Obesity class 2 - BMI 35-39.9 kg/m^2
Obesity class 3 - BMI ≥40 kg/m^2;

2. For Visceral Fat (cut point given by the manufacturer):

a) Normal: 1-9

b) High: 9-14

c) Very High: >15

Food Questionnaire

On 262 respondents, 258 adequately filled out a questionnaire (which is a part of the WHO Food Frequency Questionnaire) regarding sociodemographic data, daily activities and eating habits, in terms of its quantity and quality.

For the purpose of research, eating habits have been observed in relation to basic principles of proper nutrition according to the WHO pyramid of nutrition, as following:

1. Cereals - Healthy use of cereals implied the participation of cereals with 30-45% in total daily calorie intake, mainly grains with full grain and preserved biological value (for example black and integral flour). Deviations from these recommendations were considered an unhealthy diet (for example significantly lower or higher consumption, the use of white flour, etc.)

2. Fruits - Healthy use of fruit implied everyday use with participation in total daily caloric intake of 10-15%

3. Vegetables - Healthy use of vegetables implied everyday use with participation in total daily caloric intake of 10-15%

4. Milk and milk products - Healthy use of milk and milk products implied everyday use with participation in total daily calorie intake of 10%, mainly low-fat products such as low-fat yogurt, kefir, non-fat cheese. Deviations from these recommendations were considered an unhealthy diet (for example lower or higher consumption, use of high-fat foods such as sour cream, fatty cheeses, butter, etc.)

5. Meat and meat products - Healthy use involved meat consumption 2 to 3 times a week, mainly low-fat/high-protein meat (such as chicken, fish, etc.). Deviations from these recommendations were considered as unhealthy diet (for example significantly reduced or more frequent use of meat, the consumption of high-fat meat such as pork, dried and cured meat, fast-food, etc.)

6. Visible Fats, Sugars and Sweets: Proper nutrition involved foods from this category up to the total daily calorie intake of 5%. Deviations from recommendations were considered unhealthy diet (for example frequent use of sweets, snacks, fried foods).

At the same time, lifestyle habits were evaluated considering physical activity and time spent on TV/PC (criteria for unhealthy habit was more than 3h a day).

Statistical analysis

The data was statistically analyzed using statistical software package SPSS (ver. 21). The results are given as mean ±SE, where SE is standard error of the mean. The Kolmogorov-Smirnov test was used to determine the normality of distribution. Values of nutritional status parameters were compared using the Mann-Whitney test, while categories of nutritional status parameters were compared using the Chi-square test. Chi-square and Fisher's Exact Tests were used to compare eating and lifestyle habits to nutritional status categories. These two are also used to compare habits between age and gender categories. Values of Sig<0.05 were taken to be statistically significant.

RESULTS

Table 1 gives the examined parameters of the nutritional status of the global sample: the majority of students have normal BMI values (75.6%), 5.3% were classified as underweight, 14.9% as overweight, and 4.3% as obese (by classes of obesity: 3,1%, 0.8%, and 0.4%, respectively). Normal levels of visceral fats were found in 93.1% of respondents, while high in 5.7% and very high in 1.1%. Table 2 shows the average values of BMI and Visceral Fats within age and gender categories. There is a statistically significant difference in BMI and VF values between men and women, found on the global sample (24.41 vs. 21.05, Sig=0.000 and 5.47 vs. 3.07, Sig=0.000, respectively). Statistically significant difference in BMI and VF values between the students of the first 4 and the last 2 years of study was found on the global sample (Sig = 0.019 and 0.000, respectively) and within the male population (Sig = 0.007 and 0.000, respectively), while such a difference within the female population was found only for VF parameter (Sig=0.036), not for BMI. Also, we notice that average male student of 6th year is actually overweight according to BMI classification. Tables 3 and 4 show the prevalence of healthy and unhealthy eating, as well as lifestyle habits (according to WHO's food pyramid recommendations) measured by BMI and VF categories. We notice that significant number of students in total, not just regarding presence of obesity, has unhealthy habits when it comes to consumption of cereals, milk and milk products, meat and meat products, sweets, preparing meals and physical activity. Chi-square test showed statistically significant impact on high levels of BMI (>25) and VF for unhealthy habits considering: consumption of cereals (0.016; 0.029), meat and meat products (0.000; 0.027), fast food (0.004; /), sweets (0.001; /), snacks (0.002; /), fruits (/; 0.025), preparing meals (0.001; 0.049), less frequent physical activity (0.001; 0.000; 0.001)

and more frequent physical inactivity observed as time spent on TV/PC (0.000; 0.000).

Table 1. Percentage distribution by nutritional status parameters categories

BMI			VF	
Underweight		14 (5.3%)	Low	244 (93.1%)
Normal weight		198 (75.6%)	High	15 (5.7%)
Overweight		39 (14.9%)	Very High	3 (1.1%)
Obesity	Class 1	8 (3.1%)		
	Class 2	2 (0.8%)		
	Class 3	1 (0.4%)		

Table 2. Average values of nutritional status parameters by age and gender categories (SD)

Year of study	Gender	BMI	VF
1 st Year	Male	23.18 (1.59)	4.00 (1.61)
	Female	21.29 (2.48)	3.00 (1.32)
	Both sexes	22.17 (2.29)	3.47 (1.50)
2 nd Year	Male	23.22 (2.12)	4.39 (1.90)
	Female	21.11 (2.44)	2.83 (1.09)
	Both sexes	22.14 (2.50)	3.6 (1.7)
3 rd Year	Male	24.25 (3.27)	5.68 (3.04)
	Female	20.22 (2.20)	2.83 (0.92)
	Both sexes	22.23 (3.43)	4.3 (2.7)
4 th Year	Male	24.31 (4.33)	5.56(3.65)
	Female	20.67 (3.11)	2.92(1.25)
	Both sexes	22.53 (4.17)	4.27 (3.00)
5 th Year	Male	24.85(3.82)	6.35 (3.51)
	Female	21.36 (2.40)	3.24 (1.05)
	Both sexes	23.14 (3.6)	4.82 (3.00)
6th Year	Male	26.11 (3.66)	7.70 (3.34)
	Female	21.54 (2.50)	3.48 (1.66)
	Both sexes	23.73 (2.84)	5.5 (3.3)
Total	Male	24.41 (3.47)	20.15 (6.43)
	Female	21.05 (2.54)	28.47 (6.96)
	Both sexes	22.73 (3.47)	24.34 (7.85)

Table 3. Presence of healthy and unhealthy eating and lifestyle habbits by BMI categories

Food		Underweight	Normal Weight	Overweight	Obesity			Overall
					Class 1	Class 2	Class 3	
Cereals	Unhealty	9	128	31	8	2	1	179
	Healthy	5	68	8	0	0	0	81
Fruits	Unhealty	1	24	6	3	0	1	35
	Healthy	13	170	33	5	2	0	223
Vegetables	Unhealty	0	21	1	2	0	0	24
	Healthy	14	173	38	6	2	1	234
Milk and products	Unhealty	6	122	26	5	0	0	159
	Healthy	8	74	13	3	1	1	100
Meat and products	Unhealty	8	139	37	8	2	1	195
	Healthy	6	55	1	0	0	0	62
Sweets	Unhealty	5	77	26	4	1	1	108
	Healthy	9	123	13	4	1	0	150
Snacks	Unhealty	3	18	11	1	2	0	35
	Healthy	11	186	28	7	0	1	223
Preparing meals	Unhealty	5	71	25	5	2	0	108
	Healthy	9	123	14	3	0	1	150
Physical activity	Unhealty	7	110	30	8	2	1	158
	Healthy	7	84	9	0	0	0	100
TV/PC	Unhealty	0	27	14	5	1	1	48
	Healthy	14	167	25	3	1	0	210

Table 4. Presence of healthy and unhealthy eating and lifestyle habbits by Visceral Fat categories

Food		Normal	High	Very High	Overall
Cereals	Unhealty	160	14	3	177
	Healthy	80	1	0	81
Fruits	Unhealty	28	5	1	34
	Healthy	210	10	2	222
Vegetables	Unhealty	22	2	0	24
	Healthy	216	13	3	232
Milk and products	Unhealty	146	12	0	158
	Healthy	94	3	2	99
Meat and products	Unhealty	175	15	3	193
	Healthy	62	0	0	62
Sweets	Unhealty	96	9	2	107
	Healthy	142	6	1	149
Snacks	Unhealty	30	2	2	34
	Healthy	208	13	1	222
Preparing meals	Unhealty	95	10	2	107
	Healthy	143	5	1	149
Physical activity	Unhealty	138	15	3	156
	Healthy	100	0	0	100
TV/PC	Unhealty	38	7	2	47
	Healthy	200	8	1	209

DISCUSSION

The main importance of the study lies in the proven correlation between the nutritional status disorders (especially obesity) and numerous comorbidities, which in the first place cardiovascular etiology (2-4, 18, 19). The significance of the study is also due to the fact that, despite the importance and actuality of the topic, similar study on the student population in Serbia has not yet been published, at least known to the authors.

Majority of the students had normal BMI values (75.6%), 5.3% were classified as underweight, 14.9% as overweight, and 4.3% as obese (by classes of obesity: 3.1%, 0.8% and 0.4%, respectively). Although the prevalence of overweight and obesity was, as expected, notably lower than the research of Grujić V. et al. conducted on adult population in Serbia, where 55.7% of subjects were overweight and 19% obese, the results of our study are far from satisfactory (5).

High prevalence of pre-obesity and obesity in the student population is not only present in our country. Methodologically similar studies on larger samples have shown a similar

or greater prevalence of nutritional status disorders in the countries of North America, the European Union, Africa and Asia (6, 7, 9, 21-24, 33). The high prevalence of overweight and obesity in socioeconomic and culturally different countries asserts the global nature of this problem. The only exception were the countries of East and Southeast Asia (8, 25). Although medical students would be expected to have healthier eating habits and lower prevalence of obesity, due to better knowledge of obesity and its consequences, results of the studies show the opposite (13, 15-17, 26-28). A potential explanation was given by Wirginia Likus et al in a study conducted on medical students in Poland, that showed a very limited awareness of medical students about the effects of obesity on health. On the other hand, due to the scope of learning, students are generally forced to spend most of their time sedentary, deprived of time for regular physical activity and regular, healthy rest and sleep (29). Besides, in the medical student population Abbate C et al. showed the high prevalence of overweight/obesity in adult healthcare workers in general, probably due to the stressfulness of their jobs (30).

A significant disparity in terms of nutritional status parameters was found between male and female gender, with average values for BMI being 24.41 and 21.05. The disparity of visceral fats was 5.47 and 3.07 with statistically significant difference for both examined parameters. A significant difference in the nutritional status among genders has been shown in many other studies, both in student and adult population (5, 9, 13, 16, 21, 23, 24, 25, 30), not related to prevalence of overweight/obesity in the examined population in general. A potential explanation was given in the Margareta et al. study, which showed that women more often, and more precisely, consider themselves pre obese/obese, and would rather have some kind of diet (21). Also, the reason for disparity in the nutritional status among genders could be an imposed methodological deficiency, observed during data collection. It could be that overweight/obese female students have avoided public measurement, while this was not the case with male students.

A statistically significant difference in nutritional status was also found among younger and older students (observed through students of the first 4 years and the last 2 years of studies). The difference was found for BMI on global sample and in male subgroup, and for VF on global sample and in both gender categories.

In the Gropper S et al. study, respondents were tracked from the first to the final year of study in terms of nutritional status parameters. In all examined categories, a statistically significant increase was observed (32). A possible explanation of this phenomenon is that, over time, the cumulative effects of sedentary and unhealthy lifestyle have appeared (31). Also, the increase in education level increases the prevalence of obesity (30). This fact could, more likely, explain the high prevalence of obesity in the medical student population in general, while its explanation of increase in obesity through the course of faculty education is debatable.

However, even here, the imposed methodological defect could be the cause of a great difference. While collecting data, it was noticed that younger students were not relaxed enough and that those who were pre obese/obese were avoiding measuring, while this was not the case with older students. Therefore, the similar methodological error could lead to a significant difference in the nutritional status parameters among age and gender categories. However, even if this is true and this effect is significant, this would only mean that the real prevalence of the nutritional status disorders in the examined population is greater than shown.

Examining the nutritional habits, we note that the influence of improper nutrition (according to the WHO criteria) and lack of physical activity on the development of nutritional status disorders are statistically significant. However, improper nutrition has long been associated with the development of pre-obesity and obesity. What worries more is the significant presence of unhealthy eating and lifestyle habits in young adults in general. Surveys that studied this topic point to the global character of this problem (9, 13, 15, 16, 26, 27, 33).

This may provide answers to many questions, imposed by this study results. First of all, this could be the reason for the high prevalence of pre-obesity/obesity in the student population in general. Also, it could explain the low prevalence of nutritionl status disorders in the countries of East and Southeast Asia, where studies on this topic have shown significantly healthier eating and lifestyle habits among young adults (8, 32). Secondly, the studies showed significantly healthier habits considering nutrition and physical activity among female, compared with male gender in majority of studies, which could explain the differences in these categories. And finally, the possible explanation of higher values of nutritional status parameters in senior students may be a cumulative effect of unhealthy eating habits which resulted in nutritional status disorders.

CONCLUSION

Considering the extent of unhealthy habits among students in present, and low amount of resting time and stressfulness of jobs in the future, perhaps the examined population could reach, or even exceed the numbers of 55.7% and 19% in adulthood. Therefore, an immediate action for prevention of obesity and obesity-related health problems is needed in this population, in order to prevent a major health problem in the future.

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