



RELATIONSHIP OF BODY MASS INDEX WITH PHYSICAL ACTIVITY LEVEL OF PHYSIOTHERAPY STUDENTS IN MONTENEGRO

*Vesna Samardžić

Spec App Physiotherapy, Study Programme Applied Physiotherapy, Igalo, Medical Faculty, University of Montenegro, Montenegro.

*Corresponding Author: Vesna Samardžić

Spec App Physiotherapy, Study Programme Applied Physiotherapy, Igalo, Medical Faculty, University of Montenegro, Montenegro.

Article Received on 25/12/2019

Article Revised on 15/01/2020

Article Accepted on 05/02/2020

ABSTRACT

Obesity is defined as the presence of a body mass index (BMI) ≥ 30 and is considered to be one of the fastest growing health problems in the modern world. The incidence of overweight and obesity is rapidly increasing. Studies of healthy life style habits among future health professionals are conducted in many countries. The adequate level of physical activity is important for proper functioning of the human body. It reduces the risk of obesity and maintains good shape of our body. The primary aim of this study was to assess prevalence of overweight and obesity among physiotherapy students in Montenegro and its correlation with physical activity level. We included physiotherapy students who volunteered to participate in the study. Before assessment, students signed informed consent to participate in the research. Parameters of physical form: body mass index (BMI) and waist-hip ratio (WHR) were calculated after antropometric measurements. Physical activity (PA) level was assessed with Internationa Physical Activity Questionnaire (IPAQ)-short form. A total of 62 students (42 female, 20 male) of physical therapy aged from 19 to 25 years were enrolled in this study. BMI showed that 39 (62.9%) were normal body weight, 21 (33.9%) were overweight and 2 students were found obese (3.2%). Abdominal adiposity, as measured by increased WHR was present in only one student. Body composition of students was satisfactory. The level of physical activity was not satisfactory and there was not found statistically significant correlation between a BMI scores and the PA level. The study reinforces the need to encourage regular physical activity and healthy habits routine among physiotherapy students. Habits of healthy living started early are kept later in the life.

KEY WORDS: Body composition, BMI, Obesity, University students, Relationship, Physical activity.

INTRODUCTION

Obesity is defined as the presence of a body mass index (BMI) ≥ 30 and is considered to be one of the fastest growing health problems in the modern world. Overweight and obesity are defined as abnormal or excessive fat accumulation that presents a risk to health. A crude population measure of obesity is the body mass index (BMI), a person's weight (in kilograms) divided by the square of his or her height (in meters). A person with a BMI of 30 or more is generally considered obese. A person with a BMI equal to or more then 25 is considered overweight. Once considered a problem only in high income countries, overweight and obesity are now dramatically on rise in low-and middle-income countries, particularly in urban settings.^[1]

Overweight and obesity are established risk factors for numerous serious conditions, including cardiovascular disease (CDV), hypertension, cancer, asthma, osteoarthritis and infertility. The weight status additionally impacts, among other outcomes, health-

related quality of life, disability-adjusted life years, employment status and lifelong earnings. When all effects are combined, obesity results in major national and worldwide health and economic burdens.^[2]

In recent years BMI has become the measurement of choice for many researchers to measure overweight and obesity among adults. It provides the most useful, albeit crude, population-level measure of obesity. Waist-hip-ratio (WHR) is important indices to assess abdominal obesity and indicator of abdominal fat accumulation. The pattern of body weight distribution is recognized as an important predictor of health risk of obesity. The World Health Organization (WHO) recognizes WHR as useful research tool and that a WHR value > 0.85 for women and a WHR > 0.90 for men are unacceptable or risky.^[3, 4, 5, 6]

The fundamental cause of obesity and overweight is an energy imbalance between calories consumed and calories expended. Globally, there has been an increased

intake of energy-dense foods that are high in fat and increase in physical inactivity due to increasingly sedentary nature of many forms of work, changing modes of transportation and increasing urbanization. Changes in dietary and physical activity patterns are often the result of environmental and societal changes associated with development and lack of supportive policies in sectors such as health, agriculture, transport, urban planning, environment, food processing, distribution, marketing, and education.^[7]

It had been projected that by 2030 there will be 2.16 billion adults overweight, and 1.12 billion obese adults globally.^[8] In 2016, 39% of women and 39% of men aged 18 and over were overweight.^[7] Obesity has rapidly increased in prevalence and now affects 29% of the population in England.^[9]

One out of four Montenegrin children is overweight, with two times more frequent obesity among boys compared with girls.^[11] Obesity in male adolescents for all regions in Montenegro amounts to 15.2%, while in female adolescents the obesity reaches 9.7%.^[11]

A healthy lifestyle is a significant topic that catches your attention. Physical activity (PA) is an important component of a healthy lifestyle. A characteristic of the times we live in is a decrease in physical activity among all population groups. Reduced movement and insufficient physical activity directly affect human health. It is to be expected that as physical activity levels increase, so does physical fitness. Physical fitness represents the ability of a person to perform certain physical work in a continuous manner thanks to the integration of the optimal level of cardiorespiratory form, muscular strength, flexibility, coordination and parameters of body structure. Physical fitness is a set of attributes or characteristics that people have or achieve that relates to the ability to perform physical activity.^[4]

The relationship between physical activity and physical fitness is not clear.^[12] No correlation was found between physical activity, physical fitness and BMI.^[13,14] As obesity is major hazard among all over the world and unclear attitudes about the connection between physical activity and health-related physical fitness, in this study we evaluated the body composition of physiotherapy students: BMI and WHR. We additionally assessed the physical activity level and possible correlation between BMI and PA.

It is important to increase awareness of overweight, obesity and physical activity among students to reduce the incidence of obesity and to prevent the development of preventable diseases. Physiotherapists and other health care professionals themselves need to implement healthy lifestyle routine in everyday life not only for their own personal benefit, but because they should give the best recommendation to their patients by personal example. Physiotherapists have the

knowledge and skills to treat the patient, but also to recommend physical activity and other healthy lifestyle habits in order to maintain and improve health. We found no recorded obesity prevention interventions being conducted in Montenegro among future health professionals.

MATERIAL AND METHODS

This cross-sectional study was performed during first three months in 2016. From the total population of 230 physiotherapy students, a sample of 62 students was formed. Students were recruited on a voluntary basis. We included students of both sexes, aged 19-25 years. Inclusion criteria were met for participation in the study. We excluded students with chronic medical illness, cardiac and/or respiratory disease and professional sports. Prior to testing, students signed informed consent to participate in the research.

Each student's height and weight were measured and BMI was calculated. Subjects were classified into one of four categories: obese (BMI ≥ 30 kg/m²), overweight (BMI $25 \leq 29.9$ kg/m²), normal (BMI $18.5 \leq 24.9$ kg/m²), and underweight (BMI < 18.5 kg/m²).

The waist circumference was measured at the smallest circumference above the umbilicus and below the xiphoid process. The hip circumference was measured as the largest circumference around the buttocks, above the gluteal fold. The waist hips ratio was calculated by dividing the waist circumference by the circumference of the hips. Subjects were classified into one of two categories: normal or risk. The WHO World Health Organization recognizes that a WHR value > 0.8 for women and a WHR > 0.9 for men are unacceptable or risk(3).

The short version of the International Physical Activity Questionnaire (IPAQ) is relatively simple questionnaire and can be completed by a subject in about a minute. The IPAQ uses a variable called metabolic equivalent (MET)-minute/week for making classifications. MET-min/week is calculated by multiplying the MET level for the type of activity by the number of minutes that activity was performed per day by the number of days per week the activity was performed. Subjects were classified into one of three categories: Inactive, minimally active and health enhancing physical activity (HEPA) (3). The questionnaire responded to the global need for a unique means of assessing physical activity across different domains. The questionnaire has so far been tested in numerous studies to determine measurement characteristics. Studies have shown that the IPAQ instrument has acceptable measurement properties.^[15,16,17,18,19]

Data were collected and analyzed using the IBM SPSS Statistics 23. The categorical data were represented by number (n) and percentage (%) of observations, and continuous data by arithmetic mean (x) and standard

deviation (SD). The results of physical activity assessment and physical form were analyzed using descriptive statistics, and Pearson's Chi-squared (χ^2) test was used to study relationship between variables. Kendall's tau-b and Spearman Correlation tests were applied to determine the relation between BMI and the level of physical activity. The level of significance for all tests was accepted as 0.05.

RESULTS AND DISCUSSION

The sample consisted of 62 physiotherapy students who were recruited on a voluntary basis. There were 42

(67.75%) female and 20 (32.3%) male students. The average age of the subjects was 21.87 ± 1.43 years. The mean calculated BMI was 24.19 kg/m^2 . The BMI distribution for both, female and male students was analyzed. The BMI mean value for males was 25.36 ± 3.0 kg/m^2 . The BMI mean value for females was $23.63 \pm 3.51 \text{ kg/m}^2$.

Table 1: Distribution of BMI (kg/m^2) in male/ female students.

Sex	n	Mean \pm SD
Male	20	25.365 \pm 3.009
Female	42	23.633 \pm 3.514

Table 2: Distribution of subjects according to BMI categories.

BMI categories	Number of students	Percent	Total percent
Underweight ($< 18.5 \text{ kg/m}^2$).	0	0	
Normal body mass ($18.5 \leq 24.9 \text{ kg/m}^2$)	39	62.9%	62.9%
Overweight ($25 \leq 29.9 \text{ kg/m}^2$)	21	33.9%	96.8%
Obesity ($\geq 30 \text{ kg/m}^2$)	2	3.2%	
Total	62	100.0%	100.0%

Table 3: Number of male/female students in different categories of BMI.

		Body Mass Index			Total
		Normal body weight	Overweight	Obesity	
Male	Number of students	7	12	1	20
	% within category gender	35.0%	60.0%	5.0%	100.0%
Female	Number of students	32	9	1	42
	% within category gender	76.2%	21.4%	2.4%	100%
Total	Number of students	39	21	2	62
	% within category gender	62.9%	33.9%	3.2%	100%

The correlation between categories of Body Mass Index and gender was examined by Pearson's Chi-squared test. The test showed that there was an approximate

correlation between the BMI category and the gender of the subjects: $p = 0.007$.

Table 4: Distribution of subjects according to WHR categories.

	Frequency	Percent
Normal (Safe)	61	98.4%
Risk	1	1.6%
Total	62	100.0%

The IPAQ average, ranged from 264 to 10716, was $M = 3493.36 \text{ MET-min/week}$ with a standard deviation of $SD = 2360.97 \text{ METmin/ week}$.

Table 5: Distribution of IPAQ (MET-min/week) average in male/female students.

Sex	n	Mean \pm SD
male	20	4243 \pm 2412.6
female	42	3136.4 \pm 2278.4

The statistical analysis of the data by category showed that there were 35 (56.5%) subjects engaged in HEPA,

22 (35.5%) minimally active and 5 (8.1%) inactive students. Out of 42 female subjects, 22 (52.4%) were

involved in health enhancing physical activity (HEPA), 15 (35.7%) were minimally active and 5 (11.9%) were inactive. Out of 20 male subjects, 13 (65%) were involved in HEPA, 7 (35%) were minimally active and there was no inactive male subjects.

The aim of this study was to evaluate correlation BMI score and previously determined physical activity. The correlation of IPAQ scores and BMI categories was examined using the Spearman test ($p=-0.142$) and the Kendal tau-b test ($p=-0.136$). Both tests showed that there was no statistically significant association between the above categories. The primary aim of this study was to assess prevalence of overweight and obesity among physiotherapy students in Montenegro and its correlation with physical activity level. Our study showed that out of 62 physiotherapy students included in study, 39 students (62.9%) were normal body weight, 21 students (33.9%) were overweight and 2 students were classified as obese (3.2%). The analysis of the data showed that 61 (98.4%) students had a normal WHR and only 1 (1.6%) had a risk WHR. The WHR indicated that students were not at risk of abdominal, central obesity. Results showed that majority of the students (62.9%) were of normal weight as also was found in similar studies.^[20,21] High prevalence of obesity was found among students in other studies.^[22,23]

The BMI correlation with subject's gender: Male students (60%) have more overweight than female (21.4%). Out of the total number, 35% of normal body weight subjects were men and 76.2% were women. Overweight in men can be explained by increased muscle mass due to more intense exercise. For more accurate results, it is necessary to determine the proportion of fat in the body mass by measuring the skin fold, which was not done in this study. The WHR category showed that students were not at risk of abdominal, central obesity: 98.4% were in the safe category and only 1.6% were at risk. PA was not found to be associated with BMI as also was found in other studies.^[24,25,26,27,28]

The findings of our study show that there is no statistically significant correlation between the level of physical activity and the body composition. However, our study has limitations in order that we examined only certain parameters of the body composition, BMI and WHR, and for a more reliable conclusion it would be necessary to include an evaluation of the other parameters such as skinfold measurement and body fat percentage estimation. The criteria for inclusion and exclusion in the research itself are a limiting factor that may have influenced the results of the physical fitness components assessment.

The weaknesses of the research are the very character of the research: cross-sectional and descriptive. Potential limitation in this research is the method of sample selection - the respondents are included on a voluntary

basis. The result of the survey cannot be generalized because the respondents were more women.

CONCLUSION

Obesity is a multifactorial disease and one of the most important risk factor for other diseases. Our study showed that there was low prevalence of overweight and obesity among physiotherapy students and minimal prevalence of central adiposity distribution. It can be concluded that overweight is quite prevalent among physiotherapy students. Overweight in men can be explained by increased muscle mass due to more intense exercise. So, we can say that the body composition of students was satisfactory. The level of physical activity was not satisfactory. Also, our findings showed that there is no statistically significant correlation between BMI scores and PA level. It is desirable, through further research, to examine more closely the link between physical activity and body composition. The study reinforces the need to encourage regular physical activity and healthy habits routine among physiotherapy students. Habits of healthy living started early are kept later in the life.

REFERENCES

1. World Health Organization, Obesity. 2020. <https://www.who.int/topics/obesity/en/> Accessed Jan 2020.
2. Wadden TA, Bray GA. Handbook of Obesity Treatment, Second edition. New York: The Guilford Press, 2018. Chapter 1, pp 3-6.
3. ACSM's Health-Related Physical Fitness Assessment Manual. Third edition. Wolters Kluwer, Lippincott Williams & Wilkins: 2010.
4. World Health Organization, Obesity: Preventing and managing the global epidemic. 2004. https://www.who.int/nutrition/publications/obesity/WHO_TRS_894/en/ Accessed Jan 2020.
5. Koo HC, Robert SD, Hamid Jan JM, et al. Which is a better anthropometric indicator of cardiovascular risk factors in type 2 diabetes mellitus patients? Waist hip ratio or body mass index? *Malays J Nutr.*, 2013; 19: 163–72.
6. Ahmad N, Adam SIM, Nawi AM, et al. Abdominal Obesity Indicators: Waist Circumference or Waist-to-hip Ratio in Malaysian Adults Population. *Int J Prev Med.*, 2016; 8(7): 82.
7. WHO, Obesity and overweight, 2018. <https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight>
8. Accessed Jan 2020.
9. Barry M. Popkin, Linda S. Adair, and Shu Wen Ng. Now and then: The Global Nutrition Transition: The Pandemic of Obesity in Developing Countries. *Nutrition Reviews.* 2012 Jan; 70(1): 3-21.
10. Wilding JPH, Mooney V, Pile R. Should obesity be recognized as a disease? *BMJ* 2019; 366:l4258.
11. doi: <https://doi.org/10.1136/bmj.l4258>

12. Martinović M, Belojević G, Evans GW, Laušević D, Ašanin B, Samardžić M, Terzić M, Pantović S, Jakšić M, Boljević J. Prevalence of and contributing factors for overweight and obesity among Montenegrin schoolchildren. *Eur J Public Health*. 2015 Oct; 25(5): 833-9.
13. Vasiljevic I. "Anthropometric Parameters as Indicators of Obesity in Adolescents in Montenegro." *Iranian journal of public health*, 2018; 47(11): 1769-1770.
14. Martinez-Vizcaino V, Sanchez-Lopez M. Relationship between physical activity and physical fitness in children and adolescents, *Rev Esp Cardiol.*, 2008; 61: 108-11.
15. Cruz C, Sequeira S, Gomes H et al. Relationship between physical fitness, physical activity and body mass index of adolescents, *British Journal of Sports Medicine*, 2011.
16. Zanovec M, Lakkakula A, Johnson L, Turri G, Physical activity is associated with percent body fat and body composition but not body mass index in white and black college students, *Int J Exerc Sci.*, 2009; 2(3): 175–185.
17. Craig CL, Marshall AL, Sjostrom M et al. International physical activity questionnaire: 12-country reliability and validity, *Med Sci Sports Exerc.*, 2003; 35(8): 1381-95.
18. Hagstromer M, Ainsworth B, Oja P, Sjostrom M. Comparison of subjective and an objective measure of physical activity in a population sample, *Journal of Physical Activity and Health*, 2010; 7: 541-550.
19. Rutten A, Ziemainz H, Schena F et al. Using different physical activity measurements in eight European countries. Results of the European Physical Activity Surveillance System (EUPASS) time series survey, *Public Health Nutr.*, 2003 Jun; 6(4): 371-6.
20. Lee PH, Macfarlan DJ, Lam TH, Stewart SM. Validity of the international physical activity questionnaire short form (IPAQ-SF): A systematic review, *Int J Behav Nutr Phys Act.*, 2011; 21(8): 115.
21. Kurtze N, Rangul V, Hustvedt BE. Reliability and validity of the international physical activity questionnaire in Nord-Trøndelag health study population of men, *BMC Med Res Methodol.*, 2008 Oct 9; 8: 63.
22. Ahmed, M. S., Anee, K., Abid, M. T., Hridoy, M. O., Hasan, A. R., Marufa, M., Hassan, T., & Munmun, S. Prevalence of obesity and dietary habits of university students: a cross-sectional study. *Asian Journal of Medical and Biological Research*, 2019; 5(3): 180-185.
23. Franz DD, Feresu SA. The relationship between physical activity, body mass index and academic performance and college-age students. *Open journal of epidemiology*, 2013; 3: 4-11.
24. Peltzer K, Pengpid S. The Association of Dietary Behaviors and Physical Activity Levels with General and Central Obesity among ASEAN University Students. *AIMS Public Health.*, 2017; 4(3): 301–313.
25. Khan ZN, Assir MZ, Shafiq M, Chaudhary AE, Jabeen A. High prevalence of preobesity and obesity among medical students of Lahore and its relation with dietary habits and physical activity. *Indian J Endocrinol Metab.*, 2016; 20(2): 206–210.
26. Rauner A, Mess F, Woll A. The relationship between physical activity, physical fitness and overweight in adolescents: a systematic review of studies published in or after 2000, *BMC Pediatrics*, 2013; 13: 19.
27. Gun A, Agirbas O. The relationship between exercise addiction, physical activity level and body mass index of the students who are studying at physical education and sports college. *Asian Journal of Education and Training.*, 2019; 5(1): 50-55.
28. Hadimani CP, Kulkarni SS, Math AK, Javali SB. Patterns of physical activity and its correlation with gender, body mass index among medical students. *International Journal of Community Medicine and Public Health.*, 2018 Jun; 5(6): 2296-2300.
29. Arikan S, Revan S. Relationship between physical activity level and body compositions of university students. *Turkish Journal of Sport and Exercise.*, 2019; 21(1): 67 – 73.
30. Tlucakova L, Ruzbarska B, Cech P, Kacur P, Zvonar M, Gimunova M. Association between physical activity and body composition of high school students. *Sport TK: Revista Euroamericana de Ciencias del Deporte.*, 2016; 5 n°2, 69-76.