

*Originalni članci /  
Original articles*

BODY MASS INDEX AS A PREDICTOR OF  
PHYSICAL ACTIVITY LEVEL

INDEKS TELESNE MASE KAO PREDIKTOR  
FIZIČKE AKTIVNOSTI

**Correspondence to:**

**Prof. dr Jelena Zvekić-Svorcan**

Faculty of Medicine, University of Novi  
Sad, Special Hospital for Rheumatic  
Diseases, Novi Sad,  
Futoška 68, 21000 Novi Sad, Serbia  
E-mail:  
jelena.zvekić-svorcan@mf.uns.ac.rs

Monika Šili<sup>1</sup>, Jovana Krasić<sup>1</sup>, Aleksandra Cvetinović<sup>1</sup>,  
Milica Stanić<sup>1,2</sup>, Rastislava Krasnik<sup>1,2</sup>,  
Jelena Zvekić-Svorcan<sup>1,3</sup>

<sup>1</sup> Faculty of Medicine, University of Novi Sad, Serbia

<sup>2</sup> Institute of Child and Youth Health Care of Vojvodina, Novi Sad,  
Serbia

<sup>3</sup> Special Hospital for Rheumatic Diseases, Novi Sad, Serbia

*Ključne reči*

fizička aktivnost; indeks telesne mase;  
prediktor

*Key words*

physical activity; body mass index;  
predictor

*Sažetak*

**Uvod:** Redovna fizička aktivnost može da donese značajne zdravstvene benefite kod ljudi svih starosnih kategorija i dokazano da ona može produžiti zdravlju i samostaliji život, sprečiti invaliditet i značajno doprineti poboljšanju kvaliteta života. **Cilj:** Ispitati da li je indeks telesne mase prediktor nivoa fizičke aktivnosti. **Materijal i metode:** Retrospektivno prospektivna studija obuhvatila je 107 ispitanika oba pola, starosne dobi 22-65 godina, koji su lečeni u stacionarnim uslovima Specijalne bolnice za reumatske bolesti Novi Sad. Analizirani su sociodemografski podaci koji se odnose na pol, godine života, menopauzu, telesnu visinu (cm), telesnu masu (kg), indeks telesne mase ( $\text{kg}/\text{m}^2$ ), obim struka (cm), i prisustvo komorbiditeta. Takođe, ispitanici su popunili Internacionalni upitnik o fizičkoj aktivnosti (engl. International Physical Activity Questionnaire (IPAQ)). Dobijeni podaci su obrađeni u statističkom paketu SPSS ver. 24 (Statistical Package for the Social Sciences) for Windows. **Rezultati:** Prosečna starosna dob ispitanika je 53,80 godina, a 82,2% su osobe ženskog pola. Većina ispitanica (69,3%) je u menopauzi; prosečna dob ulaska u menopauzu je 48,01 godina. Prosečna vrednost BMI je 28,38  $\text{kg}/\text{m}^2$ . Najviše je onih sa prekomernom telesnom masom (32,7%). Pridružene bolesti ima ukupno 67,3% ispitanika. Nizak nivo fizičke aktivnosti ima 68,2% ispitanika. Odnos BMI i nivoa fizičke aktivnosti nije statistički značajan ( $p = 0,247$ ). **Zaključak:** Indeks telesne mase se nije pokazao kao prediktor fizičke aktivnosti.

*INTRODUCTION*

The prevalence of overweight status and obesity in adults has been increasing in recent decades (1). This trend is concerning, given a large number of studies confirming the correlation between higher body mass index (BMI) and mortality, as well as various health conditions (2). Obesity is also associated with increased functional limitations, disability, and poorer quality of life (QoL)(3). Evidence yielded by longitudinal studies involving adult subjects further demonstrates a link between physical activity and a reduced risk of developing several metabolic diseases (including excessive weight gain and obesity), as well as dementia and mortality(4). Regular physical activity provides significant health benefits for people of all ages and is an important predictor of lower disability levels and thus a person's capacity for a more independent life and improved QoL (5). The need for physical activity does not

decrease with age. In fact, exercise or physical activity is an important component of healthy aging, as it helps prevent or mitigate falls, pain, sarcopenia, osteoporosis, and cognitive impairment. Irrespective of age, a well-balanced exercise program includes daily aerobic, strength, balance, and flexibility components (6).

*AIM*

To determine whether BMI predicts physical activity level.

*Material and methods*

This retrospective-prospective study included 107 inpatients of both sexes, aged 22-65 years, who were treated at the Special Hospital for Rheumatic Diseases in Novi Sad. The research was approved by the institution's Ethics Committee (Approval number: 14/02-1/1-24). All subjects signed an informed consent to participate in the study before

completing the International Physical Activity Questionnaire (IPAQ) as well as a sociodemographic questionnaire developed for the purpose of this investigation (7,8).

The sociodemographic questionnaire probed into the respondents' sex, age, menopause status, body height (cm), body mass (kg), body mass index (kg/m<sup>2</sup>), waist circumference (cm), and presence of comorbidities. The participants also responded to the short-form IPAQ instrument, focusing on the types of physical activities carried out as a part of everyday life. The IPAQ is a universal questionnaire for the assessment of physical activity related to the health of adults and adolescents. The short form of this instrument was adopted in the present study to assess the level of three specific physical activity types: frequency/duration of light physical activity/walking, frequency/duration of moderate and intense physical activity, and time spent sitting/lying down. When answering questions, respondents are instructed to declare the time spent performing a specific type of physical activity in the preceding seven days. The questionnaire was designed to provide separate scores for each activity type—intense, moderate, and light (7,8).

When analyzing the obtained information, categorical data were described through frequencies and percentages, while arithmetic mean (*M*) and standard deviation (*SD*) as well as Min–Max range were reported for numerical data. Logistic regression was conducted to determine whether BMI can serve as a predictor of physical activity level. The relationship between the physical activity level and other variables was examined through the Likelihood Ratio test and the t-test for large independent samples. The probability level was set at  $p \leq 0.05$ , and all analyses were performed in SPSS ver. 24 for Windows.

## RESULTS

**Table 1.** Respondents' sociodemographic characteristics

N = 107	
<b>Sex, n (%)</b>	
Female	88 (82.2%)
Male	19 (17.8%)
<b>Mean age, M (SD) Min–Max</b>	53.80 (9.24), 22–65
<b>Age (category), n (%)</b>	
22–42	13 (12.1%)
43–52	31 (29.0%)
53–65	63 (58.9%)
<b>Menopause, n (%)</b>	
No	27 (30.7%)
Yes	61 (69.3%)
<b>Menopause onset (age), M (SD) Min–Max</b>	48.01 (4.70), 32.0–55.0
<b>Body height (cm), M (SD) Min–Max</b>	167.97 (9.64), 146.0–197.0
<b>Body mass (kg), M (SD) Min–Max</b>	79.85 (19.33), 43.0–171.0
<b>Waist circumference (cm), M (SD) Min–Max</b>	89.99 (14.60), 58.0–135.0
<b>BMI, M (SD) Min–Max</b>	28.38 (6.12), 19.6–48.4
<b>BMI, n (%)</b>	
Normal body mass	34 (31.8%)
Overweight	35 (32.7%)
Obese	23 (21.5%)
Pathologically obese	15 (14.0%)
<b>Comorbidities, n (%)</b>	
No	35 (32.7%)
Yes	72 (67.3%)

*M (SD) Min–Max* = Arithmetic mean (Standard deviation), Minimum–Maximum.

The study sample comprised 107 respondents (age: *M* = 53.80, *SD* = 9.24), 82.2% of whom were female. Most participants belonged to the 53–65 age category (58.9%), followed by those aged 43–52 (29.0%), with only 12.1% in the 22–42 group. Given the preponderance of female and older participants, it was not surprising that 69.3% were in menopause, with an average menopause onset of 48.01 years (*SD* = 4.70 years). The subjects' body height ranged from 146.0 to 197.0 cm (*M* = 167.97 cm, *SD* = 9.64 cm), whereas their body mass was in the 43.0–171.0 kg range (*M* = 79.85 kg, *SD* = 19.33 kg). Accordingly, their BMI ranged from 19.6 to 48.4 kg/m<sup>2</sup> (*M* = 28.38 kg/m<sup>2</sup>, *SD* = 6.12 kg/m<sup>2</sup>). Further examination of the calculated BMI values revealed that 31.8% of respondents had normal body weight, 32.7% were overweight, and 21.5% were obese, while 14.0% were pathologically obese. The average waist circumference was *M* = 89.99 (*SD* = 14.60) cm and 67.3% of respondents reported having at least one comorbidity.

**Table 2.** Respondents' physical activity level (IPAQ) and participation in recreational activities

N = 107	
<b>Physical activity level, n (%)</b>	
Low	73 (68.2%)
Moderate	30 (28.0%)
High	4 (3.7%)
<b>Participation in recreational activities in spare time, n (%)</b>	
Yes	54 (50.5%)
No	53 (49.5%)

Based on the self-reported physical activity levels, 68.2%, 28.0%, and 3.7% of the sample belonged to the low, moderate, and high category, respectively. Moreover, only 50.5% of the respondents indicated that they partake in some form of recreational activity in their spare time.

When physical activity levels were analyzed across BMI categories, 31.5% of respondents with normal body weight were shown to have low level of physical activity, while moderate physical activity level was recorded in 36.7% of cases. On the other hand, 32.9% and 33.3% of overweight respondents had a low and moderate level of physical activity, respectively. For obese individuals, these percentages were 20.5% and 16.7%, declining further to 15.1% and 13.3% for those with pathological obesity. However, the relationship between BMI and physical activity level was not statistically significant ( $p = 0.247$ ).

## DISCUSSION

According to the responses provided by 107 patients examined in this study (age: *M* = 53.80, *SD* = 9.24 years), only 50.5% regularly engage in recreational activities. Based on the analyses conducted by Duran et al. in 2021, middle-aged (40–64 years) individuals have higher physical activity levels compared to older subjects (>65 years)<sup>(9)</sup>. Available evidence also indicates that

**Table 3.** Respondents' physical activity level (IPAQ) and BMI

	Physical Activity Level		P
	Low	Moderate	
<b>BMI category, n (%)</b>		0.247 <sup>a</sup>	
Normal body mass	23 (31.5%)	11 (36.7%)	
Overweight	24 (32.9%)	10 (33.3%)	
Obese	15 (20.5%)	5 (16.7%)	
Pathologically obese	11 (15.1%)	4 (13.3%)	
<b>Body height (cm), M (SD)</b>	167.22 (10.07)	169.92 (8.83)	0.435 <sup>b</sup>
<b>Body mass (kg), M (SD)</b>	78.55 (16.65)	82.07 (25.38)	0.534 <sup>b</sup>
<b>Waist circumference (cm), M (SD)</b>	89.41 (13.91)	90,65 (16.78)	0.674 <sup>b</sup>

<sup>a</sup> Likelihood Ratio test, <sup>b</sup> t-test. M (SD) = Arithmetic mean (Standard deviation).

High physical activity level was omitted due to the small number of respondents in that category (n = 4).

**Table 4.** Body mass index (BMI) as a predictor of physical activity level

	B	S.E.	Wald	Df	P	Exp(B)	95% EXP(B) Lower	C.I.for Upper
<b>BMI</b>	-0.115	0.134	0.735	1	0.391	0.892	0.686	1.159
<b>Waist circumference</b>	0.032	0.060	0.288	1	0.591	1.033	0.918	1.162

Dependent variable: physical activity level (0 = low, 1 = moderate). High physical activity level was omitted due to a small number of respondents in this category (n = 4).

Neither of the examined independent variables—waist circumference (Exp(B) = 1.033, p = 0.591) and BMI (Exp(B) = 0.892, p = 0.391)—was a statistically significant predictor of physical activity level.

sex, educational attainment, functional skills, general activity level, amount of free time, and health are the key QoL components that predict the level of physical activity among the elderly, for whom it is crucial to partake in free activities (visiting friends, playing games, running) as an indirect way of increasing physical activity engagement<sup>(10)</sup>. Most of the respondents (69.3%) in our study were in menopause, with an average age of menopause onset of 48.01 years (SD = 4.70 years).

In 2024, Mudrinić et al. established that risk factors such as menopause and smoking status are not predictors of either fatigue or lower physical activity in patients with degenerative rheumatism<sup>(11)</sup>. In our study sample, BMI ranged from 19.6 to 48.4 kg/m<sup>2</sup> (M = 28.38, SD = 6.12 kg/m<sup>2</sup>). Observed by category, 31.8% of the respondents had normal body weight, while 32.7%, 21.5%, and 14.0% were overweight, obese, and pathologically obese, respectively. The absence of a relationship between BMI and physical activity is surprising, considering that it was found in other studies with diverse participants, from adolescents to elderly<sup>(12,13)</sup>. However, considering that only 107 individuals participated in the present study, it is possible that the non-parametric statistical tests used in analyses lacked the statistical power required to reveal significant differences<sup>(14)</sup>.

Indeed, research conducted by Zvekić-Svorcan and colleagues in 2024 indicates that BMI is a predictor recreational activity avoidance, but is not statistically significantly related to the occurrence of fatigue<sup>(15)</sup>. There is also a continual interaction between eating habits and physical activity which determines energy balance and consequently affects body weight. Gaining a better understanding of the exact behaviors that influence the energy balance in

different life stages and populations, and the personal, social, demographic, and environmental determinants of these behaviors provides a better basis for the development of tailored interventions aimed at combatting obesity and chronic diseases<sup>(16)</sup>.

Current guidelines recommend engagement in at least 150 minutes of moderate-intensity aerobic exercise or 75 minutes of vigorous-intensity exercise per week, along with strength training that involves all major muscle groups twice per week. For individuals seeking to maintain weight loss, much higher levels (225–420 min/week of moderate-intensity exercise) are recommended, as such regimen is associated with improved weight maintenance compared with lower levels (<150 min/week). According to Celik and Yildiz, emergence of several comorbidities—such as insulin resistance, inflammatory process, dyslipidemia, hypertension, metabolic syndrome, diabetes, lung diseases, and cardiovascular diseases—is directly related to obesity<sup>(17)</sup>. In a paper published in

2024, Cvetinović et al. also reported that increasing fatigue levels are inversely related to the propensity for engaging in recreational activities. In their study, fatigue was identified as a statistically significant predictor of avoiding recreational activities, suggesting that this risk factor should be taken into consideration in further research<sup>(18)</sup>. Most of our study participants (67.3%) reported at least one comorbidity, which is noteworthy given that in 2024 Kalmar et al. established that the presence of comorbidities increases fatigue levels but does not affect physical activity levels in patients with degenerative rheumatism<sup>(19)</sup>. However, in the same year, Krsić et al. determined that the presence of comorbidities is not a statistically significant predictor of fatigue and recreational activity avoidance<sup>(20)</sup>. As sedentary lifestyle is an important factor in the development of sarcopenia, it is important to promote physical activity in individuals with any signs of this condition in order to delay and prevent its emergence<sup>(21)</sup>.

### CONCLUSION

According to our analyses, BMI is not a predictor of physical activity level. Given that the frequency, duration, and intensity of different physical activities are influenced by a wide range of factors (including educational attainment, occupation, fatigue, motivation, barriers, and other quality of life components), further research is needed to better understand this relationship.

### Abstract

**Introduction:** Regular physical activity can bring significant health benefits to individuals of all ages as it has been demonstrated that it can prolong healthier and more independent life, as well as prevent disability, thus significantly improving quality of life. **Aim:** To examine body mass index (BMI) as a potential predictor of physical activity level. **Material and methods:** This retrospective-prospective study included 107 respondents of both sexes, aged 22–65 years, who were treated as inpatients at the Special Hospital for Rheumatic Diseases in Novi Sad. Sociodemographic data related to sex, age, menopause, body height (cm), body mass (kg), body mass index ( $\text{kg}/\text{m}^2$ ), waist circumference (cm), and presence of comorbidities were analyzed. The study participants also completed the International Physical Activity Questionnaire (IPAQ). The obtained data were processed using Statistical Package for the Social Sciences (SPSS) ver. 24 for Windows. **Results:** The study sample (mean age 53.80 years) comprised 82.2% females and 17.8% males. Majority of the respondents (69.3%) were in menopause, with the average age of menopause onset of 48.01 years. While the average BMI was  $28.38 \text{ kg}/\text{m}^2$ , 32.7% of respondents were overweight, and 67.3% reported one or more comorbidities. Although 68.2% of participants declared low level of physical activity, the relationship between BMI and physical activity level was not statistically significant ( $p = 0.247$ ). **Conclusion:** Body mass index does not appear to predict physical activity level.

### REFERENCES

- NCD Risk Factor Collaboration. Trends in adult body-mass index in 200 countries from 1975 to 2014: a pooled analysis of 1698 population-based measurement studies with 19.2 million participants. *Lancet*. 2016;387(10026):1377-96.
- Global BMI Mortality Collaboration. Body-mass index and all-cause mortality: individual-participant-data meta-analysis of 239 prospective studies in four continents. *Lancet*. 2016;388(10046):776-86.
- Samper-Ternent R, Al Snih S. Obesity in older adults: epidemiology and implications for disability and disease. *Rev Clin Gerontol*. 2012;22(1):10-34.
- Cleven L, Syrjanen JA, Geda YE, Christenson LR, Petersen RC, Vassilaki M, et al. Association between physical activity and longitudinal change in body mass index in middle-aged and older adults. *BMC Public Health*. 2023;23(1):202.
- Božić D, Zelenović M. Uticaj fizičke aktivnosti na prevenciju i broj padova kod starijih osoba. *Sportlogia*. 2022;18(1):42-56.
- Eckstrom E, Neukam S, Kalin L, Wright J. Physical activity and healthy aging. *Clin Geriatr Med*. 2020;36(4):671-83.
- Lee PH, Macfarlane DJ, Lam T, Stewart SM. Validity of the International Physical Activity Questionnaire Short Form (IPAQ-SF): a systematic review. *Int J Behav Nutr Phys Act*. 2011;8:115.
- Milanović Z, Pantelić S, Trajković N, Jorgić B, Sporiš G, Bratić M. Reliability of the Serbian version of the International Physical Activity Questionnaire for older adults. *Clin Interv Aging*. 2014;9:581-7.
- Duran M, Keklik SS, Çobanoğlu G. The Comparison of physical activity, fatigue and quality of life in different age groups. *Clin Exp Health Sci*. 2022;12(1):150-4.
- Parra-Rizo MA, Vásquez-Gómez J, Álvarez C, Diaz-Martínez X, Troncoso C, Leiva-Ordoñez AM, et al. Predictors of the level of physical activity in physically active older people. *Behav Sci (Basel)*. 2022;12(9):331.
- Mudrinić I, Kalmar K, Cvetinović A, Krasić J, Krasnik R, Zvekić-Svorcan J. Uticaj faktora rizika na fizičku aktivnost i zamor kod pacijenata koji boluju od degenerativnog reumatizma. *MD-Medical Data* 2024;16(1):17-21.
- Grasdalsmoen M, Eriksen HR, Lønning KJ, Sivertsen B. Physical exercise and body-mass index in young adults: a national survey of Norwegian university students. *BMC Public Health*. 2019;19(1):1354.
- Dewi RC, Rimawati N, Purbodjati P. Body mass index, physical activity, and physical fitness of adolescence. *J Public Health Res*. 2021;2(10):2230.
- Contador JL, Senne ELF. Testes não-paramétricos para pequenas amostras de variáveis não categorizadas: um estudo. *Gest Prod*. 2016;(3):588-99.
- Zvekić-Svorcan J, Krasić J, Cvetinović A, Mikic A, Nikolic T, Jankovic T, et al. Body mass index as a predictor of physical activity avoidance. In: World congress on Osteoporosis, Osteoarthritis and Musculoskeletal Diseases; 2024 Apr 11-14; London, Great Britain; 2024. p. 712.
- Moschonis G, Trakman GL. Overweight and obesity: the interplay of eating habits and physical activity. *Nutrients*. 2023;15(13):2896.
- Celik O, Yildiz BO. Obesity and physical exercise. *Minerva Endocrinol (Torino)*. 2021;46(2):131-44.
- Cvetinovic A, Krasic J, Zvekić-Svorcan J, Nikolov T, Mikic A, Boskovic K. Fatigue as a predictor of physical activity avoidance. In: World congress on Osteoporosis, Osteoarthritis and Musculoskeletal Diseases; 2024 Apr 11-14; London, Great Britain; 2024. p. 713.
- Kalmar K, Mudrinić I, Cvetinović A, Krasić J, Krasnik R, Zvekić-Svorcan J. Uticaj komorbiditeta na fizičku aktivnost i zamor kod pacijenata koji boluju od degenerativnog reumatizma. *MD-Medical Data*. 2023;16(1):37-41.
- Krasic J, Cvetinovic A, Zvekić-Svorcan J, Nikolov T, Mikic D, Boskovic K. Influence of comorbidities on fatigue and physical activity avoidance. In: World congress on Osteoporosis, Osteoarthritis and Musculoskeletal Diseases; 2024 Apr 11-14; London, Great Britain; 2024. p. 712-3.
- Hämäläinen O, Tirkkonen A, Savikangas T, Alén M, Sipilä S, Hautala A. Low physical activity is a risk factor for sarcopenia: a cross-sectional analysis of two exercise trials on community-dwelling older adults. *BMC Geriatr*. 2024;24(1):212.

■ The paper was received / Rad primljen: 07.09.2025.  
Accepted / Rad prihvaćen: 10.10.2025.