

## KVALITET SPAVANJA, ZAMOR I POSPANOST KOD STUDENATA MEDICINSKOG FAKULTETA

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### SAŽETAK

**Uvod/Cilj:** Studenti medicine su izloženi značajnom nivou pritiska zbog akademskih zahteva, usled čega dolazi do smanjenja kvaliteta spavanja, zamora i povećane dnevne pospanosti, što sve može uticati na efikasnost učenja, akademski uspeh, i motivaciju. Istraživanje je imalo za cilj da ispita prevalencije zamora, kvaliteta spavanja i dnevne pospanosti među studentima medicine, kao i njihovu međusobnu povezanost.

**Metode:** Studija je sprovedena u vidu studije preseka u toku decembra 2022. godine među 316 studenata treće godine Medicinskog fakulteta Univerziteta u Beogradu. Podaci su prikupljeni anketnim upitnikom, koji su studenti popunjavali na početku praktične nastave iz nastavnog predmeta Epidemiologija. Osim demografskih podataka, studenti su popunili upitnik o kvalitetu spavanja (*Pittsburgh Sleep Quality Index-PSQI*), upitnik o zamoru (*Fatigue Severity Scale-FSS*), i skalu pospanosti (*Epworth Sleepiness Scale-ESS*). U statističkoj analizi podataka korišćene su metode deskriptivne statistike,  $\chi^2$  test i Studentov t-test. Kao statistički značajna vrednost je korišćeno  $p < 0,05$ .

**Rezultati:** U studiju je bilo uključeno 312 studenata treće godine Medicinskog fakulteta Univerziteta u Beogradu, 86 muškaraca (27,5%) i 226 žena (72,2%). Prosečan uzrast studenata bio je 21,37 godina. Više od polovine studenata (54,7%) imalo je loš kvalitet spavanja, svaki četvrti student imao je povišen zamor (27,6%), a skoro polovina studenata imala je povišene nivoe pospanosti (45,8%). Između muškaraca i žena nije bilo značajne razlike u kvalitetu sna i nivou zamora, ali su žene značajno češće imale više nivoe dnevne pospanosti ( $p=0,008$ ). Studenti muškog pola koji su imali povišen zamor značajno češće su imali lošiji kvalitet sna u odnosu na studente normalnog nivoa zamora. Dok su studentkinje sa povišenim nivoom zamora značajno češće imale lošiji kvalitet sna i povišenu dnevnu pospanost.

**Zaključak:** Loš kvalitet sna, zamor i pospanost bili su učestali u populaciji studenata medicine. Više od polovine studenata (54,7%) imalo je loš kvalitet spavanja, svaki četvrti student imao je povišen zamor (27,6%), a skoro polovina studenata imala je povišene nivoe pospanosti (45,8%). Stoga je potrebno podsticati studente medicine na zdraviji način života i adekvatne obrasce spavanja još u ranijim godinama studija.

**Ključne reči:** zamor, pospanost, kvalitet sna, studenti medicine, akademski uspeh

### Uvod

Studenti predstavljaju važan resurs za budućnost društva i nacionalni kapitali svake zemlje. Ulaganje u obrazovanje i zdravlje studenata je ključno kako bi se u potpunosti osposobili da doprinesu društvu. Zbog toga neki smatraju da univerziteti treba da rade na kreiranju zdravog okruženja i da promovišu aktivnosti koje imaju za cilj podršku i podizanje svesti o mentalnom zdravlju (1). Studenti se tokom studija suočavaju sa brojnim izazovima i brigama, kao i sa opterećenjima

koja se razlikuju od drugih starosnih grupa i ljudi drugih zanimanja. Akademsko opterećenje, stalni pritisak za uspehom, zabrinutost za budućnost, finansijski problemi, kao i nedostatak slobodnog vremena i manje vremena provedenog sa porodicom česti su stresori, koji mogu dovesti do potencijalnih mentalnih problema (1,2). Rezultati studija širom sveta pokazuju da su studenti medicine podležniji pogoršanju mentalnog i fizičkog zdravlja od prosečnog studenta (3–5). Iako zvuči

## SLEEP QUALITY, FATIGUE AND SLEEPINESS IN MEDICAL STUDENTS

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### SUMMARY

**Introduction/Aim:** Medical students are exposed to a significant level of pressure due to academic demands, resulting in decreased sleep quality, fatigue, and increased daytime sleepiness, all of which can affect learning efficiency, academic success, and motivation. The research aimed to examine the prevalence of fatigue, sleep quality and daytime sleepiness among medical students and their interrelationship.

**Methods:** The study was conducted as a cross-sectional study in December 2022 among 316 third-year students of the Faculty of Medicine, University of Belgrade. The data were collected by a survey questionnaire, which students filled out at the beginning of practical classes in the subject of Epidemiology. In addition to demographic data, students filled out a questionnaire on sleep quality (Pittsburgh Sleep Quality Index-PSQI), a questionnaire on fatigue (Fatigue Severity Scale-FSS), and a sleepiness scale (Epworth Sleepiness Scale-ESS). Descriptive statistics,  $\chi^2$  test, and Student's t-test were used in the statistical analysis of the data.  $p < 0.05$  was used as a statistically significant value.

**Results:** The study included 312 third-year students of the Faculty of Medicine of the University of Belgrade, 86 men (27.5%) and 226 women (72.2%). The average age of the students was 21.37 years. More than half of the students (54.7%) had poor sleep quality, every fourth student had increased fatigue (27.6%), and almost half of the students had increased levels of sleepiness (45.8%). There was no significant difference between men and women in sleep quality and level of fatigue, but women significantly more often had higher levels of daytime sleepiness ( $p=0.008$ ). Male students who had increased fatigue significantly more often had poorer sleep quality than students with normal fatigue levels. While female students with an elevated level of fatigue significantly more often had poorer sleep quality and increased daytime sleepiness.

**Conclusion:** Poor sleep quality, fatigue, and sleepiness were common in the population of medical students. More than half of the students (54.7%) had poor sleep quality, every fourth student had increased fatigue (27.6%), and almost half of the students had increased levels of sleepiness (45.8%). Therefore, it is necessary to encourage medical students to have a healthier lifestyle and adequate sleep patterns even in the earlier years of their studies.

**Keywords:** fatigue, sleepiness, sleep quality, medical students, academic success

### Introduction

Students represent an important resource for the future of society and the national capital of each country. Investing in the education and health of students is crucial in order to fully equip them to contribute to society. Therefore, some believe that universities should work to create a healthy environment and promote activities aimed at supporting and raising awareness of mental health (1). During their studies, students face numerous challenges and worries, as well as workloads that

differ from other age groups and people of other professions. Academic load, constant pressure to succeed, worries about the future, financial problems, lack of free time, and less time spent with family are common stressors, which can lead to potential mental problems (1,2). The results of studies around the world show that medical students are more susceptible to deterioration in mental and physical health than the average student (3–5). Although it sounds paradoxical, the

paradoksalno, školovanje budućih lekara koji će brinuti o bolesnima značajno utiče na njihove mentalne i fizičke resurse (4,6).

Poznato je da je medicina suštinski zahtevna profesija, i da se studenti medicine suočavaju sa mnogim poteškoćama tokom studija koje izazivaju visok nivo stresa (7–9). Neke specifične karakteristike studiranja medicine kao što su organizacija nastave (praktična nastava, seminari, predavanja), akademsko preopterećenje, sadržaj i trajanje studija medicine, dodatno otežavaju taj perioda njihovog života. Zbog intenzivnog teorijskog i praktičnog nastavnog programa, savladavanja lekcija i spremanja ispita, studenti ulažu dosta vremena u svoje studije, a takav način života i rada može dovesti do zamora.

Zamor je psihofiziološko stanje smanjene sposobnosti i efikasnosti i može imati veliki uticaj na zdravlje i dobrobit pojedinca (10). Zamor je često praćen smanjenom mentalnom i fizičkom snagom, padom motivacije, kao i narušenim kvaliteto spavanja. Spavanje je biološki proces koji je neophodan za optimalno neurološko funkcionisanje, kao i sistemske fiziološke funkcije, uključujući imunitet, metabolizam, hormonsku ravnotežu i kardiovaskularni sistem (11). Zamor narušava pažnju mladih, što dovodi do loše percepcije i usporenog razmišljanja, dok nedostatak spavanja narušava svakodnevno funkcionisanje, efikasnost učenja i akademska postignuća studenata (10).

Poremećaj noćnog sna, kasni odlazak u krevet i rano ustajanje, posledično imaju pad kvaliteta spavanja, što izaziva pojavu pospanosti tokom dana, stresa, glavobolje, lošije pamćenje i učenje, zamor, povećanje napetosti i anksioznosti, kao i smanjenje sposobnosti suočavanja sa svakodnevnim rutinskim pritiskom (12). U nekim studijama je dokazana veza između stresa za vreme ispitnih rokova i smanjenog kvaliteta spavanja kod studenata (13).

Cilj rada je bio da se ispita kvalitet spavanja, stepen zamora i dnevne pospanosti među studentima treće godine Medicinskog fakulteta Univerziteta u Beogradu, kao i njihova međusobna povezanost.

## Metode

Studija je sprovedena u vidu studije preseka u toku decembra 2022. godine među 316 studenata treće godine Medicinskog fakulteta Univerziteta u Beogradu. Podaci su prikupljeni anketnim up-

itnikom, koji su studenti popunjavali na početku praktične nastave iz nastavnog predmeta Epidemiologija. Osim demografskih podataka, studenti su popunili upitnik o kvalitetu spavanja (*Pittsburgh Sleep Quality Index-PSQI*), skalu o zamoru (*Fatigue Severity Scale-FSS*) i skalu pospanosti (*Epworth Sleepiness Scale-ESS*). Iz studije su isključeni studenti koji su naveli prisustvo psihičkih bolesti (4 studenta).

Pitsburški indeks kvaliteta spavanja (*Pittsburgh Sleep Quality Index-PSQI*) (14) je upitnik kojim ispitanici ocenjuju kvalitet spavanja tokom prethodnih mesec dana. Upitnik sadrži 19 stavki i 5 dodatnih pitanja. Na poslednjih pet pitanja odgovara druga osoba, kao što je partner ili cimer/ka; ova pitanja obično se koriste za kliničke informacije i nisu uključena u bodovanje. Sa 19 stavki obuhvaćeno je sedam komponenti kvaliteta spavanja, pod nazivima: 1. subjektivni kvalitet spavanja, 2. latentnost u spavanju, 3. trajanje sna, 4. efikasnost spavanja, 5. poremećaj spavanja, 6. upotreba lekova za spavanje i 7. disfunkcije u toku dana. Svaka komponenta se skoruje od 0 (ne predstavlja problem) do 3 (predstavlja veliki problem). Ukupan rezultat se računa kao zbir skorova sedam komponenti, u rasponu od 0 do 21. Granična vrednost skora je 5. Odnosno, ispitanici sa skorom  $\geq 5$  imaju loš kvalitet sna. Svojstva PSQI ukazuju na njegovu korist u psihijatrijskoj kliničkoj praksi i istraživanjima. PSQI upitnik je preveden na srpski jezik i validiran (15).

Krupova skala zamora (*Fatigue Severity Scale-FSS*) koristi za procenu efekata zamora na fizičko, psihičko i socijalno funkcionisanje, kao što su fizička kondicija, motivisanost za rad, ili porodične obaveze. Ona je prvobitno dizajnirana kao instrument za merenje zamora kod osoba koje boluju od teških hroničnih bolesti, međutim danas ima mnogo šru upotrebu. Prvenstveno se primenjuje u istraživačke svrhe, ali takođe i u kliničkoj medicini i zdravstvenoj ekonomiji kada su u pitanju teme koje se odnose na kvalitet života, efekte različitih terapija, a u poslednje vreme i za procenu spavanja i sna. Skala se sastoji od 9 tvrdnji koje se boduju na osnovu sedmostepene Likertove skale, od snažnog neslaganja do potpune saglasnosti sa ponuđenom tvrdnjom. Ukupan skor može imati vrednosti od 9 do 63. Zbirna vrednost Krupove skale zamora se dalje deli sa 9 i tako se dobija prosečni skor zamora, koji može imati vrednosti od 1 (potpuno odsustvo zamora) do 7 (najizraženije prisustvo

education of future doctors who will care for the sick significantly affects their mental and physical resources (4,6).

It is known that medicine is an inherently demanding profession and that medical students face many difficulties during their studies that cause high levels of stress (7–9). Some specific characteristics of studying medicine, such as the organization of classes (practical classes, seminars, lectures), academic overload, content, and duration of medical studies, further complicate that period of their lives. Due to the intensive theoretical and practical curriculum, mastering lessons, and preparing for exams, students invest a lot of time in their studies, and such a way of life and work can lead to fatigue.

Fatigue is a psychophysiological state of reduced ability and efficiency and can majorly impact an individual's health and well-being (10). Fatigue is often accompanied by reduced mental and physical strength, a drop in motivation, and impaired sleep quality. Sleep is a biological process that is essential for optimal neurological functioning as well as systemic physiological functions, including immunity, metabolism, hormonal balance, and the cardiovascular system (11). Fatigue impairs young people's attention, leading to poor perception and slowed thinking, while lack of sleep impairs students' daily functioning, learning efficiency, and academic achievement (10).

Disruption of night sleep, late going to bed and early rising, consequently a decrease in sleep quality, which causes daytime sleepiness, stress, headaches, poorer memory and learning, fatigue, increased tension, and anxiety, as well as a decrease in the ability to cope with daily routine pressure. (12). Some studies have shown a link between stress during exam periods and reduced sleep quality in students (13).

The aim of the work was to examine the quality of sleep, degree of fatigue, and daytime sleepiness among third-year students of the Faculty of Medicine of the University of Belgrade, as well as their interrelationships.

## Methods

The study was conducted as a cross-sectional study in December, 2022 among 316 third-year students of the Faculty of Medicine at the University of Belgrade. The data were collected by

means of a survey questionnaire, which students filled out at the beginning of practical classes in the subject Epidemiology. In addition to demographic data, the students completed the questionnaire about sleep quality (Pittsburgh Sleep Quality Index-PSQI) and questionnaire about fatigue (Fatigue Severity Scale-FSS), visual-analog fatigue scale and sleepiness scale (Epworth Sleepiness Scale-ESS). Students who indicated the presence of mental disorders (4 students) were excluded from the study.

The Pittsburgh Sleep Quality Index (PSQI) (14) is a questionnaire that assesses sleep quality during the previous month. The questionnaire contains 19 items and 5 additional questions. The last five questions are answered by another person, such as a partner or roommate; these items are usually used for clinical information and are not included into scoring. Nineteen questions include seven components of sleep quality under the following names: 1. subjective sleep quality, 2. sleep latency, 3. sleep duration, 4. sleep efficiency, 5. sleep disturbances, 6. use of sleeping medications and 7. daytime dysfunction. Each component is scored from 0 (no difficulty) to 3 (high difficulty). The total score is calculated as the sum of the scores of seven components, ranging from 0 to 21. The threshold value of the score is 5. That is, respondents with the score  $\geq 5$  have poor sleep quality. The characteristics of the PSQI indicate its usefulness in psychiatric clinical practice and research. The PSQI questionnaire was translated into Serbian and validated (15).

The Krupp Fatigue Severity Scale (FSS) is used to assess the effects of fatigue on physical, psychological and social functioning, such as work motivation, physical fitness or family obligations. It was originally designed as an instrument to measure fatigue in severe chronic diseases, but today it is used much more widely. It is primarily used for research, but also in clinical medicine and health economics when it comes to topics related to the quality of life, the effects of various therapies, and recently also for the evaluation of sleep. The scale consists of nine statements that are scored according to the seven-point Likert scale, ranging from strong disagreement to complete agreement with the offered statement. The total score can have values from 9 to 63. The total value of the Krupp Fatigue Scale is further divided by nine and

zamora). Prosečnu vrednost Krupove skale zamora veću od 4 autor je označio kao patološku. Krajnji rezultat je samoprocena stepena zamora, koji se može pratiti i porediti tokom vremena, a takođe se može porediti sa drugim stanjima i oboljenjima kod kojih se javlja zamor. Od svih poznatih instrumenata za merenje stepena zamora, Krupova skala zamora je najčešće korišćena. Validirana je i potvrđena je njena interna konzistentnost. Skala je prevedena na mnoge jezike za potrebe istraživanja među obolelima i u opštoj populaciji. Ona dobro korelira sa vizuelno–analognim merama i jasno razdvaja zdravu od patološke populacije (16).

Epwortova skala pospanosti (*Epworth Sleepiness Scale-ESS*) je skala namenjena za merenje dnevne pospanosti. Sastoji se od 8 pitanja. Od ispitanika se traži da oceni verovatnoću da će zaspati u određenim situacijama na skali od 0 do 3, gde 0 znači nikad, a 3 veliku verovatnoću da će zaspati. Bodovi za osam pitanja se sabiraju da bi se dobio konačan skor. Skor u opsegu 0-9 smatra se normalnim, dok skor u opsegu 10-24 ukazuje na povišenu pospanost (10-15 povišena pospanost, 16-24 ozbiljna pospanost) (17). Skala je prevedena na srpski jezik i validirana (18).

U statističkoj analizi podataka korišćene su metode deskriptivne statistike,  $\chi^2$  test i Studentov t-test. Kao statistički značajna vrednost je korišćeno  $p < 0,05$ . Za statističku obradu podataka korišćen je program IBM SPSS verzija 23.

## Rezultati

U studiju je bilo uključeno 312 studenata 27,5% studenata muškog pola i 72,5% studenata ženskog pola. Prosečan uzrast studenata bio je  $21,37 \pm 1,29$  godina (tabela 1). Najveći broj studenata bio je iz Beograda (55,8%), oko jedne trećine iz Centralne Srbije, dok je iz Vojvodine bilo oko 6% studenata. Oko 40% studenata stanovalo je kod roditelja, u iznajmljenom stanu nešto manje od 30%, dok je oko 15% živelo u domu. Prosečna ocena studenata tokom studiranja je bila  $8,53 \pm 0,85$ . Između studenata i studentkinja nije bilo značajne razlike u odnosu na uzrast, mesto stanovanja, socio-ekonomski status, mesto stanovanja tokom studiranja i prosečnoj oceni tokom studiranja.

Prosečna vrednost PSQI skora iznosila je  $6,49 \pm 3,36$  (minimum 0-maksimum 20) tokom prethodnih mesec dana (tabela 2). Više od polovine studenata (54,5%) imalo je loš kvalitet spavanja. Prosečna vrednost skale zamora iznosila je  $3,35 \pm 1,33$  (minimum 1, maksimum 7), a nešto više od četvrtine studenata (27,6%), imalo je povišen stepen zamora. Prosečna vrednost ESS skale pospanosti iznosila je  $9,22 \pm 4,46$  (minimum 0 - maksimum 24), a skoro polovina studenata imala je povišene nivoe dnevne pospanosti (45,8%). Između muškaraca i žena nije bilo značajne razlike u kvalitetu spavanja i nivou zamora, ali su žene značajno češće imale više nivoe dnevne pospanosti ( $p=0,008$ ).

**Tabela 1.** Demografske karakteristike ispitanika

Demografske karakteristike	Muškarci N=86	Žene N=226	p vrednost	Ukupno N=312
<b>Uzrast, (<math>\bar{x} \pm SD</math>)</b>	21,55 $\pm$ 1,89	21,30 $\pm$ 0,96	0,235*	21,37 $\pm$ 1,29
<b>Mesto stanovanja, N (%)</b>				
Beograd	51 (59,3)	123 (54,4)	0,362	174 (55,8)
Centralna Srbija	25 (29,1)	84 (37,2)		109 (34,9)
Vojvodina	5 (5,8)	13 (5,8)		18 (5,8)
Drugo	5 (5,8)	6 (2,7)		11 (3,5)
<b>Socio-ekonomski status, N (%)</b>				
Dobar	62 (72,1)	153 (67,7)	0,454	215 (68,9)
Srednji	24 (27,9)	74 (32,3)		97 (31,1)
Loš	0,0	0,0		0,0
<b>Stanovanje tokom studija, N (%)</b>				
Sa roditeljima	29 (33,7)	93 (41,2)	0,144	122 (39,1)
U domu	10 (11,6)	39 (17,3)		49 (15,7)
U iznajmljenom stanu	27 (31,4)	62 (27,4)		89 (28,5)
Ostalo	20 (23,3)	32 (14,2)		52 (16,7)
<b>Prosečna ocena tokom studiranja, (<math>\bar{x} \pm SD</math>)</b>	8,49 $\pm$ 0,78	8,53 $\pm$ 0,88	0,670*	8,53 $\pm$ 0,85

$\bar{x}$  - srednja vrednost, SD – standardna devijacija, p vrednost za  $\chi^2$  test, \* p vrednost za t test

thus the average fatigue score is obtained, which can range from 1 (complete absence of fatigue) to 7 (the most pronounced presence of fatigue). The average value of Krupp Fatigue Scale greater than 4 was marked as pathological by the author. The final result is the self-assessment of the degree of fatigue, which can be monitored and compared over time, and it can also be compared to other conditions and diseases in which fatigue occurs. Of all known instruments used for measuring fatigue, the Krupp Fatigue Scale is most frequently used. It was validated and its internal consistency was confirmed. The scale was translated into many languages for the purposes of research among patients and in the general population. It correlates well with the visual-analog measures and clearly separates the healthy from the pathological population (16).

The Epworth Sleepiness Scale (ESS) is a scale designed to measure daytime sleepiness. It consists of 8 questions. The respondents are asked to assess the likelihood of falling asleep in certain situations on a scale from 0 to 3, where 0 means never and 3 means high probability of falling asleep. Scores for the eight questions are added to give the final score. The score ranging from 0-9 is considered normal, while the score from 10 to 24 indicates increased sleepiness (10-15 is increased sleepiness, 16-24 is severe sleepiness) (17). The scale was translated into Serbian and validated (18).

The methods of descriptive statistics,  $\chi^2$  square test and Student's t test were used for the analysis of data.  $p < 0.05$  was used as a statistically significant value. The IBM SPSS version 23 program was used for statistical data processing.

## Results

The study included 312 third-year students of the Faculty of Medicine of the University of Belgrade, 86 men (27.5%) and 226 women (72.2%) (table 1). The average age of students was 21.37 years. The largest number of students was from Belgrade (55.8%), about one third from Central Serbia, while about 6% were from Vojvodina. About 40% of students lived with their parents, slightly less than 30% of them lived in rented apartments, while about 15% lived in student dormitories. The average grade was  $8.53 \pm 0.85$ . There was no significant difference between male and female students regarding age, place of residence, socio-economic status, residence during studies and average grade on studies.

The average score of the Pittsburgh Sleep Quality Index was  $6.49 \pm 3.36$  (minimum 0, maximum 20), more than half of the students (54.5%) had poor sleep quality during the previous month (table 2). The average value of the Fatigue Severity Scale was  $3.35 \pm 1.33$  (minimum 0, maximum 7), and every fourth student had increased fatigue (27.6%). The average value of

**Table 1.** Demographic characteristics of the respondents

Demographic characteristics	Males N=86	Females N=226	p value	Total N = 312
<b>Uzrast, (<math>\bar{x} \pm SD</math>)</b>	21.55 $\pm$ 1.89	21.30 $\pm$ 0.96	0.235*	21.37 $\pm$ 1.29
<b>Place of residence, N (%)</b>				
Belgrade	51 (59.3)	123 (54.4)	0.362	174 (55.8)
Centrala Serbia	25 (29.1)	84 (37.2)		109 (34.9)
Vojvodina	5 (5.8)	13 (5.8)		18 (5.8)
Other	5 (5.8)	6 (2.7)		11 (3.5)
<b>Socio-economic status, N (%)</b>				
Good	62 (72.1)	153 (67.7)	0.454	215 (68.9)
Middle	24 (27.9)	74 (32.3)		97 (31.1)
Poor	0.0	0.0		0.0
<b>Place of residence during studies, N (%)</b>				
With parents	29 (33.7)	93 (41.2)	0.144	122 (39.1)
In student dormitories	10 (11.6)	39 (17.3)		49 (15.7)
In rented apartments	27 (31.4)	62 (27.4)		89 (28.5)
Other	20 (23.3)	32 (14.2)		52 (16.7)
<b>Grade point average, (<math>\bar{x} \pm SD</math>)</b>	8.49 $\pm$ 0.78	8.53 $\pm$ 0.88	0.670*	8.53 $\pm$ 0.85

$\bar{x}$  - mean, SD – standard deviation, p value for  $\chi^2$  test, \* p value for t test

**Tabela 2.** Distribucija muškaraca i žena u odnosu na kvalitet spavanja, zamor i stepen dnevne pospanosti

	Muškarci N=86	Žene N=226	p vrednost	Ukupno N=312
<b>Kvalitet spavanja</b>				
$\bar{x} \pm SD$	6,35 $\pm$ 3,37	6,54 $\pm$ 3,37	0,647*	6,49 $\pm$ 3,36
med (min – max)	6 (0-20)	6 (0-17)		6 (0-20)
Dobar (PSQI < 5)	41 (47,7)	101 (44,7)	0,636	142 (45,5)
Loš (PSQI $\geq$ 5)	45 (52,3)	125 (55,3)		170 (54,5)
<b>Zamor</b>				
$\bar{x} \pm SD$	3,21 $\pm$ 1,26	3,41 $\pm$ 1,36	0,242*	3,35 $\pm$ 1,33
med (min–max)	3 (1,11-6,56)	3,22 (1-7)		3,11 (1-7)
Normalan (FSS $\leq$ 4)	67 (77,9)	159 (70,4)	0,182	226 (72,4)
Povišen (FSS > 4)	19 (22,1)	67 (29,6)		86 (27,6)
<b>Dnevna pospanost</b>				
$\bar{x} \pm SD$	8,03 $\pm$ 4,15	9,67 $\pm$ 4,50	0,004*	9,22 $\pm$ 4,46
med (min–max)	7 (0-18)	10 (0-24)		9 (0-24)
Normalna (ESS 0-9)	57 (66,3)	112 (49,6)	0,008	169 (54,2)
Povišena (ESS 10-24)	29 (33,7)	114 (50,4)		143 (45,8)

$\bar{x}$  - srednja vrednost, SD – standardna devijacija, p vrednost za  $\chi^2$  test, \* p vrednost za t test, PSQI – Pittsburgh Sleep Quality Index, FSS – Fatigue Severity Scale, ESS – Epworth Sleepiness Scale

**Tabela 3.** Demografske karakteristike, kvalitet spavanja i dnevna pospanost u odnosu na stepen zamora kod muškaraca

	Normalan stepen zamora N = 67	Povišen stepen zamora N = 19	p vrednost	Ukupno N=86
<b>Mesto stanovanja, N (%)</b>				
Beograd	39 (58,2)	12 (63,2)	0,984	51 (59,3)
Druga mesta	28 (41,8)	7 (36,8)		35 (40,7)
<b>Socio-ekonomski status, N (%)</b>				
Dobar	51 (76,1)	11 (57,9)	0,118	62 (72,1)
Srednji	16 (23,9)	8 (42,1)		24 (27,9)
<b>Stanovanje tokom studija, N (%)</b>				
Sa roditeljima	22 (32,8)	7 (36,8)	0,941	29 (33,7)
U domu	8 (11,9)	2 (10,5)		10 (11,6)
U iznajmljenom stanu	22 (32,8)	5 (26,3)		27 (31,4)
Ostalo	15 (22,4)	5 (26,3)		20 (23,2)
<b>Kvalitet spavanja, N (%)</b>				
Dobar (PSQI < 5)	38 (56,7)	3 (15,8)	0,002*	41 (47,7)
Loš (PSQI $\geq$ 5)	29 (43,3)	16 (84,2)		45 (52,3)
<b>Dnevna pospanost, N (%)</b>				
Normalna (ESS 0-9)	47 (70,1)	10 (52,6)	0,154	57 (66,3)
Povišena (ESS 10-24)	20 (29,9)	9 (47,4)		29 (33,7)
<b>Prosečna ocena tokom studiranja, (<math>\bar{x} \pm SD</math>)</b>	8,49 $\pm$ 0,78	8,53 $\pm$ 0,88	0,670*	8,53 $\pm$ 0,85

$\bar{x}$  - srednja vrednost, SD – standardna devijacija, p vrednost za  $\chi^2$  test, \* p vrednost za t test, PSQI – Pittsburgh Sleep Quality Index, FSS – Fatigue Severity Scale, ESS – Epworth Sleepiness Scale

**Table 2.** Distribution of male and female students regarding sleep quality, fatigue and sleepiness

	Males N=86	Females N=226	p value	Total N = 312
<b>Sleep quality</b>				
$\bar{x} \pm SD$	6.35 $\pm$ 3.37	6.54 $\pm$ 3.37	0.647*	6.49 $\pm$ 3.36
med (min – max)	6 (0-20)	6 (0-17)		6 (0-20)
Good (PSQI < 5)	41 (47.7)	101 (44.7)	0.636	142 (45.5)
Poor (PSQI $\geq$ 5)	45 (52.3)	125 (55.3)		170 (54.5)
<b>Fatigue</b>				
$\bar{x} \pm SD$	3.21 $\pm$ 1.26	3.41 $\pm$ 1.36	0.242*	3.35 $\pm$ 1.33
med (min–max)	3 (1.11-6.56)	3.22 (1-7)		3.11 (1-7)
Normal (FSS $\leq$ 4)	67 (77.9)	159 (70.4)	0.182	226 (72.4)
Increased (FSS > 4)	19 (22.1)	67 (29.6)		86 (27.6)
<b>Daily sleepiness</b>				
$\bar{x} \pm SD$	8.03 $\pm$ 4.15	9.67 $\pm$ 4.50	0.004*	9.22 $\pm$ 4.46
med (min–max)	7 (0-18)	10 (0-24)		9 (0-24)
Normal (ESS 0-9)	57 (66.3)	112 (49.6)	0.008	169 (54.2)
Increased (ESS 10-24)	29 (33.7)	114 (50.4)		143 (45.8)

$\bar{x}$  - mean, SD – standard deviation, p value for  $\chi^2$  test, \* p value for t test, PSQI – Pittsburgh Sleep Quality Index, FSS – Fatigue Severity Scale, ESS – Epworth Sleepiness Scale

**Table 3.** Demographic characteristics, sleep quality and fatigue in relation to the level of fatigue in men

	Normal fatigue N = 67	Increased fatigue N = 19	p value	Total N=86
<b>Place of residence, N (%)</b>				
Beograd	39 (58.2)	12 (63.2)	0.984	51 (59.3)
Druga mesta	28 (41.8)	7 (36.8)		35 (40.7)
<b>Socio-ekonomski status, N (%)</b>				
Dobar	51 (76.1)	11 (57.9)	0.118	62 (72.1)
Srednji	16 (23.9)	8 (42.1)		24 (27.9)
<b>Place of residence during studies, N (%)</b>				
With parents	22 (32.8)	7 (36.8)	0.941	29 (33.7)
In student dormitories	8 (11.9)	2 (10.5)		10 (11.6)
In rented apartments	22 (32.8)	5 (26.3)		27 (31.4)
Other	15 (22.4)	5 (26.3)		20 (23.2)
<b>Sleep quality, N (%)</b>				
Good (PSQI < 5)	38 (56.7)	3 (15.8)	0.002*	41 (47.7)
Poor (PSQI $\geq$ 5)	29 (43.3)	16 (84.2)		45 (52.3)
<b>Sleepiness, N (%)</b>				
Normal (ESS 0-9)	47 (70.1)	10 (52.6)	0.154	57 (66.3)
Increased (ESS 10-24)	20 (29.9)	9 (47.4)		29 (33.7)
<b>Grade point average, (<math>\bar{x} \pm SD</math>)</b>				
	8.49 $\pm$ 0.78	8.53 $\pm$ 0.88	0.670*	8.53 $\pm$ 0.85

$\bar{x}$  - mean, SD – standard deviation, p value for  $\chi^2$  test, \*p value for t test, PSQI – Pittsburgh Sleep Quality Index, FSS – Fatigue Severity Scale, ESS – Epworth Sleepiness Scale



**Tabela 4.** Demografske karakteristike, kvalitet spavanja i dnevna pospanost u odnosu na stepen zamora kod žena

	Normalan stepen zamora N = 159	Povišen stepen zamora N = 67	p vrednost	Ukupno N=226
<b>Mesto stanovanja, N (%)</b>				
Beograd	90 (56,6)	33 (49,3)	0,984	123 (54,4)
Druga mesta	69 (43,4)	34 (50,7)		103 (45,6)
<b>Socio-ekonomski status, N (%)</b>				
Dobar	113 (71,1)	40 (59,7)	0,095	153 (67,7)
Srednji	46 (28,9)	27 (40,3)		73 (32,3)
<b>Stanovanje tokom studija, N (%)</b>				
Sa roditeljima	65 (40,9)	28 (41,8)	0,661	93 (41,2)
U domu	29 (18,2)	10 (14,9)		39 (17,3)
U iznajmljenom stanu	44 (27,7)	18 (26,9)		62 (27,4)
Ostalo	21 (13,2)	11 (16,4)		32 (14,2)
<b>Kvalitet spavanja, N (%)</b>				
Dobar (PSQI < 5)	79 (49,7)	22 (32,8)	0,020	101 (44,7)
Loš (PSQI ≥ 5)	80 (50,3)	45 (67,2)		125 (55,3)
<b>Dnevna pospanost, N (%)</b>				
Normalna (ESS 0-9)	86 (54,1)	26 (38,8)	0,036	112 (49,6)
Povišena (ESS 10-24)	73 (45,9)	41 (61,2)		114 (50,4)
<b>Prosečna ocena tokom studiranja, (<math>\bar{x} \pm SD</math>)</b>	8,52 ± 0,94	8,57 ± 0,74	0,735*	8,49 ± 0,78

$\bar{x}$  - srednja vrednost, SD – standardna devijacija, p vrednost za  $\chi^2$  test, \* p vrednost za t test, PSQI – Pittsburgh Sleep Quality Index, FSS – Fatigue Severity Scale, ESS – Epworth Sleepiness Scale

Između muškaraca sa povišenim stepenom zamora i onih sa normalnim vrednostima stepena zamora nije bilo značajne razlike u odnosu na mesto stanovanja, socio-ekonomski status, mesto stanovanja tokom studija i prosečnu ocenu tokom studija (tabela 3). Studenti sa povišenim stepenom zamora značajno češće su imali loš kvalitet spavanja tokom prethodnih mesec dana (84,2%) u odnosu na studente sa normalnim vrednostima stepena zamora (43,3%), dok u stepenu dnevne pospanosti između njih nije bilo razlike.

Između studentkinja sa povišenim stepenom zamora i onih sa normalnim vrednostima stepena zamora nije bilo značajne razlike u odnosu na mesto stanovanja, socio-ekonomski status, mesto stanovanja tokom studija i prosečnu ocenu tokom studija (tabela 4). Studentkinje sa povišenim stepenom zamora značajno češće su imale loš kvalitet spavanja tokom prethodnih mesec dana (67,2%) u odnosu na studentkinje sa normalnim vrednostima stepena zamora (50,3%), kao i povišene nivoe dnevne pospanosti (61,2% vs. 45,9%).

## Diskusija

Loš kvalitet spavanja je uobičajen kod studenata medicine i povezan je sa brojnim negativnim zdravstvenim ishodima. Međutim, procenjena učestalost lošeg kvaliteta spavanja kod studenata medicine varira u različitim studijama (19). Prema rezultatima naše studije loš kvalitet spavanja imalo je više od polovine studenata, i to 52,3% muškaraca i 55,6% žena.

U populacionim studijama procenjena prevalencija poremećaja spavanja kreće se od 15 do 42%, a kod starijih osoba može biti i do 72% (20). Meta-analiza iz 2020. godine, koja je obuhvatila studije u kojima je kvalitet spavanja procenjivan PSQI skorom, pokazala je da je prevalencija lošeg kvaliteta spavanja kod studenata medicine 52,7% (19). To je značajno više nego među drugim univerzitetskim studentima (23%) (21) i starijoj populaciji (38,3%) (22). Ovakav rezultat verovatno je povezan sa visokim akademskim pritiskom na medicinskim fakultetima, jer se često akademske obaveze studenata završavaju na račun kvaliteta njihovog spavanja. Pored toga, određeni psihološki faktori, kao što su anksioznost i depresivni simp-

**Table 4.** Demographic characteristics, sleep quality and sleepiness in relation to the level of fatigue in women

	Normal fatigue N = 159	Increased fatigue N = 67	p value	Total N=226
<b>Place of residence, N (%)</b>				
Beograd	90 (56.6)	33 (49.3)	0.984	123 (54.4)
Druga mesta	69 (43.4)	34 (50.7)		103 (45.6)
<b>Socio-ekonomski status, N (%)</b>				
Dobar	113 (71.1)	40 (59.7)	0.095	153 (67.7)
Srednji	46 (28.9)	27 (40.3)		73 (32.3)
<b>Place of residence during studies, N (%)</b>				
With parents	65 (40.9)	28 (41.8)	0.661	93 (41.2)
In student dormitories	29 (18.2)	10 (14.9)		39 (17.3)
In rented apartments	44 (27.7)	18 (26.9)		62 (27.4)
Other	21 (13.2)	11 (16.4)		32 (14.2)
<b>Sleep quality, N (%)</b>				
Good (PSQI < 5)	79 (49.7)	22 (32.8)	0.020	101 (44.7)
Poor (PSQI ≥ 5)	80 (50.3)	45 (67.2)		125 (55.3)
<b>Sleepiness, N (%)</b>				
Normal (ESS 0-9)	86 (54.1)	26 (38.8)	0.036	112 (49.6)
Increased (ESS 10-24)	73 (45.9)	41 (61.2)		114 (50.4)
<b>Grade point average, (<math>\bar{x} \pm SD</math>)</b>	8.52 ± 0.94	8.57 ± 0.74	0.735*	8.49 ± 0.78

$\bar{x}$  - mean, SD – standard deviation, p value for  $\chi^2$  test, \*p value for t test, PSQI – Pittsburgh Sleep Quality Index, FSS – Fatigue Severity Scale, ESS – Epworth Sleepiness Scale

ESS sleepiness scale was  $9.22 \pm 4.46$  (minimum 0, maximum 24), and almost half of the students had elevated levels of sleepiness (45.8%). There was no significant difference between men and women regarding sleep quality and level of fatigue, but women significantly more often had higher levels of daytime sleepiness ( $p=0.008$ )

There was no significant difference between men with increased fatigue and those with normal values of fatigue in relation to their place of residence, socio-economic status, place of residence during studies and average grade on studies (table 3). Students with increased fatigue had poor sleep quality during previous month significantly more often (84.2%) in comparison to students with normal fatigue scores (43.3%), while there was no difference between them in relation to sleepiness.

Between female students with an elevated level of fatigue and those with normal values of the level of fatigue, there was no significant difference in relation to the place of residence, socio-economic status, place of residence during studies and average grade during studies (table 4). Female

students with an increased degree of fatigue significantly more often had poor sleep quality during the previous month (67.2%) compared to female students with normal values of the degree of fatigue (50.3%), as well as increased levels of daytime sleepiness (61.2% vs. 45.9%).

## Discussion

Poor sleep quality is common among students of medicine and it is connected with a number of negative health outcomes. However, estimates of the prevalence of poor sleep quality in medical students vary in different studies (19). According to the results of our study, more than half of the students had poor sleep quality, namely 52.3% of men and 55.3% of women.

In population studies, the estimated prevalence of sleep disorders ranges from 15 to 42%, while in the elderly it can be up to 72% (20). One meta-analysis from 2020, which included studies in which sleep quality was assessed by the PSQI score, showed that the prevalence of poor sleep in medical students was 52.7% (19). This is significantly higher in comparison to other

tomi relativno su česti kod studenata medicine (14), što je povezano sa većim rizikom nastanka problema sa spavanjem (3).

Rezultati dobijeni ovim istraživanjem ukazuju da je svaki četvrti student imao povišen stepen zamora, a skoro polovina studenata povišen nivo dnevne pospanosti. Učestalost povišene dnevne pospanosti je značajno veća među ženama, nego među muškarcima. Osim toga, veća je učestalost lošeg kvaliteta spavanja među muškarcima i ženama sa povećanim vrednostima stepena zamora. U našoj studiji nije otkrivena povezanost akademskog uspeha studenata sa zamorom, pospanošću i, kvalitetom spavanja. Prosečna ocena studenata tokom studiranja je bila visoka, i iznosila je 8,53, ali nije uočana značajna razlika u uspehu na studijama u odnosu na pol, a ni među studentima sa povišenim i onih sa normalnim vrednostima stepena zamora. Međutim, rezultati drugih studija ukazuju da i zamor i loš kvalitet spavanja mogu značajno da utiču na akademski uspeh, kao i da povećaju rizik nastajanja sindroma sagorevanja, anksioznosti, depresije i poremećaja pažnje kod studenata (23).

Zamor i pospanost značajni su za studente medicine i sa aspekta što su oni budući zdravstveni radnici. Studije ukazuju na povećane vrednosti dnevne pospanosti, skraćeno vreme reagovanja, povećanu varijabilnost vremena odgovora, kao i na povećanu učestalost medicinskih grešaka i pogrešnog donošenja odluka kod zdravstvenih radnika (24). Usled nestandardnog radnog vremena, odnosno rada u smenama, noćnih dežurstava, izmenjene dinamike rada, svakodnevnog pritiska i stresa, zamor i dnevna pospanost se u velikom procentu javljaju i kod zdravstvenih radnika u kliničkoj praksi (24). Stoga je potrebno motivisati studente medicine na zdraviji način života već u nižim godinama studija.

Ovo istraživanje je sprovedeno na uzorku studenata treće godine studija medicine, pa se rezultati ne mogu generalizovati na studente svih godina studija. Kako se sa godinama studija menja i akademsko opterećenje bilo bi značajno da se istraživanje sprovede među studentima svih godina studija. Osim toga, kako je istraživanje dizajnirano po tipu studije preseka, ima sva ograničenja koja su karakteristična za ovaj tip studija, pre svega nemogućnost utvrđivanja uzročno-posledične veze. Stoga bi bilo značajno sprovesti studije koje bi omogućile detaljniji uvid u navike u dnevnom

funkcionisanju i akademskom opterećenju studenata, koje bi zajedno sa podacima o kvalitetu spavanja, stepenu zamora i pospanosti pružile informacije o njihovom mentalnom stanju, što bi dalo osnov za primenu odgovarajućih preventivnih mera. Potrebno je podržati studente i omogućiti im da uz profesionalne veštine razviju neophodne kapacitete koji će im omogućiti da održe zdravlje i blagostanje kako tokom studiranja pod visokim pritiskom i tako i tokom zahtevne profesionalne karijere.

## Zaključak

Loš kvalitet spavanja, zamor i dnevna pospanost su učestali među studentima medicine. Više od polovine studenata medicine ima loš kvalitet spavanja, svaki četvrti student medicine ima povišen stepen zamora, a skoro polovina studenata medicine ima povišen nivo dnevne pospanosti. U cilju smanjenja učestalosti neželjenih zdravstvenih posledica lošeg kvaliteta spavanja, neophodno je sprovesti dodatnu edukaciju studenata medicine o uticaju kvaliteta spavanja i zamora na zdravlje, kao i edukacije o zdravim obrascima spavanja i efikasnoj organizaciji vremena tokom studiranja.

## Konflikt interesa

Autori su izjavili da nema konflikta interesa.

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university students (23%) (21) and the elderly population (38.3%) (22). This result is probably related to the high academic pressure at medical faculties, because academic duties are often completed at the expense of good quality sleep. In addition, certain psychological factors, such as anxiety and depressive symptoms are relatively common in medical students, which is associated with a higher risk of sleep problems (3).

The results obtained from this research indicated that the prevalence of increased fatigue is 27.6%, and increased daytime sleepiness even 45.8%. The frequency of increased sleepiness is significantly higher among women (50.4%) than among men (33.7%). In addition, the frequency of increased sleepiness is significantly higher among women (50.4%) than among men (33.7%). In addition, the frequency of poor sleep quality is higher among men and women with increased fatigue. In this study, the correlation between the academic success of students and increased fatigue, sleepiness and poor sleep quality was not found. The average grade of students was high, 8.53, but there was no significant difference between genders in relation to academic success, as well as between students with increased and those with normal fatigue scores. However, the results of other studies indicate that fatigue and poor sleep quality can significantly influence the academic success, as well as increase the risk of burnout, anxiety, depression and attention deficit disorders (23).

Fatigue and sleepiness are important for medical students because they are future healthcare workers. Numerous studies have pointed to increased sleepiness, decreased reaction time, increased variability of response time, as well as increased frequency of medical errors and incorrect decision-making in healthcare workers (24). Due to non-standard working hours, that is, shift work, nightshifts, changed work dynamics, everyday pressure and stress, fatigue and sleepiness occur in healthcare workers in clinical practice in a large percentage (24). Therefore, it is necessary to encourage medical students to adopt a healthier lifestyle in the earlier years of studies.

This research was conducted on a sample of students in the third year of medical studies, so the results cannot be generalized to students of all years of study. As the academic load changes

with the years of study, it would be significant if the research was conducted among students of all years of study. In addition, as the research was designed as a cross-sectional study, it has all the limitations characteristic of this type of study, primarily the impossibility of establishing a cause-and-effect relationship. Therefore, it would be essential to conduct studies that would allow more detailed insight into the habits of daily functioning and academic workload of students, which, together with data on the quality of sleep, degree of fatigue, and sleepiness, would provide information about their mental state, which would provide a basis for the application of appropriate preventive measures. It is necessary to support students and enable them to develop, along with professional skills, the necessary capacities that will help them to maintain health and well-being both during high-pressure studies and during a demanding professional career.

## Conclusion

Poor sleep quality, fatigue and daytime sleepiness are common among medical students. More than half of medical students have poor sleep quality, every fourth medical student has an increased level of fatigue, and almost half of medical students have an increased level of daytime sleepiness. In order to reduce the frequency of unwanted health consequences of poor sleep quality, it is necessary to conduct additional education of medical students about the impact of sleep quality and fatigue on health, as well as education about healthy sleep patterns and efficient organization of time during studies.

## Competing interests

The authors declared no competing interests.

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