Evaluation of sleep and daytime sleepiness in Medical students at a public university

Avaliação do sono e da sonolência diurna em estudantes de Medicina de uma universidade pública

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ABSTRACT

Introduction: Quality sleep is essential for consolidating cognition, memory and learning. Its deprivation tends to generate negative effects on the knowledge acquisition process, as well as adverse effects on health. Medical students tend to experience various sleep disorders, due to the high demand of the course and the heavy workload.

Objective: To evaluate the quality of sleep and the presence of excessive daytime sleepiness in medical students at Universidade Federal da Bahia and correlate sleep quality and excessive daytime sleepiness with the current academic semester and student performance.

Method: This is an observational, cross-sectional, quantitative study, based on data collection through a questionnaire, of which research participants comprised 517 medical students regularly enrolled at the Faculty of Medicine of Bahia (FMB) of Universidade Federal da Bahia (UFBA), Salvador - Bahia, attending from the 1st to the 8th semesters. A questionnaire containing a sociodemographic profile and two self-administered questionnaires, validated and adapted into Portuguese, were applied to assess sleep quality and daytime sleepiness in a sample stratified by semesters in 8 groups: 1st semester (n-61), 2nd semester (n-67), 3rd semester (n-60), 4th semester (n-64), 5th semester (n-56), 6th semester (n-70), 7th semester (n-67), and 8th semester (n-65). The software Statistical Package for Social Sciences (SPSS Inc., Chicago, IL, USA) was used for the statistical analysis.

Results: Poor sleep quality (IQSP > 5) was found in 84.1% of the research participants and was associated with a lower performance coefficient. Excessive daytime sleepiness was present in 65.4% of those evaluated. There was no statistically significant difference in the comparison between the scores on the IQSP® and ESSE scales with the academic semester attended. An association was observed between excessive daytime sleepiness and poor sleep quality, female gender and worse academic performance.

Conclusion: There is a high prevalence of sleep disorders among medical students.

Keywords: Sleep-Wake Disorders; Medical Students; Sleep Quality; Daytime Sleepiness.

RESUMO

Introdução: *Um sono de qualidade é fundamental para a consolidação da cognição, da memória e do aprendizado. A privação de sono tende a gerar efeitos negativos no processo de aquisição de conhecimentos, bem como efeitos adversos à saúde. Os estudantes de Medicina tendem a apresentar diversos distúrbios do sono devido à alta demanda do curso e à carga horária elevada.*

Objetivo: *Este estudo teve como objetivos avaliar a qualidade do sono e a presença de sonolência excessiva diurna em discentes de Medicina da Universidade Federal da Bahia (UFBA) e correlacioná-las com o semestre letivo em curso e a performance estudantil.*

Método: *Trata-se de um estudo observacional, transversal, de caráter quantitativo, baseado na coleta de dados realizada por meio de um questionário. Participaram da pesquisa 517 alunos de Medicina regularmente matriculados na Faculdade de Medicina da Bahia (FMB) da UFBA, do primeiro ao oitavo semestre. Utilizaram-se um questionário contendo perfil sociodemográfico e dois questionários autoaplicáveis, validados e adaptados para o português, com o propósito de avaliar a qualidade do sono e a sonolência diurna em amostra estratificada por semestres em oito grupos: primeiro (n = 61), segundo (n = 67), terceiro (n = 60), quarto (n = 64), quinto (n = 56), sexto (n = 70), sétimo (n = 67) e oitavo (n = 65). Para a análise estatística, adotou-se o software Statistical Package for Social Sciences (SPSS).*

Resultado: *Observou-se qualidade de sono ruim (IQSP > 5) em 84,1% dos participantes da pesquisa que foi associada a um menor coeficiente de rendimento. A sonolência excessiva diurna esteve presente em 65,4% dos avaliados. Não houve diferença estatística significativa na comparação entre os escores das escalas IQSP e ESE com o semestre letivo cursado. Foi observada associação entre sonolência excessiva diurna e má qualidade do sono, gênero feminino e pior desempenho acadêmico.*

Conclusão: *Existe alta prevalência de distúrbios do sono entre os estudantes de Medicina.*

Palavras-chave: *Distúrbios do Sono; Estudantes de Medicina; Qualidade do Sono; Sonolência Diurna.*

INTRODUCTION

Adequate sleep is an active process with an important role in the restoration of synaptic homeostasis, a decisive role in strengthening cognitive capacities, as well as in the consolidation and integration of memory and learning[1]. Quality sleep is associated with better academic performance[2,3] and its deprivation, even when partial, can have a negative effect on the learning process[4]. Sleeping less than 7 hours a night is associated with adverse health outcomes, such as impacts on the cardiovascular, metabolic, and mental performance fields[5].

The sleep-wake cycle is a circadian rhythm, repeating itself in an approximate period of 24 hours, and is linked to the interference of environmental and endogenous factors. The alternation of day-night (light-dark), daily activities, physical activities and meetings with family members are examples of exogenous factors that synchronize this cycle. In addition to this environmental synchronization, the sleep-wake cycle is generated and regulated endogenously by the suprachiasmatic nucleus, located in the hypothalamus, which is considered our biological clock[6].

The sleep of the adult human being consists of cycles, comprising the REM (Rapid Eye Movement) sleep and NREM (non-REM) sleep, with an average duration of ninety minutes. These cycles repeat four or five times during the night. NREM sleep occupies about 75% of the total sleep time, with the following general characteristics: being physiologically calm and stable compared to wakefulness and REM sleep, heart and respiratory rates tend to be low and more regular, the muscles are relaxed, and muscle tone is present throughout the NREM stage. It is subdivided into three stages – I, II and III, ranging from the lightest to the deepest sleep. REM sleep occupies about 20 to 25% of the total sleep time, and presents several physiological changes: low muscle activity, elevation and irregularity of heart and respiratory rates, and increased blood pressure. There is also an increase in brain temperature and greater oxygen consumption. Additionally, there is an intense loss in muscle tone. Muscle tremors may also occur, which may be related to dreams[7]. Activities at the cell level, in the hippocampal area, hich occur in NREM sleep are related to the process of brain plasticity and are affected by the quantity and quality of sleep achieved[8].

Sleep deprivation, translated into a period without sleep or fragmented sleep, is usually associated with poor sleep quality and leads to excessive daytime sleepiness (EDS), which is perceived as an increased tendency to fall asleep during daily activities[9].

Instruments for subjective measurements of sleep quality and sleepiness can be used both in clinical routine and in research protocols. Two widely used instruments, which are easy to understand and quickly filled out, are the Pittsburgh Sleep Quality Index (PSQI) and the Epworth Sleepiness Scale (ESS)[10].

The Pittsburgh Sleep Quality Index is a self-rated questionnaire that assesses sleep quality and disturbances over the course of a month. Nineteen individual items generate seven "component" scores: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleep medications, and daytime dysfunction. There are 19 questions related to these 7 components with scores distributed from 0 to 3, which after adding together produce an overall score, ranging from 0 to 21, with 0 being better sleep quality and 21 worse sleep quality[11].

The Epworth Sleepiness Scale is a simple and self-administered questionnaire that measures the level of daytime sleepiness, assessing the chances of falling asleep in eight different everyday situations. For each daily action, a score is assigned, related to the probability of napping, ranging from 0 to 3, with 0 corresponding to no chance of napping and 3 being highly probable. The result ranges from 0 to 21, and a score greater than 10 indicates excessive daytime sleepiness[12].

The Medicine Course, when compared to other courses at Universidade Federal da Bahia (UFBA), is the one with the highest average workload per semester, 750 hours/semester, as compared to other courses: Law 440 hours/semester, Chemical Engineering 404 hours/semester and Dentistry 446 hours/semester. In this context, the population of medical students tends to have a high prevalence of sleep disorders, mainly due to the large demand for time for studies and extracurricular activities (internship, monitoring, extension projects, academic leagues), a fact that is not restricted to the UFBA course, being the target of study in other universities around the world[13-18]. The aim of this research is to subjectively evaluate the quality of sleep and the presence of excessive daytime sleepiness in medical students, correlating these parameters with each other and with other variables, such as the attended academic semester and academic performance.

METHOD

This is an observational and cross-sectional study in which a questionnaire containing sociodemographic profile questions and two self-administered questionnaires, validated and adapted into Portuguese, the Pittsburgh Sleep Quality Index and the Epworth Sleepiness Scale, were applied in November 2019 to a sample of a group of students from the Faculty of Medicine of Bahia – FMB, attending from the 1st to the 8th semester, who met the criteria for voluntary participation in research. The evaluated subjects were explained the risks of the study, which could imply the embarrassment of the student/

research participant in answering a question or the identification of the questionnaire; thus, these risks were reduced as much as possible. In addition, the Free and Informed Consent Form (ICF), which was distributed before the research, makes it clear that, when feeling embarrassed to answer any question, the research participant could leave the answer blank and/or give up their participation in the study at any time, without incurring any harm to their academic life. It was also assumed that the non-identification of the interviewee allows impartiality, which was assured to the participant in the evaluation of the data and in the publication of the results. The questionnaires were applied in classes/activities with all students of the academic semester, aiming to include a larger number of participants.

Inclusion Criteria

All medical students, of both genders, regularly enrolled at FMB/UFBA who were attending the 1st, 2nd, 3rd, 4th, 5th, 6th, 7th and 8th semesters participated in the study.

Exclusion criteria

Students who did not fully fill out the self-administered questionnaires were excluded from the study.

Academic performance was measured using the performance coefficient (PC) reported by the students. The PC is an index that measures the student's academic performance throughout the course, being the result of the weighted average of the final grade and workload of the subjects taken. The categorized PC and mean PC were compared with the scores of the Pittsburgh Sleep Quality Index and the Epworth Sleepiness Scale.

For the creation of the database and descriptive and inferential analysis, the software Statistical Package for Social Sciences (SPSS Inc., Chicago, IL, USA) version 24.0 for MAC was used. The results are presented in tables. Categorical variables are expressed as frequencies and percentages. Continuous variables with normal distribution are expressed as mean and standard deviation, and those with non-normal distribution as median and interquartile range. The normality of the numerical variables was verified through descriptive statistics, graph analysis and the Kolmogorov-Smirnov test.

In the comparison between the groups with and without Excessive Daytime Sleepiness, the Mann Whitney U-test was used for numerical variables with non-normal distribution and the x^2 test for categorical variables. Spearman's correlation test was used to calculate the correlation coefficient between the quantitative variables performance coefficient and PSQI and ESS scores. Odds ratios with 95% confidence intervals were calculated using logistic regression to identify associations.

For the multivariate analysis, variables with a p<0.20 value obtained in the univariate analysis were considered for entry into the logistic regression model. For statistical inferences, a value of p<0.05 was adopted as statistically significant.

RESULTS

From a sample of 517 medical students eligible for the study, 459 students were included for analysis, considering only those who were regularly attending the academic semester. The female gender corresponded to 50.8% of the total sample and a similar distribution of the completion of the questionnaires was obtained between the evaluated semesters.

Table 1 shows a statistically significant association between excessive daytime sleepiness (EDS) and the female gender, a higher median frequency of physical activity in the group without EDS, higher use of medication or stimulants to awaken in the group with EDS, and a median coefficient of higher performance in the group without EDS.

Table 1. Sociodemographic and clinical characteristics of the population of medical students.

| Variables | EDS | | P-value |
| | Yes | No | |
	N= 300	N= 159	
Age, median (p25-p75)	22 (21-25)	22 (20-25)	0,830*
Semester attended, n(%)			
1st	39 (13.0)	21 (13.2)	
2nd	45 (15.0)	18 (11.3)	
3rd	31 (10.3)	23 (14.5)	
4th	37 (12.3)	27 (17.0)	0.114**
5th	34 (11.3)	16 (10.1)	
6th	48 (16.0)	12 (7.5)	
7th	37 (12.3)	20 (12.6)	
8th	29 9.7)	22 (13.8)	
Female gender, n(%)	166 (55.3)	67 (42.1)	0.007**
Married marital status, n(%)	21 (7.0)	10 (6.3)	0.773**
Has children, n(%)	11 (3.7)	8 (5.0)	0.485**
Performs extra-curricular activity, n(%)	188 (62.7)	92 (57.9)	0.315**
Works, n(%)	60 (20.0)	23 (14.5)	0.143**
Hours worked per week, median (p25-p75)	20 (10-30)	18 (9-30)	0.743*
Performs physical activity, n(%)	180 (60.0)	83 (52.2)	0.108**
Frequency of physical activity per week, median (p25-p75)	3 (2-4)	4 (3-5)	0.028*

In the group of students with EDS, 67.7% reported the use of medications or stimulants to wake up, with a higher frequency of coffee consumption (43%), followed by the association of coffee and energy drinks (16.7%), coffee, energy drinks and *guarana* (3.7%), energy drinks alone (1.3%), coffee and *guarana* (1%), in addition to teas (0.7%), association with drugs (0.3%) and others (1%). In the group without EDS, 50.9% use medications or stimulants to wake up. The use of coffee was observed in 42.1% of this group, the association of coffee and energy drinks in 3.8%, energy drinks alone in 2.5%, coffee and *guarana* in 1.3% and the association of coffee and energy drinks and *guarana* in 1.3%.

Less than 10% of each group reported using sleep medications. The use of anxiolytics, antidepressants, herbal medications, muscle relaxants, melatonin, antipsychotics, cannabis, antihistamine, hypnotics, and alcohol use, as well as combinations of substances, were reported. No statistically significant difference was observed in the groups in relation to the use of sleep medications.

Regarding the characteristics of the PSQI®, after analyzing the 7 components of the PSQI and calculating the PSQI® score, it was possible to verify that a considerable number of the students (84.1%) have, according to information regarding the last month, poor sleep quality (PSQI >5). The participants' overall average in the PSQI was 8.56 ± 3.08. We observed that students with EDS had a higher median global PSQI® score compared to those with normal daytime sleepiness, in addition to a lower median of hours of sleep per night. Students with excessive daytime sleepiness had a higher frequency of sleep quality classified as poor or very poor. When separately evaluating the sleep components in the PSQI®, a statistically significant difference was observed between students with and without excessive daytime sleepiness in relation to subjective sleep quality, sleep

Table 1. Continuation.

Variables	EDS		P-value
	Yes	No	
	N= 300	N= 159	
Duration of physical activity in minutes, median (p25- p75)	60 (60-90)	60 (60-90)	0.562*
Use of electronic media before bedtime, n(%)	292 (97.3)	153 (96.2)	0.512**
Time in minutes of electronic media use, median (p25-p75)	60 (30-60)	60 (30-60)	0.447*
Use of medication or stimulants to awaken, n(%)	203 (67.7)	81 (50.9)	0.000**
Use of sleep medication, n(%)	26 (8.7)	14 (8.8)	0.587**
Coefficient of performance, median (p25-p75)	8.1 (7.6-8.5)	8.3 (7.8-8.7)	0.023*

Abbreviations: n= number of participants.
EDS = excessive daytime sleepiness.
* Mann-Whitney U test.
** Pears x^2 test.
Source: Prepared by the authors.

duration, sleep disorders, and daytime dysfunction (Table 2). It is noteworthy that only 19 (4.1%) of the participants reported being able to sleep more than 7 hours a night and that, when asked about their perception of sleep quality, 252 (54.9%) of the students understood they had poor or very poor sleep quality (PSQI question 6).

Table 3 shows a statistically significant association between more advanced degrees of EDS and poor sleep quality.

We obtained a weak direct correlation between the quantitative variables of the PSQI® and ESS scores (r= 0.297, p=0.000). Weak inverse Spearman's correlations were obtained for the performance coefficient and PSQI® score (r= -0.108,

Table 2. Characteristics of sleep quality, according to the PSQI® components.

Variables	EDS		P-value
	Yes	No	
	N= 300	N= 159	
Sleep latency, median (p25-p75)	27.3 (10.0-30.0)	29 (10.0-30.0)	0.274*
Hours of sleep per night in the last month, median (p25-p75)	5.5 (5.0-6.0)	6.0 (5.0-7.0)	0.000*
Overall sleep quality, n(%)			
Very good	9 (3.0)	11 (6.9)	0.000**
Good	104 (34.7)	84 (52.8)	
Poor	147 (49.0)	52 (32.7)	
Very poor	40 (13.3)	12 (7.5)	

Continue...

Table 2. Continuation.

Variables	EDS		P-value
	Yes	**No**	
	N= 300	**N= 159**	
Global PSQI score, median (p25-p75)	2.0 (2.0-3.0)	2.0 (1.0-2.0)	0.000*
Component 1: Subjective sleep quality	0.0 (0.0-0.0)	0.0 (0.0-0.0)	0.000*
Component 2: Sleep latency	9.0 (7.0-11.0)	7.0 (6.0-9.0)	0.651*
Component 3: Sleep duration	2.0 (1.0-2.0)	1.0 (1.0-2.0)	0.000*
Component 4: Habitual sleep efficiency	1.0 (1.0-2.0)	1.0 (1.0-2.0)	0.961*
Ha Component 5: Sleep disorders	2.0 (1.0-2.0)	1.0 (1.0-2.0)	0.000*
Component 6: Use of sleep medication	0.0 (0.0-1.0)	0.0 (0.0-1.0)	0.222*
Component 7: Daytime dysfunction	1.0 (1.0-2.0)	1.0 (1.0-1.0)	0.000*

Abbreviations: n= number of participants.
EDS = excessive daytime sleepiness.
PSQI: Pittsburgh Sleep Quality Index.
* Mann-Whitney U-test.
** Pearson x^2 test.
Source: Prepared by the authors.

p= 0.033) and for the performance coefficient and ESS score (r= -0.113, p=0.025). No significant correlation was identified between the scores of the PSQI® and ESS scales and the academic semesters (p= 0.251 and p=0.267, respectively).

In this sample, physical activity was a risk factor significantly and independently associated with excessive daytime sleepiness. The lower the frequency of physical activity, the lower the excessive daytime sleepiness. The scores of components 3, 5 and 7 of the PSQI remained significantly and independently associated as a risk factor with EDS in the multivariate analysis. The final PSQI score showed an association as a protective factor, so that the lower the score, which translates as better sleep quality, the less excessive daytime sleepiness.

DISCUSSION

The objective of this study was to evaluate the quality of sleep and the presence of excessive daytime sleepiness in medical students at Universidade Federal da Bahia, correlating it with the academic semester and academic performance. Sleep quality and impacts on life are a very relevant topic for medical students and have been evaluated in several places in Brazil and around the world[19]. Our results showed that 84.1% of the students have, according to information related to the previous month, poor sleep quality (PSQI>5), which corroborates what was found in studies with medical students, such as in the study carried out at Universidade da Paraíba – 2020 (64.5%, n=234)[14], Centro Universitário de Anápolis – 2019 (44.6%, n=157)[20], Botucatu School of Medicine – 2017 (87.1%, n=372)[17], Morocco School of Medicine – 2018 (58.2%, n=457)[21], Public University of Pakistan – 2019 (64.24%, n=797)[22].

Table 3. Association of the excessive daytime sleepiness classification according to the Epworth Sleepiness Scale, with sleep quality.

Variables	Sleep quality		p-value
	Good	**Poor**	
	N= 73	**N= 386**	
Mild EDS, n(%)	11 (15.1)	50 (13.0)	
Moderate EDS, n(%)	16 (21.9)	94 (24.4)	
Severe EDS, n(%)	8 (11.0)	121 (31.3)	0.000*
Lower NDS, n(%)	13 (17.8)	23 (6.0)	
Higher NDS, n(%)	25 (34.2)	98 (25.4)	

Abbreviations: n= number of participants.
EDS: excessive daytime sleepiness.
NDS: normal daytime sleepiness.
*Pearson's x^2 test.
Source: Prepared by the authors.

Table 4. Final logistic regression model defining the variables independently associated with the outcome of excessive daytime sleepiness.

Variables	Beta	Odds ratio (95%CI)	p-value
Physical activity	1.189	3.285 (1.547-6.976)	0.002
Frequency of physical activity	-0.198	0.820 (0.686-0.980)	0.029
PSQI component 3: sleep duration	0.732	2.079 (1.446-2.990)	0.000
PSQI component 5: sleep disorders	0.552	1.737 (1.074-2.809)	0.024
PSQI component 7: daytime dysfunction	1.137	3.116 (2.205-4.403)	0.000
PSQI	-0.177	0.838 (0.733-0.957)	0.009

Abbreviation: PSQI: Pittsburgh Sleep Quality Index
Source: Prepared by the authors.

Most studies consider a normal average of between 7 and 8 hours of sleep per night, while some studies adopt an average of less than 6 hours of sleep per night as a criterion for chronic sleep deprivation[23], with the average time of sleep hours per night being a relevant factor in sleep quality. It was observed that, on average, medical students at UFBA sleep 5:36 hours, a sleep duration associated with health impacts[5], similar to that observed in medical students in Paraíba – 2017 (5:50h)[24] and at the Saudi School of Medicine – 2016 (5:40h)[25].

It was not possible to verify whether there is an influence of the academic semester on sleep quality (p= 0.251), different from what was demonstrated with students at the Centro Universitário de Anápolis – 2019, where there was an increase in poor sleep quality between the 5th and 7th semesters. It was also reported that the highest prevalence of poor quality was associated with the start of attendance at the clinic and surgical practice and because it was a period close to the beginning of the internship[20].

Our study showed statistically significant associations between the performance coefficient and PSQI° score (r= -0.108, p= 0.033) and the performance coefficient and ESS score (r= -0.113, p=0.025), in agreement with other studies, where poor sleep quality and excessive daytime sleepiness were associated with low academic performance[19, 26]. This is different from what was found with medical students from Morocco in 2018[21] and Saudi Arabia in 2016[25], where it was not possible to verify an association between sleep quality and academic performance.

In this study, the prevalence of excessive daytime sleepiness (Epworth sleepiness scale score >10) was 65.4%, with no association with the academic semester. Excessive daytime sleepiness is particularly frequent among medical students in Brazil, with a prevalence ranging from 36.31 to 81.6%[14,24,27,28]. A similar result *was* found with medical students at UFBA - 2014, with a prevalence of EDS of 74.0%[18].

When we compared the PSQI with the Epworth sleepiness scale, a value of p = 0.001 was found, and an association was identified between the variables, which would indicate that excessive daytime sleepiness is associated with poor sleep quality. This same finding was observed with medical students in Maranhão (p= 0.001)[28].

Some studies indicate a variation by gender in relation to sleep disorders, especially when the Epworth score is applied, with the female gender showing a higher prevalence of higher ESS scores. Differences between genders are attributed to a possible variation between socially acceptable levels of fatigue and the incidence of sleep, medical, and psychiatric disorders associated with sleepiness[29,30]. In a systematic review study with 18,619 medical students from 13 countries, no significant association was found between gender and sleep quality or excessive daytime sleepiness[31]. In our study, a statistically significant association was found between excessive daytime sleepiness and the female gender (p = 0.007).

Contrary to what is widely disseminated[32], our study showed that physical activity is a risk factor for excessive daytime sleepiness. Some studies conducted with medical students, however, have not shown a statistically significant association between these variables[33,34]. Moreover, an African study showed that intense and very frequent physical activity in medical students can have a negative impact on sleep quality[35]. These apparently divergent data may indicate a need to carry out studies that seek to evaluate whether, in scenarios of strenuous routines, EDS can acquire a dual correlation with physical activity, depending on its intensity and/or frequency.

Finally, perhaps the period in which the questionnaire was applied, the last month of the academic semester, may have contributed to the values found in the study, and it would be interesting to carry out the same study in another month during an academic semester.

CONCLUSIONS

It is concluded that medical students at Universidade Federal da Bahia have, on average, fewer hours of sleep than recommended, in addition to having a high prevalence of excessive daytime sleepiness and poor sleep quality.

Knowing the importance of sleep in academic performance and overall health, and considering the data that demonstrate the high prevalence of poor sleep quality and excessive daytime sleepiness in UFBA medical students, it is necessary to create strategies to improve the sleep pattern of this population.

AUTHORS' CONTRIBUTIONS

CONFLICTS OF INTEREST

SOURCES OF FUNDING

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