Influence of sleep quality on academic performance of medical students

Influência da qualidade do sono no desempenho acadêmico de estudantes de medicina

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ABSTRACT

Objective: To know the prevalence of "poor" sleepers among medical students, to identify the main factors affecting sleep quality in this population, and the probable relationship between sleep and academic performance throughout the course. **Methods:** This is a cross-sectional qualitative and quantitative study carried out at a higher education private institution in the city of Araguari (MG) Brazil. The sample consisted of 110 medical students. A sociodemographic questionnaire and the Pittsburgh Sleep Quality Index were applied. Statistical analysis was performed using ANOVA one-way test with the post-hoc Tukey test, two-way ANOVA test and Student's *t* test. **Results:** Of the 105 students analyzed, 19.05% (n=20) were classified as "good" sleepers, and 80.95% (n=85) as poor sleepers. No statistically significant difference was observed between the Pittsburgh Sleep Quality Index scores and the students' grade averages or the students' academic terms. **Conclusion:** The majority of the students was classified as poor sleepers. The consumption of energetic substances and the female sex were the two significant factors that could affect sleep quality. There was no relationship between sleep quality and academic performance.

Keywords: Sleep; Sleep deprivation; Students, medical; Memory consolidation; Sleep wake disorders

RESUMO

Objetivo: Conhecer a prevalência de maus dormidores, identificar os principais fatores que afetam a qualidade do sono dessa população e a provável relação entre o sono e o desempenho escolar ao longo do curso de medicina. **Métodos:** Estudo transversal de cunho qualiquantitativo, realizado em uma instituição privada de Ensino Superior da cidade de Araguari (MG). A amostra foi constituída de 110 acadêmicos do curso de medicina regularmente matriculados. Aplicaram-se um questionário sociodemográfico e o Índice de Qualidade do Sono de Pittsburgh. A análise estatística foi realizada pelo ANOVA *one-way* com *post-hoc* de Tukey, teste ANOVA *two-way* e teste *t* de Student. **Resultados:** Dos 105 estudantes analisados, 19,05% (n=20) foram classificados como bons dormidores e 80,95% (n=85) como maus dormidores. Não houve diferença significativa entre o escore do Índice de Qualidade do Sono de Pittsburgh e as médias de notas semestrais, tampouco entre o escore do Índice de Qualidade do Sono de Pittsburgh e os períodos letivos. **Conclusão:** A maioria dos acadêmicos foi classificada como maus dormidores. O uso de substâncias energéticas e o sexo feminino foram os fatores significativos que podem afetar a qualidade do sono. Não houve relação entre a qualidade do sono e o desempenho acadêmico.

Descritores: Sono; Privação do sono; Estudantes de medicina; Consolidação da memória; Transtornos do sono-vigília

INTRODUCTION

Sleep is an active, repetitive and reversible behavior, which interferes with many different physiological functions, including learning processes and memory consolidation.[1] In cases of sleep deprivation, which have increased in modern society, these functions may be secondarily affected.[1] During sleep, restructuring of all physiological functions of the organism takes place, and functional conditions existing in the preceding waking period are restored.[2] An adult requires an average of 7 to 8 hours of sleep within 24 hours.[3]

The learning process is a cognitive activity stemming from memory consolidation, and sleep plays a fundamental role in this process.[4] Understanding the phenomenon of sleep, taking its several aspects in consideration, is a scientific procedure to find solutions for sleep disorders, to achieve a satisfactory performance throughout daily activities.[4] Sleep disorders entail several repercussions to humans, resulting in loss of quality of life and autonomic dysfunction, decrease in the professional or academic performance, increased incidence of psychiatric disorders, and decrease in vigilance, with damages to personal security and consequent increase in the number of accidents.[5]

Restriction and fragmentation are the most common causes of sleep impairment.[6] Sleep deprivation may be a result of work or curricular demands, family responsibilities, use of medication, personal factors and lifestyle.[6] Fragmentation results in inadequate sleep quality and duration, and it is a consequence of biological and/or environmental factors causing interruptions.

In this context, medical students form a group prone to have sleep disorders due to their full time curricular load, extracurricular activities, high stress and pressure towards high performance, and the time demanded in studies.[7]

Therefore, due to the lack of studies relating sleep quality and academic development, and due to the likelihood of medical students to develop an irregular sleep-vigilance pattern and a high prevalence of sleep disorders, the present study aimed to show the prevalence of "poor" sleepers (PS) and identify the main factors affecting the sleep quality of this population and the probable relationship between sleep and academic performance throughout the course.

METHODS

This is a cross-sectional, qualitative-quantitative study carried out at a private institution of higher education in the city of Araguari (MG), Brazil. The study sample was calculated using F tests analysis of variance (ANOVA) one-way, consisting of 110 medical students regularly enrolled in the first semester of 2017. Students from the first to the eleventh term were included in the study, with those who were not following the regular hour load (students repeating failed modules), those who were under the age of 18, and those who did not properly fill out the research instruments being excluded.

Students were invited to take part in the study through a verbal invitation. After elucidations on the methodology and study objectives, they signed a free and Informed Consent Form, volunteering for the research. Next, students answered a structured questionnaire with sociodemographic data exclusively developed for this research, including questions related to age, gender, marital status, number of children, medication use, consumption of energy drinks and alcoholic beverages, practice of physical and leisure activities, and existence of chronic-degenerative and metabolic diseases. They also answered a sleep quality assessment instrument, the Pittsburgh Sleep Quality Index (PSQI), validated into Brazilian Portuguese.[8] This instrument analyzes seven components: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medications, and daytime dysfunction. The score varies from zero to 21 points. Scores ≥5 indicate PS and possible sleep disorders.

Data storage and tabling were done in Microsoft Excel®, version 2013, and GraphPad Prism 5.0.

The descriptive data treatment was performed after these procedures. ANOVA one-way test with Tukey *post-hoc*, two-way ANOVA, and Student's *t* test assessed the data of questionnaires and the average grade of the students during the course cycle terms. The significant value for analysis was $p < 0.05$.

The study was approved by the institution's Human Research Ethics Committee. The Ethics Committee process number was CAAE 62725516.7.0000.8041.

RESULTS

The study population comprised 110 students. Five were withdrawn due to inappropriate filling of instruments, totaling 105 participants. Out of them, 76 students were in the first through the eighth terms of the course, and 27 were in the internship cycle (ninth to eleventh term). Out of participants, 62% were female (n=65) and 38% (n=40) were male. Students' average age was 23.4±4.0 years; the lowest average age was of students of the first term, 20.6±2.8 years old; and the eighth period had the highest average age, 27.2±5.5 years old. Regarding their marital status, 92% of students (8) were single. In relation to their body mass index (BMI), 75% of

students were eutrophic, 18% (n=19) were overweight, 3.5% (n=4) were obese level 1, and 3.5% (n=4) were underweight. Out of the total number of volunteers, 54% (n=57) were sedentary.

Thirty four percent of volunteers (n=36) said they were on continuous use of medication, and oral contraceptives were the most common. Seventy nine percent of volunteers (n=83) used stimulant substances, of which 57% (n=48) said they used them four or more times per week. Ten participants (11%) presented chronic diseases, listed as thrombocytopenic purpura, asthma, diabetes, rheumatoid arthritis, isolated systolic hypertension, hypothyroidism, migraine, and aortic and bicuspid valves stenosis. Of these, only 50% (n=5) were taking continuous medication.

In relation to the overall PSQI score, 20 students, out of 105, presented scores up to 5 points, that is, 19.05% of the students were classified as good sleepers (GS), and 85 students presented scores >5, that is, 80.95% were classified as PS. Table 1 describes GS and PS sociodemographic profile data.

In the analysis between sleep quality and academic performance, there was no significant difference in students' performance, as the average grade of GS was 81.5±4.84 and of PS was 80.5±4.92 (Figure 1). PSQI scores did not present significant differences when analyzed for each term, that is, the course cycle term did not influence the students' sleep quality (Figure 2).

DISCUSSION

During medical school, students are subject to a rigorous schedule and curricular obligations. This lifestyle may lead to sleep deprivation, which can compromise one's quality of life and academic performance by negatively affecting memory and learning. Therefore, assessing
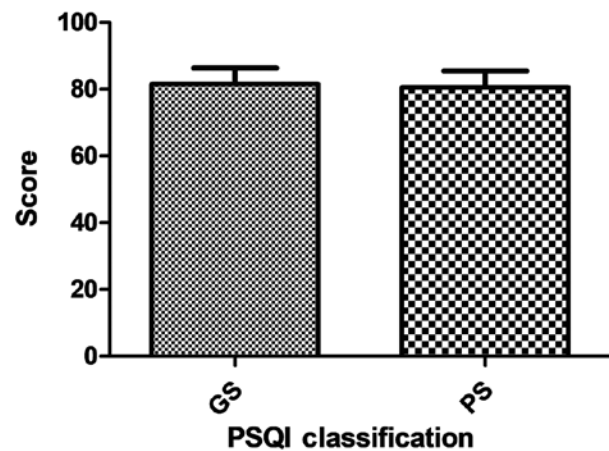
p<0.05 for Student's t test.
GS: good sleepers; PS: poor sleepers; PSQI: Pittsburgh Sleep Quality Index.
Figure 1. Comparison of average grades per course cycle term between good and poor sleepers. There was no significant difference in the average grades per course cycle term between good and poor sleepers.

Table 1. Sociodemographic profile of good and poor sleepers

Variables	Good sleepers	Poor sleepers
Sex		
Male	16 (80)	24 (28.24)*
Female	4 (20)	61 (71.76)*
Age	23.95±3.76	23.31±4.09
BMI	24.18±3.63	22.66±2.97
Alcoholic beverages intake		
Yes	18 (90)	67 (78.82)
No	2 (10)	18 (21.18)
Smoking		
Yes	0	3 (3.52)
No	20 (100)	82 (96.48)
Physical activities		
Sedentary	10 (50)	47 (55.30)
Physically active	10 (50)	38 (44.70)
Use of stimulant substances		
Yes	11 (55)	72 (84.71)*
No	9 (45)	13 (15.29)*

Results expressed as n (%) or medium ± standard deviation.
* This variable presented a significant difference between good and poor sleepers, p<0.05 in the analysis of variance one-way test.
BMI: body mass index.
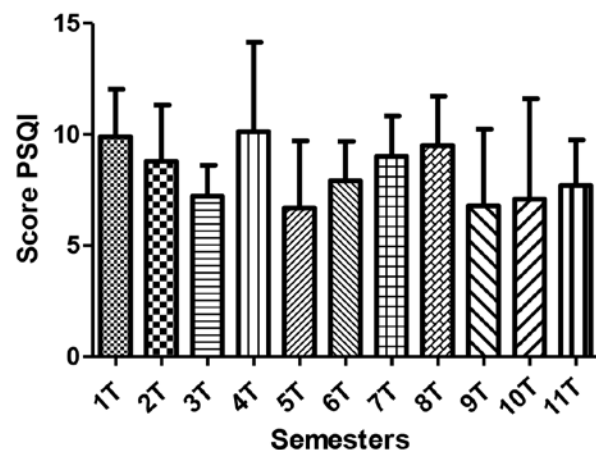
p≤0.05 for two-way ANOVA.
PSQI: Pittsburgh Sleep Quality Index; T: term.
Figure 2. Comparison of the Pittsburgh Sleep Quality Index scores between terms. There was no significant difference between Pittsburgh Sleep Quality Index scores from first to eleventh term. "P" indicates term. In all terms, the medical students were classified as poor sleepers.

sleep quality through PSQI in medical students helps creating awareness-raising actions to balance study, quality of life and academic performance.

In this study, 80.95% of participants were ranked as PS, out of which 71.76% were women and 28.24% were men. A similar study by Weber et al.[9] found a prevalence of 87.1% of PS (PSQI score <5). A study by Montibeller et al.[10] involving medical students used PSQI and the Epworth sleepiness scale to demonstrate that women presented longer sleep duration, more sleep disorders, and greater occurrence of daytime dysfunction. Gender similarity was found when analyzing the overall PSQI score.

This demonstrates that most medical students do not have adequate sleep quality, and women are more likely to present sleeping disorders.

The present study found no significant difference regarding the influence of sleep quality on the students' academic performance. However, a study conducted by Medeiros et al.[5] with medical students in the third, fourth and seventh course terms assessed their grades in a curricular evaluation, after which they applied PSQI. They found that the students who presented the worst performance had more irregular sleep, with a higher standard deviation of sleep onset, delayed sleep onset, and shorter sleep duration. Bicho[11] conducted a study with medical students in the first, third and sixth years by comparing students' average grades with PSQI. A significant difference for the sixth year was found, concluding that those with the highest average grades presented better sleep quality (PSQI 1-5), and those with the lowest averages presented lower sleep quality. The same study by Bicho[11] observed that the distribution of students' average grades was higher for those with "great" sleep quality, and lower for those with poor sleep quality. Differences were significant, meaning that the lowest grades are related to a PSQI score ≥8 (PS quality).

Concerning physical activity, 54.2% of the study sample were sedentary. Maia et al.,[12] found a similar result. They studied the level of physical activities of medical students from the city of Fortaleza using the International Physical Activity Questionnaire (IPAQ), and classified 51.2% of the study sample as sedentary. In another study involving 800 medical students from several Brazilian institutions, 50% (n=402/800) of participants revealed that they practiced fewer physical exercises than they would like to due to their extensive academic hour load.[13] However, regular physical exercises can contribute to one's quality of life, improving physiological abilities, reducing depression and anxiety, and contributing to sleep efficiency and quality.[14]

Concerning drug use, 80.05% of students reported drinking some type of alcoholic beverage, and 3.52% of them used tobacco. A study involving medical students from four institutions of Fortaleza assessed the prevalence of alcohol and tobacco consumption. They presented similar results regarding alcohol intake, as 81.20% of the study population drink alcoholic beverages, and a higher rate of smoking students, as 24.6% reported having used tobacco.[15] However, the use of tobacco may be higher in the study sample because a few so-called "social smokers" may have not declared their use of tobacco, which is only done occasionally, at parties, for example.

This study found no significant difference regarding alcohol intake and GS and PS. A similar result was found by a study conducted at a federal university of Fortaleza, Brazil, with students of four areas (Sciences, Agrarian Sciences, Humanities and Technology) and several schools (Law, Education, Economy, Business Administration, Economics and Actuarial Sciences, Pharmacy, Dentistry and Nursing). They applied the Brazilian version of Alcohol Use Disorders Identification Test (AUDIT) to classify the pattern of alcohol consumption, and PSQI to assess sleep quality. Smoking was divided into four categories (daily smokers, occasional smokers, ex-smokers, and non-smokers).[16] This study also did not find any statistically significant proportional differences between students who were GS and PS regarding alcoholism.[16]

The present study found that 79.04% (n=83) of the participants used stimulant substances, and 86.74% (n=72) of these students were PS, thus presenting a statistical relation between PS and use of stimulant substances. A different result was found by Ribeiro et al.[6] They assessed the sleep quality of 184 medical students using PSQI; 82% (n=148) of them denied using stimulant substances, and 23.8% (n=43) were GS. Different from the present research, Frasson et al.[17] applied PSQI to 153 medical students and found that 60.8% (n=93) were PS, and 24.83% of the total used some kind of stimulant substance.

One limitation of the present study was the non-randomization of the sample.

Additionally, although significant, the sample calculated was insufficient to produce possible relevant results after correlations between the terms. Furthermore, the Epworth Sleepiness Scale, which has been used in similar studies, could have been used in the present research to assess daytime sleep dysfunction. Another limitation of the cross-sectional study is that it is not possible to establish cause and effect relations.

CONCLUSION

The present study demonstrated that most medical students were classified as poor sleepers. The use of stimulant substances and the female gender were the significant variables that could affect sleep quality. Additionally, there was no relationship between sleep quality and academic performance.

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