Poor sleep quality and associated factors in university students in Bogotá D.C., Colombia

ABSTRACT

Objective: Poor sleep quality is a common problem in the general population, frequently associated with personal habits and comorbid conditions. University students may be a vulnerable population because of their daily routine, habits and sleep hygiene behavior. There are few related studies on this subject in Colombian undergraduates. The aim of this study is to characterize sleep quality in Colombian university undergraduates and examine possible associated factors. Methods: Cross-sectional study was performed with self-administered questionnaires including demographic data, lifestyle habits, sleep hygiene habits and sleep quality measured by the Pittsburgh Sleep Quality Index (PSQI). The study group included 414 students from different schools enrolled at the Pontificia Universidad Javeriana in Bogotá, Colombia. Results: Prevalence of poor sleep quality according to PSQI was 58.9%. Multivariate analysis showed an association of poor sleep quality with smoking (OR = 3.17 [1.51-6.66]) and eating in bed (OR = 2.13 [1.31-3.47]), with probable protective factors in sleeping at the same time (OR = 0.37 [0.25-0.59]) and having breakfast 5 or more days of the week (OR = 0.53 [0.31-0.91]). Discussion: Poor sleep quality is frequent among undergraduates, regardless of their area of study. The identification of possible related factors may help to design targeted preventive measures, as it is promoting healthy lifestyle habits, adequate sleep hygiene practices and avoiding tobacco use.

Keywords: Sleep; Sleep Hygiene; Students; Colombia.
INTRODUCTION

Sleep problems are common in the general population, with approximately one-third of adults reporting any form of insomnia\(^1\). Poor sleep quality has been described as a public health issue due to its association with several comorbid conditions such as: coronary heart disease, obesity, psychiatric disorders, traffic and work-related accidents, and a diminished cognitive performance\(^2-6\). There are certain protective factors that are linked with an improved sleep quality such as: exercise, normal body weight, a healthy diet and sleep hygiene practices\(^7,8\).

University students may be particularly vulnerable to sleep deprivation and a poor sleep quality due to high academic load and in some cases the need to stay awake at night as part of their academic duties\(^1\). Among those students who report a poor sleep quality, higher levels of psychosocial stress are observed, manifested by increased irritability, anxiety, confusion, and general health problems\(^9\).

A 2016 survey applied to 546 dental students in Saudi Arabia showed that 72.5% had poor sleep quality according to the Pittsburgh Sleep Quality Index (PSQI) and a significant correlation between poor sleep quality and a lower GPA\(^1\). Poor sleep quality was evidenced in 54.7% out of 4318 university students in Taiwan\(^10\). Some studies have found risk factors for poor sleep quality such as females, smoking, alcohol and energy drink use\(^11-13\).

A survey on Colombian university students showed that 79.3% had a poor sleep quality according to the PSQI, this was linked with a lower academic performance\(^14\). On a different Colombian university 79.5% of its surveyed medical students had poor sleep quality associated with 60.2% of them having excessive daytime sleepiness\(^15\). There are few studies about sleep quality in Colombian undergraduate students and its associated risk factors. Furthermore, the consulted studies focused solely on medical students. Therefore, it is important to characterize the quality of sleep among undergraduate students from various areas of study.

We expected to obtain a similar prevalence of poor sleep quality found in other studies, since no significant differences were found between studies undertaken in Colombia compared to other countries regarding poor sleep quality and associated factors. Also, we presumed to observe an increased prevalence of poor sleep quality in medical students compared to non-medical students, in part due to the heavy clinical rotation schedule, academic workload and sleep cycle disturbances associated with night shifts.

MATERIAL AND METHODS

Research design and sample

This descriptive, observational, cross-sectional study was conducted during September and October 2017. It included data from 414 male and female undergraduate students from 17 schools of the Pontificia Universidad Javeriana in Bogotá, D.C., Colombia: medicine (n=120), engineering (n=37), psychology (n=37), architecture and design (n=31), communication and language sciences (n=31), dental medicine (n=24), politic and administrative sciences (n=22), economy and administration (n=21), social sciences (n=20), rural and environmental sciences (n=19), science (n=17), law (n=15), arts (n=8), philosophy (n=8), nursery (n=2), education (n=1) and theology (n=1). The proportion of medicine students surveyed related to the total was 120/1,002, non-medicine students’ proportion related to the total was 294/18,914. Sampling was done by convenience. An electronic survey was posted in social media university groups, asking students to voluntarily participate in a study to characterize their sleep quality.

Two restaurant gift cards were randomly given as an incentive to participate. The survey was anonymous and written consent was obtained from all subjects before beginning the survey.

Questionnaires

The survey was designed using the REDCap* software, and included the Pittsburgh Sleep Quality Index (PSQI), which is validated for its use in Colombia\(^16\), as well as other questions assessing possible associated factors that may influence the quality of sleep such as: BMI, sleep hygiene practices, food intake, alcohol consumption, smoking, energy drink consumption, use of nootropics to enhance academic performance (such as amphetamines or methylphenidate) and GPA among others. The survey was answered by 428 students; 14 surveys were excluded due to incomplete information. Therefore, the study had a sample size of 414 undergraduate students.

The survey included basic demographic information: sex, age, school, semester, people they live with, weight and height. To evaluate sleep hygiene, questions were asked regarding sleeping and waking up schedules, self-reported chronotype, napping times, time elapsed between last meal and sleep, using the bed for other purposes but sleeping, exercising before sleeping and sleeping in a completely dark room\(^17\).

Participants were asked to provide their cumulative GPA (which consists of a numerical scale from 0.0 to 5.0, being 3.0 a passing grade), if they held a part-time job, they were asked how many hours they worked per week. Subjects were asked if they had noticed changes in their sleeping pattern since starting their undergraduate degree. Nutrition habits such as how many days they had breakfast\(^18\). Finally, they were asked about consumption of stimulants, alcohol, caffeinated beverages, energy drinks and tobacco (Table 1).

Sleep quality was evaluated using the PSQI, which is a self-rated questionnaire, which assesses sleep quality and sleep disturbances during the previous month. Nineteen to twenty-four individual questions generate seven component scores: subjective sleep quality, sleep latency, sleep duration, use of sleeping medication, habitual sleep efficiency, sleep disturbances and daytime dysfunction. The sum of scores of these seven components yields one global score, with a global PSQI score \(> 5\) having a diagnostic sensitivity of 89.6% and specificity of 86.5% in distinguishing poor sleep quality\(^19\). The Spanish translated version was used in this study\(^16\).
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Statistical analysis

Statistical analysis was performed using STATA® version 12 software package. A descriptive analysis was performed on demographic variables, sleep quality and the other previously mentioned categorical variables in the survey. Chi-square was used for proportion comparison and evaluation of bivariate associations between sleep quality and dichotomous variables. Shapiro-Wilk test was used to determine normality on quantitative variables, and Student's T-test and Mann-Whitney's U tests were used accordingly to correlate sleep quality with the aforementioned variables. A bivariate analysis was performed using logistic regression in order to estimate the association between sleep quality and characteristics or habits of university students. All significant variables in the bivariate analysis were included in a multivariate logistic regression using a backward approach; final models and statistical significance were defined at \( p \)-value < 0.05.

Ethical considerations

The study protocol was reviewed and approved by the Research and Ethics Committee of the Pontificia Universidad Javeriana (FM-CIE-0617-18). The study was classified as a minimal risk research and conducted in agreement with the Declaration of Helsinki, 64th WMA General Assembly, Fortaleza, Brazil, October 2013 and in accordance with the current Colombian legislation.

RESULTS

The survey was completed by a total of 414 undergraduate students from 17 different schools, 291 (70.3%) were women and 123 (29.7%) were men, participants were between 16 and 37 years old. Overall, 170 (41%) students had a PSQI score equal to or below 5 indicating a good sleep quality, and 244 (59%) students had a PSQI score indicating poor sleep quality (Table 2).

Table 1. Demographics, sleep hygiene and substance use.

| Characteristic       | n  | %   |
|----------------------|----|-----|
| Gender               |    |     |
| Male                 | 123| 29.7|
| Female               | 291| 70.3|
| School               |    |     |
| Medicine             | 120| 29  |
| Other                | 294| 71  |
| BMI*                 |    |     |
| Low weight (<18.5 kg/m²) | 51 | 12.3|
| Normal weight (18.5 - 25 kg/m²) | 312| 75.3|
| Overweight (25 - 30 kg/m²) | 47 | 11.3|
| Obesity (>30 kg/m²)  | 4  | 0.9 |
| Chronotype           |    |     |
| Morning type         | 253| 61.1|
| Evening type         | 161| 38.9|
| Living alone         | 48 | 11.6|
| Work and study       | 80 | 19.4|
| Weekly hours of work |    |     |
| None                 | 334| 80.7|
| Less than 8 hours    | 29 | 7.0 |
| 8 - 20 hours         | 29 | 7.0 |
| More than 20 hours   | 22 | 5.3 |
| Sleep hygiene        |    |     |
| Taking naps          | 185| 44.7|
| Duration of naps (minutes) | 45 | 50  |
| Go to bed at the same time | 174| 42.1|
| Wake up at the same time | 232| 56.2|
| Eat in bed           | 124| 30  |
| Study in bed         | 380| 91.8|
| Physical activity near to sleep time | 97 | 23.5|
| Sleep in dark and quiet room | 318| 76.8|
| Have breakfast five or more week days | 318| 76.8|
| Substance use        |    |     |
| Alcohol              | 292| 70.5|
| Tobacco              | 56 | 13.5|
| Energy drinks        | 51 | 12.7|
| Caffeine             | 275| 66.5|
| Nootropics drugs     | 12 | 2.9 |
| Changes in sleep pattern during university |    |     |
| Yes                  | 342| 82.8|
| No                   | 71 | 17.2|
| Sleep quality (PSQI)*|    |     |
| Good quality         | 170| 41.1|

* BMI: Body Mass Index; PSQI: Pittsburgh Sleep Quality Index, a score less than 5 indicates good sleep quality; a score of 5 or more indicates poor sleep quality.

The bivariate analysis showed that a poor sleep quality was significantly associated with the following variables: being overweight/obese, having an evening chronotype, lack of sleep hygiene habits (e.g. not sleeping and waking up at the same time, taking naps, eating in bed and not sleeping in a completely dark room), eating breakfast less than five days a week, use of energy drinks and smoking (Table 3).

The multivariate analysis showed statistically significant associations between sleeping at the same time every night and eating breakfast five or more days a week as protective factors against poor sleep quality. On the other hand, eating in bed and smoking were associated with a poor sleep quality (Table 4).

Table 2. Demographics, sleep hygiene and substance use.

| Characteristic       | Median | IQR* |
|----------------------|--------|------|
| Age (years)          | 21     | 4    |
| Weight (kg)          | 58     | 13   |
| Height (m)           | 1.65   | 0.11 |
| BMI (kg/m²)          | 21.4   | 16.3 |
| GPA* (from 0 to 5.0) | 4      | 0.43 |

*BMI: Body Mass Index; IQR: Interquartile Range; GPA: Grade Point Average.

The bivariate analysis showed that a poor sleep quality was significantly associated with the following variables: being overweight/obese, having an evening chronotype, lack of sleep hygiene habits (e.g. not sleeping and waking up at the same time, taking naps, eating in bed and not sleeping in a completely dark room), eating breakfast less than five days a week, use of energy drinks and smoking (Table 3).

The multivariate analysis showed statistically significant associations between sleeping at the same time every night and eating breakfast five or more days a week as protective factors against poor sleep quality. On the other hand, eating in bed and smoking were associated with a poor sleep quality (Table 4).

No association was found between sleep quality and: gender, being in a higher semester, or use of caffeine. Also, no difference in sleep quality was found when comparing medical school students and other schools.
Table 3. Association between poor sleep quality and characteristics or habits of university students.

| Characteristics                        | Good sleep quality (%) | Poor sleep quality (%) | P-value | Unadjusted OR Poor sleep quality (CI 95%) |
|----------------------------------------|------------------------|------------------------|---------|------------------------------------------|
|                                       | n = 170                | n = 244                |         |                                          |
| Sex                                    |                        |                        |         |                                          |
| Women                                  | 40.6                   | 59.4                   | 0.744   | 1.07 (**0.70 - 1.65**)                   |
| Men                                    | 42.3                   | 57.7                   |         |                                          |
| BMI*                                   |                        |                        |         |                                          |
| Low or normal weight                   | 43                     | 57                     | 0.035   | 1.99* (**1.04 - 3.82**)                  |
| Overweight or obesity                  | 27.4                   | 72.6                   |         |                                          |
| School                                 |                        |                        |         |                                          |
| Medicine                               | 46.7                   | 53.3                   | 0.139   | 0.72 (**0.47 - 1.11**)                   |
| Other                                  | 38.8                   | 61.2                   |         |                                          |
| Chronotype                             |                        |                        |         |                                          |
| Morning type                           | 46.2                   | 53.8                   | 0.007   | 0.57* (**0.38 - 0.86**)                  |
| Evening type                           | 32.9                   | 67.1                   |         |                                          |
| Living alone                           |                        |                        |         |                                          |
| Yes                                    | 52.1                   | 47.9                   | 0.099   | 0.60 (**0.33 - 1.10**)                   |
| No                                     | 39.6                   | 60.4                   |         |                                          |
| Go to bed at the same time             |                        |                        |         |                                          |
| Yes                                    | 55.2                   | 44.8                   | 0.000   | 0.36* (**0.24 - 0.55**)                  |
| No                                     | 31                     | 69                     |         |                                          |
| Wake up at the same time               |                        |                        |         |                                          |
| Yes                                    | 47                     | 53                     | 0.007   | 0.57* (**0.39 - 0.86**)                  |
| No                                     | 33.7                   | 66.3                   |         |                                          |
| Taking naps                            |                        |                        |         |                                          |
| Yes                                    | 34.6                   | 65.4                   | 0.015   | 1.64* (**1.10 - 2.45**)                  |
| No                                     | 46.5                   | 53.5                   |         |                                          |
| Eat in bed                             |                        |                        |         |                                          |
| Yes                                    | 26.6                   | 73.4                   | 0.000   | 2.48* (**1.57 - 3.94**)                  |
| No                                     | 47.4                   | 52.6                   |         |                                          |
| Study in bed                           |                        |                        |         |                                          |
| Yes                                    | 41.3                   | 58.7                   | 0.830   | 0.92 (**0.45 - 1.91**)                   |
| No                                     | 39.4                   | 60.6                   |         |                                          |
| Physical activity near to sleep time   |                        |                        |         |                                          |
| Yes                                    | 37.1                   | 62.9                   | 0.354   | 1.25 (**0.78 - 1.99**)                   |
| No                                     | 42.4                   | 57.6                   |         |                                          |
| Sleep in dark and quiet room           |                        |                        |         |                                          |
| Yes                                    | 44.4                   | 55.6                   | 0.016   | 0.55* (**0.34 - 0.90**)                  |
| No                                     | 30.5                   | 69.5                   |         |                                          |
| Work and study                         |                        |                        |         |                                          |
| Yes                                    | 32.5                   | 67.5                   | 0.080   | 1.58 (**0.94 - 2.65**)                   |
| No                                     | 43.2                   | 56.8                   |         |                                          |

* Statistically significant difference; ** Fisher exact adjustment; BMI: Body Mass Index.

**DISCUSSION**

This study attempted to characterize the sleep quality and associated factors in Colombian university students from various areas of study. Some findings are consistent with previous studies done in different countries with similar study populations. A significant proportion of the surveyed students were found to have poor sleep quality, something that has been observed in other studies, including research on Colombian students. Other known risk factors that were observed in our study include high BMI, energy drink consumption and smoking. Lack of sleep hygiene practices such as not sleeping and waking up at the same time every day, eating in bed and not sleeping in a completely dark room were associated with poor sleep quality. The evidence on an association between evening chronotype and poor sleep quality is conflicting, showing no association in some research while the present study did find a statistically significant association as other studies.
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Table 4. Poor sleep quality associated factors, multivariate analysis.

| Characteristic                          | Full model       | Significant model |
|-----------------------------------------|------------------|------------------|
|                                         | Adjusted OR CI 95% | Adjusted OR CI 95% |
| Age (year)                              | 0.96 (0.88 - 1.05) |                  |
| Sex (female)                            | 1.12 (0.68 - 1.83) |                  |
| Study subject (medicine)                | 0.8 (0.48 - 1.34) |                  |
| Living alone                            | 0.6 (0.31 - 1.19) |                  |
| Working along studies                   | 1.4 (0.75 - 2.62) |                  |
| BMI (overweight or obesity)             | 1.86 (0.90 - 3.82) |                  |
| Chronotype (morning type)               | 0.77 (0.49 - 1.23) |                  |
| Sleeping at the same time               | 0.46 (0.29 - 0.71) | 0.37 (0.25 - 0.59) |
| Taking naps                             | 1.43 (0.91 - 2.25) |                  |
| Eat at bed                              | 2.03 (1.22 - 3.36) | 2.13 (1.31 - 3.47) |
| Sleeping in dark and silent bedroom     | 0.73 (0.42 - 1.27) |                  |
| Five or more days having breakfast      | 0.56 (0.31 - 0.98) | 0.53 (0.31 - 0.91) |
| Five or more alcohol drinks per month   | 0.98 (0.60 - 1.59) |                  |
| Energy drink use                        | 1.46 (0.69 - 3.10) |                  |
| Smoking                                 | 2.52 (1.10 - 5.77) | 3.17 (1.51 - 6.66) |
| Nootropics use*                         | 1.17 (0.21 - 6.64) |                  |

*pseudo R² coefficient: 0.1213 0.0989

* Statistically significant difference.

Nonetheless, the present study did not find an association between some variables that other authors have described as potential risk factors for poor sleep quality such as use of alcohol, caffeine and stimulants11,13.

The prevalence of poor sleep quality found in this study is comparable with that found in the literature. This study showed no difference in sleep quality when comparing medical students and other schools. This finding, contrary with our predictions at the beginning of the study, could be explained in multiple ways. Students from other schools could have similar academic workloads and sleep cycle alterations. Other possible cause could be related to medicine students having a better awareness of sleep health and therefore having better sleep habits, which could improve their sleep quality in some degree. Further research would serve to further close this knowledge gap.

The prevalence of poor sleep quality in medical students was lower compared to other Colombian studies. One study that surveyed medical students from the same university as this study found that 65.7% had a PSQI score indicative of poor sleep quality, while another study with medical students from a different city found a poor sleep quality prevalence of 88.1%21,22. Of the 414 students surveyed in this study, 120 were medical students, and poor sleep quality was found in 53.3% of them. These variations may be explained by differences in academic programs between universities.

Regarding academic performance, it was found that students with a GPA less than 4.0 (passing grade of 3.0 out of 5.0) were more associated with a poor sleep quality compared with students with a lower GPA (Table 3). Although this finding may suggest that students with lower GPA may have worse sleep quality, evidence is somewhat conflicting with other studies finding similar associations, no association or the opposite relationship9,14,13,18,22,27,28.

This study has some limitations that must be considered. Being a cross-sectional study, it is not possible to establish a causal relationship between the variables and poor sleep quality, only an association. There is a risk of sampling bias considering the sample was limited to those students who volunteered to participate; also, the possibility of a self-reporting bias. The sample has a large proportion of medicine students, more representation from other schools may allow to compare sleep quality between them.

The study was done exclusively on students enrolled in the Pontificia Universidad Javeriana in Bogotá, D.C., Colombia, so these results cannot be extrapolated to all Colombian university students or the population in that age range.

Another possible limitation of this study consists on the formulation of certain questions in the survey. For instance, subjects were asked about physical activity near bedtime without inquiring about the exact time that the students exercise at night. Other studies have shown that the timing of exercise can impact sleep, as exercise in periods adjacent to the sleep period between 8 p.m. and 11 p.m. was associated with shorter sleep durations29.

Despite its limitations, the present study presents some important strengths. There are few studies regarding sleep quality in Colombian university students, and specifically comparing medical students and other areas of study. This may serve as a starting point to further analyze risk factors and take educational and preventive measures.

Some studies have analyzed the validity of the PSQI as a screening tool for sleep dysfunction in clinical and non-clinical contexts, showing a strong reliability and validity30. Data from the University Hospital located within the University show that in 2018 a sleep disorder was diagnosed in 0.77 per 1,000 patients and 0.46 per 1,000 patients in external consultation and consultation.
ER consultation, respectively, in the 15-30 age range. Future studies can be performed to evaluate the utility of the PSQI as a screening tool for sleep disorders.

CONCLUSION

Poor sleep quality was observed in 59% of the surveyed students, which is a concerning finding. This reflects the need for further research in larger populations and with the aim to determine causality, which may allow taking specific preventive measures to address this problem. Keeping a normal BMI, sleep hygiene practices and avoiding tobacco and energy drink consumption appear to be some lifestyle modifications that can improve sleep quality.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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