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Quality of Sleep and Academic Performance in Second Year Medical Students of Two Public Universities from Argentina

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Abstract

Objectives: The purpose of this study was to assess sleep quality in second year students of the schools of medicine in two public universities in Argentina: Buenos Aires (UBA) and La Matanza (UNLaM), at the beginning and at the end of the academic year, and determine whether poor sleep quality (PSQ) is associated with a poor academic performance.

Methods: In this prospective, longitudinal study, the assessment was made by means of a self-administered anonymous demographic poll, and self-administered Pittsburgh´s Sleep Quality Index.

Results: The prevalence of poor quality of sleep was 65% in students from UBA, and 85% in students from UNLaM had a poor quality of sleep. This was not associated to any demographic factors analyzed. Students with a poor quality of sleep had a worse academic performance than those with good sleep quality (t-Student statistic 880, $p = 0.024$)

Conclusion: The prevalence of bad quality of sleep is strikingly high in both Universities, even higher to what was previously reported. Poor sleep quality is not associated to any of the demographic variables analyzed. However, as it was shown in a previous pilot study, this might be related to anxiety trait and state, or else, to cultural factors.

Keywords: *Sleep; Quality of Sleep; Students; Academic Performance*

Introduction

Sleep is a fundamental need of the organism. This state lasts one-third of our lives, about 25 years; however, some of its functions are still unknown [1]. Its role in cognitive and emotional processes concerning the stages of slow sleep, REM sleep, and the presence of spindles of sleep is well recognized [2].

According to the National Sleep Foundation, 66% of the studied population sleeps less than 8 hours during weekdays, and 52% sleeps more than 8 hours during holidays. These percentages increase over the years, with crescent crescents for those who sleep < 6 hours a day during weekdays [3].

After conducting surveys, a study showed that at least 10% of respondents have sleep disorders, insomnia being the most frequent [4], with differences laying on ethnicity, educational and socioeconomic levels [5]. However, in a Brazilian population, it was shown that a higher percentage of the studied population has sleep disorders (46%), associating them with educational level and the performance or

not of regular physical activity [6]. A study that evaluated people between 17 and 25 years old in the United States, shows that 36% have sleep disorders [7]: these cause multiple cognitive and behavioral disabilities in high school and university students [8].

According to our knowledge, only three studies evaluated the prevalence of sleep disorders in university students: in these, a percentage of around 40% were poor sleepers and, therefore, had a lower academic performance [8,9].

Due to a pilot study performed in the Academic Unit 2 of the Department of Physiological Sciences of the Faculty of Medicine of the University of Buenos Aires (Universidad de Buenos Aires, FMED-UBA-UA2DCF) in 2016, it was found that 58.5% of the students belonged to the category of "bad sleepers", and that poor quality of sleep was associated with anxious state and trait [10]. However, none of the studies were longitudinal.

The objective of this work was to determine the prevalence of sleep disorders at the beginning and at the end of the school year in second-year students of the medical career at UBA and the National University of La Matanza (Universidad Nacional de La Matanza, UNLaM).

Aim of the Study

The aim was to establish the association between sleep quality and academic performance at the end of the school year; and finally, to establish the association between the quality of sleep and other demographic variables (distance, consumption of legal or illegal substances).

Materials and Methods

This is a prospective, descriptive, and analytical, longitudinal study, with two evaluations: the first one, conducted on the second day of the academic year of the Physiology course, and the second evaluation performed on the last day of the course, i.e. at the end of the academic year.

On the first day of classes, the students were explained how the study would be carried out i.e., through self-administered surveys.

The Physiology and Biophysics course is taught in the second year of the Medicine Career at UBA, while at UNLaM, it is encompassed as a scenario called Morphophysiology, which is taught throughout the first three years of the career with different contents in every year. University of Buenos Aires is located in the Capital City of the Argentine Republic. National University of La Matanza is located outside the Capital City, in the suburbs called the Conurbano, with a lower cost of living: both locations have different demographic and cultural characteristics.

Students from the second year of Medicine have participated in both institutions.

The inclusion criteria were:

- Students of both genders studying Physiology and Biophysics at FMED-UBA-UA2DCF, and the Morphophysiology stage of the second year of the Medicine career at UNLaM.

The exclusion and elimination criteria were:

- History of diagnosis of anxiety and depression in treatment with psychotropic drugs
- History of hospitalization for psychiatric reasons in the last year
- They have not signed the informed consent
- They have not answered all the questions.

The students had to answer the following questions on their first and last day of their academic year

An anonymous survey: Students had to respond to demographic issues. They had to answer questions about gender, age, marital status, children (if any), living alone, nap sleeping, alcohol intake, energy-drink intake, coffee and mate intake, time of turnaround trip, tobacco and marijuana smoking, use of illegal substances, tranquilizer intake and use of Modafinil. In the end-of-the-year survey, they had to register the marks obtained during the academic year.

The variables "coffee and mate" were grouped for their analysis in a single variable: infusions, with three categories: no infusions, few infusions (up to 1 cup of coffee per day or less than a litre of mate per day), many infusions (more than the previous category).

For the variable "alcohol intake", three categories were considered: none, a little (up to once a week), or lot (more than the previous one).

For the variable "travel time to and from the university (turnaround trip)", two categories were considered: short time (up to 1 hour of the total turnaround trip) and long time (more than one hour of the total turnaround trip)

For the variable "nap", three categories were considered: no nap, a little (1 to 2 times a week) and a lot (more than twice a week).

The academic performance referred to the average of the scores the students obtained throughout the academic year. The score system consists of test scaling from 0 to 10.

Self-administered Pittsburg Sleep Inventory Questionnaire validated in the Spanish language [11]. A cut-off point of 5 points was considered to differentiate those with good sleep quality (good sleepers, score ≤ 5) or poor quality of sleep (poor sleepers, score ≥ 6).

For statistical analysis, it was used the SPSS program for Mac, version 24. Parametric tests (t-Student and ANOVA with Bonferroni test as appropriate) were used for the analysis of non-categorical variables; and nonparametric tests (X^2 or Fisher's exact test, as appropriate), for categorical variables.

The surveys were self-administered and anonymous. The study was conducted under the ethical standards that govern human research under the National Law on Protection of Personal Data No. 25,326 (Habeas Data Law) and the Declaration of Helsinki in its latest version (Fortaleza 2013). The surveyed participants signed the Informed Consent designed for this purpose. The work was approved by the UNLaM Ethics Committee, as a CyTMa2 Research Project (Science and Technology of UNLaM), code C2SAL-021, to be developed during 2019.

Results

UBA

Beginning of the academic year: 168 students answered the complete survey: 60 males of average age 23.31 ± 5.9 years and 108 females of average age 21.95 ± 2.84 years. The mean age of the men was significantly higher than that of the women (p = 0.002). Four female students reported being married or in common law and five female students reported having children. Thirty-one surveys were excluded due to missing responses, which made their analysis difficult.

There were no significant differences in the scores obtained from the Pittsburgh Questionnaire in all independent variables, except for women with children, and those who used tranquilizers, whose mean scores were significantly higher than those without children, and those who did not take tranquilizers, respectively.

One hundred ten students were classified as poor sleepers: This shows a prevalence of 65.87% of PQS, without finding significant differences regarding sex, marital status, the fact of working apart from studying, the travel time from home to school, the habit of taking a

nap, drinking infusions (coffee or mate), smoking, the habit of consuming energy drinks, marijuana use, alcohol consumption more than three times a week.

All the students who reported having children were poor sleepers. Only one student reported the use of Modafinil, five students reported the use of sleep medication, and a single student reported the use of other illicit drugs other than marijuana: all had a score on the Pittsburgh scale consistent with poor sleep quality.

End of the academic year: 128 students answered the questionnaire: 40 males aged 22.96 ± 3.81 years, and 88 females aged 22.75 ± 3.02 years, without significant age differences. Four female students reported being married or in a civil union relationship, and five reported having children.

Male students got a Pittsburgh score of 7.27 ± 2.69; female students scored, 7.18 ± 3.01. The were no significant differences between both sexes (t-Student test, p = 0.352). No significant difference was found in the averages of the scores obtained from the Pittsburgh Questionnaire in almost all independent variables, except in women with children, in the students who reported consuming energy drinks, and those who reported consuming tranquilizers, who had an average score significantly higher than childless women, those who do not consume energy drinks or tranquilizers.

No difference was found in the frequency of bad sleepers concerning gender, marital status, the fact of having children, the travel time between home and college; the fact of working apart from studying, the habit of taking a nap, the habit of taking infusions, the consumption of energy drinks, smoking, the consumption of marijuana. Only one student reported consumption of Modafinil, seven students reported taking tranquilizers for sleep, and three students reported using ecstasy: they all were poor sleepers.

No significant difference was found between weekly study hours for good sleepers (28.22 ± 1.46) and poor sleepers (31.19 ± 1.63), using the t-Student test (p = 0.24), nor was there an association found between good and bad sleepers and the time of the survey (beginning or end of the year; X^2 = 1,422, p = 0.233).

When comparing the Pittsburgh scores of the students during the first semester (6.87 ± 2.88) and those obtained in the second semester (7.21 ± 2.89), the difference was not significant (t-Student statistic 0.001, p = 0.97).

When considering the average scores of the group of good sleepers (7.26 ± 0.22 points), with the average corresponding to the bad sleepers (5.94 ± 0.19 points), the difference was, indeed, significant (t-Student statistic 880, p = 0.024).

The results can be found in table 1 and 2.

UNLAM

At the beginning of the course, 80 students answered the survey: 68 women (age 21.84 ± 3.18) and 12 men (25.50 ± 6.49). The mean age of the men was significantly higher than that of the women (t-Student statistic= -3.059, p = 0.003). Twelve reported being married or living with their partners (all males). Five of them reported having children.

67 students were classified as "poor sleepers", indicating an 83.75% prevalence of poor sleep quality. The mean score for Pittsburgh was significantly higher for those childless and single students who napped not more than twice a week, thus compared to students who had children, were married or living with their partners, or those who did not nap or sleep more than twice a week, respectively.

No significant association was found between the frequency of bad sleepers, and most of the independent variables analyzed, except for the variable "marital status": the highest frequency was observed in single students (X^2 = 9,426, p = 0.002).

Variable		Pittsburg	Good sleepers N (%)	Poor sleepers N (%)
Gender	Female	6.59 ± 2.78	39 (36.4)	68 (63.6)
	Male	6.67 ± 3.22	18 (30.5)	41 (69.5)
Marital status	Single	6.53 ± 2.86	56 (34.8)	105 (65.2)
	Married/ Civil Union	10.25 ± 3.86	1 (20)	4 (80)
Children	No children	6.53 ± 2.87	57 (35.2)	105 (64.8)
	Without children	10.33 ± 3.51*	0	5 (100)^
Turn-around trip	Short time	6.72 ± 3.49	20 (33.4)	40 (66.6)
	Long time	6.63 ± 2.59	32 (24.43)	69 (52.67)
Work and study	No	6.44 ± 2.91	44 (35.77)	79 (64.23)
	Yes	7.28 ± 2.95	12 (27.27)	32 (72.73)
Nap sleeping	No	5.93 ± 1.55	25 (34.2)	48 (65.8)
	A little	5.70 ± 1.63	24 (34.8)	45 (65.2)
	A lot	6.62 ± 1.79	8 (33.3)	16 (66.7)
Infusions	No	7.22 ± 3.27	8 (25)	24 (75)
	A little	6.27 ± 2.84	18 (34.6)	34 (65.4)
	A lot	6.65 ± 2.84	31 (36.9)	53 (63.1)
Modafinil	No	6.60 ± 2.89	57 (34.1)	110 (65.9)
	Yes	12	0	1 (100)
Tobacco smoking	No	6.05 ± 1.58	50 (32.47)	104 (67.53)
	Yes	5.21 ± 1.75	6 (46.15)	7 (53.85)
Energy-drinks	No	6.47 ± 2.72	55 (36.67)	95 (63.33)
	Yes	8.17 ± 1.17	2 (13.33)	13 (86.67%)***
Tranquilizers	No	6.52 ± 2.76	55 (34.8)	103 (65.2)
	Yes	11.20 ± 4.08**	0	5 (100)^
Alcohol	No	7.02 ± 2.77	17 (26.2)	48 (73.8)
	A little	6.45 ± 3.1	35 (38.5)	56 (61.5)
	A lot	6.64 ± 2.9	5 (45.5)	6 (54.5)
Marijuana	No	6.65 ± 2.94	51 (32.05)	105 (67.95)
	Yes	6.50 ± 2.81	6 (46.16)	7 (53.84)
Other illegal substances	No	6.63 ± 2.94	57 (34.3)	109 (65.7)
	Yes	7	0	2 (100)

Table 1: *Results of the surveys from UBA students at the beginning of the academic year.*

**: t-student: -2.26, p = 0.025; **: t-student = -3.664, p < 0.001; ***: p < 0.05; ^: All of them were bad sleepers.*

Variable		Pittsburg	Good sleepers N (%)	Poor sleepers N (%)
Gender	Female	7.18 ± 3.01	11 (22.92)	37 (77.08)
	Male	7.27 ± 2.69	29 (36.25)	51 (63.75)
Marital status	Single	7.34 ± 3.23	39 (31.5)	85 (68.5)
	Married/ Civil Union	5.75 ± 0.50	1 (25)	3 (75)
Children	No children	7.35 ± 3.21	38 (30.9)	85 (69.1)
	With children	5.60 ± 0.54*	2 (40)	3 (60)
Turnaround trip	Short time	7.55 ± 3.17	12 (20.69)	46 (79.31)
	Long time	6.53 ± 2.73	27 (40.91)	39 (59.09)
Work and study	No	6.72 ± 2.80	29 (31.2)	64 (68.8)
	Yes	7.67 ± 3.37	11 (33.3)	22 (66.7)
Nap sleeping	No	7.38 ± 3.26	19 (32.2)	40 (67.8)
	A little	6.86 ± 2.74	14 (29.2)	34 (70.8)
	A lot	6.35 ± 2.66	7 (33.3)	14 (66.7)
Infusions	No	7.38 ± 2.70	5 (20.8)	19 (79.2)
	A little	5.94 ± 2.46	8 (21.05)	30 (78.95)
	A lot	7.49 ± 3.24	17 (25.8)	49 (74.2)
Modafinil	No	7.01 ± 0.99	40 (31.5)	87 (68.5)
	Yes	7	0	1 (100)
Tobacco smoking	No	7 ± 3.05	38 (32.5)	79 (67.5)
	Yes	7.11 ± 2.08	2 (18.2)	9 (81.2)
Energy-drinks	No	6.77 ± 2.89	37 (33.3)	74 (66.7)
	Yes	8.60 ± 3.13**	3 (18.8)	13 (81.3)
Tranquilizers	No	6.62 ± 2.51	40 (33.3)	80 (66.7)
	Yes	13 ± 3.41***	0	7 (100)
Alcohol	No	7.02 ± 2.63	13 (26.5)	36 (73.5)
	A little	7.02 ± 3.18	22 (33.8)	43 (66.2)
	A lot	6.92 ± 3.39	5 (35.7)	9 (64.3)
Marijuana	No	7.08 ± 2.99	36 (32.1)	76 (67.9)
	Yes	6.36 ± 2.94	4 (25)	12 (75)
Other illegal substances	No	6.97 ± 3	40 (32)	85 (68)
	Yes	8.33 ± 1.5	0	3 (100)

Table 2: *Results of the surveys from UBA students at the end of the academic year.*

: T-student 1.081, p = 0.03; **: t-student –2.25, p=0.02; *: t-student –6.36, p < 0.001.*

All students who reported taking tranquilizers were poor sleepers. None of them declared taking Modafinil or consuming any other illegal substances but marijuana.

Bad sleepers studied significantly more hours per week (24.29 ± 1.84) than good sleepers (16.78 ± 1.72, t-Student = -2.004, p = 0.04).

81 students answered the survey at the end of the academic year: 65 women and 16 men. The age of the women was 22.97 ± 3.31, and that of the men, 26.50 ± 5.46 (Student t -3.335, p = 0.001). Of all respondents: 1 lived together with the partner (de facto union), 2 did not answer, and 15 women and one man reported having children. Pittsburgh's average score was 9.12 ± 3.38: females, 9.30 ± 3.30, and males, 8.37 ± 3.70 (t-Student = 0.988, p = 0.102).

No significant differences were found in the mean of the Pittsburgh scores between the different independent variables, except for the variable "smoking": those who smoked had a significantly higher mean score than those who did not smoke (t-Student = -2,125, p = 0.592).

Seventy-one students were poor sleepers, evidencing an 87.65% prevalence of poor sleep quality. No significant association was found between the frequency of bad sleepers and all the independent variables evaluated.

The only respondent who reported not being single, the nine participants who reported being tobacco users, and the four students who declared taking tranquilizer medications had scores consistent with poor sleep quality. The only one who reported taking Modafinil was a good sleeper. None of the above reported using drugs other than marijuana.

When comparing the Pittsburgh scores at the beginning of the academic year with the score obtained at the end of that year, an increase in the mean score was evident: however, this difference was not significant (Student's t-test = -0.526, p = 0.53). There was not a different percentage of good and bad sleepers between the first and the last survey (X^2 = 0.88, p = 0.34).

Since the students answered the end-of-the-academic-year survey before sitting for exams, it was not possible to analyze academic performance in this group.

The results can be seen in table 3 and 4.

Discussion

In this study, we found a prevalence of PQS of around 65% in the UBA and around 85% in the UNLaM. In the UBA, the prevalence of bad sleep quality was 63% at the beginning, and 77% at the end of the academic year; in the UNLaM, the respective percentages were 85 and 90%. In the UBA, the percentage was somewhat higher than that found in the pilot work carried out in this same Academic Unit in 2016 (58%) [10] and even higher than other studies carried out in our country (about 40%) [8,9]. The percentage obtained at UNLaM was strikingly higher.

Surprisingly, there was no evidence of any association between poor quality of sleep and most of the variables analyzed in students from UBA: gender, total amount of time of the turnaround trip, napping, and intake of alcohol, tobacco, marijuana, and energy drinks. However, women having children, and students who took tranquilizers had a worse quality of sleep.

Among UNLaM students, a higher frequency of bad sleepers was found in students who were single: at the beginning of the academic year, seven students reported not being single; at the end of the it, only one student reported not being single. Besides, those having children have a higher frequency of good quality of sleep at the beginning of the academic year, but, at the end of it, this difference was not evident. No associations were found between the frequency of poor sleep quality and the rest of the variables explored in the two evaluations.

In the present study, there was no association between gender and poor quality of sleep. However, some authors report that women have a worse quality of sleep and more daytime sleepiness than men due to genetic, endocrinological and social factors [12]. Nevertheless, although this might be related to affective disorders, this should be taken with caution [13]. In the study carried out at UBA in 2016, there

Variable		Pittsburg	Good sleepers N (%)	Poor sleepers N (%)
Gender	Female	8.75 ± 3.12	10 (14.7)	58 (85.3)
	Male	9.08 ± 3.60	3 (25)	9 (75)
Marital Status	Single	8.41 ± 1.45*	9 (12.3)	64 (87.7)**
	Married/ Civil Union	5.75 ± 1.72	4 (57.1)	3 (42.9)
Children	No	9 ± 3.13***	11 (14.7)	64 (85.3)
	Yes	5.80 ± 2.38	2 (40)	3 (60)
Turnaround trip	Short time	8.39 ± 2.95	11 (19.3)	46 (80.7)
	Long time	9.83 ± 3.53	2 (8.7)	21 (91.3)
Work and study	No	8.45 ± 2.93	10 (17.9)	46 (82.1)
	Yes	9.63 ± 3.60	3 (12.5)	21 (87.5)
Nap sleeping	No	7.96 ± 2.92	9 (19.6)	37 (80.4)
	A little	10.10 ± 3.28****	4 (12.9)	27 (87.1)
	A lot	8.33 ± 1.52	0	3 (100)
Infusions	No	7.85 ± 2.7	4 (30.8)	9 (69.2)
	A little	8.88 ± 3.16	4 (15.4)	22 (84.6)
	A lot	9.05 ± 3.32	5 (12.2)	36 (87.8)
Modafinil	No	8.80 ± 3.18	13 (16.25)	67 (83.75)
	Yes	N/A	0	0
Tobacco smoking	No	8.17 ± 1.48	10 (13.7)	63 (86.3)
	Yes	7.61 ± 1.67	3 (42.9)	4 (57.2)
Energy-drinks	No	8.78 ± 3.11	11 (15.1)	62 (84.9)
	Yes	9 ± 4	2 (28.6)	5 (71.4)
Tranquilizers	No	8.66 ± 3.06	13 (17.1)	63 (82.9)
	Yes	11.5 ± 4.50	0	4 (100)
Alcohol	No	7.61 ± 1.51	8 (22.9)	27 (77.1)
	A little	8.67 ± 1.46	5 (11.6)	38 (88.4)
	A lot	9.12 ± 1.82	0	2 (100)
Marijuana	No	8.64 ± 3.08	11 (16.7)	55 (83.3)
	Yes	9.57 ± 14.3	2 (14.3)	12 (85.7)
Other illegal sub-stances	No	8.80 ± 3.18	13 (16.25)	67 (83.75)
	Sí	N/A	0	0

Table 3: *Results of the surveys from UNLaM students at the beginning of the academic year.*
: t-Student = 2.513, p = 0.014; **: X^2 = 9.426, p = 0.002; *: t-Student = 2.23, p = 0.02; ****: Anova F = 4.62, p = 0.013 with Bonferroni post Hoc test; N/A: Not applicable.*

Variable		Pittsburg	Good sleepers N (%)	Poor sleepers N (%)
Gender	Female	9.30 ± 3.30	6 (9.2)	59 (90.8)
	Male	8.37 ± 3.70	4 (25)	12 (75)
Marital Status	Single	9.18 ± 3.44	10 (12.8)	68 (87.5)
	Arrived/ Civil Union	10	0	1 (100)
Children	No children	8.92 ± 3.30	8 (12.3)	57 (87.7)
	With children	9.93 ± 3.67	2 (12.5)	14 (87.5)
Turnaround trip	Short time	8.74 ± 3.14	7 (13)	50 (86.2)
	Long time	9.23 ± 3.80	2 (8.7)	21 (91.3)
Work and study	No	9.06 ± 3.68	8 (13.8)	50 (86.2)
	Yes	9.26 ± 2.52	2 (8.7)	21 (91.3)
Nap sleeping	No	9.09 ± 3.53	8 (14.8)	46 (85.2)
	A little	9.13 ± 3.25	2 (8.7)	21 (91.3)
	A lot	9.50 ± 2.51	0	4 (100)
Infusions	No	8.25 ± 2.84	4 (25)	12 (75)
	A little	8.23 ± 1.85	1 (5.90)	16 (94.1)
	A lot	9.72 ± 3.84	5 (10.4)	43 (89.6)
Modafinil	No	9.17 ± 3.37	9 (11.3)	81 (88.8)
	Yes	5	1 (100)	0
Tobacco smoking	No	8.84 ± 3.24	10 (13.9)	62 (86.1)
	Yes	11.33 ± 3.80*	0	9 (100)^
Energy-drinks	No	9.18 ± 3.40	9 (11.7)	68 (88.3)
	Yes	8 ± 2.94	1 (25)	3 (75)
Tranquilizers	No	9 ± 3.26	10 (13)	67 (87)
	Yes	11.5 ± 5.25	0	4 (100)^
Alcohol	No	8.87 ± 3.06	4 (8.9)	41 (91.1)
	A little	9.37 ± 3.87	16 (18.8)	26 (81.3)
	A lot	10 ± 3.16	0	4 (100)
Marijuana	No	9.16 ± 3.32	7 (10.3)	61 (89.7)
	Yes	8.92 ± 3.81	3 (23.1)	10 (76.9)
Other illegal substances	No	9.12 ± 3.38	10 (12.35)	71 (87.65)
	Yes	N/A	0	0

Table 4: *Results of the surveys from UNLaM students at the end of the academic year.*
**: t-Student = -2.125, p = 0.03; ^: They all were poor sleepers.*

was an association of students' sleep disorders with the presence of anxious states and traits, predominantly in women [10].

In the UBA, women with children had a higher frequency of poor quality of sleep. However, male students with children at the UNLaM were better sleepers than those who were childless. This difference might be due to the influence of gender on sleep quality.

We found no association between the quality of sleep and the habit of napping.

Some works find a benefit of napping in those people who sleep less than 7 hours a day, whereas, in those people who sleep more than 9 hours a day, it would have deleterious effects [14]. A meta-analysis found the association of naps of more than 60 minutes in duration with increased mortality in general [15]. The Spanish Society of Sleep Medicine recommends taking a short nap after lunch, and in case one is very sleep-deprived, it would be advisable to sleep for 90 minutes straight. On the other hand, they warn that, in case of having difficulties sleeping at night, or a fragmented dream, napping should be avoided [16].

The fact of working and studying did not prove to be a variable associated with a poor quality of sleep in the present study. However, other researchers have shown that those who study and work have a higher frequency of sleep disorders than those who only study [17,18].

The ingestion of infusions in small or large quantities was not a factor associated with the frequency of PQS in the study population.

Some researchers evaluated the effect of caffeine on sleep. Caffeine prolongs sleep latency, reduces total sleep time, and worsens perceived sleep quality, although it is lower in younger people. Caffeine is known to antagonize adenosine receptors in the brain, although polymorphisms of this receptor gene could explain individual differences in susceptibility to this substance. Furthermore, caffeine would have a stimulating effect on sympathetic nerves that inhibit sleep function [19,20]. On the other hand, in our country it is common to drink mate, an infusion of yerba mate leaves, which come from the *Ilex paraguayensis*: the leaves of this tree contain caffeine at concentrations of 1 - 2%: the consumption of this infusion has a facilitating effect of wakefulness at the expense of NREM sleep reduction, in addition to reducing daytime sleepiness and not causing rebound sleep due to deprivation [21].

9.1% of the students reported taking energy drinks regularly. The use of these drinks would contribute to the improvement of the cognitive ability, apart from reducing drowsiness.

In this work, the energy-drink consumption did not link to poor sleep quality. These beverages have a higher concentration of caffeine than the FDA allows, with their adverse effects related to sleep: from low quality of sleep to insomnia [22,23]. In a study of medical students at the University of Copperbelt, Zambia, 27% of the people surveyed consumed these drinks: a significant association was found between this type of drink and PSQ [24].

55 - 60% of the students from both universities reported drinking alcohol. Students from the UBA drank alcoholic drinks more than three times a week, whereas those from UNLaM drank less than three times a week. No association was found between alcohol consumption, with poor quality of sleep. This data is surprising since, according to previous reports, consumption of < 1g/kg of alcohol has a deleterious effect on sleep by shortening the duration of REM sleep; in those who consume more than 1 g/kg, sleep latency and efficiency are reduced, the number of awakenings increases, although it has different manifestations of sleep in the first part of the night compared to the second part of the night.

On the other hand, the consumption of alcohol at earlier times, even in small doses, causes a shallower sleep with greater ease of awakening [25]. The effect of alcohol on sleep would be through adenosine and its type 1 receptor as sleep promoters, although they also have a profound interaction with circadian rhythms [26].

About 8 - 10% of respondents from both universities reported smoking. Smoking was not associated with poor quality of sleep in the UBA students; On the other hand, in the UNLaM, all smokers had a poor quality of sleep at the end of the academic year. The association between sleep and smoking is complex and multifactorial. There seems to be a reciprocal relationship between sleep and smoking, regardless of the presence of other psychiatric or substance abuse pathologies, although it can be associated with the concomitant presence

of these pathologies [27]. Nicotine per se causes increased attention and arousal by interacting with the release of neurotransmitters that regulate awakening; It also has a stimulatory effect on muscle tone in the upper airways. Chronic smoking increases sleep fragmentation, the frequency of nightmares, daytime sleepiness, difficulties waking up, and the frequency of leg movements during sleep, bruxism, snoring, and sleep apneas [28].

Less than 20% of students from both universities smoked marijuana. However, they did not have a worse quality of sleep than those who did not take this illicit drug. The consumption of this substance is frequent among those aged 18 - 25 in some cases, to improve a pre-existing sleep disorder (among other reasons). Some authors found worse results in terms of sleep quality and insomnia in those who consumed this substance daily, with a more significant effect on the female sex [29]. However, several studies demonstrated contradictory results [30], probably due to the variable concentrations of tetrahydrocannabinol and cannabidiol in marijuana cigarettes [31].

A single respondent at the UBA and one at the UNLaM reported the use of Modafinil to stay awake, a few students reported the use of tranquilizing medications to sleep (without having reported having a diagnosis or treatment for psychiatric or mood diseases) and a few others, at the UBA, the use of ecstasy. All had poor quality of sleep, except for the one from UNLaM, who used to take Modafinil. Modafinil is a wakefulness-inducing compound indicated for the treatment of excessive daytime sleepiness in patients with sleep apnea, restless leg syndrome, narcolepsy, and shift-work sleep disorders, in addition to having cognitive-enhancing effects. Its mechanism of action is through hypocretinergic, histaminergic, α-adrenergic, glutamatergic and dopaminergic brain systems [32]. The use of Modafinil is probably related to the awakening or the cognitive properties of the drug.

Ecstasy (3,4-methylenedioxyamphetamine) is a recreational drug frequently used in electronic parties. It interacts with presynaptic serotonin reuptakers, binds to the 5-HT2 receptor, and causes a rapid release of dopamine. Forty-eight hours after consumption, the consumer may have a non-restful sleep with increased wakefulness. Some neurophysiological studies demonstrated a reduction in stage 2 and an increase in stage 1 sleep, suppression of REM sleep, or a decrease in total sleep time. However, more studies are needed to homogenize the electrophysiological findings [30].

Benzodiazepines are compounds with anxiolytic, hypnotic, and muscle relaxant effects. The mechanism of action is achieved by binding with the GABAA receptor. It is the third drug of illicit use in adults and adolescents in the United States.

Young adults typically start taking benzodiazepines at ages 18 - 24. Occasionally, those who abuse benzodiazepines obtain these drugs from family or friends [33]. As a central nervous system depressant, benzodiazepines may affect ventilation control during sleep (especially in patients with chronic obstructive pulmonary disease), as well as the function of the upper airway muscles, causing snoring or obstructions [34]. In a study carried out in people with chronic insomnia who used high doses of these drugs, by polysomnography, a significant alteration of the sleep microstructure was evidenced, aggravating the pre-existing disturbance of this structure in people with insomnia who were virgin of medication [35]. Taking into consideration a study carried out in patients with chronic insomnia on prolonged treatment with these medications, an increase in sleep latency and a reduction in the duration of sleep resulted evident; however, these patients highlighted their efficacy as hypnotics. This alteration is not seen in those on short benzodiazepine treatments [36].

Finally, a significant (albeit weak) correlation was found between the number of hours of study per week and academic performance. Students with good quality sleep had significantly better academic performance than those with MCS. This result agrees with the study carried out at the University of Córdoba [8] and with others carried out in other countries [37-40]. Sleep plays a vital role in the development of the growing brain since brain plasticity processes occur when sleeping; it also has a fundamental role in memory, learning, mood and behavior states, immune and metabolic responses. During non-REM sleep, hippocampal-dependent episodic memory consolidation takes place by strengthening the increase in synaptic connections. The presence of slow waves and sleep spindles is essential for learning: slow waves coordinate the rhythm and oscillations between sleep spindles and sharp hippocampal waves. In this way, the information

processes acquired during wakefulness are activated and enhanced [41]. At this time, the hippocampus transfers information to the cerebral cortex in a slow pattern for the generation and consolidation of long-term memory [42]. During REM sleep, the ponto-thalamus-cortical connection is activated with a rapid flow of information to the neocortex, to eliminate redundant connections and preserve effective ones [41]. The shortening of sleep times is associated with a prolongation of the brain reaction time, a reduction in cognitive performance, and an increased risk of suffering traffic accidents, metabolic syndrome, or cardiovascular diseases. Even the irregularity of sleep moments related to the circadian clock, regardless of the duration of sleep time, has cognitive adverse effects, leading to a worsening of academic performance [43].

The prevalence of poor sleep quality in UBA and UNLaM students is high. In the present work, sleeping bad was not associated with most of the variables studied. Probably, as demonstrated in a research work carried out at the UBA in 2016, it is related to anxious states and traits [10]. Some authors found an association between poor quality of sleep and cultural factors [44]. Some researchers found that poor quality of sleep was linked to internet addiction in adolescents [45,46] and medical students [47]. In the present study, this kind of addiction was not evaluated. As the present study was, indeed, a survey, the Hawthorne effect [48] should not be ruled out.

Moreover, the addiction to social networks Facebook, Instagram, youtube, and Tindr is growing. Kircaburun found that 33% of university students were addicted to Instagram [49].

Future studies should be designed to search for an association between social media addiction, sleep quality, and academic performance.

The American Academy of Sleep Medicine published the third edition of the International Classification of Sleep Disorders in 2014. This includes six main divisions (insomnia, central disorders of hypersomnolence, sleep-related disorders, circadian rhythm sleep-wake disorders, parasomnia, sleep-related movement disorders), with their respective subclassifications, which make, at least, 70 sleep disorders. For an accurate diagnosis, a set of criteria should be fulfilled through anamnesis and polysomnography or out-of-center sleep testing. Further studies should be required in some instances (i.e. Cerebral Spine Fluid hypocretin-1 concentration for the diagnosis of narcolepsy) [50,51].

The Pittsburgh Sleep Quality Index was designed to measure sleep quality and identify good and bad sleepers. It does not provide accurate diagnoses of specific sleep disorders: bad sleepers should be studied with further laboratory tests in a clinical setting [52]. The present study showed a high prevalence of poor sleep quality in students, and bad sleepers had a more unsatisfactory academic performance than good sleepers. As this is alarming, some psychological interventions have been examined. A recent systematic review recommends Cognitive- Based Therapy as it provides the best effects for the improvement of sleep variables in students [53]. Schlarb and colleagues could show, in their pilot study, that SWIS (Studieren Wie In Schlaf; Studying In Your Sleep) approach may be useful for the treatment of sleep problems in students, as it may have positive effects on sleep and cognitive outcomes [54].

Conclusion

The prevalence of bad quality of sleep is strikingly high in both Universities, even higher to what was previously reported. Poor sleep quality is not associated to any of the demographic variables analyzed. However, as it was shown in a previous pilot study, this might be related to anxiety trait and state, or else, to cultural factors.

Acknowledgments

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