

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

Nicolás Gómez-Chiappe ^{1*}
Paula Andrea Lara-Monsalve ¹
Ana María Gómez ¹
David C. Gómez ¹
Johanna Catalina González ¹
Luisa González ¹
Juan Esteban Gutiérrez-Prieto ¹
María Alejandra Jaimes-Reyes ¹
Luna Daiana González ¹
Juan Sebastián Castillo ²

¹ Pontificia Universidad Javeriana, School of Medicine - Bogotá D.C. - Colombia.

² Pontificia Universidad Javeriana, Department of Social and Preventive Medicine - 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.

*Corresponding author:

Nicolás Gómez-Chiappe
E-mail: n.gomezc@javeriana.edu.co

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INTRODUCTION

Sleep problems are common in the general population, with approximately one-third of adults reporting any form of insomnia¹. 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 performance²⁻⁶. 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 duties¹. 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 problems².

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 GPA⁹. Poor sleep quality was evidenced in 54.7% out of 4318 university students in Taiwan¹⁰. Some studies have found risk factors for poor sleep quality such as females, smoking, alcohol and energy drink use¹¹⁻¹³.

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 performance¹⁴. 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 sleepiness¹⁵. 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 Colombia¹⁶, 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 room¹⁷.

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 breakfast¹⁸. 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 quality¹⁹. The Spanish translated version was used in this study¹⁶.

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/m ²)	51	12.3
Normal weight (18.5 - 25 kg/m ²)	312	75.3
Overweight (25 - 30 kg/m ²)	47	11.3
Obesity (>30 kg/m ²)	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.

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 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/m ²)	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 (%) n = 170	Poor sleep quality (%) n = 244	P-value	Unadjusted OR Poor sleep quality (CI 95%)
Sex				
Women	40.6	59.4	0.744	1.07
Men	42.3	57.7		(0.70 - 1.65)
BMI*				
Low or normal weight	43	57	0.035	1.99*
Overweight or obesity	27.4	72.6		(1.04 - 3.82)
School				
Medicine	46.7	53.3	0.139	0.72
Other	38.8	61.2		(0.47 - 1.11)
Chronotype				
Morning type	46.2	53.8	0.007	0.57*
Evening type	32.9	67.1		(0.38 - 0.86)
Living alone				
Yes	52.1	47.9	0.099	0.60
No	39.6	60.4		(0.33 - 1.10)
Go to bed at the same time				
Yes	55.2	44.8	0.000	0.36*
No	31	69		(0.24 - 0.55)
Wake up at the same time				
Yes	47	53	0.007	0.57*
No	33.7	66.3		(0.39 - 0.86)
Taking naps				
Yes	34.6	65.4	0.015	1.64*
No	46.5	53.5		(1.10 - 2.45)
Eat in bed				
Yes	26.6	73.4	0.000	2.48*
No	47.4	52.6		(1.57 - 3.94)
Study in bed				
Yes	41.3	58.7	0.830	0.92
No	39.4	60.6		(0.45 - 1.91)
Physical activity near to sleep time				
Yes	37.1	62.9	0.354	1.25
No	42.4	57.6		(0.78 - 1.99)
Sleep in dark and quiet room				
Yes	44.4	55.6	0.016	0.55*
No	30.5	69.5		(0.34 - 0.90)
Work and study				
Yes	32.5	67.5	0.080	1.58
No	43.2	56.8		(0.94 - 2.65)

* 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^{14,15,20-22}. Other known risk factors that

were observed in our study include high BMI²³, energy drink consumption and smoking^{11,13}. 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 quality²⁰. The evidence on an association between evening chronotype and poor sleep quality is conflicting, showing no association in some research²⁴ while the present study did find a statistically significant association as other studies^{25,26}.

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)		
<i>pseudo R2 coefficient</i>		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 stimulants^{11,13}.

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%^{22,27}. 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 relationship^{9,14,15,18,22,27,28}.

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

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 of 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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REFERENCES

1. Azad MC, Fraser K, Rumana N, Abdullah AF, Shahana N, Hanly PJ, et al. Sleep disturbances among medical students: a global perspective. *J Clin sleep Med*. 2015;11(1):69-74.
2. Pensuksan WC, Lertmaharit S, Lohsoonthorn V, Rattananupong T, Sonkprasert T, Gelaye B, et al. Relationship between poor sleep quality and psychological problems among undergraduate students in the southern Thailand. *Walailak J Sci Technol*. 2016;13(4):235-42.
3. Oginska H, Pokorski J. Fatigue and mood correlates of sleep length in three age- social groups: school children, students, and employees. *Chronobiol Int*. 2006;23(6):1317-28.
4. Engle-Friedman M, Riela S, Golan R, Ventuneac AM, Davis CM, Jefferson AD, et al. The effect of sleep loss on next day effort. *J Sleep Res*. 2003;12(2):113-24.
5. Shamsuzzaman ASM, Gersh BJ, Somers VK. Obstructive sleep apnea: implications for cardiac and vascular disease. *J Am Med Assoc*. 2003;290(14):1906-14.
6. Pilcher JJ, Walters AS. How sleep deprivation affects psychological variables related to college students' cognitive performance. *J Am Coll Health*. 1997;46(3):121-6.
7. Bartel KA, Gradisar M, Williamson P. Protective and risk factors for adolescent sleep: a meta-analytic review. *Sleep Med Rev*. 2015;21:72-85.
8. Romero-Corral A, Caples SM, Lopez-Jimenez F, Somers VK. Interactions between obesity and obstructive sleep apnea: implications for treatment. *Chest*. 2010;137(3):711-9.
9. Elagra MI, Rayyan MR, Alnemer OA, Alshehri MS, Alsaifan NS, Al-Habib RS, et al. Sleep quality among dental students and its association with academic performance. *J Int Soc Prev Community Dent*. 2016;6(4):296-301.
10. Cheng SH, Shih CC, Lee IH, Hou YW, Chen KC, Chen KT, et al. A study on the sleep quality of incoming university students. *Psychiatry Res*. 2012;197(3):270-4.
11. Sanchez SE, Martínez C, Oriol RA, Yanez D, Castañeda B, Sanchez E, et al. Sleep quality, sleep patterns and consumption of energy drinks and other caffeinated beverages among peruvian college students. *Health (Irvine Calif)*. 2013;5(8B):26-35.
12. Faris MAIE, Jahrami H, Al-Hilali MM, Chehyber NJ, Ali SO, Shahda SD, et al. Energy drink consumption is associated with reduced sleep quality among college students: a cross-sectional study. *Nutr Diet*. 2017;74(3):268-74.
13. Lohsoonthorn V, Khidir H, Casillas G, Lertmaharit S, Tadesse MG, Pensuksan WC, et al. Sleep quality and sleep patterns in relation to consumption of energy drinks, caffeinated beverages, and other stimulants among Thai college students. *Sleep Breath*. 2013;17(3):1017-28.
14. Machado-Duque ME, Chabur JEE, Machado-Alba JE. Excessive daytime sleepiness, poor quality sleep, and low academic performance in medical students. *Rev Colomb Psiquiatr*. 2015;44(3):137-42.
15. Escobar-Córdoba F, Benavides-Gélvez RE, Montenegro-Duarte HG, Eslava-Schmalbach JH. Excessive daytime drowsiness in ninth-semester medical students attending the Universidad Nacional de Colombia. *Rev Fac Med*. 2011;59(3):191-200.
16. Escobar-Córdoba F, Eslava-Schmalbach J. Colombian validation of the Pittsburgh Sleep Quality Index. *Rev Neurol*. 2005;40(3):150-5.
17. Irish LA, Kline CE, Gunn HE, Buysse DJ, Hall MH. The role of sleep hygiene in promoting public health: a review of empirical evidence. *Sleep Med Rev*. 2015;22:23-36.
18. Wang L, Qin P, Zhao Y, Duan S, Zhang Q, Liu Y, et al. Prevalence and risk factors of poor sleep quality among Inner Mongolia Medical University students: a cross-sectional survey. *Psychiatry Res*. 2016;244:243-8.
19. Buysse DJ, Reynolds CF, Monk TH, Berman SR, Kupfer DJ. The Pittsburgh sleep quality index: A new instrument for psychiatric practice and research. *Psychiatry Res*. 1989;28(2):193-213.
20. Lund HG, Reider BD, Whiting AB, Prichard JR. Sleep patterns and predictors of disturbed sleep in a large population of college students. *J Adolesc Heal*. 2010;46(2):124-32.
21. Orzech KM, Salafsky DB, Hamilton LA. The state of sleep among college students at a large public university. *J Am Coll Health*. 2011;59(7):612-9.
22. Barahona-Correa JE, Aristizabal-Mayor JD, Lasalvia P, Ruiz AJ, Hidalgo-Martínez P. Sleep disturbances, academic performance, depressive symptoms and substance use among medical students in Bogota, Colombia. *Sleep Sci*. 2018;11(4):260-8.
23. Quick V, Shoff S, Lohse B, White A, Horacek T, Greene G. Relationships of eating competence, sleep behaviors and quality, and overweight status among college students. *Eat Behav*. 2015;19:15-9.
24. Gobin CM, Banks JB, Fins AI, Tartar JL. Poor sleep quality is associated with a negative cognitive bias and decreased sustained attention. *J Sleep Res*. 2015;24(5):535-42.
25. Voinescu B, Szentagotai-Tatar A. Sleep hygiene awareness: its relation to sleep quality and diurnal preference. *J Mol Psychiatry*. 2015;3(1):1.
26. Thun E, Bjorvatn B, Flo E, Harris A, Pallesen S. Sleep, circadian rhythms, and athletic performance. *Sleep Med Rev*. 2015;23:1-9.
27. Castro AM, Caamaño LU, Julio SC. Calidad del dormir, insomnio y rendimiento académico en Estudiantes de Medicina. *Duazary*. 2014;11(2):85-97.
28. Lemma S, Berhane Y, Worku A, Gelaye B, Williams MA. Good quality sleep is associated with better academic performance among university students in Ethiopia. *Sleep Breath*. 2014;18(2):257-63.
29. Yao CJ, Basner M. Healthy behaviors competing for time: associations of sleep and exercise in working Americans. *Sleep Heal*. 2019;5(1):23-30.
30. Mollayeva T, Thurairajah P, Burton K, Mollayeva S, Shapiro CM, Colantonio A. The Pittsburgh Sleep Quality Index as a screening tool for sleep dysfunction in clinical and non-clinical samples: a systematic review and meta-analysis. *Sleep Med Rev*. 2015;25:52-73.