




## Relación entre los niveles de estrés, la calidad del sueño y la actividad física en estudiantes universitarios de medicina

### Relationship between stress levels, sleep quality, and physical activity in medical university students

Katalina Marín-Lagos<sup>1</sup>, Oscar Ramirez-Barrientos<sup>1</sup>, Joaquín Mecardo-Cárcamo<sup>1</sup>, Manuel Velásquez-Cárdenas<sup>1</sup>, Matías Castillo-Aguilar<sup>2</sup> , Jonathan Henríquez-Lühr<sup>2</sup>, Oscar Niño-Méndez<sup>3</sup> , Cristian Núñez-Espinosa<sup>1,2,\*</sup> 

#### Resumen

**Introducción:** el estrés es un fenómeno contemporáneo que afecta a la población mundial y a los estudiantes universitarios, este factor pudiese ser uno de los que interviene en la calidad de sueño, la cual es importante de cuidar sobre todo en los alumnos debido a su relevancia en el proceso de aprendizaje, y por otro lado la actividad física puede afectar tanto en cómo manejar los niveles de estrés o prevenir trastornos del sueño, es por ello que este estudio tiene como objetivo relacionar los niveles de estrés con la calidad del sueño y la actividad física en estudiantes de medicina. **Métodos:** se desarrolló un estudio descriptivo, correlacional y transversal basado en diferentes estudios. Se analizaron las respuestas de 116 estudiantes de Medicina de la Universidad de Magallanes mediante tres evaluaciones: Escala de Estrés Percibido, Cuestionario Internacional de Actividad Física (IPAQ) y Test de Pittsburgh. **Resultados:** los estudiantes de Medicina presentaron una correlación positiva ( $p=0.4$ ,  $p<0.001$ ) entre la Escala de Estrés Percibido (EEP) y la de Pittsburgh (Pitts). Una de las variables EEP (incapaz de controlar las cosas) y la disfunción del estudiante en la realización de sus tareas esenciales diarias (disfunción durante el día) tienen una correlación positiva ( $p=0.54$ ,  $p<0.001$ ). La actividad física tuvo un promedio de 930 MET's, y no se encontró correlación significativa con las variables EEP y Pitts. **Conclusión:** la relación entre el estrés y la calidad del sueño es inversamente proporcional; por lo tanto, a mayor nivel de estrés percibido, menor calidad de sueño del estudiante, lo cual no está relacionado.

**Palabras Clave:** estrés psicológico; duración del sueño; IPAQ; estudiantes; medicina.

#### Abstract

**Introduction:** Stress is a contemporary phenomenon that affects the world population and university students, this factor could be one of those involved in the quality of sleep, which is important to take care of, especially in students because of its relevance in the learning process, and on the other hand physical activity can affect both how to manage stress levels or prevent sleep disorders, which is why this study aims to relate stress levels with sleep quality and physical activity in medical students. **Methods:** A descriptive, correlational, and cross-sectional study was developed based on different studies. The responses of 116 Medicine students from the University of Magallanes were analyzed using three evaluations: The perceived Stress Scale, the International Physical Activity Questionnaire (IPAQ), and the Pittsburgh Test). **Results:** Medicine students presented a positive correlation ( $p=0.64$ ,  $p<0.001$ ) between the Perceived Stress Scale (PSS) and Pittsburgh (Pitts). One of the PSS variables (unable to control things) and the student's dysfunction in performing their essential daily tasks (dysfunction during the day) have a positive correlation ( $p=0.54$ ,  $p<0.001$ ). Physical activity averaged 930 METs, and no significant correlation was found with the PSS and Pitts variables. **Conclusion:** The relationship between stress and sleep quality is inversely proportional; therefore, the higher the level of stress perceived, the lower the student's sleep quality, which is not related.

**Keywords:** Psychological Stress; Sleep Duration; IPAQ; Students; Medicine.

Fecha de envío: 2024-03-22 - Fecha de aceptación: 2024-11-11

(1) Escuela de Medicina. Universidad de Magallanes. Punta Arenas. Chile.

(2) Centro Asistencial de Docencia e Investigación (CADI-UMAG). Punta Arenas. Chile.

(3) Centro de Investigación en Actividad Física, Ejercicio y Deporte (CAFED). Facultad de Ciencias del Deporte y la Educación Física. Universidad de Cundinamarca. Fusagasugá. Colombia.

\*Autor de correspondencia: [cristian.nunez@umag.cl](mailto:cristian.nunez@umag.cl)



## Introduction

According to the World Health Organization (WHO), stress is defined as a state of worry or mental tension generated by a difficult situation (WHO, 2023). Being in contexts of high tension levels leads to physical, psychological, and behavioral responses. Physically, it is common to see exhaustion, sleep disturbances, appetite changes, and muscle pain. Psychologically, the reaction involves the thoughts and feelings people experience in response to certain situations and behavioral reactions (Marquina-Lujan & Adiazola-Casas, 2020). Moreover, sleep is a fundamental biological function that allows the entire organism to rest, influencing many somatic, cognitive, and psychological processes. Various studies have shown that poor sleep or chronic sleep deprivation (sleeping less than 6 hours) has negative physical effects, including a higher prevalence of non-communicable chronic diseases, increased mortality, and cognitive and psychological impairments. It is during sleep (Ozkan *et al.*, 2020) that the brain can recharge and be active the next day. For students, good sleep is related to better academic performance (Bugueño *et al.*, 2017; López *et al.*, 2020) and affects mood (Mendiburu-Zavala *et al.*, 2021), being another important factor in the correlation with stress levels (Stojanov *et al.*, 2021).

The WHO defines physical activity (PA) as any bodily movement produced by skeletal muscles that requires energy expenditure; in other words, any movement performed. Both moderate and intense physical activities have been shown to improve health, with common forms of PA including walking, cycling, playing sports, and participating in recreational activities (WHO, 2024). Regular physical activity (PA) has been studied to verify its association with reduced risk of premature death and various chronic diseases, in addition to multiple benefits, including physical, mental, social, and emotional (Warburton & Bredin, 2017). It has been observed that university students often do not meet the recommended levels of physical activity, and emotional stress is prevalent among the higher education student population (Durán-Galdo & Mamani-Urrutia, 2021).

Undoubtedly, entering university is an adaptive process that can be challenging for students due to factors such as excessive academic workload, lack of free time and organization, competitive feelings among peers, and the emergence of academic stress accompanied by various physical and psychological symptoms, among others (Pozos-Radillo *et al.*, 2015). In the specific case of medical students, the situation may be even worse, as various studies indicate that anxiety levels in the early years of the program tend to be higher than in later years, considering the transition from pre-university to university life (Puentes & Díaz, 2019). In this regard, the variables related to stress, sleep quality, and physical activity in medical students are important factors to study, as they affect student

health, such as decreased immune system defenses, headaches, anxiety behaviors, low academic performance, lack of interest in studies, and a desire to abandon the program, which can translate into alterations in the student's quality of life (Jahel *et al.*, 2019). Given the above, the subsequent research aimed to relate the variables of perceived stress, sleep quality, and physical activity specifically among medical students at the University of Magallanes, a specific group within the regional population that, due to geographical and/or academic context, could see their quality of life affected by the various factors considered in the development of this study. Specifically, the study aimed to analyze the relationship between stress perception, sleep quality, and physical activity among medical students.

## Material and method

### Study design

A descriptive, correlational, and cross-sectional study was developed based on different studies examining these variables in students (Puentes & Díaz, 2019). Participants were selected through non-probability sampling among medical students at the University of Magallanes, resulting in a sample of 116. Students were informed about the evaluations and the associated risks/benefits. Subsequently, all participants signed an informed consent form before participating in the study.

Inclusion criteria included being aged between 18 and 30 years, being enrolled in a Medicine program at the University of Magallanes during the years 2019 and 2020, residing in the city of Punta Arenas for at least six months during the year, having no clinically diagnosed depressive disorder, not undergoing psychological and/or pharmacological treatment for depressive or anxiety disorders, having no psychological diagnosis of intellectual disability, and having no diagnosed heart disease. Individuals who did not fully complete the forms or tests were excluded from the study.

### Instruments

The instruments used for this research are tests that seek to analyze a specific parameter. The respondent was given three online surveys: the Pittsburgh Test (PSQI), the Perceived Stress Scale (PSS), and the International Physical Activity Questionnaire (IPAQ). The tests were answered and then analyzed according to the respondents' results.

**Perceived stress scale (PSS):** an instrument for measuring individual stress levels regarding situations or experiences during the last month. It consists of 10 short questions with five alternative answers with a range of 0 (never) to 4 (very often) points, which is added, and the degree of stress of the participant is evaluated (Campo-Arias *et al.*, 2014).

**Test de Pittsburg (PSQI):** instrument capable of assessing the quality of individual sleep in the last month according to 7 parameters contained in 10 questions with four response alternatives with a range of 0 (no difficulty) to 3 (severe difficulty) points, which are added and allow classifying the degree of sleep quality of the respondent (Solis *et al.*, 2015).

**International Physical Activity Questionnaire (IPAQ):** an instrument for measuring individual physical activity level, whose evaluation covers certain general activities associated with daily living. This questionnaire, in its short version, is carried out using the unit of measurement of the metabolic rate (MET) to classify the training or physical movement carried out by the respondent during a week, as compiled within a questionnaire of 7 questions focused on three levels of physical activity (low or inactive, moderate and high) (Bortolozo *et al.*, 2017).

### Procedure

Each participant voluntarily signed their respective informed consent forms to complete the previously mentioned surveys through an online questionnaire, estimated to take about 15 minutes, available at the participant's convenience. This was conducted during the third week of August 2022, a few days after the winter break and the return to in-person classes.

### Statistic analysis

The analysis was performed using graphs representing the distribution of the object of study according to each variable. All statistical analyses were calculated and implemented in the R programming language (R Core Team 2021), where the variables academic year, sleep quality (PSQI), perceived stress scale (PSS), and physical activity (IPAQ) were included. Each of the items of the applied tests was also included. The data obtained were expressed as means with +/- standard deviation (SD). In addition, a descriptive and correlational analysis (Spearman's coefficient) was used for data comparison, with a statistical significance criterion set at  $p < 0.05$ .

### Results

One hundred sixteen medical students were recruited to be study participants: 72 women (62.1%) and 44 men (37.9%), the largest number being women, who belonged to the first, second, and third years.

### Perceived Stress Scale (PSS)

The average obtained by the PSS students was 18.9 points with a standard deviation of  $\pm 7.28$ . Table 1 shows the results obtained in different academic years. Twelve percent of students reported no stress, while 88% experienced stress, most of whom had low stress levels (68.5%). Among this percentage, second and third-year students accounted for most cases, while moderate stress (19.7%) was predominantly found in first and second-year students.

**Table 1:** Representation of the data obtained with the participants' results of the different academic years according to their level of stress (low, moderate or high) or no stress.

	Points	First Year	Second Year	Third Year	Fourth Year	Fifth Year	Total	
No stress	0 – 10	1	6	2	5	0	14	<b>12%</b>
Low stress	10 – 25	14	26	27	9	3	79	<b>68.5%</b>
Moderate stress	26 – 35	10	7	4	2	0	23	<b>19.7%</b>
High stress	>35	0	0	0	0	1	1	<b>0.8%</b>
								<b>100%</b>

### Sleep quality (Pittsburgh)

The average score obtained by students on the Pittsburgh Sleep Quality Index was 9.23 points, with a standard deviation of  $\pm 3.87$ . Seventeen percent of students reported good sleep quality, while

83% experienced poor sleep, of which 37% were classified as having sleep disturbances. The highest concentration of students with poor sleep quality was found among first—and second-year students. The detailed results can be seen in Table 2.

**Table 2:** Stratified results according to academic year and sleep quality in medical students, classified as good, bad or disturbed sleep.

	Points	First Year	Second Year	Third Year	Fourth Year	Fifth Year	Total	
Good	0 – 5	0	4	9	7	0	<b>20</b>	<b>17%</b>
Bad	6 - 10	10	21	16	5	2	<b>54</b>	<b>46%</b>
Sleep disturbance	11 – 21	15	14	8	4	2	<b>43</b>	<b>37%</b>
								<b>100%</b>

### Physical activity level (IPAQ)

The mean was 930 MET, with a standard deviation of  $\pm 1074$ . Table 3 shows the respondents' results: More than half of the students in each course perform low physical activity.

**Table 3:** Stratified results according to the academic year and the level of physical activity in medical students, classified into low, moderate and high levels.

	Points	First Year	Second Year	Third Year	Fourth Year	Fifth Year	Total	
AF low	< 600	17	21	18	10	3	<b>69</b>	58.9%
AF moderate	600-15000	6	10	7	5	1	<b>29</b>	24.7%
AF intense	> 1500	2	8	8	1	0	<b>19</b>	16.2%
								100%

When analyzing the correlations between the different variables, it was found that physical activity variables did not significantly correlate with sleep quality, stress, or academic year. Notably, there was a correlation among the different sleep quality variables, perceived stress, and academic year.

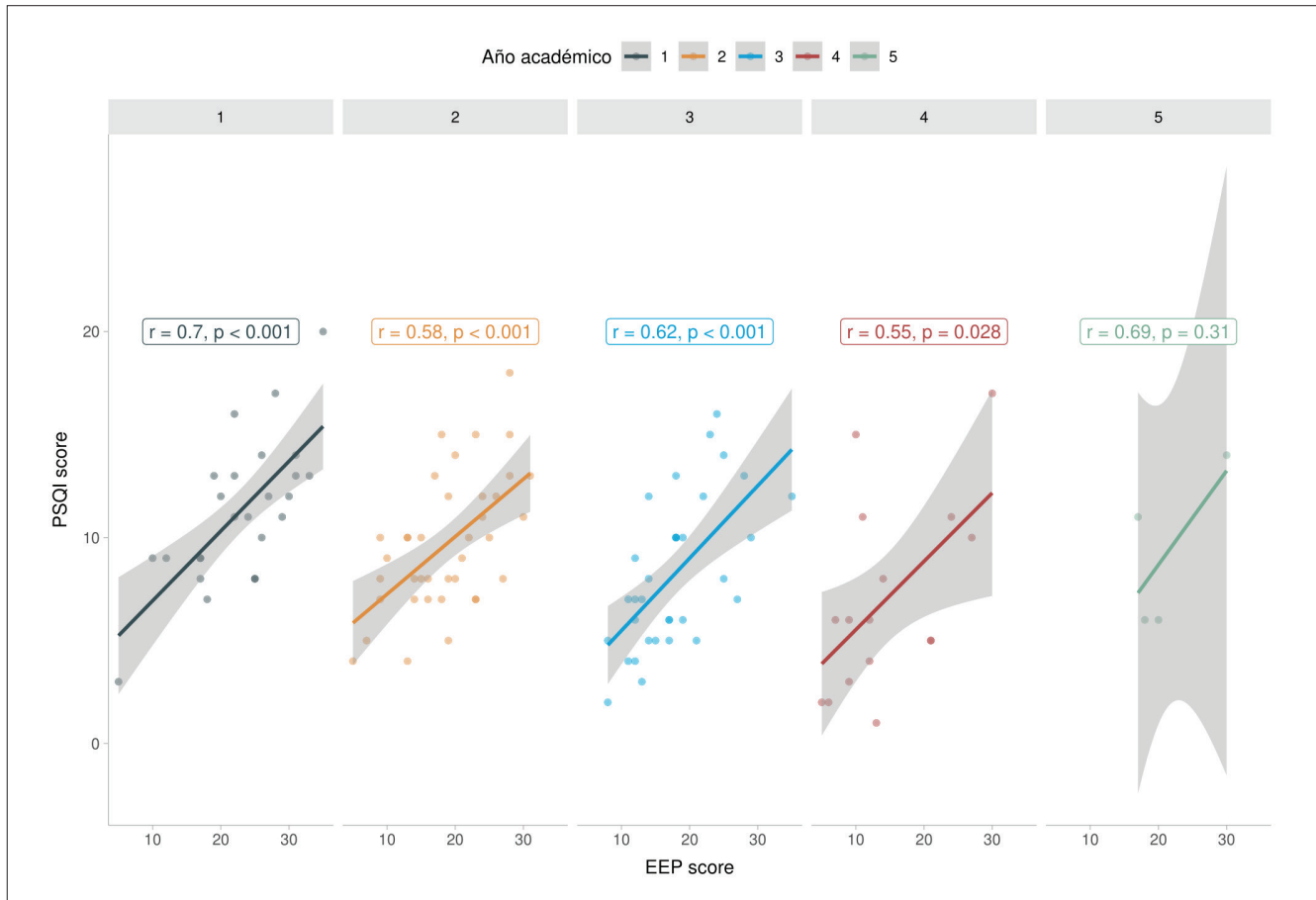
Based on the relationship of the variables studied, a significance between the PSQI Score and PSS Score used in the study was possible, which can be observed in detail in Table 4.

**Table 4:** Correlations of variables belonging to the Perceived Stress Scale (PSS) and Pittsburg Test (PSQI)

		PSQI Score	Subjective sleep quality	Dysfunction during the day	Sleep duration	Disturbances
PSS Score	r	0.64	0.54	0.55	0.43	0.52
	p	0	0	0	0	0
Inability to control things	r	0.57	0.46	0.54	0.34	0.46
	p	0	0	0	0.045	0
Nervous or stressed	r	0.62	0.5	0.44	0.43	..
	p	0	0	0	0.001	..
Accumulation of difficulties	r	0.53	0.45	0.49	..	0.46
	p	0	0	0	..	0
Academic year	r	-0.35	-0.43	..	-0.39	..
	p	0.037	0	..	0.004	..
Control difficulties	r	0.37	0.36	0.41	..	..
	p	0.011	0.016	0.002	..	..

Table 4 shows the degree of correlation between variables belonging to PSS and PSQI, with the variables with  $p=0$  and  $r$  greater than or equal to 0.44 having the highest degree of relationship. The results are organized according to the name of the investigated variable. The total Perceived Stress Scale (PSS Score) and the Pittsburgh test (PSQI score) are shown. Spearman's correlation coefficients ( $r$ ) and statistical significance are described ( $p$ -value).

In addition, a relationship was observed between the general score of both scales according to the year of study of the participating students. These relationships can be observed in Figure 1.



**Figure 1:** The relationship between the Pittsburgh score (PSQI Score) and the perceived stress score (PSS Score) of the first to fifth-year medical students who participated in the study is described. The significance values of the relationship between both scores are presented.

### Discussion

This study contributes to the objectives of relating stress levels with sleep levels and physical activity in medical students. The results showed high levels of stress in the sample under study, being a similar situation at the national and international level, as shown by the investigations carried out on students of the Colombian medicine career (Lemos *et al.*, 2018), Ecuador (Jiménez & Junes, 2020), Saudi Arabia (Alotaibi *et al.*, 2020), Perú (Allende-Rayme *et al.*, 2022) and United States (Almojali *et al.*, 2017) who reported results of 64%, 98%, 63.5%, 97% and 57% respectively. High levels of stress are due to different factors. However, this is primarily due to academic overload (Baquerizo-Quispe *et al.*, 2022). High stress levels are due to different factors (Baquerizo-Quispe *et al.*, 2022), for medical students it is attributed to a high academic overload, and the highly rigorous, and very demanding training context (García-Araiza *et al.*, 2020). It is an important factor to investigate since medical students will dedicate their lives to the health care of the population, and protecting their health is essential to avoid high levels of stress. Keeping their bodies constantly on alert will have

consequences in different organ systems: increased incidence of infectious diseases, successive inflammatory diseases, pathologies in the heart and arteries, or acquiring autoimmune diseases, and psycho-emotional disorders, among others (Santalla-Corrales, 2022).

On the other hand, sleep quality presented a high rate of students with poor sleep quality being classified as “bad sleepers.” Students in this same career in Chile and other countries have a similar prevalence. An investigation in Chile at the University of San Sebastián revealed that 83.0% had poor sleep quality, with mild sleep dysfunction. (Pallares *et al.*, 2022). Within the investigations carried out on medical students in Latin America, it has been found that between 48 and 73% are defined as poor sleepers (Tafoya *et al.*, 2013). Being “bad sleepers” could harm learning, thinking and attention level. Some scientific papers report high levels of sleepiness during daytime hours and an increase in the prevalence of cognitive and psycho-emotional disorders (Zúñiga-Vera *et al.*, 2021). Finally, sleep quality is important for memory consolidation, learning, and other cognitive functions (Lira & Custodio, 2018).

On the other hand, physical activity reported low levels among medical students; however, a significant percentage of the sample demonstrated moderate to high physical activity. Globally, according to the WHO, 60-85% of the population leads a sedentary lifestyle, and the situation for medical students is notable as they are part of the physically inactive population. In Chile, the level of sedentarism among medical students is unknown, but other studies indicate that half of the students are sedentary (Abarca *et al.*, 2015). The recommended amount of moderate or vigorous physical activity per week by the WHO is 150 to 300 minutes and 75 to 150 minutes, respectively (Montoya, 2022). Therefore, it is concluded that the ideal is 750 MET-min/week, with 49% of students falling below 500 MET-min/week.

In our study, no significant correlation was found between physical activity, sleep quality, and the students' academic year. However, several studies state that physical activity can influence mental health by reducing stress levels, although it is not the only factor to be addressed in the psychological area (Abarca *et al.*, 2015). Other studies assert that physical exercise will decrease emotional stress and improve adaptation to stressful factors (Durán-Galdo & Mamani-Urrutia, 2021). Additionally, other research shows the relationship between sleep quality and physical activity, indicating that exercising positively affects sleep quality, with lower prevalence of sleep disorders in students who exercise compared to those who do not (Xu *et al.*, 2023). Other studies have demonstrated that moderate physical activity can be more effective than pharmacological therapy for this issue (Reyes *et al.*, 2019).

This study revealed the importance of sleep quality and stress, two factors that have a bidirectional relationship, where one affects the other. Poor sleep quality can manifest as stress and irritability. Conversely, stress can disrupt the onset of sleep through effects on the activation of the hypothalamic-pituitary-adrenal (HPA) axis, as well as increasing adrenal secretion and sleep latency in younger university students (Vilchez-Cornejo *et al.*, 2016). A study conducted on Saudi students showed that high stress is a significant predictor and contributor to poor sleep quality, suggesting a model in which anxiety-related symptoms help explain the difficulties experienced during sleep and the adverse effects they have during the same period (Tafuya *et al.*, 2013). Similar research on the relationship between sleep quality and stress found that stressed students have a prevalence of poor sleep quality of 86%, while 64% of non-stressed students reported poor sleep (Almojali *et al.*, 2017). Among the studies, most have found an association between these variables. However, further investigation is needed to determine if there is a significant relationship between stress levels and sleep quality (Tafuya *et al.*, 2013).

Regarding the year in which students are most affected, the first year of university shows the highest prevalence of stress, reflecting how belonging to a higher academic year is a mitigating factor for high stress levels. This relationship is also observed with the difficulty of falling asleep. Both situations are attributed to the adaptive mechanisms that students acquire in previous years and their ability or learning to manage a heavy academic load (Vilchez-Cornejo *et al.*, 2016). The Perceived Stress Scale reflected how feelings of control, fear, insecurity, and tension impact cognition (del Toro *et al.*, 2014). Other factors that may influence sleep disorders include academic workload and the use of digital technology, which can lead to daytime sleepiness and negatively affect academic performance (Villavicencio *et al.*, 2020). Additionally, various studies indicate that students have limited knowledge and misconceptions about the importance of sleep care (Villavicencio *et al.*, 2020).

## Conclusion

In conclusion, medical students exhibit elevated stress levels. As seen in other studies, first-year students experience the highest levels of stress, which can be attributed to various factors. This study demonstrated that good sleep quality can lead to lower stress levels, and vice versa. Therefore, it is crucial to care for these areas of students' lives to prevent negative consequences on their future health and to ensure that their current quality of life is not affected. Physical activity did not correlate with perceived stress or sleep quality, contrary to what other studies have shown. Sleep quality remains poor for half of the medical students, which is why we believe it is essential for students to educate themselves about how stress affects sleep and to dispel false beliefs about it in an effort to improve their health.

## Acknowledgments

The Ethics Committee of the University of Magallanes, Chile (011/SH/2022) reviewed and approved the studies involving human participants. The patients/participants provided written informed consent to participate in this study.

## Recognitions

All of the above authors have contributed substantially, directly, and intellectually to the work and have approved it for publication. They contributed in the following roles according to CRediT: conceptualization, formal analysis, research, methodology, visualization and writing of the original draft, and review and editing.

We thank all study participants for their contribution.

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