

Association between sleep quality and symptoms of anxiety and stress in Jiu-jitsu practitioners

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Abstract

Introduction: Evidence suggests positive effects of exercise on sleep. Sleep disorders have been associated with negative impacts on physical and psychological health, including symptoms of anxiety and stress. Jiu-Jitsu practitioners report to practice this sport to alleviate symptoms of stress and anxiety. Improvement in these symptoms can impact the sleep quality, however, Jiu-Jitsu practitioners report sleep complaints. **Objectives:** This study aimed to determine whether sleep quality was related to symptoms of anxiety and stress in Jiu-Jitsu practitioners and to compare these symptoms between practitioners with and without sleep complaints. **Material and Methods:** This was a cross-sectional study. Subjective sleep quality was evaluated using the mini-sleep questionnaire (MSQ). Symptoms of anxiety and stress were measured using the depression anxiety stress scale-21 (DASS-21). **Results:** Data were analyzed using SPSS version 27. This study included 225 participants (181 men and 44 women). From the total, 59.6% presented sleep complaints, 45.8% anxiety symptoms, and 46.7% stress symptoms. There were significant correlations of sleep with symptoms of stress ($r = 0.533$; $p < 0.001$) and anxiety ($r = 0.444$; $p < 0.001$). Odds Ratio analyses demonstrated that Jiu-Jitsu practitioners who have symptoms of stress and anxiety are respectively 6.3 and 3.3 times more likely to have sleep complaints than those who do not have these symptoms. **Conclusion:** The results suggest association of sleep quality with symptoms of anxiety and stress in Jiu-Jitsu practitioners. In addition, the practitioners classified as having symptoms of anxiety and very severe stress have higher sleep scores and, consequently, poorer sleep quality.

Keywords: exercise, martial arts, combat sports, mood, sleep.

Introduction

Sleep is a physiological, natural, and periodic condition of human brain activity with characteristic changes in the state of consciousness and less sensitivity to external stimuli, accompanied by specific motor and postural characteristics (Tufik, 2010). Good sleep quality is recognized as a predictor of physical and mental health, well-being, and general vitality (Buysse et al., 1989; Clement-Carbonell et al., 2021; Ohayon et al., 2017; Wang et al., 2015). On the other hand, poor sleep quality is associated with negative impacts on various areas of physical and psychological health, such as high blood pressure, decreased testosterone levels, increased levels of anxiety and stress, and so forth (Leprout, 2011; Wang et al., 2015). The literature shows that, generally, athletes sleep less than necessary. Silva et al (Silva et al., 2019) evaluated elite athletes from the Brazilian Olympic Team in individual sports and found that 36% of them have some type of sleep disorder.

People react differently to stressful factors depending on physiological, cognitive, and affective conditions (Bystritsky & Kronemyer, 2014). Anxiety can be understood as the normal manifestation of an affective state, as a symptom (found in various disorders), or as a term to name a group of mental disorders (Araújo et al., 2006; Bortoluzzi, 2012; Frota et al., 2022). Stress is a complex process resulting from one's non-specific response to an external or internal stressor (Pinto et al., 2015). Studies indicate a correlation between sleep quality and stress and anxiety levels in the general population. Sleep disorders are also highly prevalent in individuals with anxiety disorders (Horenstein et al., 2019).

Vieira et al., 2015, report poor sleep quality in Jiu-Jitsu athletes. Stress is often associated with sleep problems (Agorastos & Olf, 2021; Potter et al., 2016). A previous study indicated that 70% of Jiu-Jitsu athletes train to relieve stress, and 60% to relieve anxiety (Ferreira et al., 2018). In this sense, there is an indication that many Jiu-Jitsu practitioners seek out the sport precisely to alleviate symptoms of stress and anxiety, which could promote better quality of sleep.

The findings from these studies could provide some meaningful practical applications for athletes. A comprehensive understanding of these results highlights the critical role of sleep quality as a key determinant for physiological and psychological domains of health and athletic performance. Adequate sleep exerts an influence

on emotional regulation, which could impact the performance of athletes. However, to our knowledge, no previous studies have evaluated the relationship between sleep quality, anxiety and stress levels in Jiu-Jitsu practitioners. Therefore, the present study aimed to verify whether sleep quality is associated with symptoms of anxiety and stress in Jiu-Jitsu practitioners and compare the symptoms of anxiety and stress in practitioners with and without sleep complaints.

Material and Methods

This cross-sectional study was carried out online with self-applied questionnaires, filled out via Google Forms. Participants were invited to participate in the study through a message sent via WhatsApp, using the snowball method (Kennedy-Shaffer et al., 2021) with non-probability sampling. Each person who answered the questionnaire was free to pass it on to other Jiu-Jitsu practitioners. The data was collected between June 10 and October 30, 2022.

Before answering the survey, the volunteers read and agreed to an informed consent form. The email address of study participants was used to check for duplicate responses. The research was approved by the Research Ethics Committee and followed the principles of the Declaration of Helsinki for Human Studies (CAAE 59157022.5.0000.5077).

The sample size was calculated using the G*Power 3.1 program, considering a significance level of $\alpha = 0.05$ (for type I error) and statistical test power of $1 - \beta = 0.80$ (for type II error). Based on these criteria, a minimum sample of 200 individuals proved to be sufficient to detect a medium effect size in the statistical analyses of this study.

The sample comprised adult participants of both sexes, living in different regions of Brazil. Altogether, 292 questionnaires were answered for sample selection (Figure 2). After applying the inclusion criteria (age ≥ 18 years; training time: ≥ 6 months; and weekly training frequency: ≥ 2 times/week) and exclusion criteria (shift workers and incompletely answered questionnaires), 225 participants were included in the study (181 men and 44 women).

Instruments

A semi-structured questionnaire was used to evaluate the characteristics and profile of the sample of Jiu-Jitsu practitioners. The sociodemographic variables evaluated were sex, age, and level of education. It also collected data on their body composition – self-reported body mass (kg) and height (cm) – and practice profile – degree (belt), practice time (months and years), weekly training frequency, session duration (minutes), session intensity (light, moderate, or high), and whether they participated in competitions. Additional information was also collected, such as the use of caffeine, energy drinks, alcohol, and smoking.

Subjective sleep parameters were evaluated with the Mini-sleep Questionnaire (MSQ), created by Zomer (Zomer, 1985) and validated in Brazil by Falavigna (Falavigna et al., 2011). It has a 10-item self-reported scale, and each item has a Likert scale ranging from 1 (“never”) to 7 (“always”). The total score for each subscale is defined as the arithmetic sum of the scores for its items. The total sum of scores is divided into four levels of sleep quality (10 to 24 points: good sleep quality; 25 to 27 points: mild sleep difficulties; 28 to 30 points: moderate sleep difficulties; 31 points or more: severe sleep difficulties). Sleep duration was calculated with a self-reported weighted average of sleep, considering weekdays and weekends.

Anxiety and stress symptoms were assessed with the Depression Anxiety Stress Scale-21 (DASS-21) (Falavigna et al., 2011; Vignola & Tucci, 2014). It has a self-reported scale with a set of three 4-point Likert subscales, ranging from 0 to 3, in which 0 means “totally disagree” and 3 means “Totally agree”. Each DASS-21 subscale has seven items. The variations in the scores correspond to the severity of the symptoms for each subscale, varying between “normal”, “minimal”, “mild”, “moderate”, “severe”, and “very severe”. The scores for each subscale were calculated by summing the scores of the seven items, multiplied by two.

Statistical Analysis

Statistical analyses were performed using the programs: SPSS version 27 and OriginLab Pro 2021. Descriptive statistics were used to calculate absolute and relative frequencies, mean, and standard deviation. Data normality was assessed using the Shapiro-Wilk test. The Mann-Whitney and Kruskal-Wallis tests were used to compare anxiety, stress, and sleep scores with other variables involved in the study. Dunn's post-hoc was used to locate the position of differences.

The chi-square test (χ^2) was used to verify associations between nominal or categorical variables, calculating the odds ratio (OR) and 95% confidence intervals. Spearman correlation tests were used for the relationship between variables. The significance level was set at $p < 0.05$.

Results

The descriptive variables of the study are presented in Table 1 – age, body mass, height, body mass index (BMI), training time, number of training sessions/week, and number of training hours/week).

Table 1 – General characterization of the sample (n = 225).

Variables	N	Medium
Age (years)	225	35.3 ± 9.6
Body mass (kg)	225	81.9 ± 16.3
Height (cm)	225	173.9 ± 8.5
BMI	225	23.5 ± 4.1
Training Time (years)	225	9.8 ± 8.9
Trainings (times/week)	225	3.9 ± 1.3
Weekly Training Duration (hours)	225	6.1 ± 3.6
Sleep Duration (hours)	225	7.3 ± 1.1
MSQ Sleep (score)	225	30.8 ± 9.6
DASS Stress (score)	225	14.3 ± 10.7
DASS Anxiety (score)	225	9.8 ± 10.3

Notes: BMI: body mass index; MSQ: Mini-sleep Questionnaire; DASS: Depression Anxiety Stress Scale-21; (Data are expressed in mean ± standard deviation [SD]).

The sample had 80.4% (n = 181) of men and 19.6% (n = 44) of women. Regarding training intensity, 41.8% (n = 94) of individuals reported that they trained intensely, 55.6% (n = 125) moderately, and 2.6% (n = 6) lightly. Regarding competitions, 55.6% (n = 125) of individuals reported that they participated or had already participated in some level of competition. As for degree, 33.8% (n = 76) of the sample are black belts and 66.2% (n = 149) are made up of other belts. As for the level of education, 1.3% (n = 3) had finished middle school; 4.4% (n = 10) had incomplete high school; 14.7% (n = 33) had graduated from high school; 18.7% (n = 42) had incomplete higher education; 30.2% (n = 68) had a bachelor's degree; and 30.7% (n = 69) had a postgraduate degree. Of the total sample, 88% (n = 198) reported taking caffeine in their daily lives, 4% (n = 9) reported being smokers, 52% (n = 117) reported not consuming alcohol, and 33% (n = 75) consumed energy drinks.

The results of sleep scores and classifications are presented in Table 2, which shows that 70.7% were classified as having some type of sleep difficulty (mild, moderate, or severe).

Table 2 – Sleep score and classification.

SCORE	CLASSIFICATION	N	PERCENTAGE
12 a 24	Good Quality	66	29,3%
25 a 27	Light Difficulty	25	11,1%
28 a 30	Moderate Difficulty	20	8,9%
31 or more	Serious Difficulty	114	50,7%
Total		225	100,0%

Table 3 describes the scores and classifications of stress and anxiety symptoms. Of the total, 45.8% (n = 103) of the sample had symptoms of stress (minimal, moderate, severe, or very severe) and 46.7% (n = 105) had symptoms of anxiety (minimal, moderate, severe, or very serious).

Table 3 – Stress and anxiety score and classification.

STRESS SCORE	STRESS CLASSIFICATION	N	PERCENTAGE
0 a 14	Normal	122	54,2%
15 a 19	Minimum	25	11,1%
20 a 25	Moderate	41	18,2%
26 a 32	Serious	24	10,7%
33 or more	Very Serious	13	5,8%
Total		225	100,0%
ANXIETY SCORE	ANXIETY CLASSIFICATION	N	PERCENTAGE
0 a 6	Normal	120	53,3%
7 a 9	Minimum	15	6,7%
10 a 15	Moderate	32	14,2%
16 a 19	Serious	18	8,0%
20 or more	Very Serious	40	17,8%
Total		225	100,0%

Sleep was positively correlated with stress ($\rho = 0.533$; $p < 0.001$) and anxiety ($\rho = 0.444$; $p < 0.001$) – the higher the stress and anxiety level, the higher the sleep score. Moreover, sleep complaints were positively correlated with the stress score ($\rho = 0.412$; $p < 0.001$) and the anxiety score ($\rho = 0.344$; $p < 0.001$).

Table 4 shows that significant associations were also found between sleep complaints and stress symptoms ($\chi^2(1) = 38.2$; $p < 0.001$) and anxiety symptoms ($\chi^2(1) = 17.7$; $p < 0.001$). OR analyses demonstrated that Jiu-Jitsu practitioners with stress symptoms are 6.4 times more likely, and with anxiety symptoms, 3.3 times more likely to have sleep complaints than practitioners who do not have these symptoms.

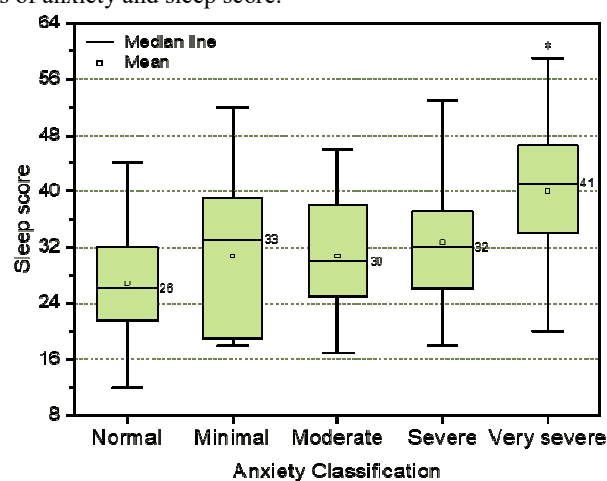
Table 4 – Odds ratio analyses between sleep complaints and anxiety and symptoms of anxiety and stress.

Variables	Sleep complaints		OR [▷]	IC 95% [#]	value p*
	Yes n (%)	No n (%)			
Stress					
With symptoms	84 (63)	19 (21)	6.37	3.44 - 11.77	< 0.001
No symptoms	50 (37)	72 (79)			
Anxiety					
With symptoms	78 (58)	27 (30)	3.3	1.88 - 5.81	< 0.001
No symptoms	56 (42)	64 (70)			

▷OR = Odds Ratio; [#]IC 95% = Confidence interval; * Test χ^2 de Pearson.

Statistically significant results were found in the assessment of sleep scores and anxiety classification (normal, minimal, moderate, severe, and very severe) ($H(4) = 46.9$; $p < 0.001$) (Figure 1). The results showed that participants classified as having very severe anxiety ($Md = 41$) had higher sleep scores than those classified as normal ($Md = 26$, $p < 0.001$), minimal ($Md = 33$, $p < 0.01$), and moderate ($Md = 30$, $p < 0.001$).

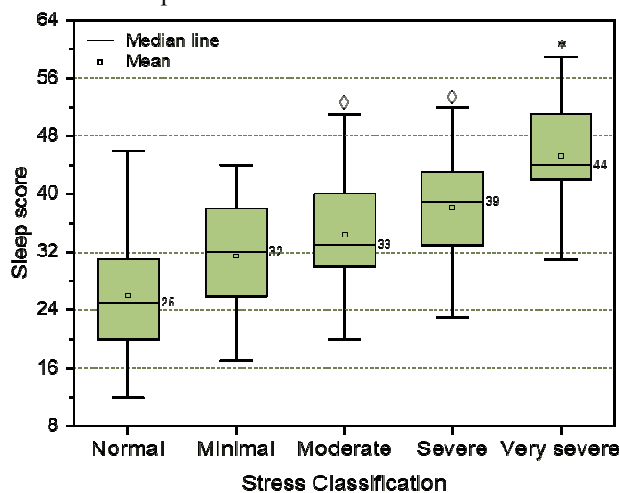
Figure 1 – Levels of anxiety and sleep score.



* Statistically different from normal, minimal and moderate.
 (Kruskal-Wallis test and Dunn's post-test; $p < 0.05$).

When evaluating sleep scores and stress classification (normal, minimal, moderate, severe, and very severe), the results were statistically significant ($H(4) = 68.88$; $p < 0.001$). The results showed that participants classified with very severe stress ($Md = 44$) had higher sleep scores than those with normal ($Md = 25$, $p < 0.001$), minimal ($Md = 32$, $p < 0.001$), and moderate stress symptoms ($Md = 33$, $p < 0.001$) (Figure 2).

Figure 2 – Stress levels and sleep score.



* Statistically different from normal, minimal and moderate;
 ◊ Statistically different from normal;
 (Kruskal-Wallis test and Dunn's post-test; $p < 0.05$).

Jiu-Jitsu practitioners who take caffeine ($Md = 31$; $n = 198$) had more sleep problems ($U = 2005$; $p < 0.05$) than those who did not take it ($Md = 25$; $n = 27$).

Female participants ($Md = 18$; $n = 44$) have a higher stress level ($U = 2850$; $p < 0.01$) than men ($Md = 12$; $n = 181$). Moreover, women ($Md = 12$; $n = 44$) have higher anxiety levels ($U = 2874,5$; $p < 0.01$) than men ($Md = 6$; $n = 181$). Individuals who have trained for 5 or fewer years ($Md = 16$; $n = 91$) have a higher stress level ($U = 5041$; $p < 0.05$) than those who have trained for more than 5 years ($Md = 12$; $n = 134$). People who have a shorter training time ($Md = 10$; $n = 91$) are more anxious ($U = 4369,5$; $p < 0.001$) than those who have been training for more than 5 years ($Md = 4$; $n = 134$).

Smokers ($Md = 26$; $n = 9$) have a higher stress level ($U = 492,5$; $p < 0.05$) than non-smokers ($Md = 14$; $n = 216$). Smokers ($Md = 16$; $n = 9$) have more anxiety ($U = 586,5$; $p < 0.05$) than non-smokers ($Md = 6$; $n = 216$). Individuals who have a black belt ($Md = 4$; $n = 76$) have a lower anxiety level ($U = 4078,5$; $p < 0.001$) than those with other types of belts ($Md = 8$; $n = 149$).

Discussion

To our knowledge, this is the first study that investigates the relationship between sleep quality and symptoms of anxiety and stress in Jiu-Jitsu practitioners. Sleep has been increasingly studied and has proved to be an important component of people's overall health and well-being (Clement-Carbonell et al., 2021; Ohayon et al., 2017). It was found that most of the study sample had some type of difficulty with sleep. Changes in normal sleep patterns can increase stress and anxiety levels (Ben Simon et al., 2019; Horenstein et al., 2019). On the other hand, studies report that impaired sleep quality may result from an increase in perceived stress (Erlacher et al., 2011; Juliff et al., 2015) and anxiety (Youngstedt, 2005). This study also found positive moderate correlations of sleep score with anxiety and stress symptoms.

The results of the present study indicate that 70.3% of the sample was classified as having sleep complaints. These data corroborate the study by Vieira et al., 2021, who likewise evaluated the sleep quality of Jiu-Jitsu athletes. The percentage means in the present study are higher than those reported in the validation of the Mini-sleep Questionnaire (MSQ) for the Brazilian population, carried out with university students (Falavigna et al., 2011). This study reported that 59.3% of the sample had sleep complaints. Poor sleep quality can lead to losses in technical/physical performance. In that regard, Charest et al., 2020 demonstrate that poor sleep quality can negatively influence strength, speed, reaction time, decision-making, creativity, learning, and memory, thus increasing the risk of injuries and damage to the athlete's mental health.

Of our total sample, 45.8% reported symptoms of stress and 46.7% symptoms of anxiety. The study by Beiter et al., 2015, carried out with university students, found data close to those of the present study (40% with symptoms of anxiety and 38% with symptoms of stress).

The results of the present study demonstrate that Jiu-Jitsu practitioners with anxiety and very severe stress had higher sleep scores, which reflects poorer sleep quality. Corroborating these findings, the study by Manzar et al., 2021, carried out in university students, demonstrated a high prevalence of anxiety symptoms, which was associated with a greater state of psychological stress and, consequently, poor sleep quality. In this context, Grandner et al. 2021 reported in their study with athletes that poor sleep quality may be associated with symptoms of anxiety and stress.

Female participants in the present study had a higher level of stress and anxiety than male participants. A longitudinal study with university students also found higher levels of anxiety in women, although with no significant differences between the sexes in stress levels (Gao et al., 2020). The study by Veigas, Gonçalves, 2009, et al. analyzed the influence of physical exercise on anxiety, depression, and stress, and found no significant differences between the sexes. These data indicate that the relationship between sleep, anxiety, and stress may vary depending on the sample evaluated, which suggests the need for further studies that investigate which variables could influence these responses.

The present study showed that higher level of stress and anxiety, resulted in higher sleep score. Corroborating our findings, Halson et al., 2022 evaluated 131 elite athletes and observed that stress symptoms are associated with poor sleep quality. Biggins et al., 2018, also report a significant relationship between poor sleep quality and increased stress in adults. The study by Ghrouz et al., 2019, carried out in university students, also found a significant positive association between poor sleep quality and anxiety. The results of these studies corroborate our findings and demonstrate that similar behaviors related to sleep, anxiety, and stress are also observed in Jiu-Jitsu practitioners. Furthermore, in our study OR analyses indicate that Jiu-Jitsu practitioners with symptoms of stress ($OR = 6.37$) and anxiety ($OR = 3.3$) are more likely to have sleep complaints than those who do not have these symptoms.

We found that smokers have a higher level of stress and anxiety than non-smokers. El-Sherbiny et al., 2022, in a study with adults showed that one of the reasons that lead individuals to smoke is to reduce stress symptoms. Also, Jiu-Jitsu practitioners who consume caffeine reported more sleep problems than those who do not use it. Riera-Sampol et al., 2022, report that caffeine intake is associated with poorer sleep quality. Moreover, Weibel et al., 2021, suggest that regular caffeine intake may affect sleep architecture.

In our study, 55.6% of individuals participate or have participated in some type of competition. According to Gupta et al., 2017, the competitive environment (physical load and psychological pressure) is among the main risk factors for sleep disorders in athletes. A study carried out by Erlacher et al., 2011 in athletes from various sports identified that 65.8% had poor sleep the nights before important competitions or games. Athletes also report difficulties in overcoming pre-competition anxiety and fear that poor sleep will have a negative effect on sports performance (Lastella et al., 2014; Leger et al., 2005). Perhaps this is one of the factors that may have contributed, in part, to the poor quality of sleep reported by some of the Jiu-Jitsu practitioners.

The results of the analyses of training time and degree of Jiu-Jitsu practitioners demonstrate that training time (\leq or equal to 5 years versus $>$ 5 years) can influence symptoms of anxiety and stress and belt degree (black belt versus other belts) can influence anxiety symptoms. In other words, the longer the athlete's time and experience, the lower the symptoms of anxiety and stress. Studies (Bhattacharya et al., 2022; Potoczny et al., 2022) suggest that there is a relationship between the practice of martial arts and better well-being. Greater self-control, decreased aggressiveness, and greater tolerance to stress are among some of the benefits for those who practice martial arts regularly.

The present study has some limitations: 1) online data collection. The online methodology has some methodological advantages (e.g., the possibility of including people from different regions), but the adequate completion of electronic questionnaires depends on the interviewees' transparency and level of understanding of the instrument. 2) use of a convenience sample, which may pose a risk of non-selection and randomization bias. 3) type of study. A cross-sectional study involves an observational analysis, which does not necessarily represent a causality between the observed associations. Data that can represent causality must be obtained with randomized clinical trials.

Conclusions

The results suggest association of sleep quality with symptoms of anxiety and stress in Jiu-Jitsu practitioners. In addition, the practitioners classified as having symptoms of anxiety and very severe stress have higher sleep scores and, consequently, poorer sleep quality. Sleep has an important role in the performance of Jiu-Jitsu practitioners, impacting both physical and mental health. Athletes and coaches can implement strategies to optimize performance and achieve the full potential of athletes. This cross-sectional study reported data regarding the significant association between poor sleep quality and symptoms of anxiety and stress in Jiu-Jitsu practitioners. However, the cross-sectional nature of the study limits our understanding of the temporal relationship between these variables. Longitudinal studies are needed to investigate the effects of sleep, anxiety, and stress indicators over time. An approach could elucidate whether regular practice of this martial art positively or negatively influences these parameters, and which points in the training trajectory these effects are most evident. Additionally, identifying risk factors for sleep disorders in Jiu-Jitsu practitioners could facilitate the implementation of personalized interventions to promote mental health and athletic performance in these athletes.

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