Original Research

The Comparison of Effects of State and Trait Anxiety on the Components of Sleep Quality

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Abstract

Background and Objective: College students suffer from sleep problems. The implications of sleep problems can affect different areas of students' life, and this, in turn, can be influenced by other psychological characteristics such as anxiety. The aim of this study was to investigate the relationship between state and trait anxiety with components of students' sleep quality.

Materials and Methods: In this descriptive cross-sectional study, 365 students of Kermanshah University of Medical Sciences, Kermanshah, Iran, in 2018, were selected randomly and evaluated by two questionnaires: Pittsburgh Sleep Quality Index (PSQI) and Spielberger's State-Trait Anxiety Inventory (STAI) with ethical considerations.

Results: There was a significant difference in sleep quality between different age groups ($P < 0.001$). As the age of study participants increased, the quality of sleep became poorer. The prevalence of poor sleep in students was about 63%. The highest level of correlation of state and trait anxiety was observed with the sleep latency, and the lowest level of correlation of trait anxiety was observed with the use of sleep medications.

Conclusion: Sleep quality is more influenced by trait anxiety and the use of sleep medications is more influenced by state anxiety. It can also be said that the anxiety of the state and trait together predict more subjective sleep quality and contribute less to the prediction of sleep duration.

Keywords: Anxiety; Sleep; Students

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Introduction

Sleep is a psycho-physiological response and its related disturbances can affect different areas of life. Several studies have examined sleep problems related to physical and mental health (1, 2). In addition, many studies have been carried out in different populations in terms of sleep and the most prominent problems that university students have.

Several studies have shown that between 40% and 68% of students report poor sleep (3-5). In Iran, the prevalence of poor sleep quality in students is reported to be about 56% (6). The consequences of sleep-related problems during a university course include reduced cognitive function (e.g., memory loss) (7-9), less life satisfaction (3), problems with mood and physical complaints (10-12), and interpersonal problems (13). In other studies, there was a lot of emotional stress among students (14, 15) and the quality of students' sleep was significantly lower than that of general population (16). This can also be added to the other problems affecting the quality of life of students. Fewer studies have looked at the components of sleep (17). In a study, Menz et al. found that about 27% of students had poor sleep quality, 36% slept less than 7 hours per night, and 43% needed more than 30 minutes of sleep time (18). This shows that students' sleep contains a variety of problems, and more research is needed to describe the rate of

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sleep problems in college students, especially in terms of the components involved in sleep quality, which can be explained through other psychological characteristics such as anxiety. It has been shown that sleep disorders can interact with anxiety disorders (19-21). The surveys have shown well the effects of anxiety and anxiety disorders on the rate of each of the stages of sleep, sleep-onset problems, sleep efficiency (SE), and wake-up time after sleep. However, the aim of clarification of the anxiety distinction as a personality trait and anxiety-dependent situations and their impact on sleep quality has not been practiced.

From theoretical point of view, Spielberger and Gorsuch distinguished between the two structures of anxiety (22). State anxiety is associated with the evolution of the autonomic nervous system (ANS) and its dependence on specific situations of daily living. Trait anxiety is defined as a sustained individual and personal character in responding to a stressful stimulus (22). Both structures are quantitatively measured by the State-Trait Anxiety Inventory (STAI). Horvath et al., by examining the structure of sleep through polysomnography (PSG), found that SE, total sleep time (TST), nighttime waking, and duration of sleep at stages 2 and 3 were not significantly different in terms of the effect of low and high state and trait anxiety. However, in the latency of the onset of sleep, the percentage of stages 2 and 3 of the TST, the number and stages of rapid eye movement (REM) in the evening, and the latency of REM (REM latency) were significantly affected by the low and high level of state and trait anxiety (23). The study of Horvath et al. was not performed to predict the components of sleep quality based on state and trait anxiety (23).

The purpose of this study was to compare the anxiety dependent on state of situation (state) and personality (trait) in influencing the components of sleep quality, and to predict the total quality of sleep based on the state and trait anxiety, which has not been studied before. Considering the importance of some modifiable variables, the results of this study can improve students' sleep hygiene as a short-term goal and quality of life as a long-term goal.

Materials and Methods

This study was a descriptive cross-sectional study. The research population was the students of Kermanshah University of Medical Sciences, Kermanshah, Iran. At first, 50 subjects from each school of Kermanshah University of Medical Sciences were randomly selected. With 8 schools available, 400 subjects finally were obtained. The sample size was calculated according to Krejcie and Morgan table. 365 students completed a questionnaire including demographic information, Spielberger's STAI, and Pittsburgh Sleep Quality Index (PSQI) in the presence of the researchers. The inclusion criteria were defined as voluntary participation, informed consent, and having enough time to answer the questionnaires. Exclusion criteria also included the unwillingness of the person to answer the rest of the questionnaire questions. In this study, the history of psychiatric care was not investigated. In order to access students' interest in their personal status and to comply with ethical standards, guidance was provided to the participants and the questionnaires were distributed anonymously and by email option.

Pittsburgh Sleep Quality Index (PSQI): PSQI is used to assess the sleep quality and sleep pattern. The questionnaire differentiates optimal sleep from poor sleep using 19 questions through seven components over the preceding month. Each question is scored from 0 to 3. The total score of these seven components will determine the total score ranging from 0 to 21. The higher the score, the weaker sleep quality is. Score 6 and above denote poor sleep quality (24). The components of this questionnaire are subjective sleep quality, sleep latency, sleep duration, habitual SE, daytime dysfunction, sleep disturbance, and use of sleep medication (24). The validity of PSQI was evaluated with Cronbach's alpha of 0.80 and its test-retest reliability ranged from 0.93 to 0.98 (25); it has been shown to be highly reliable in many studies (24, 26-28).

State-Trait Anxiety Inventory (STAI): STAI is used to measure anxiety. It can also be used to validate the benefits and effectiveness of psychotherapy and other interventions (29). This self-report questionnaire contains 40 items that individuals must identify on a 4-point scale from "almost never" to "almost always" or "not at all" to "very much". Items are divided into two subgroups of self-report (STAI-T for trait anxiety and STAI-S for state anxiety) within which the state and trait anxiety are characterized by specific features and it measures the tendency of people to experience general anxiety and view stressful situations as threatening (22, 29).

Table 1. Demographic characteristics of the study participants

Variable	Category	n (%)	Total sleep quality	
			Mean ± SD	P-value
Age (year)	18-30	301 (82.47)	4.11 ± 2.96	< 0.001
	> 30	64 (17.53)	4.50 ± 3.41	
Sex	Men	197 (54.00)	7.05 ± 3.22	0.353
	Women	168 (46.00)	6.60 ± 2.99	
Sleep quality	Optimal	135 (37.00)	3.91 ± 1.15	< 0.001
	Poor	230 (63.00)	8.86 ± 2.58	

SD: Standard deviation

The scores for each subscale can range from 20 to 80. The higher scores indicate higher anxiety. The validity of STAI was evaluated with Cronbach's alpha of 0.90 and its test-retest reliability ranged from 0.93 to 0.95 (22, 29), which shows a high reliability (29).

Data were analyzed by SPSS software (version 20, IBM Corporation, Armonk, NY, USA). Pearson correlation, independent t-test, and multivariate regression models were used to present the data according to the research hypotheses. The aim of using multivariate regression model was to examine the predictive value of sleep quality components based on state and trait anxiety. Independent t-test was used to determine the difference between sleep quality means based on age and sex.

Results

A total of 365 students were evaluated, of which 197 (54%) were men and 168 (46%) were women. The average age of the participants was 21.8 ± 3.25 years (from 18 to 48 years). The mean of anxiety scores was 38.86 and 46.02 (range 31-49) for state and trait anxiety, respectively. 63% of students had poor sleep quality (PSQI ≥ 6) with an average of 8.86 ± 2.58. The details of the descriptive results are shown in table 1, which are designed to compare the overall quality of sleep in the levels of demographic variables and their descriptions.

One of the goals of this study was to examine the relationship between each component of sleep quality with state and trait anxiety. The correlation results are presented in table 2.

As shown in the correlation matrix (Table 2), there was a significant correlation between all components of sleep quality and state and trait anxiety ($P < 0.001$). The highest and lowest correlation among sleep quality components and state anxiety were related to total sleep quality and sleep duration, respectively, which was also the case with trait anxiety. The total sleep quality with other components of sleep quality in this study showed a high and statistically significant correlation. The mean of state anxiety score was 38.86 ± 10.77, the mean of trait anxiety score was 46.16 ± 10.14, and for total sleep quality, the mean score was 6.84 ± 3.12.

Table 2. Correlation matrix between total sleep quality and its components with state and trait anxiety

Variables	Total state anxiety	Total trait anxiety	Total sleep quality
Subjective sleep quality	0.42**	0.55**	0.70**
Sleep latency	0.30**	0.48**	0.64**
Sleep duration	0.14*	0.26**	0.59**
Sleep disturbance	0.35**	0.41**	0.49**
Use of sleep medication	0.31**	0.21**	0.38**
Daytime dysfunction	0.31**	0.37**	0.59**
SE	0.17**	0.39**	0.55**
Total sleep quality	0.47**	0.61**	1

SE: Sleep efficiency
*$P < 0.010$, **$P < 0.001$

Another aim of the study was to explore the predictability of each component of sleep quality based on state and trait anxiety and also to compare the effect of state and trait anxiety on each of the components of sleep quality. In a standardized multivariate regression analysis (Table 3) for sleep quality, the effect of trait anxiety was $\beta = 0.32$ which was statistically significant ($P = 0.004$). State and trait anxiety accounted for 19% of the variance of sleep quality ($R^2 = 0.19$, $P < 0.001$). For sleep latency, the amount of effect of trait anxiety was $\beta = 0.26$ which was statistically significant ($P = 0.029$), and state and trait anxiety in total accounted for 9% of variance in sleep latency ($R^2 = 0.09$, $P < 0.001$). The results of regression analysis for sleep duration did not show a statistically significant effect ($P > 0.050$). In total, only 1% of sleep duration variance was explained by state and trait anxiety ($P < 0.050$). For sleep disturbances, the magnitude of the effect of trait anxiety was $\beta = 0.27$ and it was significant ($P = 0.022$), and 11% of variance of sleep disturbances was explained by state and trait anxiety ($R^2 = 0.11$, $P < 0.001$).

Table 3. Results of simultaneous multivariate regression analysis for sleep quality components based on state and trait anxiety

Dependent variable	Predictor variable	B	β	T	P-value
Subjective sleep quality	State anxiety	0.00	0.12	1.12	0.262
	Trait anxiety	0.02	0.32	2.87	0.004
Sleep latency	State anxiety	0.00	0.05	0.46	0.644
	Trait anxiety	0.02	0.26	2.18	0.029
Sleep duration	State anxiety	0.00	-0.05	-0.40	0.687
	Trait anxiety	0.01	0.19	1.59	0.111
Sleep disturbance	State anxiety	0.00	0.08	0.72	0.468
	Trait anxiety	0.01	0.27	2.29	0.022
Use of sleep medication	State anxiety	0.00	0.16	1.32	0.185
	Trait anxiety	0.00	0.05	0.45	0.652
Daytime dysfunction	State anxiety	0.01	0.15	1.32	0.186
	Trait anxiety	0.01	0.19	1.65	0.100
SE	State anxiety	0.00	-0.02	-0.16	0.867
	Trait anxiety	0.01	0.17	1.43	0.151
Total sleep quality	State anxiety	0.03	0.11	1.04	0.299
	Trait anxiety	0.10	0.37	3.41	0.001

SE: Sleep efficiency

For use of sleep medication, the magnitude of the effect of state and trait anxiety was not statistically significant ($P > 0.050$) and a total of 4% of the variance of use of sleep medication was explained by state and trait anxiety ($R^2 = 0.04$, $P < 0.001$). For daytime dysfunction, the magnitude of the effect of anxiety was not statistically significant ($P > 0.050$), and a total of 11% of the variance of daytime dysfunction was explained by state and trait anxiety ($P < 0.001$). For SE, the magnitude of the effect of state and trait anxiety was not statistically significant ($P > 0.050$). In total, only 2% of the variance in SE was explained by state and trait anxiety ($R^2 = 0.02$, $P < 0.010$). For total sleep quality, the effect of trait anxiety was $\beta = 0.37$ and it was statistically significant ($P = 0.001$), and state and trait anxiety in general accounted for 22% of the variance in total sleep quality ($R^2 = 0.22$, $P < 0.001$).

Also, according to table 3, trait anxiety can predict the components of sleep quality with the exception of sleep duration, use of sleep medications, daytime dysfunction, and SE. The highest predictability based on the state and trait anxiety was related to the total sleep quality, and after that, the subjective sleep quality, and the smallest amount was related to sleep duration.

Discussion

The present study provided empirical evidence of sleep quality and its components in relation to state and trait anxiety in students. Considering the importance of sleep problems in mental and physical health, especially in university students, it is expected that the results of this study will be used to determine the appropriate interventions to prevent or improve health of students and promote educational programs. Also, on a more general level, their quality of life would be affected.

There was a statistically significant difference in the quality of sleep between different age groups ($P < 0.001$). As the age of participants increased, their average sleep quality became weaker by the PSQI score. With the rise of age, the quality of sleep becomes poorer, as is shown in several other studies (30, 31). There was no statistically significant difference between male and female students in the total quality sleep ($P < 0.050$), and this suggests that gender is not a determinant in the quality of sleep in students. This finding is not consistent with the results of other studies conducted in the general population (32-34). Of course, in some other studies in which the quality of sleep was objectively investigated through actigraphy or PSG, women had better sleep quality than men (32, 35, 36). One of the most important factors explaining the difference in the data obtained in this area is the difference in 1) the method of research, 2) the measurement of sleep quality, 3) the sample size, and 4) the cultural context of the studies.

The most important outcome of this study was the 63% prevalence of poor sleep quality in students. Many studies have been done in this regard, and various controversial results have been presented. A meta-analysis conducted by Ranjbaran in Iran, through gathering research data for a decade in 2015, indicated that the average prevalence of poor sleep quality in Iranian students ranging

from 15.5% to 86.4% based on university, sample size, and city was nearly 56% (6). In studies outside Iran, the results are not significantly different. For example, in a study by Lund et al. on a sample of 1125 students aged 17-24 years, the prevalence of poor sleep quality was reported nearly 60% (3). These studies are almost consistent with the results obtained in our study. Of course, this value is far higher than the prevalence of poor sleep quality compared to the general population. In various studies, it has been shown that between 5% and 40% of the general population have complained of sleep problems (27, 37, 38). Among factors explaining the high prevalence of poor quality of sleep in students, higher conflicts were related to educational issues (39), emotional problems (14, 15), more use of internet and technology (40), and perfectionist attributes (41). This amount of sleep problems can be seen as a warning sign to the existence of psychosocial problems, as well as a risk factor for the health and academic status of the students, which will require further investigation .

Another goal of this study was to investigate the relationship between sleep quality factors and students' state and trait anxiety. All components of sleep quality had a significant positive correlation with state and trait anxiety ($P < 0.001$) except for sleep duration, which was significant with state anxiety ($P < 0.050$). Since the pattern of sleep time is determined based on the routine rhythm in a relatively long time, it can be expected that state anxiety as a transient characteristic is less associated with the duration of a one-month sleep. This exception can also be explained by the fact that students usually try to compensate for the amount of sleep lost during the night with napping (23). On the other hand, the amount of daily naps reaches to such a degree that the hours of sleep lost are quantitatively compensated for. Therefore, a significantly lower level of sleep time with state anxiety associated with anxiety before sleep (21) can be expected. The highest correlation of trait and state anxiety was between total sleep quality and subjective sleep quality. Given the relatively high and meaningful correlation between these components of sleep, this outcome was predictable. One of the explanations of this issue can be related to the subjective evaluation in this study. Of course, in relation to higher correlation, sleep latency with trait anxiety, it can be said that this conclusion is not consistent with the study conducted by Horvath et al. (23). One of the most important reasons for this is the difference between the research methodology and the sample of two studies. Differentiating the state and trait anxiety in influencing on the components of sleep will differ in subjective method and objective one, while the psychological characteristics of the students may differ with those who are diagnosed with the disorder. The lowest level of adolescent anxiety correlation was observed with the use of hypnotic drugs. This result, due to the higher correlation between state anxiety and use of sleep medication, seems to be related to the higher level of anxiety of students before sleep (state anxiety) that interferes with their sleep. Sometimes use of sleep medication can help get sleep.

The most important goal of this study was to predict sleep quality components based on state and trait anxiety and also to compare the state and trait anxiety in influencing the components of sleep quality. In fact, we intended to determine the components of sleep quality in terms of the anxiety effect that a person had before falling asleep in relation to stressful events and anxiety that was experienced as a stable personality trait regardless of stressful events (21). The results of multivariable regression analysis among sleep quality components and state/trait anxiety showed that the components of total sleep quality, subjective sleep quality, sleep latency, and sleep disturbances were significantly more affected by trait anxiety. However, the components of sleep duration, use of sleep medication, daytime dysfunction, and SE were not significantly affected by state and trait anxiety. The only component which was mostly affected by state anxiety was the use of sleep medication, which was not statistically significant. These findings show that trait anxiety (dependent on personality, from a theoretical point of view) (21) further explains sleep and its components. Of course, based on the concept of Spielberger et al., the effects of trait anxiety on the level of perceived state anxiety cannot be neglected (21, 22, 29). Among sleep quality components after total sleep quality, subjective sleep quality was more than other components explained by state and trait anxiety (about 19%), which indicates that anxiety greatly affects the perception of sleep of individuals. On the other hand, other psychiatric symptoms were not studied in this study, which in turn could affect this perception (42, 43). Among the components of sleep quality, state and trait anxiety had the least

amount of ability to explain sleep duration (1%), which strongly suggests that the duration of sleep is affected by various factors. The explanatory factors of this issue include circadian rhythm and naps. Therefore, it cannot be concluded that students' level of anxiety interferes with their sleep duration.

Several limitations in this study should be noted; first, the status of previous psychiatric care was not investigated. Psychiatric disorders in students, while experiencing other problems, can be considered as a serious health issue. Therefore, it is recommended that students' psychiatric status be evaluated in future studies. Second, this study evaluated the students' sleep quality subjectively. It is clear that the use of objective measurement methods such as actigraphy or PSG can furtherly explain the findings. Third, the sample studied included students and also the study was cross-sectional; therefore, findings were not universally applicable. It is suggested that by reducing its constraints, this study be done in a larger scale in order to be more generalizable.

Conclusion

Based on the results, it can be concluded that among the components, subjective sleep quality is more influenced by trait anxiety and the use of sleep medication is more affected by state anxiety. It can be said that the state and trait anxiety, together, predict subjective sleep quality more and they are less likely to be involved in the prediction of sleep duration. Considering these factors, it can be argued that using psychological interventions in order to reduce students' anxiety levels can mainly affect their experience of sleep (subjective sleep quality) and unhealthy behavior patterns for the onset of sleep (use of sleep medication) instead of having an effect on their sleep duration.

Conflict of Interests

Authors have no conflict of interests.

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