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RESEARCH ARTICLE

The relationship between physical activity, fatigue, sleep quality, and anxiety levels of students during the university examination period

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ABSTRACT

Aim: The aim of this study was to assess the physical activity level of university students during exam week and to investigate the relationship between physical activity level and the severity of fatigue, sleep quality, and anxiety.

Methods: Volunteers aged 18-30 years, studying in health sciences, were included in the study. Physical activity was assessed using the International Physical Activity Questionnaire (IPAQ) short form, fatigue was assessed using a visual analog scale, sleep quality was assessed using the Pittsburgh Sleep Quality Index (PSQI), and anxiety was assessed using the State and Trait Anxiety Inventory (STAI).

Results: The mean age and body mass index of the 92 students included in the study were 21.1±2.0 years and 22.0±3.5 kg/m^2, respectively. Among the students, 38% were inactive, 56.6% were minimally active, and 5.4% were in the highly active physical activity category. There was a moderate negative correlation between IPAQ scores and fatigue (-0.449, p<0.001). Additionally, there was a moderate negative correlation between IPAQ scores and PSQI scores (-0.426, p=0.002), a moderate negative correlation between IPAQ scores and STAI-State (-0.435, p=0.001), and a weak negative correlation between IPAQ scores and STAI-Trait scores (-0.362, p=0.003).

Conclusion: Physical activity levels were found to be lower among university students during exam week compared to those reported in the literature. Additionally, as physical activity levels increased, fatigue and anxiety levels decreased and sleep quality improved. Encouraging university students to maintain adequate physical activity during exam week may be beneficial for improving fatigue, sleep quality, and anxiety.

Keywords: anxiety, exam, fatigue, physical activity, sleep quality, university students

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INTRODUCTION

Physical activity is defined as the movement of the body resulting from the energy expended by the skeletal muscles in performing daily activities. Adequate physical activity is essential for maintaining a healthy life. Regular and sufficient physical activity, especially from childhood or young adulthood onwards, has positive effects on aerobic capacity, body composition, blood pressure, glucose metabolism, and physical and psychological health (1). A study analyzing the physical activity levels of 19,928 university students in 23 countries found that 23% of the students in Northwest Europe and the USA, 39% in Mediterranean countries, 30% in Central and Southern Europe, 42% in Asia-Pacific countries, and 44% in developing countries were inactive (2).

Young individuals who perform adequate physical activity have lower levels of depression and higher academic achievement (1,3). In addition, physical activity levels are directly related to quality of life, physical function, general health, physical pain, mental health, and vitality (4). Physical activity is essential for maintaining good health and reducing stress and anxiety. Exam weeks, which are a stressful time for university students, can have a significant impact on their physical and mental health. Studies have reported the positive effects of physical activity on social and personal success, sleep quality, depression levels, anxiety, and stress in healthy individuals (5-7).

Anxiety is most intense during the school exam period. Test anxiety is a specific type of anxiety experienced as a feeling of discomfort mixed with fear (1,3). Although negative conditions such as increased anxiety, stress, and fatigue levels, and deterioration in sleep quality are common during the exam period, no study has assessed the physical activity status of students during this time or examined the relationship between physical activity and fatigue severity, sleep quality, and anxiety levels. Therefore, the aim of this study was to determine the physical activity levels of university students during exam week and to investigate the relationship between physical activity levels and fatigue severity, sleep quality, and anxiety.

MATERIALS AND METHODS

The study protocol was approved by the Hitit University Ethics Committee for Non-Interventional Clinical Research (Decision No: 2023-01). Written and verbal informed consent was obtained from all participants in accordance with the Declaration of Helsinki.

Volunteers between the ages of 18 and 30 who were continuing their university education in the field of health sciences were included in the study. Individuals with orthopedic, neurological, rheumatological, oncological, mental, and cognitive diseases, and those who were currently pregnant or had a history of pregnancy or childbirth, were excluded from the study. Demographic, physical, and medical information was recorded.

Students' physical activity levels were assessed using the International Physical Activity Questionnaire - short form (IPAQ), which has been shown to be valid and reliable in Turkish. The questionnaire asks about the time spent in walking, moderate activity, vigorous activity, and sitting. The energy expenditure during physical activity is calculated by the metabolic equivalent (MET-minute) score. There are standardized MET values for different physical activities: 3.3 METs for walking, 4.0 METs for moderate physical activity, and 8.0 METs for vigorous physical activity. The calculation of these values determines the level of physical activity (inactive / minimally active / highly active) (8,9).

The fatigue felt by the students during the examination week was assessed using a 10 cm visual analog scale (VAS). On the scale, the starting point of “0 cm” means 'I do not feel tired at all,' and the endpoint of “10 cm” means 'I feel unbearably tired.' Participants were asked to mark the point on the scale that they felt was closest to their level of fatigue during the examination week. Higher scores indicate greater levels of fatigue (10).

The Pittsburgh Sleep Quality Index (PSQI) (10) assesses sleep quality and sleep disturbance. The index consists of a 19-item self-report and 7 components: subjective sleep quality, sleep duration, sleep latency,

sleep disturbance, habitual sleep efficiency, daytime dysfunction, and sleep medication use. Each sleep component is evaluated on a 0-3 point scale. The total score of the 7 dimensions gives the total scale score (between 0 and 21). A total score greater than 5 indicates poor sleep quality.

Anxiety levels were assessed using the State-Trait Anxiety Inventory (STAI), which was validated by Öner and Le Compte in 1983. This scale assesses two different parameters: the 'State Anxiety Scale' and the 'Trait Anxiety Scale.' Each scale has 20 items. The State Anxiety Scale defines how individuals feel at the assessed time and under certain conditions, and individuals should answer the items by thinking about their feelings regarding the situation they are in. The Trait Anxiety Scale assesses how the individual feels in general. The total score for both scales can range from 20 to 80, with a high score indicating a high level of anxiety and a low score indicating a low level of anxiety (11).

Statistical analysis

Statistical analyses were performed using SPSS version 22. Numerical data were analyzed using visual and analytical methods, and it was determined that the data did not meet the criteria for normal distribution. Numerical data were presented as median and interquartile range, and categorical data were presented as numbers and percentages. The relationship between physical activity levels and participants' fatigue, sleep quality, and anxiety levels was analyzed using the Spearman test. According to Spearman correlation coefficients, the degree of association was determined as follows: no association (0-0.19), weak association (0.20-0.39), moderate association (0.40-0.69), strong association (0.70-0.89), very strong association (0.90-1). In the reference study, the correlation coefficient was 0.37. Accordingly, it was calculated that 95% power could be achieved with a 95% confidence interval if at least 70 people were included in the study (12).

RESULTS

Of the 155 students who were assessed for inclusion in the study, 37 had incomplete assessments, 7 had chronic illnesses, and 4 had a history of pregnancy/maternity. Fifteen of the students did not wish to take part in the study. The assessment was completed for a total of 92 students who met the inclusion criteria. The mean age and body mass index of the 92 students included in the study were 21.1 ± 2.0 years and 22.0 ± 3.5 kg/m^2, respectively. Of those included in the study, 51 (55.4%) were female and 41 (44.6%) were male (Table 1).

Table 1. Demographic and physical characteristics of the participants (n=92)

Age (year)	21.0 (20.0-22.0)
BMI (kg/m^2)	22.09 (20.2-25.4)
Sex	
Female	51 (55.4%)
Male	41 (44.6%)
Smoking (yes %)	29 (31.5%)
Alcohol (n - %)	
Never	62 (67.4%)
Rarely	18 (19.6%)
Sometimes	12 (13.0%)
Most of the time	-
Always	-

Data are presented as median (interquartile range) or as number (percentage). BMI: Body Mass Index.

Table 2 shows the data from the participants' physical activity, fatigue, sleep quality, and anxiety

Table 2. Participants' physical activity, fatigue, body awareness, sleep quality and anxiety status (n=92)

IPAQ	960.0 (594.0-1386.0)
Inactive	35 (38%)
Minimally Active	52 (56.6%)
Highly Active	5 (5.4%)
Fatigue (cm)	6.0 (4.0-7.7)
PSQI	6.0 (4.0-7.0)
STAI-State	39.0 (33.0-49.0)
STAI-Trait	38.0 (33.0-45.7)

Data are presented as median (interquartile range) or as number (percentage). IPAQ: International Physical Activity Questionnaire-Short Form. PSQI: Pittsburgh Sleep Quality Index. STAI-State: State-Trait Anxiety Inventory. STAI-Trait: Trait Anxiety Scale.

Table 3. Relationship between physical activity values and fatigue, body awareness, sleep quality, and anxiety of the participants

	IPAQ r (p)
Fatigue (cm)	-0.449 (<0.001*)
PSQI	-0.426 (0.002*)
STAI-State	-0.435 (0.001*)
STAI-Trait	-0.362 (0.003*)

*Statistically significant association. r: Spearman correlation coefficient. IPAQ: International Physical Activity Questionnaire-Short Form. PSQI: Pittsburgh Sleep Quality Index. STAI-State: State-Trait Anxiety Inventory. STAI-Trait: Trait Anxiety Scale.

questionnaires. Among the students, 38% were inactive, 56.6% were minimally active, and 5.4% were in the highly active physical activity category.

A statistically significant relationship was observed between the physical activity levels of the participants during the exam week and their fatigue, sleep quality, and anxiety levels ($p<0.05$). There was a moderate negative correlation between IPAQ scores and fatigue (-0.449, $p<0.001$). Additionally, there was a moderate negative correlation between IPAQ scores and PSQI scores (-0.426, $p=0.002$), a moderate negative correlation between IPAQ scores and STAI-State (-0.435, $p=0.001$), and a weak negative correlation between IPAQ scores and STAI-Trait scores (-0.362, $p=0.003$) (Table 3).

DISCUSSION

The aim of this study was to determine the physical activity levels of university students during exam week and to investigate the relationship between physical activity levels and fatigue severity, sleep quality, and anxiety levels. The study found a moderate negative correlation between physical activity level and both fatigue severity and state anxiety levels, a weak negative correlation between physical activity level and trait anxiety level, and a moderate positive correlation between physical activity level and sleep quality. This study is significant because it is the first to assess the physical activity levels of university students during exam week and their relationship to fatigue, sleep quality, and anxiety.

When the physical activity levels of university students were examined during exam week, it was found that 38% were inactive, 56% were minimally active, and 5% were in the highly active physical activity category. Compared to other studies on the physical activity levels of university students, the participants in this study had lower physical activity levels (12-14). This decrease in physical activity could be attributed to stress, increased workload, and inadequate time management during exam week.

In general, sleep problems are common among university students. Poor sleep quality has been reported among students due to insufficient sleep, irregular bedtimes, use of alcohol and/or over-the-counter drugs to regulate sleep, and use of stimulants to stay awake (15,16). Smokers are known to have poorer sleep quality, as nicotine acts as a stimulant, making it difficult to fall asleep and negatively affecting sleep quality (12). In this study, the smoking habits of participants were similar to those reported in the literature, while alcohol use was found to be lower (17-19). Psychosocial and physical health problems were significantly higher among students with poor sleep quality compared to those with good sleep quality. Insomnia can lead to issues such as difficulty concentrating, irritability, fatigue, anxiety, and depression among students (20).

A moderate relationship was found between the physical activity level of university students during exam week and their sleep quality and fatigue severity. Sleep quality decreased and fatigue severity increased as physical activity levels decreased. This may be due to long study hours, stress, and inadequate time management during exam week. Physical activity has been reported to help resist fatigue by increasing muscle strength and functionality in both healthy individuals and patients of all ages. Additionally, physical activity may help students distract themselves from negative thoughts during exam week, enhancing their sense of refreshment and supporting a return to a stable physiological state. Physical activity also reduces stress, improves physiological conditions such as blood pressure, and prevents fatigue from becoming a chronic condition (5-7). Studies on physical activity and sleep disorders indicate that increasing physical activity reduces sleep disorders, while sleep problems

can decrease physical activity levels due to lethargy and daytime sleepiness. Therefore, physical activity and sleep problems have a reciprocal effect on each other (21).

The state and trait anxiety levels of the participants in this study were higher compared to the literature. Some studies report that trait anxiety is a better indicator of test anxiety than state anxiety, while others suggest that test anxiety may be related to either state anxiety or both state and trait anxiety. Exams are the most intense moments of anxiety in schools. For students, the stress of failing to meet family expectations for academic success can lead to increased anxiety (22).

Anxiety levels are expected to increase during exam week due to stress and increased workload. However, the present study found that both state and trait anxiety decreased with higher levels of physical activity. Regular physical activity is known to reduce anxiety, stress, and depression, and is associated with psychological well-being, life satisfaction, and a positive mood (23). Exercise is often the first step in lifestyle modification for the prevention and management of chronic diseases. A recent systematic review and meta-analysis found a negative association between physical activity levels and anxiety. Regular physical activity has been shown to influence the relationship between the sympathetic nervous system and the hypothalamic-pituitary-adrenal axis, regulating the release of corticotropin-releasing factor from the hypothalamus and adrenocorticotropic hormone from the anterior pituitary. These findings suggest that exercise-induced changes help modulate stress reactivity and anxiety in humans (24).

Due to stress, increased workload, and poor time management, students may experience increased sleep problems, fatigue, and anxiety during exam week. Additionally, students may limit their physical activity as they focus on studying. Physical activity is known to improve biopsychosocial well-being and is effective in managing sleep problems and fatigue. Restricting physical activity during exam week due to lack of time, stress, and workload can further exacerbate sleep problems, fatigue, and anxiety. Therefore, it is crucial to encourage students to maintain sufficient levels of physical activity during exam weeks, as recommended by physical activity guidelines, and to raise awareness about time management to allocate time for physical activity.

This study has several limitations. First, due to the transition to distance education following the earthquake on February 6, 2023, in Kahramanmaraş, an adequate number of students from each department could not be included, which prevented sub-analyses by department groups. Therefore, analyses were conducted on the overall sample. Second, students with orthopedic, neurological, oncological, or psychiatric conditions were excluded based on self-reports. Including participants after a medical examination by a physician could strengthen the findings in future studies. Lastly, the use of the IPAQ short form is a limitation. Although the short form is valid and reliable, it was chosen for its brevity due to participants' limited availability during the exam week. The long version could provide more detailed insights into different physical activity domains. Additionally, future studies may benefit from using objective tools, such as activity monitors, to improve the accuracy of physical activity data.

CONCLUSION

The results of this study showed that university students had lower levels of physical activity, higher levels of fatigue and anxiety, and poorer sleep quality during exam week compared to the literature. Additionally, there was a moderate negative relationship between physical activity levels and levels of fatigue and state anxiety, a weak negative relationship with trait anxiety, and a moderate positive relationship between physical activity levels and sleep quality. The beneficial effects of physical activity in managing fatigue, sleep disturbance, and anxiety have been well-documented in the literature. It is important to encourage university students to maintain an appropriate level of physical activity during exam week and to raise awareness of effective time management for incorporating physical activity. Moreover, universities should provide facilities such as walking areas, recreational spaces, healthy living programs, and exercise classes catering to diverse preferences to help students engage in adequate physical activity.

Ethical approval

This study has been approved by the Ethics Committee for Non-interventional Clinical Research of Hitit University (approval date 28/02/2023, number 2023-01). Written informed consent was obtained from the participants.

Author contribution

Concept: EB; Design: EB; Data Collection or Processing: EB, AY; Analysis or Interpretation: EB, AY; Literature Search: EB, AY; Writing: EB, AY. All authors reviewed the results and approved the final version of the article.

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Conflict of interest

The authors declare that there is no conflict of interest.

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