

The effect of Pilates exercise on sleep quality and fatigue among female student dormitory residents

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Research Article

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Abstract

Background: Sleep quality and fatigue have been documented as a challenge for college students, with reports indicating impacts on daytime functioning and academic achievement. The present study evaluates the effect of Pilates exercise on sleep and fatigue among female student residents in the dormitory.

Methods: This quasi-experimental study involving 67 participants consisted of one experimental group (assigned Pilates exercise) and one control group. Participants in the experimental group received three one-hour sessions of Pilates exercise weekly for eight-week. Sleep quality and fatigue levels were measured by the Pittsburgh Sleep Quality Index (PSQI) and standard Multidimensional Fatigue Inventory (MFI-20), respectively. These variables were assessed at baseline, weeks four and eight of the study.

Results: After four and eight weeks, findings showed an improvement in the sleep quality score ($p < 0.001$ and $p < 0.0001$, respectively). After four weeks of intervention, the mean score of the subjective sleep quality and daytime dysfunction in the Pilates group was significantly less than the control group ($p < 0.001$ and $p < 0.002$, respectively). Eight weeks of intervention had an additional effect on sleep duration and habitual sleep efficiency ($p < 0.04$ and $p < 0.034$, respectively). Also, Pilates exercise significantly reduced the total score of fatigue and its dimensions in weeks four and eight, compared to the control group ($p < 0.001$).

Conclusions: Eight weeks of the Pilate's exercises had a significant improvement in most components of sleep quality; however, the effect of Pilates exercise on fatigue was evident from week four of the intervention.

Trial registration: The study was registered on 6/2/2015 in the Iranian Registry of Clinical Trials (IRCT) with IRCT201412282324N15.

Highlights

- Pilates, an alternative form of exercise, is widely used for health enhancement.
- Pilates exercises improved sleep quality and reduced fatigue among female students.
- Pilates exercises due to low cost, availability, no side effect, and effectiveness can be a practical step in improving students' quality of sleep and fatigue.

1. Introduction

Sleep is a complex physiological and behavioral process that is important for physical and mental health [1]. Poor sleep quality is a severe public health problem [2], prevalent among the general university population [3]. Poor sleep quality decreases health quality and is associated with physical and psychological problems [4]. Sleep quality and quantity have been documented as a challenge for college students [5]. A report from China's ministry of education noted that about 31.43 million students live in

residence halls [6]. In a report, 16% and 23% of young adults have symptoms of poor sleep quality [3]. In a recent study, 75% of college students surveyed experienced sleep problems such as delayed sleep phase syndrome, difficulty falling asleep, sleep disturbances, and excessive daytime sleepiness [7]. Studies show that students go to bed at varying times, do not get enough sleep, have poor sleep quality, and use stimuli to stay awake [8]. Insufficient sleep has been shown to affect academic performance [1, 5]. It is also associated with anxiety, depression, and an increased risk for other psychiatric disorders [9]. According to the reports, female college students have been shown to have longer sleep latency, more awakenings, and lower sleep quality than male college students [7].

Good sleep is curative and relieves fatigue, and then individuals feel ready to face the challenges of a new day [10]. Fatigue is one of the most common complaints when seeking medical advice in primary care [4]. Fatigue causes disability, burnout, yawning, drowsiness, and lack of interaction [11]. One study reported that 19.8% and 67.2% of Iranian university students suffered from severe and moderate fatigue, respectively [12]. Studies have shown a relationship between sleep quality and severity of fatigue, and the severity of fatigue increases as sleep quality decreases [10].

Physical exercise is recommended by academic sleep associations as a low-cost, easily administered, and non-pharmacologic intervention for improving sleep [9]. Pilates, an alternative form of exercise, is widely used for health enhancement [13]. Joseph created Pilates in the 1920s, and its philosophy relies on the tenet "balance of body and mind" [14]. It also has been widely applied in healthy subjects because of its positive effects [2]. It provides complete coordination of body, mind, and spirit [15]. Pilates exercise is based on six principles: centering, concentration, control, precision, flow, and breathing [16]. It is a flow of exercise that develops physical, psychological, and motor functions [17]. It is especially considered an attractive mainstream form of exercise in women worldwide [17, 18].

Accordingly, the Pilates method has emerged as an alternative form of exercise to improve sleep quality [19]. Different studies showed positive effects of Pilates exercises on quality of sleep [5], [20–22], and fatigue [5, 23–27] using different designs of activity and populations. In a meta-analysis of six randomized trials comprising 477 participants, all studies reported the positive effect of Pilates on sleep quality, but not on the use of sleep medication, so suggested well-designed and large-scale RCTs [2].

As an alternative form of exercise, Pilates has been relatively understudied [16, 27]. One study has examined the effect of Pilates on university students. Studies reported Pilates is an effective exercise to improve sleep quality in college-age individuals [28]. Another study said the Pilates exercises have an essential role in healing the PMS symptoms in university students [17]. Research on the effects of Pilates on students is limited. In one study, aerobic exercise reduced university students' total sleep quality and fatigue scores [29].

Living in a student dormitory could impact sleep quality among students [30]. Because health professions' curricula, such as medicine, nursing, and pharmacy, are more intense and tiring, these students experience sleep problems more frequently [8]. In a study of 658 students at one university of medical science in Iran, sleep quality was poor in 49.2% of students [12]. The main objective of our study

was to analyze the effects of Pilates exercise on the sleep quality and fatigue of medical college students. We hypothesized that participants who performed an eight-week Pilate's exercise program would show improvements in sleep quality, as well as significant decreases in fatigue.

2. Method

Study design and sampling

Setting in this quasi-experimental was the student dormitories of the Iran University of Medical Sciences (IUMS). Two dormitories were randomly selected, then randomly assigned to the Pilates exercise or control group.

Participants

Eighty participants enrolled in this study (40 from each of the two dormitories). Participants were Iranian females college students between 18-26 years of age who met the following criteria: BMI < 29 (kg/m²), non-smoking, no acupuncture or other complementary medicines over the last six months, and no exposure to stressful events the past three months. The exclusion criteria were: a presence of physical or mental illness or surgical history, unwillingness to continue the study, absence for three consecutive or five non-consecutive exercise sessions, any regular physical activity outside of the intervention program designed in the study, the use of complementary medicines or herbal therapy that influences sleep or fatigue level (i.e., energy-enhancing drugs or sleeping medications).

Tools

Seven areas of the Pittsburgh Sleep Quality Index (PSQI): subjective sleep quality, sleep latency, sleep duration, sleep efficiency, sleep disturbances, use of sleeping medications, and daytime dysfunction have been confirmed with scoring a Likert scale of 0 to 3 (total score of 21). Higher scores indicate poorer sleep quality [31]. In the present study, we did not allow students who took sleeping medication to participate, so all students received a score of zero for area six (the use of sleeping medications). Several studies have evaluated the validity and reliability of the PSQI [32–34]. In one Iranian study, the reliability of the Persian version of the PSQI had a Cronbach's alpha coefficient of 0.77 [33]. In our sample, the PSQI Cronbach's alpha coefficient was 0.80.

The Multidimensional Fatigue Inventory (MFI-20) consists of a 20 - item survey covering five dimensions: general fatigue, physical fatigue, mental fatigue, reduced activity, and reduced motivation. The score of each part ranges from 4-20. The total score of fatigue level is the sum of the five parts' scores (i.e., the total score ranges from 20-100). Higher scores indicate high-level fatigue. The validity and reliability of MFI-20 have been tested previously [35]. The reliability of the Persian version of MFI-20 was evaluated in Multiple Sclerosis [36]. The reliability of the MFI-20 in the present sample resulted in a Cronbach's alpha coefficient of 0.85.

Study procedure

The first research objectives were explained to the participants; then, informed consent was achieved. All participants filled out a demographic questionnaire, the PSQI, and the MFI - 20. Pilates exercises from a specialized coach in the dormitories' gym were present for the participants in the experimental group. The participants exercised with the trainer during three one-hour sessions weekly for eight consecutive weeks. Each session consisted of three stages of preparation, Pilates, and relaxation. Warming up was done in the first 15 minutes of each session, then for 30 minutes strength and stretching movements (first standing and then sitting) and in the 15 final minutes, movements were performed to cool the body. The schedule was from 17:00 to 18:00. At the end of the fourth and eighth weeks of the intervention, all participants filled out the PSQI and MFI-20 questionnaires. Students in the control group performed their daily routines (Figure 1).

Sample size

According to the expected difference in study outcomes between the experimental and control groups, with a 25% difference in sleep quality between the two groups, the sample size was estimated at 72 (36 per group). The power was 80%, with a 5% significance level and effect size 1. However, this study recruited 40 students for each group to avoid follow-up losses.

Statistical tests

SPSS version 25 was used to analyze. The independent t-test was utilized to compare quantitative variables between two groups. The exact Fisher test was used to compare the qualitative data and Repeated measurement to compare sleep quality, fatigue, and components between the two groups at different periods. In cases where the sphericity of the test is not assumed Greenhouse-Geisser test was used.

3. Results

32 and 35 participants, respectively in the experimental and control group, completed this eight-week intervention (Fig. 2). Demographic characteristics had no significant differences between the two groups (Table 1). Sleep quality (Table 2) and fatigue level (Table 3) were similar in the two groups at the baseline.

After four weeks of the intervention, the experimental group has been significantly improved in the mean score of the sleep quality and two of its components (subjective sleep quality and daytime dysfunction) compared with the control group (Table 2). After eight weeks of the intervention, the mean score of the sleep quality and its components (except for sleep latency and sleep disturbance) in the experimental group were significantly lower than the control group (Table 2). At four and eight weeks after the Pilates exercises, the total score of fatigue level and its dimensions in the experimental group were significantly lower than the control group (Tables 3).

The Greenhouse-Geisser test showed improvement in the mean score of the sleep quality and its components (except for sleep duration, sleep latency, and sleep disturbance) (Table 2); also, a decrease in the fatigue levels and its' components have been achieved in the Pilates group (Tables 3).

4. Discussion

The present study aimed to assess the effect of an eight-week Pilates exercise on sleep quality and fatigue among female student dormitory residents. After four weeks, findings showed an improvement in sleep quality and two of its components (subjective sleep quality and daytime dysfunction). However, eight weeks of intervention had an additional effect on sleep duration, habitual sleep efficiency, and daytime dysfunction. It is noteworthy that with increasing the time of Pilates exercises, a significant improvement has been achieved in most components of sleep quality. Comparison of the two groups at different periods showed eight weeks of Pilates exercises improved the total scores of sleep quality and its' components (except sleep duration, sleep latency, and sleep disturbance).

In an intervention that has been conducted in parallel with a recent study, eight weeks of aerobic exercise had a positive effect on all components of students' sleep quality compared to the control group. The exercise was not part of the students' routine, and the exercise intensity was designed from mild to severe. The positive effect of the intervention could be related to the design of the intervention, which undoubtedly, such a design was not possible in the recent study. The result of a systematic review and meta-analysis of five RCTs (n= 660 women, with a mean age range from 48.6 to 55.8 years) showed that moderate physical activity (aerobic exercise) for 12-16 weeks improved sleep quality, but not with yoga [37].

The current study results showed that four and eight weeks of Pilates exercises improved fatigue levels and components, so even four weeks of Pilates exercises can also significantly improve fatigue components. This result consists of a study conducted parallel with a recent study. After four weeks of intervention, aerobic exercise positively reduced the total fatigue score and its components [29].

As for Pilates exercises, randomized clinical trials that have examined the effects on the sleep quality and fatigue of college students are scarce. However, after a fifteen-week Pilates exercise, which is implemented in two different time methods (twice a week for 75 min each class period or three times per week for 50 min each class period), improved sleep quality in college students [28]. In one study, a 12-week (60 min, twice per week) Pilates exercises program significantly increased sleep quality in a sedentary young population between 18 and 30 years [19]. In another study, after eight weeks of home-based 30-min Pilates exercises, improvement in subjective sleep quality, daytime dysfunction, and global PSQI score in primigravida postpartum women have been achieved [21].

Improvements in sleep quality and all domains in 110 postmenopausal women age 60 and older after twelve weeks of Pilates exercise have been reported [4]. In another study Pilates exercises twice a week in 60-min sessions in older women (at least 60 years old) improved PSQI total score, sleep latency, and use of sleeping medication [20]. A recent systematic reviews support the beneficial effects of Pilates exercise

on the quality of sleep. In contrast, no significant improvement in the use of sleep medication was observed [2]. In our study, none of the participants took sleeping medication, so all received a score of zero for area six of the PSQI (the use of sleeping medications), which was removed from the list of sleep quality questionnaires

College years are when students gain critical knowledge, skills, human capital, and credentials to become successfully employed and contribute to society after graduation [6]. Sleep is a complex physiological and behavioral process that is important for both physical and mental health. Epidemiologic investigations identify college students as a population at risk for insufficient sleep [1]; also, fatigue dramatically affects many aspects of people's lives through performing activities and precious living roles [12].

Physical exercise has different biological and physiological aspects [13]. Activity constitutes a therapeutic behavior, can improve body composition and fitness, which is critical in enhancing sleep quality [2, 13]. It has been suggested that increased brain serotonin levels due to exercise can affect circadian rhythm to improve sleep quality [19]. Pilates is a mind-body exercise approach that can be considered a complementary and alternative medicine therapy that requires core stability, strength, flexibility, and attention to muscle control, posture, and breathing [38]. Breathing is one of the primary rules in Pilates exercises. As a result of the breathing in pilates activity, sympathetic nervous system activity can decrease, and parasympathetic nervous activity can increase [39]. In dormitory students, due to the high level of inactivity and lack of access to sports facilities, Pilates exercises due to low cost, availability, no side effect, and effectiveness can be a practical step in improving the quality of sleep and health of this group of young people.

Conclusion

The study results showed that performing eight weeks of Pilates exercise can positively affect students' fatigue, sleep quality. Therefore, due to its low cost and ease of implementation, we recommend the performance of this sport to students living in dormitories.

Limitation

The impossibility of controlling the daily sleep hours and daily routines among study participants can be considered one of the limitations of this study.

Abbreviations

PSQI

Pittsburgh Sleep Quality Index

MFI-20

Multidimensional Fatigue Inventory

IUMS

Declarations

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Authors' contributions

Maryam Keshavarz participated in the study design, acquisition, and analysis of the data and writing of the manuscript; Azam Amzajerdi contributed to writing the manuscript and consultant in some parts of the study; Maryam Ezati in sampling and consultant in some parts of the study. Fateme Sarvi verified the analysis of the data. All authors read and approved the final version of the submitted manuscript.

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Ethical

The ethical committee approved the study of the IUMS with ethical code number 110427. The study was registered in the Iranian Registry of Clinical Trials (IRCT) with the number IRCT201412282324N15. All participants signed the written consent formed, also had permitted for publishing the study data.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

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Tables

Tables 1-3 are available in the Supplementary Files section.

Figures

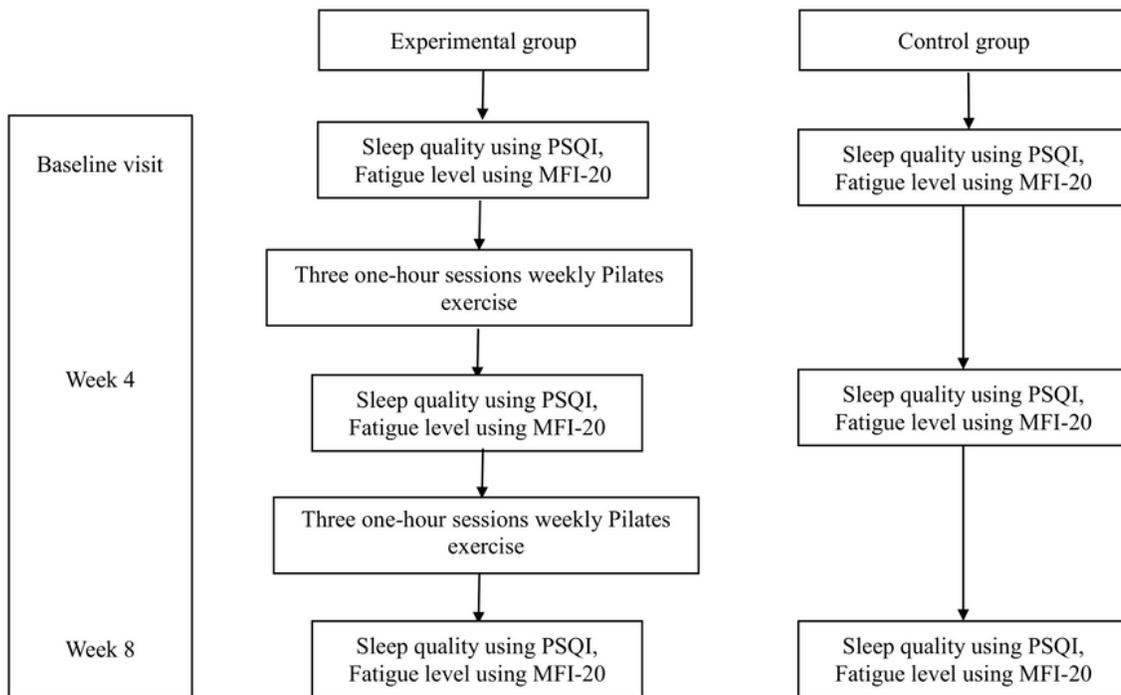


Fig. 1: Study procedure flow chart. PSQI, Pittsburgh Sleep Quality Index; MFI-20, Multidimensional Fatigue Inventory-20.

Figure 1

Study procedure flow chart. PSQI, Pittsburgh Sleep Quality Index; MFI-20, Multidimensional Fatigue Inventory-20.

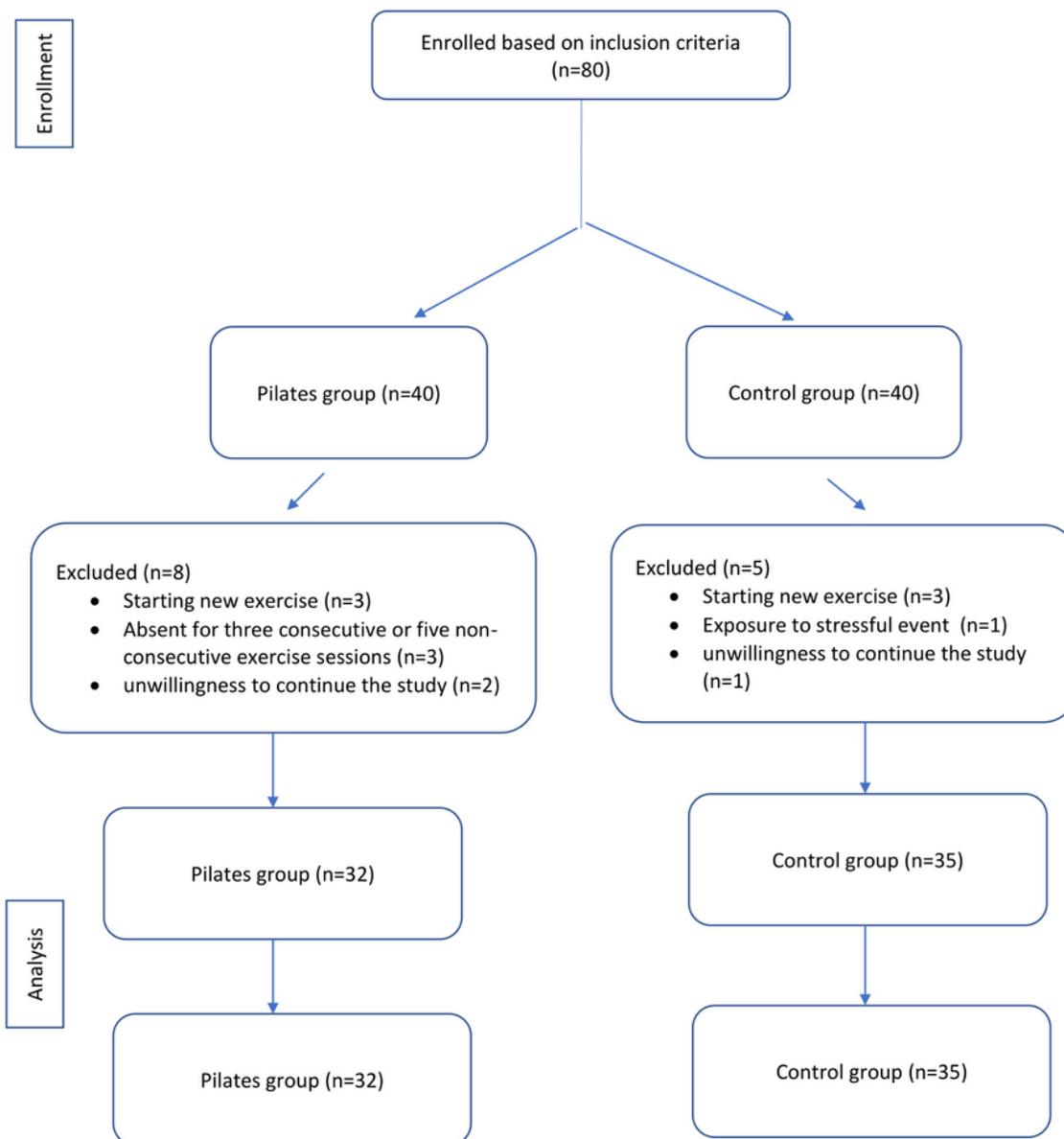


Fig. 2: Consort flow diagram

Figure 2

Consort flow diagram

Supplementary Files

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