

The Effect of Daily in-School Sleep Program on Educational Performance among High School Students

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Abstract

Background and Objective: Sleep is one of the important factors in the quality of brain function. In particular, the function of the person, learning, memory, concentration, and the potential of the individual are closely related to sleep. With regard to age and physiological changes, the average sleep time among adolescents is low. In this study, the effect of a daily nap on the promotion of academic performance of high school adolescents in Tehran, Iran, has been assessed.

Materials and Methods: In this research, 56 high school students from one of Tehran's schools with an average age of 15.3 years were volunteered. Students went to the school hall after finishing classes in the morning at 12:10, and it was 50 minutes when they were considered for their sleep. Students informed researchers with a questionnaire on the educational activities outside the school.

Results: The participants showed to have an average of 2059.50 minutes after-school activity during the 2 weeks preceding the intervention, which reached 2388.11 minutes after the implementation of the in-school sleep program. This time was significantly higher than after-school activity time before intervention.

Conclusion: According to the results of this study, there is a significant positive correlation between daytime napping and the capacity of after-school activity in adolescents. More investigation about installing in-school sleep programs for improving educational performance in adolescents is recommended.

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Introduction

Sleep is an important factor to maintain mental health and balance (1) and plays an active role in reducing stress and anxiety. Sleep also helps recycle energy, boost adapting, enjoy daily activities, concentrate better (2), and enhance memory, learning, and performance at educational setting (3).

Students at different educational levels usually suffer from chronic sleep-restricted state or poor quality of sleep and complain about excessive sleepiness during daytime (4).

During adolescence, delayed sleep-wake pat-

tern is a normal feature of growth (5), which is caused by profound biological, psychological, and social changes that arise throughout this period. Such variations are comorbid with insufficient sleep, irregular sleep patterns and duration, as well as insomnia during puberty (6).

The American Academy of Sleep Medicine (AASM) has recommended that to attain complete daily consciousness and optimal health, teenagers (adolescents aged 13-18 years) are required to sleep 8-10 hours a day on a regular basis (7). However, a substantial body of research has revealed that teenagers sleep on average of 6.4-7.7 hours per day. Hence, daytime sleepiness is common among adolescents, and the proportion of adolescents complaining about daily sleepiness ranges from 25 to 84 percent worldwide (8). Re-

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search in Spain also reported daily sleepiness as the most common sleep-associated problem among high school students (9). In Iran, a study conducted on students in Qazvin showed that daily sleepiness was one of the most common sleep disorders among the study population (10).

There seems to be a general consensus about inadequate sleep in adolescents around the world, where sleepiness among teenagers is increasingly recognized as a public health concern of this age group. Sleepiness and sleep deprivation in adolescence years are associated with many adverse health consequences, including weight gain, obesity, cardiovascular diseases (CVDs), headache and abdominal pain, suicidal intentions, smoking, alcohol and marijuana use, drowsiness during driving and consequent traffic crashes, weakened emotional-behavioral states, impaired memory, decreased cognitive abilities (sustained attention and executive functioning), and poor academic performance (8).

A study in Argentina showed a statistically significant negative association between breathing-related sleep disorders and sleepiness with academic performance in adolescents (11).

In addition, a research on students in Isfahan, Iran, showed that sleep disorders had a negative effect on adolescents' academic performance (12). Research on students in Ahvaz, Iran, also revealed that those who reported severe drowsiness often experienced poor educational performance and encountered many psychosocial problems (13).

Another study in Italy showed that students at all levels of education (from school to university) were constantly deprived of sleep or suffered from poor sleep quality. This causes daytime drowsiness as a sign of insufficient quality or quantity of nighttime sleep. The drop in sleep quality is closely related to students' learning capacity and academic performance, and sleep loss is often accompanied by poor learning and reduced oral and written performance in students (14).

A brief napping throughout the day is a new strategy for alertness management and is shown to improve the negative effects of inadequate sleep (15). This strategy is grounded on a potential way to reduce daytime sleepiness (16). Laboratory studies have demonstrated the beneficial effects of napping on biological systems, including cognitive functioning, stress, immunity, and pain management. In addition, laboratory findings have pinpointed that taking a 20-30-minute nap at noon

assists improving the mood and mental states (17, 18), depression due to insufficient sleep (19), learning process, personal ability (15), learning capacity, creativity and energy, reduced stress, increased stamina, improved perception and sexual functions, and helps in weight loss and decision making (20).

Chronic sleep deficiency and inadequate sleep are the main underlying causes of drowsiness during the day (8), while adolescents compensate their sleep deprivation by napping during and after school hours (5). On the other hand, resting throughout the day improves cognitive functioning and has a positive effect on brain activity (21), verbal declarative memory, memory consolidation, and academic performance (16). Due to the dearth of research on the effectiveness of daytime napping on the academic performance of high school students in Iran, the present study was conducted with the aim of evaluating the effectiveness of daytime napping on the academic performance of high school students in Tehran, Iran. After-school educational activity was served as an index for measuring educational performance in this study.

Materials and Methods

This research was designed as a before-after study and was carried out using the following steps:

Participants

A total of 56 students from a high school in Tehran were recruited in the present study. All students were selected from the same grade; thus, they all had equal educational condition. The participants were matched for socioeconomic status as well as the quantity and quality of formal education in the school. Prior to the study, official permission was obtained through a formal letter to the parent-teacher association.

Implementation of school-based sleep program

Three days prior to the study, the benefits and impacts of daytime naps and the principles of napping were instructed as a 60-minute training session for the participants. Students were also asked to specify the number of nights sleeping less than 7 hours in the last week on a 4-option scale of "no night", "one or two nights", "most nights", and "all nights". The assessment method was validated by an expert panel.

Families were also informed about the implementation of the school-based sleep program and students were asked to have sleeping equipment.

During the study period which lasted for 12 school days (two weeks), subsequent to the morning classes at 12:10, the students went to the school hall to get a 50-minute sleep. The sleep program lasted until 13:00. During the sleep time, students were not allowed to do other work, such as studying or speaking to others. Two observers were also present at the hall to monitor the program. After the end of the sleep program, routine school schedule was resumed.

Recording the amount of after-school educational activity

Students were given a sheet for recording after-school educational activities. Students were asked to record the amount of time spent on each lesson out of school setting per day in minutes. This sheet was validated by an expert panel including experienced teacher, counselor, and an education specialist. The amount of students' daily after-school educational activities was recorded during the two weeks prior to and two weeks after the school-based sleep program. At the end of the program, the students' data were collected and analyzed.

Results

The subjects recruited in this study were 56 high school students. Their average age was 15.3 years. All of the students were matched for socioeconomic status. The average school-day length was 9 hours and 15 minutes (the lowest was 8.5 and the highest was 11.5 hours).

Weekly after-school educational activity

Descriptive statistics of weekly after-school educational activity for 4 weeks are summarized in table 1. The school-based sleep program was conducted in the third and fourth weeks.

Moreover, the trend of variations in the level of a student's weekly after-school educational activity during the four weeks of implementation of this program is shown in figure 1.

Participants had an average of 2059.50 minutes after-school educational activity during the two weeks preceding the intervention, which reached

2388.11 minutes after the implementation of the school-based sleep program. Thus, the amount of weekly after-school educational activity significantly improved after the implementation of the sleep program ($P < 0.05$).

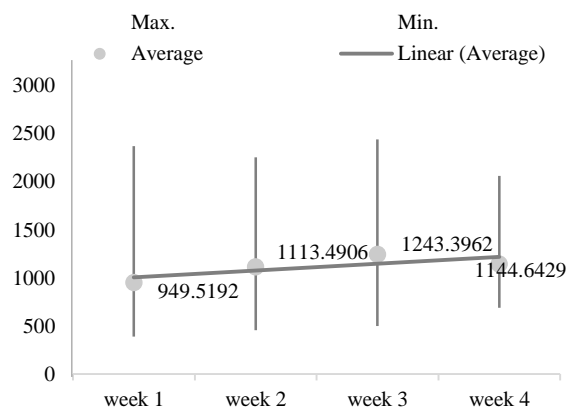


Figure 1. The trend of variations in the level of a student's weekly after-school educational activity during the four weeks

The frequency of nocturnal sleep less than 7 hours is summarized in table 2. Accordingly, there was no significant association between improved weekly after-school educational activity and the amount of nocturnal sleep before in-school sleep program ($F = 2.047$, $P = 0.121$).

Discussion

According to the results of this study, there was a significant positive association between daytime napping and the after-school educational activity in male students. In other words, the students' weekly after-school educational activity was significantly higher than prior to the intervention, so that the out-of-school activity of the participants was noted an average of 2059.50 minutes for two weeks prior to the study and this rate reached 2388.11 minutes. In addition, no significant difference was seen in weekly after-school educational activity improvement between students' group with different amount of nocturnal sleep.

Table 1. Descriptive statistics of weekly after-school educational activity (minute) for 4 weeks

Activity	N	Range	Minimum	Maximum	Mean ± SD
Week 1	52	1980.00	390.00	2370.00	949.51 ± 371.69
Week 2	53	1800.00	455.00	2255.00	1113.49 ± 367.54
Week 3	53	1940.00	500.00	2440.00	1243.39 ± 385.59
Week 4	56	1370.00	690.00	2060.00	1144.64 ± 326.60
Total before intervention	51	3545.00	865.00	4410.00	2059.50 ± 684.02
Total after intervention	53	3240.00	1260.00	4500.00	2388.11 ± 646.70

SD: Standard deviation

Table 2. Frequency of nocturnal sleep ≤ 7 hours one week prior to the study and the mean of weekly after-school activity improvement in each group

	n (%)	Weekly after-school activity improvement (minute) (mean \pm SD)
No night	12 (21.4)	478.75 \pm 311.68
2-3 nights per week	16 (28.6)	165.00 \pm 362.68
Most nights	21 (37.5)	490.58 \pm 588.88
All nights	7 (12.5)	163.75 \pm 80.24

SD: Standard deviation

The authors have served after-school educational activity as educational/school performance index because of some educational and cultural issues in Iran, which make high school students continue their school activity at home in order to prepare themselves for national exams. Thus, after-school educational activity is an important concern for Iranian adolescents, which is improved by some strategies such as daytime sleep programs for next achievements. Hence, this concept was served as an important index for probable school-based interventions. However, studies on the association between sleep and education have especially focused on other educational/school performance indices such as memory and attention.

Dozens of research on adults have claimed that a 30-60-minute tactical snooze plays a role in increasing the perceptual learning of individuals as equal to approximately 8 hours of nocturnal sleep (22). Similarly, several literatures in the field for teens concur with these findings.

The results of a research in Singapore on 57 students showed that the rate of memory process and learning retention was significantly higher among students with an experience of daytime napping.

To put it in a nutshell, the literature has recognized the reduced adverse effects of sleep deprivation using daytime sleep (23). Another research on Chinese teens investigated the impact of sleep habits, especially during the midday, on verbal declarative memory in adolescents and reported a successful recall of two exercises among the cases who had received one-hour sleep intervention compared to the controls. Therefore, the findings of this study provide information on improved memory stabilization in participants with napping in their natural habitat. In addition, other result detected by this data is that this sleep habit has the potency to be an applied recompense strategy for students (16).

A cohort study in Denmark used the data obtained from standardized tests conducted on 570376 Danish students aged 6-10 years and marked a significant and considerable improvement in test results after 20-30 minutes rest, which

implies that resting has a positive impact on cognitive performance at least in the short term (24).

In addition, research data in China indicated that participants who experienced a 30-60-minute midday napping had a higher level of attention and performance in tasks, indicating a positive association between daytime napping and neurocognitive functions among teens. As in China, midday napping is embedded as an after-lunch program for many adults in workplaces and students in school settings. In this vein, literature has recognized that individuals who had a daily nap within 5-7 days of the week had higher potential for non-verbal reasoning and spatial memory (25).

Conclusion

It can be said that all of the aforementioned studies have been consistent with the present study in terms of the beneficial effects of the midday nap on adolescents and would confirm the significance of this study. Therefore, only 15% of adolescents obtain the recommended > 9 hours of nocturnal sleep (26). The important point is that sleep deprivation, insufficient rest, and the subsequent sleepiness affect the physical and psychological well-being of adolescents and are associated with high levels of depression, physical complaints such as headache, abdominal pain, fatigue, lack of concentration, and reduced academic performance (27).

The strategic use of daytime napping is shown to reduce fatigue and mistake and improve the cognitive and psychomotor performance (28), attention, and individual capacity for learning (29).

It seems that the educational policymakers could consider planned nap as a countermeasure technique against poor academic performance due to sleep pressure (23), given its potential effectiveness in academic learning (22).

It should be noticed that authors could not access to cognitive profile of the participants such as memory domains, attention, and executive functions because of some limitations in conducting this study. However, it is important to design and

conduct complementary studies in order to evaluate the relationship between after-school activity and cognitive domains and the impact of consequent sleep quantity and quality in students.

Conflict of Interests

Authors have no conflict of interests.

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