The Impact of Physical Activity on Sleep Quality

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Abstract

Background: Physical activity participation is known to be beneficial to both objective and subjective sleep. However, the benefits may depend upon the amount of time engaged in physical activity.
Purpose: This study aimed to investigate the impact of different durations of physical activity (PA) participation on the quality of sleep among 100 college students. It was hypothesized that greater levels of moderate-to-vigorous physical activity (MVPA) would increase sleep efficiency and total sleep time (TST).
Methods: 100 students who were recruited from Fudan University voluntarily participated in the study. Students' PA and sleep data were objectively collected through the ActiGraph Activity Monitor (wBT3x-BT) which each participant wore for 7 consecutive days. To investigate the relationships between levels of physical activity participation and quality of sleep, data were analyzed by means of descriptive statistics, an independent t-test, bivariate correlation, and multiple R-squared linear regression.
Results: The independent t-test indicated that Group 1 (n = 59) ($\bar{x}$ = 34.496 min. MVPA per day) exhibited significantly higher levels of sleep efficiency and total sleep time than did Group 2 (n = 41) ($\bar{x}$ = 70.826 min. MVPA per day) (t = 4.064, p < .01; t = 4.074, p < .01). Furthermore, the results of the multiple linear regression indicated that sleep efficiency and total sleep time were significantly associated with daily MVPA (F = 23.104, p < .01)
Conclusion: The results rejected our hypothesis. 60 minutes or more of MVPA per day resulted in lower sleep efficiency and less total sleep time. Therefore, moderate levels (<60 min. MVPA per day) should be carried out for optimal sleep quality.

Actigraph Activity Monitor (wBT3x-BT)

Research Purpose

The purpose of this research is to investigate the impact of different durations of moderate-to-vigorous physical activity participation on the sleep quality of college students.

Hypothesis: Greater levels of moderate-to-vigorous physical activity (MVPA) will increase sleep efficiency (the percentage of time spent asleep to the time spent lying in bed) and total sleep time (TST) (the number of minutes one is asleep).

Background: Moderate physical activity includes activities such as bicycling or brisk walking; vigorous physical activity refers to activities that result in significant increases in breathing or heart rate, such as running or dancing. The majority of prior studies investigate the impact of various intensities of exercise on sleep quality; our study investigates the impact of different durations of MVPA participation on sleep quality.

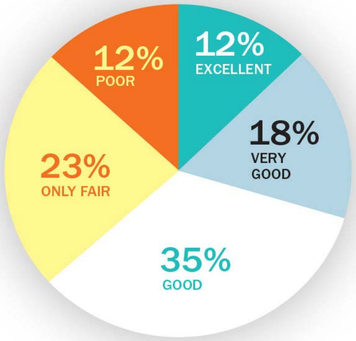
Methods

Sample: 100 students were recruited from Fudan University in Shanghai, China (83 male, 17 female; mean age = 18.54 years)

Procedure: The physical education teachers distributed an ActiGraph Activity Monitor (wBT3x-BT) to each of the participants. The total time in bed (TBT) for each of the participants was instructed to be 600 minutes per night throughout the week.

Measures: The 100 participants wore the ActiGraph Activity Monitor (wBT3x-BT) for 7 consecutive days starting from Monday at 8:00 AM through the next Monday at 8:00 AM. The device was to be worn on the right wrist using an elasticated belt, worn during the day and throughout the evening except when showering or swimming. The students utilized a daily wearing log by marking an "X" in the spaces provided for each day of the week to indicate that they wore the device. To find the current levels of daily and weekly physical activity among the college students as well as their current sleeping patterns, descriptive statistics were conducted. To investigate the relationships between levels of physical activity participation and quality of sleep, bivariate correlation and multiple R-squared linear regression analyses were conducted.

The students' data were divided into two groups: Group 1 (the 59 students with an average of less than 60 minutes of MVPA per day) and Group 2 (the 41 students with an average of 60 minutes or more of MVPA per day).



Results

Table 1 shows the descriptive statistics of each of the 2 groups:

- **Mean MVPA** for Group 1 = 34.49641 minutes (SD = 10.284091 min.; SE = 1.338875 min). Group 2 mean MVPA = 70.82623 minutes (SD = 15.717502 min; SE = 2.454661 min).
- **Mean sleep efficiency** for Group 1 = 91.9986% (SD = 2.3099%; SE = 0.38158%). Group 2 mean sleep efficiency = 88.8012% (SD = 4.40510%; SE = 0.68796%).
- **Mean total sleep time** for Group 1 = 552.0593 minutes (SD = 17.67335 min.; 2.30087 min). Group 2 mean total sleep time = 532.8076 minutes (SD = 26.43107 min.; SE = 4.12784 min).
- **Mean total MVPA** for Group 1 = 274.6412429 minutes (SD = 81.92563803 min.; SE = 10.66580960 min). Group 2 mean total MVPA = 566.6097561 minutes (SD = 125.7403885 min.; SE = 19.63734949 min).

The independent t-test indicated that Group 1 exhibited significantly higher levels of sleep efficiency and total sleep time than did Group 2 (t = 4.064, p < .01; t = 4.074, p < .01). Furthermore, the results of the multiple linear regression indicated that sleep efficiency and total sleep time were significantly associated with daily MVPA (F = 23.104, p < .01)

Conclusion

Our findings indicated that greater durations of MVPA (≥60 min. per day) compared to lower levels of MVPA (<60 min. per day) result in lower sleep efficiency and less total sleep time. Therefore, the results rejected our hypothesis. This study suggests that moderate levels (<60 min. MVPA per day) should be carried out for optimal sleep quality.

Discussion

In other studies, participants' levels of physical activity are often manipulated through interventions (Kalek, et. al, 2012; Flausino, et. al, 2011; Bulckaert et al, 2011). Furthermore, the majority of studies take an all-or-nothing approach, in which a control group engages in little-to-no exercise. However, our study took a more naturalistic approach, as all of the students continued their own exercise routines as well as their regular physical activity classes. To investigate the data, the students were sorted into 2 groups according to their levels of MVPA in minutes. This study suggests that those who experience sleep problems may try to avoid engaging in greater levels of MVPA (≥60 min. per day) to experience enhanced sleep quality. However, further investigation should be conducted to determine the optimal level of physical activity for maximum quality of sleep.

	Sample Size (N)	Mean	Std. Deviation	Std. Error
Avg. MVPA per day	**Group 1**: 59 **Group 2**: 41	**Group 1:** 34.49641 **Group 2:** 70.82623	**Group 1**: 10.284091 **Group 2**: 15.717502	**Group 1:** 1.338875 **Group 2:** 2.454661
Efficiency	**Group 1**: 59 **Group 2**: 41	**Group 1**: 91.9986% **Group 2:** 88.8012%	**Group 1:** 2.3099% **Group 2**: 4.40510%	**Group 1:** 0.38158% **Group 2**: 0.68796%
Total Sleep Time (TST)	**Group 1**: 59 **Group 2**: 41	**Group 1:** 552.0593 **Group 2:** 532.8076	**Group 1**: 17.67335 **Group 2**: 26.43107	**Group 1**: 2.30087 **Group 2:** 4.12784
Total MVPA	**Group 1**: 59 **Group 2:** 41	**Group 1:** 274.6412429 **Group 2:** 566.6097561	**Group 1**: 81.92563803 **Group 2:** 125.7403885	**Group 1:** 10.66580960 **Group 2:** 19.63734949

T-Test
Table 1. Group Statistics
(Group 1 = <60 min. MVPA; Group 2 = ≥60 min. MVPA