

Effects of Pre-Sleep Anaerobic vs. Aerobic Activity on Young Adults' Sleep Duration, Quality, Onset Latency, and Night-Time Awakenings

Xu Han

*College of Letters and Science, University of California, Davis, USA
hanxu20070830@126.com*

Abstract. The impact of exercise type and temporal proximity of exercise on young adults' sleeping patterns remains inadequately explored. Prior studies were often focused on one exercise type and frequently contained gender imbalances, small samples, and a lack of control for confounding variables. This study aims to study how anaerobic and aerobic exercise prior to sleep and the temporal proximity to sleep affect the sleep duration, onset latency, and nighttime awakenings in Chinese young adults. It takes a deductive approach, starting with 2 research questions and 4 hypotheses. A quantitative, cross-sectional survey was distributed to 41 participants (aged 18-22) via WeChat. Data on pre-sleep exercise (type, intensity, and duration), previous-night sleep metrics (sleep duration, onset latency, and nighttime awakenings), and potential confounders (caffeine intake, stress, and chronic conditions) were collected. Participants reporting high stress, caffeine intake, or pre-existing conditions were excluded from the data. Compared to no exercise (58.5% of sample), the aerobic exercise (29.3%) group had better sleep outcomes, with a 25.0 percentage-point increase in achieving ≥ 7 hours of sleep and a 29.2 percentage-point increase in falling asleep within 15 minutes. The anaerobic group (12.2%) also showed better outcomes than the no-exercise group, though the sample size was small. This study concluded that aerobic activity 2-3 hours before bedtime was associated with the most favorable sleep outcomes across all three indicators. Therefore, it is recommended to participate in moderate level aerobic exercise 2-3 hours before sleep to ensure optimal sleep quality.

Keywords: Pre-Sleep Exercise, Aerobic/Anaerobic Exercise, Temporal Proximity, Young Adults, Sleep Quality

1. Introduction

Adolescence sleep continues to receive substantial attention, as it is crucial for physical growth, cognitive development, and emotional well-being [1]. However, the intricate interplay between pre-sleep physical exercise and sleep remains a topic that is inadequately and incomprehensively explored. Anaerobic and aerobic exercise are common in the evening routines of young adults, but how they impact sleep duration, quality, onset latency, and night-time awakenings lacks exploration. The objective of this study is to examine the relationship between the type of physical activity

(aerobic versus anaerobic), its timing relative to sleep, and the subsequent sleep outcomes. Furthermore, this article proposes practical recommendations and workable strategies to help with the integration of evening exercise into one's schedule so that it does not adversely impact the quality of sleep. This paper can guide young adults to optimize their evening exercise routines, thereby promoting better sleep hygiene and overall health.

2. Literature review and hypothesis

A critical research gap exists: the majority of prior studies on the effects of physical activity on sleep have focused exclusively on a single gender, have shown substantial gender imbalances or consist completely of one gender in their experimented or surveyed sample population [1-3]. Moreover, sample sizes have typically been insufficient to produce generalizable conclusions [4]. Due to time constraints, these investigations have frequently failed to incorporate participants with poor sleep quality, and have likewise neglected to control for individual chronotypes and pre-sleep behaviors—such as caffeine consumption and pre-existing health conditions [4,5]. Furthermore, key characteristics of physical activity, including its type and duration, remain unexamined [6].

Hence, this study proposes four hypotheses:

H1: Moderate-intensity aerobic activity 2–3 hours before sleep enhances sleep duration and quality, shortens onset latency, and reduces nighttime awakenings.

H2: High-intensity anaerobic activity within 1 hour of sleep prolongs onset latency, lowers sleep quality, and increases awakenings.

H3: High intensity anaerobic activity within 1 hour of sleep will have a more adverse effect on sleep compared to high intensity aerobic activity.

H4: Both Low-intensity anaerobic and aerobic activity within 1-2 hours before sleep shortens onset latency.

3. Methodology

3.1. Research design

This paper analyzes how the type of physical activity (aerobic versus anaerobic), and its temporal proximity to sleep, relate to the sleep outcomes of Chinese young adults aged 18-22. This study measures sleep quality with these variables: Sleep Duration, Quality, Onset Latency, and Night-Time Awakenings. Consequently, two research questions were defined as: “What are the differences in sleep outcomes—including sleep quality, latency, duration, and nighttime awakenings—between participating in aerobic exercise, anaerobic exercise, or no exercise within three hours prior to bedtime?” and “Does the temporal proximity of exercise prior to sleep (<1 hour, 1–2 hours, 2–3 hours, or >3 hours) affect the relationship between exercise type and sleep quality in young adults?” The study adopts a positivist approach and collects data objectively through an online survey. The research adopts a quantitative, correlational design and takes a deductive approach, starting with 2 research questions and 4 hypotheses. The data for this study is cross-sectional.

3.2. Participants and sampling

The study involves Chinese young adults aged 18-22. Two separate batches of participants were randomly surveyed on September 2nd and 3rd, 2025, respectively, within a 48-hour window. The survey was handed out to participants via WeChat (a popular Chinese social media app).

This study surveyed a valid sample of 41 participants. Amongst them, 22 were male (53.7%) and 19 were female (46.3%). The distribution of exercise types within the 3 hours before bedtime was aerobic – 12 participants (29.3%), anaerobic – 5 participants (12.2%), and no exercise – 24 participants (58.5%). Among those who exercised ($n=17$), the time interval between exercise and bedtime was 1–2 hours for 5 participants (29.4%), 2–3 hours for 8 participants (47.1%), and >3 hours for 4 participants (23.5%). There are no sample of participants who exercised less than 1 hour before bed.

3.3. Data collection and processing

Data was collected through an online survey that takes on average 93 seconds to complete and is divided into four sections: General information, pre-sleep exercise habits, sleep situation last night, and other information. Part A asks for the general information of the participants, whether they are between 18 and 22 years old, their gender, and whether last night was a weekday or weekend. Part B inquires about pre-sleep exercise information. This section assessed the frequency of engaging in physical activity, asking questions like how many days last week the participant engaged in physical activity within 3 hours before bed, whether or not they engaged in physical activity three hours before bed last night, and, if so, what type of physical activity they engaged in: aerobic (running, cycling, swimming, ball-related sports) or anaerobic activity (strength training, HIIT training, plyometrics, sprint training). If the participants answered no to this question, they are automatically directed to part C. Then participants were asked about the temporal proximity of the exercise prior to sleep (<1 hour, 1–2 hours, 2–3 hours, or >3 hours) and their perceived intensity of the exercise. Exercise intensity was categorized into three levels: low, medium, and high. To better help participants recall their exercise intensity, the survey described low-intensity exercise as being able to breathe steadily and talk easily during the exercise, medium-intensity exercise as breathing moderately and being able to talk briefly, and high-intensity exercise as breathing rapidly and feeling difficult to talk. Afterwards, they were asked for the duration of the exercise (15–30 mins, 31–45 mins, 46–60 mins, or >60 minutes). Part C asks for the participant's sleep quality last night through their total sleep duration (<5 hours, 5–6 hours, 6–7 hours, or 7–8 hours), onset latency (<15 mins, 15–30 mins, 30–45 mins, 45–60 mins, or >1 hour), and nighttime awakenings (0, 1, or >2 times). Part D surveys other habits that the participants may have that could confound the results of the study. Questions include whether the participants had caffeine intake within 4 hours before bed, whether or not they were diagnosed with chronic or mental illnesses, and their perceived stress level last week ranging from 1 to 5. For data processing, if they answer “yes” to ingesting caffeine or having a chronic and mental illness diagnosis, or if their stress level is 4 or above, they are automatically excluded from the data.

4. Results

4.1. By exercise type

Compared with no exercise, anaerobic exercise was associated with better sleep outcomes through the three sleep indicators. Table 1 shows the proportion of participants who slept ≥ 7 hours was 75.0% (aerobic) vs. 50.0% (no exercise), suggesting a difference of +25.0 percentage points. As demonstrated in Table 2, the proportion of participants falling asleep within 15 minutes was 66.7% (aerobic) vs. 37.5% (no exercise), showing a difference of +29.2 percentage points. Table 3 illustrates that the number of 0 night awakenings was 58.3% (aerobic) vs. 54.2% (no exercise), a

difference of +4.1 percentage points. The anaerobic group showed proportions of 60.0%, 60.0%, and 60.0%, respectively (n=5), better than the no-exercise group in “sleeping 7 hours or more” and “falling asleep within 15 minutes,” and “0 night awakenings,” and worse than the aerobic group in “sleeping 7 hours or more,” “falling asleep within 15 minutes,” and similar to the aerobic group in “the number of 0 night awakenings”, but the sample size was small.

Table 1. Exercise type and measures of sleep duration

Exercise type	How many hours did you sleep last night				% sleep duration>7 hours
	5-6 hours	6-7 hours	7-8 hours	Total	
No exercise	6	6	12	24	50%
Aerobic exercise		2	3	5	60%
Anaerobic exercise		3	9	12	75%
Total	6	11	24	41	

Table 2. Exercise type and measures of onset latency

Exercise type	How long did it take for you to fall asleep?						% Fall asleep within 15mins
	>60mins	45-60mins	30-45mins	15-30mins	<15 mins	Total	
No exercise	2	1	1	9	11	24	37%
Anaerobic exercise			1	3	1	5	60%
Aerobic exercise	1		1	8	2	12	66%
Total	3	1	3	20	14	41	

Table 3. Exercise type and measures of night time awakenings

Exercise type	How many times did you wake up last night				% who woke up 0 times
	0 times	1 time	≥2times	Total	
No exercise	13	10	1	24	54%
Anaerobic exercise	3	2		5	60%
Aerobic exercise	7	4	1	12	58%
Total	23	16	2	41	

4.2. By time window before bedtime, exercise group only

Among the four time windows, there were no records of exercise within <1 hour before bedtime. The proportions of “good sleep indicators” in the remaining three time windows are shown in Tables 4, 5 and 6.

Table 4. Temporal proximity of exercise to sleep and measure of sleep duration

Temporal proximity to sleep	How many hours did you sleep last night			% sleep duration > 7 hours
	6-7 hours	7-8 hours	Total	
1-2 hours	1	4	5	80%
2-3 hours	4	4	8	50%
>3 hours		4	4	100%
Total	5	12	17	

Table 5. Temporal proximity of exercise and measures of onset latency

Temporal proximity to sleep	How long did it take for you to fall asleep?					% Fall asleep within 15mins
	15mins	15-30mins	30-45mins	>60mins	Total	
1-2 hours	2	3			5	40%
2-3 hours	1	5	2		8	62.5%
>3 hours		3		1	4	75%
Total	3	11	2	1	17	

Table 6. Temporal proximity of exercise and measures of nighttime awakenings

Temporal proximity to sleep	How many times did you wake up last night				% who woke up 0 times
	0 times	1 time	≥2 times	Total	
1-2 hours	2	2	1	5	40%
2-3 hours	5	3		8	62.5%
>3 hours	3	1		4	75%
Total	10	6	1	17	

Overall, the >3-hour group had the best performance for all three indicators. Compared to the 1–2 hour group, the 2–3 hour group performed slightly better in “falling asleep within 15 minutes” (+2.5 percentage points) and “0 night awakenings” (+22.5 percentage points), but lower in “≥7 hours of sleep” (–30.0 percentage points). The 2-3 hour group performed the worst in the “≥7 hours of sleep” criteria.

5. Discussion

This study helps guide young university students to better navigate their sleep schedule and helps better incorporate exercise into their evening schedule. In this study’s sample population, aerobic exercise was associated with better sleep outcomes compared to no exercise, especially in achieving ≥7 hours of sleep (100 percentage points). Additionally, when the time window was larger (i.e., >3 hours before bedtime), it was linked to better sleep quality. Due to the small sample size in the anaerobic group (n=5) and the >3 hours group (n=4), and the lack of data within the <1 hour window, there are limitations in this study. Hypotheses H2/H3 (“<1 hour high-intensity anaerobic exercise is more detrimental”) and (low-intensity anaerobic and aerobic activity within 1-2 hours before sleep shortens onset latency) could not be directly tested. The generalizability of the findings

is limited by the age of our research participants, all being in the age range of 18-22. Future research should include a larger sample, cover the <1 hour window, explore more on how exercise intensity plays a role in determining onset latency and overall sleep quality, and include a larger age group to improve generalizability. This research study supports previous studies done on athlete and non-athlete students that show aerobic exercise significantly improved sleep quality [7-8].

6. Conclusion

In this university student sample, aerobic exercise within the 3 hours before bedtime was associated with better sleep. Furthermore, exercising earlier before bedtime — $\geq 2-3$ hours, and preferably >3 hours before bedtime—was linked to longer sleep duration, quicker sleep onset and fewer night awakenings. Therefore, it is recommended for university students to do moderate intensity aerobic exercise approximately 2-3 hours before bed and avoid high intensity workouts close to bedtime.

This study is limited by a small sample size in the anaerobic group ($n=5$) and the >3 hours group ($n=4$), and the lack of data within the <1 hour window. Due to the small sample size, the study failed to reach conclusion within the anaerobic exercise group and couldn't compare the sleep outcomes between the two exercise groups (aerobic and anaerobic). This study also didn't take exercise intensity into account due to the lack of data. Hence, it is strongly suggested to acquire a sufficient sample size before conducting the study. Future research can seek to explore how aerobic and anaerobic exercise differ in how they affect sleep outcomes, and how exercise intensity plays a part in this difference.

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