

Move more, sleep more? Examining the impact of exercise duration on sleep quantity among undergraduate students at the University of Washington

Raahul Narayanan ^{1,*}, Esther Carpenter ², Leslie Jacobo ², Binqi Li ², Tyler Reynolds ³ and Jack Evers ⁴

¹ Perelman School of Medicine, University of Pennsylvania, USA; University of Washington School of Public Health, University of Washington, USA.

² University of Washington School of Public Health, University of Washington, USA.

³ Duke University School of Medicine, Duke University, USA; University of Washington School of Public Health, University of Washington, USA.

⁴ College of Health, Oregon State University, USA; University of Washington School of Public Health, University of Washington, USA.

World Journal of Biology Pharmacy and Health Sciences, 2024, 19(01), 112–117

Publication history: Received on 26 May 2024; revised on 01 July 2024; accepted on 04 July 2024

Article DOI: <https://doi.org/10.30574/wjbphs.2024.19.1.0399>

Abstract

Understanding the relationship between exercise duration and sleep quantity among undergraduate students is essential for promoting their overall health and well-being. This study investigates this association through a cross-sectional survey of 51 students aged 18-24 at the University of Washington. The results indicate an average daily exercise duration of 32 minutes and a mean sleep duration of 7.0 hours. Analysis reveals that students with higher exercise durations exhibit a 14% reduced odds of achieving high sleep quantity compared to those with lower exercise durations. Notably, caffeine consumption serves as an effect modifier in this relationship. These findings suggest that increased exercise does not necessarily correlate with increased sleep in this population, emphasizing the need for a nuanced understanding of the factors influencing sleep among college students. Addressing these variables can inform the development of targeted interventions to enhance student health and academic performance.

Keywords: Exercise duration; Sleep quantity; Sleep quality; Caffeine; College students

1. Introduction

The rapid pace of student life on large university campuses in the United States poses an issue of balancing time commitments. These constraints can impact spare time designated for physical activity and time allocated for sleep [1]. Sleep is vital for cognitive and physical health, allowing the human body to function more effectively [2]. As many as 50% of college students report daytime sleepiness, and 70% report attaining an insufficient amount of sleep [1]. Exercise has been observed to improve people's overall health, help reduce short-term anxiety, and lower the risk of disease. However, due to time constraints, sedentary lifestyles are becoming increasingly common [3, 4]. This study aims to investigate the association between exercise duration and sleep quantity in undergraduate college students.

Previous research has explored the association between exercise quantity and sleep duration in other study populations [5]. In a study on renal transplant patients, after ten weeks of exercise activity, an improved quantity and quality of sleep was observed among the participants [6]. Public health research exploring the association between exercise quantity and sleep duration among college students has been limited. This study focuses on understanding the relationship between the average daily duration of exercise and the average sleep quantity among undergraduate students aged 18-24 at the University of Washington. Developing an improved understanding of this relationship in

* Corresponding author: Raahul Narayanan

students at large public universities (35,000+ students) could aid in constructing interventions that promote the health of this community.

2. Material and Methods

A cross-sectional study using convenience sampling, a subset of non-probability sampling, was conducted. A cross-sectional survey was administered to 51 undergraduate students aged 18 to 24 at the University of Washington. This method was employed as it was low-cost, highly feasible, and convenient.

The target population was undergraduate college students aged 18 to 24 at large (35,000+ students) public universities in the United States. The source population was undergraduate students at the University of Washington. To be included in this project, participants must have been undergraduate students at the University of Washington aged between 18 to 24. To limit skewed results, individuals formally diagnosed by a physician with sleep disorders, including insomnia, sleep apnea, narcolepsy, restless leg syndrome, parasomnias, and REM sleep behavior disorder, were excluded.

The survey was a participant-administered electronic survey. Participants independently completed this survey electronically by filling out a Google form that could be accessed in the form of a hyperlink or QR code on a recruitment flier. The survey had four distinct sections: consent, demographic information, caffeine consumption, and exercise and sleep habits. The survey employed a combination of multiple-choice, multiple select, and binary choice question formats. One open-ended question on factors that contribute to sleep duration was asked. Demographic information on gender identity, class standing, and age was gathered; however, these questions were not intended nor specific enough to personally identify participants.

Informed consent was obtained from all participants before they started the survey. It was clearly communicated in the electronic survey that by proceeding, participants agreed to take part in the study and consented to the use of their responses for research purposes, including the publication of relevant data. This ensured their acceptance of participation in the study and the publication of relevant data in the journal.

The daily duration of exercise was measured by asking participants to report the number of minutes they engaged in physical activity above the intensity of a brisk walk. Activities could include biking, jogging, weightlifting, and team sports. Exercise durations were categorized to distinguish between higher and lower levels of physical activity. Sleep quantity was assessed by asking participants to report their total amount of sleep occurring in 24 hours, averaged over one week. This included both nighttime sleep and naps. Sleep durations were categorized to identify those who achieved a higher quantity of sleep. Caffeine consumption was considered a potential confounder due to its possible effects on both exercise and sleep. Participants reported their daily caffeine intake, which was then calculated by multiplying the number of servings of caffeinated beverages or substances by the caffeine content per serving. Additional potential confounders included class standing, which could influence both sleep and exercise patterns.

Data analysis involved calculating average exercise and sleep durations, and creating binary variables to facilitate the calculation of odds ratios. Stratification by caffeine consumption levels was performed to examine its modifying effect on the relationship between exercise and sleep. Qualitative responses to the open-ended question about factors influencing sleep were analyzed using qualitative content analysis. Text responses were categorized into themes, with detailed codes developed to capture the factors contributing to more or less sleep. Two researchers conducted the analysis independently to ensure consistency and accuracy in identifying themes.

3. Results

The sample size consisted of 51 participants, with an average age of 20 years. The majority of the population (66%) identified as cisgender women. The mean daily sleep duration was 7.0 hours, while the average exercise duration was 32 minutes per day. Among the participants, 75% reported sleeping less than 7 hours per day (Table 1).

Table 1 Population Characteristics of University of Washington undergraduate students, May 2022

Characteristic	Statistic (Mean (SD) or n (%))
Total respondents	51
Age	20 (1.3)
Gender identity	
Agender	2 (4%)
Cisgender man	7 (14%)
Cisgender woman	34 (66%)
Cisgender woman, Intersex	1 (2%)
Nonbinary	2 (4%)
Not reported	5 (10%)
Class Standing	
2022-2023 expected graduation	15 (29%)
2024-2027+ expected graduation	36 (71%)
Average exercise (minutes/day)	32 (36)
>21	25 (49%)
≤21	26 (51%)
Average daily sleep (hours/day)	7 (1.5)
>7	13 (25%)
≤7	38 (75%)
Caffeine Consumption (mg/day)	72 (595)
>135	11 (22%)
≤135	40 (78%)

*5 participants did not supply a response for gender

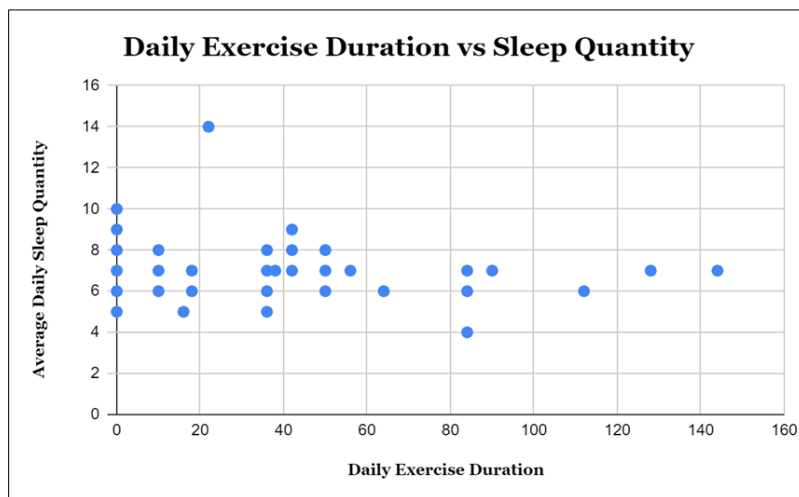


Figure 1 Plot of Daily Exercise Duration vs Sleep Quantity; University of Washington undergraduate students, May 2022 (N=51)

The mean exercise duration among participants was 32 minutes per day, with a standard deviation of 36. A majority exercised between 0 to 80 minutes per day, although several outliers exercised more than 100 minutes per day (Figure 1). An inverse relationship was observed between exercise duration and sleep quantity. The crude odds ratio (OR) of 0.86 suggested that participants with higher exercise duration had 14% reduced odds of achieving high sleep quantity compared to those with lower exercise durations (Table 2). Further stratification by caffeine consumption revealed that the adjusted OR for high caffeine consumers was 0.9, indicating a 10% lower odds of high sleep among those with high exercise levels compared to those with low exercise levels (Table 2). Conversely, for low caffeine consumers, the adjusted OR was 1.1, suggesting a 10% higher odds of high sleep among those with high exercise levels compared to those with low exercise levels (Table 2).

Table 2 Crude and adjusted OR's for the association between daily exercise duration and high sleep; UW undergraduate students Spring Quarter 2022 (N=51)

Group	High Sleep n/N (%)	Crude OR (95% CI)	Adjusted OR (95% CI)
High Exercise Duration	6/25 (24%)	0.86 (0.23 - 3.12)	0.90 (0.23 - 3.12)
Low Exercise Duration	7/26 (27%)	Referent	Referent

Qualitative data from the open-ended question about factors influencing sleep highlighted several themes. Participants reported that caffeine consumption, stress, sleeping environments, distractions, class schedules, bedtimes, extracurricular activities, social life, and school work all impacted their sleep duration. School work was the most commonly cited factor, with 24 participants mentioning it as a reason for reduced sleep. One participant noted, "The amount of sleep that I get each week depends on the intensity of schoolwork and studying each week" (20-year-old non-binary person). Increased social obligations were also reported to reduce sleep time. Only two participants mentioned exercise as a factor contributing to better sleep, with one stating, "I sleep better, or maybe my body just wants to fall asleep faster and deeper on days I work out" (18-year-old cisgender woman).

4. Discussion

The results indicate that the majority of UW students did not meet the recommended exercise duration, with only 49% exercising more than 21 minutes per day. The findings challenge the hypothesis that increased exercise duration correlates with higher sleep quantity, which is inconsistent with previous studies suggesting a positive correlation [2, 4, 7].

The study found an inverse relationship between exercise duration and sleep quantity, with higher exercise duration associated with lower odds of high sleep quantity. However, this relationship was modified by caffeine consumption. For high caffeine consumers, the relationship between exercise and sleep was negative, whereas for low caffeine consumers, the relationship was slightly positive. These findings support existing research that suggests that caffeine consumption may significantly influence the relationship between exercise and sleep [8, 9].

Qualitative responses revealed that numerous factors impact sleep duration, with school work and social obligations being the most frequently cited. The qualitative data highlighted that while exercise was mentioned by some participants as a positive factor for sleep, it was not the predominant factor affecting sleep duration. This suggests that other aspects of student life, such as academic pressures and social activities, may have a more substantial impact on sleep.

The study's strengths include the use of validated survey questions and the consideration of potential confounders such as caffeine consumption. However, limitations include the small sample size, potential recall bias from self-reported data, and selection bias due to convenience sampling. The findings are not generalizable to the entire University of Washington student population or other college student populations due to the likely overrepresentation of certain demographics, such as Public Health majors and cisgender women.

Future research should explore the complex relationship between exercise, caffeine, and sleep further, considering additional factors such as varying doses of caffeine and different types of physical activity. Reducing selection bias and increasing the diversity of the study sample would improve the generalizability of the findings.

5. Conclusion

Among undergraduate students at the University of Washington, there is no clear positive correlation between exercise duration and sleep quantity. Other factors, particularly school work and social obligations, appear to have a more significant impact on sleep. The findings suggest that addressing academic pressures and social commitments may be more effective in improving sleep quantity among college students than increasing exercise duration alone. Future research should further investigate these relationships to develop more comprehensive interventions for enhancing student health and well-being.

Compliance with ethical standards

Acknowledgements

We would like to thank all University of Washington undergraduate students who took part in this study. We also appreciate the support of professors and peers who provided valuable feedback throughout the research process. Special thanks to Dr. Kate West, PhD, and the University of Washington School of Public Health for their guidance and support.

Disclosure of conflict of interest

No conflict of interest to be disclosed.

Statement of ethical approval

The study was conducted in accordance with the ethical guidelines set forth by the University of Washington School of Public Health. These guidelines ensure that participants' rights and privacy are protected, and that the research is conducted with integrity and transparency. The data collected were kept confidential and used solely for the purposes of this research.

Statement of informed consent

Informed consent was obtained from all individual participants included in this study. Participation in the study was voluntary, and participants had the option to stop filling out the electronic form at any point without any consequences. The survey responses were anonymized to protect participants' privacy.

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