Background

Approximately, 44% of college students report insufficient sleep (<7 hours per night). Insufficient sleep is associated with Type 2 Diabetes, cardiovascular disease, depression, and obesity, all of which may be treated or modulated with physical activity (2-5). However, in addition to sleep deprivation, college students also report a lack of physical activity (6).

One measure of health that has been studied in relation to sleep health is physical fitness. Health-related physical fitness is broken down into cardiorespiratory fitness, muscular strength, muscular endurance, and flexibility. One study found that as the academic year progresses, sleep disturbances in young adults increase, and physical activity decreases (7). Additionally, sleep disturbances in teenagers were associated with poor performance on sprinting tests, flexibility, muscular strength, and poor academica (1, 8).

Previous studies on sleep and fitness have primarily focused on combative professions, such as those in the military, firefighters, or athletes (2, 9, 10). These studies showed that there is an insignificant effect of sleep deprivation on exercise, however, the subjects used in these studies were accustomed to sleep deprivation due to their professions. Previous studies that examined this relationship in young adults relied on subjective measures of sleep, and also have not examined the relationship between sleep architecture and physical fitness. The present study aimed to evaluate the relationship between sleep architecture and physical fitness.

Methods and Materials

Young adults ages 18-26 years (N= 28; See Figure 1 and Table 1) were recruited from the Sleep Architecture and Body Composition parent study via flyer advertisement and in person referral. Data collection occurred between November 2019 and March 2020 in Loor Classroom Building on the Rutgers Cook/Douglass Campus (Figure 2).

The study began with a scripted sleep and body composition protocol. Participants wore a wrist Actiwatch for 2 weeks to track sleep patterns. A sleep profiler device was worn on 2 non-consecutive nights to analyze sleep patterns and the amount of time spent in sleep stages (NREM1-4 and REM), and other sleep variables (WASO, total sleep time, sleep quality). Participants were then categorized as Sufficient Sleepers (>7 hrs) or Insufficient Sleepers (<7 hrs).

Statistical Analysis:
- Multiple Linear Regressions were run to evaluate the relationship between sleep architecture variables and physical fitness outcomes.
- Separate between subjects ANOVA were run to examine differences in physical fitness outcomes between Sufficient Sleepers vs. Insufficient Sleepers and Good vs. Poor Sleepers, respectively.

Results

Normal Sleep:
- There was a positive relationship between hand-grip strength and WASO (3.31 ± 1.4, p= .031).
- There was an absolute relationship between REM time and forward trunk flexion (5.014 ± 2.232, p= .038).
- There was a positive relationship between forward trunk flexion and NREM2 time (4.722 ± 1.849, p= .021).

Poor Sleep:
- There was a negative relationship between subjective sleep quality and hand-grip strength (5.664 ± 8.894, p= .048).
- There was also a negative relationship between the number of push-ups performed and subjective sleep quality (-8.270 ± 3.880, p= .048).
- This study was the first of its kind to evaluate the relationship between sleep architecture and low extremity muscular endurance.
- It was found that those who slept for longer and had better sleep quality were able to perform more push-ups.

Discussion

This project was able to be conducted thanks to the Department of Kinesiology and Health Honors Research Program, Rutgers Aresy Research Center, and mostly Dr. Andrea Spaeth and Emily Glavin. A special thanks to all participants for completing the assessments.

Acknowledgements

This project was able to be conducted thanks to the Department of Kinesiology and Health Honors Research Program, Rutgers Aresy Research Center, and mostly Dr. Andrea Spaeth and Emily Glavin. A special thanks to all participants for completing the assessments.