

High-Protein Diet Has No Effect on Sleep Quality and Quantity in Exercise-Trained Men and Women

Research Brief

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Abstract

Introduction: There is evidence to suggest that one's diet may affect sleep quality and/or quantity. The purpose of this investigation was to determine if a high-protein diet (>2.2g/kg/d) affected parameters of sleep in exercise-trained men and women.

Methods: Eighteen trained individuals participated in this 14-day randomized crossover investigation (mean±SD: age: 32±8 years; height: 162.9±29.0 centimeters; body weight: 65.6±6.0 kilograms; body fat percentage: 17.8±6.7 %). Subjects consumed a high-protein (>2.2 g/kg/d) and a lower protein diet (<2.2 g/kg/d) for 7 days in a randomized order. Total sleep time and quality was calculated through the use of Actiwatch wrist monitors and Actiware software (Phillips Respironics). Body composition was assessed via the Bod Pod®.

Results: There was a significantly higher intake of protein and calories during the high-protein phase of the study; however, there were no significant differences vis a vis the other dietary measures. There was no effect of protein intake on any measures of sleep.

Conclusions: The consumption of a high protein diet had no effect on sleep quality or duration.

Key Words: polysomnography, actigraphy, measurement

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Introduction

Previous research has shown that macronutrient intake may have an effect on sleep quality/quantity. For example, a study on the composition of a night workers daily diet, found that an increase in the consumption of carbohydrates by 20-30% resulted in longer sleep duration than an increase of 30-40% protein intake.¹ Previous studies have shown various effects on sleep with the intake of protein. One study found that low protein intake (<16% of total energy) was associated with poor quality of sleep and difficulty initiating sleep.² Conversely, sleep quality improved in a group of overweight individuals that consumed a high protein diet.³ The purpose of this investigation was to determine if a high-protein diet (>2.2 g/kg/d) affected parameters of sleep in exercise-trained men and women.

Methods

Participants

Eighteen subjects (6 male, 12 female) participated in this 14-day randomized crossover investigation (mean±SD: age: 32±8 years; height: 162.9±29.0 centimeters; body weight: 65.6±6.0 kilograms; body fat percentage: 17.8±6.7 %). All subjects were exercised trained (mean±SD: average years of training: 14±8 years; average hours of resistance training per week: 4±2 hours; average hours of aerobic exercise per

week: 4±2 hours). Subjects consumed a high-protein (>2.2 g/kg/d) and a lower protein diet (control, <2.2 g/kg/d) for seven days in a randomized order. Total sleep time and quality was calculated through the use of Actiwatch wrist monitors and Actiware software (Phillips Respironics, New Jersey). Subjects wore the Actiwatch wrist monitors 24 hours per day for 14 consecutive days.

Protocol

Body composition was assessed via Bod Pod. The Bod Pod was calibrated as per manufacturer's protocol prior to the start of testing, as well as between each subject. All participants were measured in controlled conditions. Participants were instructed to refrain from exercise and to fast for three hours before being tested. The participants wore minimal, athletic clothing, secured their hair in a cap and removed all metal jewelry. At least two sets of measurements were performed on each subject. If movement was noted by the software, a third measurement was tested.

Actigraphy

Actiwatch wrist monitors (Actiwatch Spectrum Plus, Phillips Respironics, NV, USA) were used to assess sleep and activity measures for the duration of the study. The participants were required to wear their activity monitors throughout this period and they were constantly monitored. Sleep data were derived from the Actiwatch monitors utilizing the default software provided with the monitors.

Statistical Analysis

Data is provided as mean ± SD. A $p \leq 0.05$ was considered statistically significant a priori and all statistics were analyzed using IBM SPSS 25.0 (version 25.0, IBM Inc., Armonk, NY).

Results

There was a significantly higher intake of protein and calories during the high-protein phase of the study; however, there were no significant differences vis a vis the other dietary measures (Table 1). There was no effect of protein intake on any measures of sleep or total daily activity (Table 2).

Table 1. Diet	Control	High-Protein
Kcal	1740±396	2105±451*
Protein (g)	122±50	214±63*
Carbohydrate (g)	176±64	165±65
Fat (g)	61±21	66±21
Kcal/kg/day	27.3±8.2	32.7±8.3*
Protein g/kg/day	1.9±0.9	3.3±1.2*
Carbohydrate g/kg/day	2.8±1.2	2.6±1.1
Fat g/kg/day	1.0±0.4	1.0±0.3

Data are expressed as the mean±SD. Legend: g- grams, kg – kilograms

*Significant difference between control and high-protein, $p < 0.0001$

Table 2. Sleep Quality and Duration	Control	High-Protein
Sleep duration (hours)	6.70±0.65	6.47±0.76
Onset latency (minutes)	12.2±15.0	15.0±13.0
Sleep efficiency (percent)	85.1±4.1	84.5±3.5
WASO (minutes)	48.3±20.4	44.1±11.1
Number of awakenings	24.1±5.4	23.6±6.4

Data are expressed as the mean±SD.

Legend:

Number of awakenings – number of times you wake up after falling asleep.

Onset latency – how long it takes to fall asleep.

Sleep efficiency – percentage of time you are actually sleeping after you fall asleep.

WASO – wake time after sleep onset (i.e., amount of time a person spends awake after first falling asleep).

Discussion

This is the first investigation of its kind that has examined the effects of a high-protein diet on sleep in trained men and women. There are numerous factors that affect sleep quality in individuals, especially in trained individuals. Travel time changes, performance stress, physical exhaustion, and improper macronutrient intake, have a negative effect on the sleep quality needed to maintain optimal performance.⁵

Protein consumption, especially high protein diets, have been observed to increase resting energy expenditure, which could possibly lead to changes in sleep quality.⁶ However, it is not entirely clear how protein intake affects sleep quality or duration. For example, a study by Lineseth (2013), shows an increase in sleep quality with the intake of protein. During this study a decrease in wake after sleep onset (WASO) was associated with a high protein diet when compared to a control diet.⁷ However, other studies have shown protein to play a negative effect on the quality of sleep, such as difficulty maintaining sleep.²

In the current investigation, individuals consumed a significantly higher amount of protein and calories. Although the sleep duration was lower than the recommended 7 to 9 hours of sleep, which is often found in the athletic population, there were no significant differences between the high protein and control conditions regarding sleep quality or duration.^{8,9,10}

In conclusion, further exploration should be examined to see if there is a relationship between protein intake and timing. This study was limited by a small sample size (n = 18), therefore generalizations should be made with caution.

Media-Friendly Summary

Consuming a high-protein diet has no effect on sleep duration or quality in those who exercise regularly.

Reference

1. Nehme, P., et al., *Effects of a carbohydrate-enriched night meal on sleepiness and sleep duration in night workers: a double-blind intervention*. Chronobiol Int, 2014. 31(4): p. 453-60.
2. Tanaka, E., et al., *Associations of protein, fat, and carbohydrate intakes with insomnia symptoms among middle-aged Japanese workers*. J Epidemiol, 2013. 23(2): p. 132-8.
3. Zhou, J., et al., *Higher-protein diets improve indexes of sleep in energy-restricted overweight and obese adults: results from 2 randomized controlled trials*. Am J Clin Nutr, 2016. 103(3): p. 766-74.
4. James, B.D., et al., *Total daily activity measured with actigraphy and motor function in community-dwelling older persons with and without dementia*. Alzheimer Dis Assoc Disord, 2012. 26(3): p. 238-45.
5. Lee, A. and J.C. Galvez, *Jet lag in athletes*. Sports Health, 2012. 4(3): p. 211-6.
6. Bray, G.A., et al., *Effect of dietary protein content on weight gain, energy expenditure, and body composition during overeating: a randomized controlled trial*. JAMA, 2012. 307(1): p. 47-55.
7. Lineseth, G., P. Lineseth, and M. Thompson, *Nutritional effects on sleep*. West J Nurs Res, 2013. 35(4): p. 497-513.
8. Foundation, N.S. *Sleep and Recovery*. 2018; Available from: www.nationalsleepfoundation.org.
9. Leeder, J., et al., *Sleep duration and quality in elite athletes measured using wristwatch actigraphy*. J Sports Sci, 2012. 30(6): p. 541-5.
10. Gupta, L., Morgan, K., & Gilchrist, S., *Does Elite Sport Degrade Sleep Quality? A Systematic Review*. Sports Med, 2017. 47(7): p. 1317-1333.

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