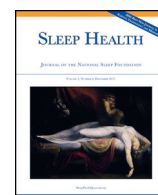




Contents lists available at ScienceDirect

Sleep Health

Journal of the National Sleep Foundation

journal homepage: sleephealthjournal.org

Poor sleep quality and insufficient sleep of a collegiate student-athlete population

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ARTICLE INFO

Article history:

Received 28 September 2017

Received in revised form 6 February 2018

Accepted 19 February 2018

Available online xxx

Keywords:

Sleep quality

Sleep restriction

Sports

Student-athlete

ABSTRACT

Objective: Poor and inadequate sleep negatively impact cognitive and physical functioning and may also affect sports performance. The study aim is to examine sleep quality, sleep duration, and daytime sleepiness in collegiate student-athletes across a wide range of sports.

Design: Questionnaire.

Setting: University setting.

Participants: 628 athletes across 29 varsity teams at Stanford University.

Measurements: Athletes completed a questionnaire inquiring about sleep quality via a modified Pittsburgh Sleep Quality Index (PSQI), sleep duration, and daytime sleepiness via Epworth Sleepiness Scale. Sleep quality on campus and while traveling for competition was rated on a 10-point scale.

Results: Collegiate athletes were classified as poor sleepers (PSQI 5.38 ± 2.45), and 42.4% of athletes experience poor sleep quality (reporting PSQI global scores >5). Athletes reported lower sleep quality on campus than when traveling for competition (7.1 vs 7.6, $P < .001$). Inadequate sleep was demonstrated by 39.1% of athletes that regularly obtain <7 hours of sleep on weekdays. Fifty-one percent of athletes reported high levels of daytime sleepiness with Epworth scores ≥ 10 . Teen student-athletes in the first and second year of college reported the highest mean levels of daytime sleepiness. Greater total sleep time was associated with daytime functioning including lower frequency of difficulty waking up for practice or class ($P < .001$) and lower frequency of trouble staying awake during daily activities ($P < .001$).

Conclusions: Collegiate athletes frequently experience poor sleep quality, regularly obtain insufficient sleep, and commonly exhibit daytime sleepiness.

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Introduction

Sleep has a critical role in human functioning, physiology, and cognitive and physical recovery. Previous studies have demonstrated that sleep deprivation and chronic sleep loss can negatively impact cognitive functioning, learning and memory, reaction time, auditory vigilance, and mood.^{1–3} Insufficient hours of sleep have also been shown to impact metabolism and endocrine function, increase perceived exertion during exercise, and impair performance outcomes such as weight training.^{4–6} For athletes, optimal functioning in the aforementioned areas is critical, as sports performance strongly relies on the combination of cognitive, physiological, and physical outputs.

Sleep quality and sleep duration have important roles for athletic training, postexercise recovery, mood, and sports performance^{7–10};

however, the current literature characterizing the sleep of athletes is sparse. The available evidence suggests that highly trained rugby and cricket athletes experience poor sleep quality and high levels of daytime sleepiness.¹¹ Olympic athletes from 4 sports have demonstrated poorer indicators of sleep quality assessed by objective actigraphy than nonathletic controls.¹² Moreover, sleep disturbances and poor sleep prior to competition have been reported among Australian and German individual and team sports.^{13,14} Additionally, differences in training demands between sports may impact sleep need.¹² Little is known about the sleep health, including sleep quality and sleep duration, of individual and team sport athletes across a wide range of sports and how their functioning is impacted outside of the laboratory within the context of the psychological, emotional, and physical demands that are present during a competitive season.

The present study therefore aimed to investigate the sleep quality and sleep duration, as well as the subsequent daytime functioning, of an entire collegiate athlete population at a single university. It was

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hypothesized that athletes experience poor sleep quality, regularly obtain insufficient hours of sleep, and experience daytime sleepiness. Knowledge of sleep behaviors may aid in identifying potential areas for intervention to improve sleep and recovery in athletes.

Methods

Participants

Athletes were recruited from Stanford University, which is a National Collegiate Athletic Association member institution and participates at the Division I level. There are approximately 800 total varsity athletes at Stanford comprising 35 varsity sports teams: 16 for men, 19 for women, and 1 coed (sailing). Athletes were included if they were members of a varsity sports team at Stanford University during the 2011–2012 National Collegiate Athletic Association season. Athletes completed the study questionnaire before or after a regularly scheduled practice session during November and December 2011. Participant age was categorized as ≤ 18 , 19, 20, 21, and ≥ 22 years old. Athletes were excluded if they did not wish to participate or did not attend the practice session when the questionnaire was administered. The Panel on Human Subject Research approved the study, and written informed consent was obtained from all participants.

Questionnaire

The study questionnaire included 2 validated instruments to examine sleep quality and levels of daytime sleepiness. A modified Pittsburgh Sleep Quality Index (PSQI) was used to assess sleep duration, sleep onset latency, subjective sleep symptoms, sleep medications, and disturbances. The PSQI measures a broad range of symptoms of sleep disturbances over a 1-month period. Responses are categorized into 7 component scores; these are then combined to create 1 global score. The total global PSQI score ranges from 0 to 21. The PSQI score was used to create a dichotomous variable, distinguishing poor sleepers (global PSQI score greater than 5), from good sleepers.¹⁵ PSQI questions for time in bed were modified to assess weekday sleep, which was used for the global score, and weekend time in bed was assessed separately. The PSQI question 8 inquires daytime dysfunction specifically trouble staying awake during daily activities. Daytime sleepiness was quantified using the Epworth Sleepiness Scale. The Epworth measures sleep propensity on a 0–3 scale in 8 standardized daily situations. Possible scores range from 0 to 24, with higher scores reflecting greater sleepiness and a score of 10 or greater indicating clinically high levels of daytime sleepiness.¹⁶ The Epworth score was considered a continuous variable. The study questionnaire also included questions regarding sleep quality at the home location on campus vs during travel for games or competition rated on a 10-point scale (1 = poor, 10 = excellent), frequency of tiredness and difficulty waking up using a Likert scale, frequency and duration of routine and precompetition napping habits, sleep environment disturbances, and aids that athletes use to help sleep (Tables 3 and 4).

Statistical analysis

Statistical analyses were performed using Stata/IC10.1 (StataCorp LP, College Station, TX). Linear regression tested associations between sleep duration or age as the independent variable and daytime functioning or Epworth scores as the dependent variable. χ^2 test evaluated association between sexes. *t* test evaluated association between ratings of sleep at home vs while traveling. *P* values $< .05$ were considered statistically significant.

Table 1
Participant demographics

	Total n (%)	Men n (%)	Women n (%)
Participants	628	343 (54.6)	285 (45.4)
Ethnicity			
African American	79 (12.6)	55 (16.0)	24 (8.4)
Asian/Pacific Islander	34 (5.4)	11 (3.2)	23 (8.1)
Hispanic	17 (2.7)	10 (2.9)	7 (2.5)
Native American	1 (0.2)	0 (0.0)	1 (0.3)
White	443 (70.5)	240 (70.0)	203 (71.2)
Multiracial	43 (6.8)	22 (6.4)	21 (7.4)
Unknown	11 (1.8)	5 (1.5)	6 (2.1)
Age (y)	19.6 \pm 1.3	19.7 \pm 1.3	19.4 \pm 1.2
17	3 (0.5)	1 (0.3)	2 (0.7)
18	149 (23.8)	68 (19.8)	81 (28.6)
19	180 (28.7)	102 (29.7)	78 (27.6)
20	142 (22.7)	76 (22.2)	66 (23.3)
21	105 (16.8)	60 (17.5)	45 (15.9)
22	40 (6.4)	29 (8.5)	11 (3.9)
23	6 (0.9)	6 (1.7)	0 (0.0)
26	1 (0.2)	1 (0.3)	0 (0.0)
Height (m)	1.8 \pm 0.1	1.9 \pm 0.1	1.7 \pm 0.1
Range	1.5–2.1	1.6–2.1	1.5–2.1
Weight (kg)	79.5 \pm 18.4	90.1 \pm 16.9	66.4 \pm 9.5
Range	43.6–163.6	59.1–163.6	43.6–104.5
BMI (kg/m ²)	24.3 \pm 3.6	25.9 \pm 3.7	22.5 \pm 2.3
Range	17.4–42.8	18.9–42.8	17.4–32.6

Data are presented as mean \pm standard deviation unless otherwise indicated. BMI, body mass index.

Results

Participants

A total of 628 athletes participated in the study and were members of the following 29 varsity sports teams at Stanford University: men's and women's basketball, golf, gymnastics, rowing, sailing, soccer, swimming & diving, tennis, track & field, volleyball, water polo; men's baseball, football, wrestling; and women's field hockey, lacrosse, lightweight rowing, softball, synchronized swimming. Several track & field athletes also participate on the men's and women's cross country teams but were classified as track & field athletes because they were training for this sport when the questionnaires were completed. Men's sailing and women's sailing were classified as 1 team because they frequently compete together. Table 1 provides demographic information and characteristics of the study population. Nearly all undergraduate students at Stanford University live in on-campus housing in a range of options including dormitories, suites, and small group houses. Only 19 athletes in the study indicated that they live off campus.

Sleep quality and sleep disturbances

Athletes had a mean PSQI score of 5.38 ± 2.45 (Table 2), and 42.4% of athletes were identified as poor sleepers with PSQI scores > 5 . "Fairly bad" or "very bad" sleep quality was reported by 16.6% (104 athletes: 19.5% men vs 13.0% women) on the PSQI, with men reporting worse sleep quality than women, $\chi^2(4) = 11.3, P = .02$. Athletes reported lower sleep quality at home on campus than when traveling, 7.1 vs $7.6, t(557) = -4.97, P < .001$. Sleep disturbances that commonly occurred 3 or more times per week included the inability to fall asleep within 30 minutes (9.7%), waking up in the middle of the night or early morning (23.9%), and using the bathroom (17.0%). Table 3 provides the environmental factors that athletes reported impact sleep and aids that athletes use to help sleep. Over the past month, athletes reported using prescription or over-the-

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