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Influence of sleep quality and patterns on different sports events of collegiate athletes in Bangladesh: Insights from the Pittsburgh Sleep Quality Index

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Abstract

Poor sleep quality and insufficient sleep can adversely affect cognitive and physical health, potentially impairing athletic performance and overall well-being. This study investigates sleep quality, duration and daytime sleepiness among collegiate athletes from Bangladesh. A cross-sectional, questionnaire-based study was conducted across 18 universities in Bangladesh, involving 258 athletes from 9 different sports. Participants provided data on demographics, diet, sports activity, academic performance and self-reported health. Sleep quality was assessed using the validated Modified Bangla Pittsburgh Sleep Quality Index (PSQI), a 19-item tool measuring seven sleep components with a total score range of 0 to 21, where scores above 5 indicate poor sleep quality. The athletes had an average PSQI score of 5.52±2.75 reflecting a high prevalence of poor sleep quality, particularly among cricket, football players and male athletics athletes. The average duration of nocturnal sleep on campus was 6.66 ± 1.04 hours. A significant positive association was found between PSQI scores (β = 0.140, 95% CI: 0.036 to 0.395, p = 0.019) and the duration of time it takes to fall asleep after dinner (β = 0.140, 95% CI: 0.080 to 0.872, p = 0.019) with BMI after adjustment for age and sex using linear regression analysis. Gender was significantly associated with napping patterns with weekly nap frequency ($p<0.0001$) and nap duration ($p<0.05$). This study emphasizes the prevalence of poor sleep quality among collegiate athletes in Bangladesh, its association with greater BMI and the importance of specific strategies to enhance sleep, sport performance and overall well-being.

Keywords: *Sleep patterns, PSQI assessment, Sleep restriction, Sports, Student-athlete*

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Introduction

Sleep is a fundamental component of overall health and well-being, playing a key role in numerous physiological functions, including learning, memory, cognition, metabolism, immune response, and cardiovascular regulation (Baranwal et al., 2023; Besedovsky et al., 2019). Quality sleep is essential for maintaining these processes, with most adults requiring between 7 and 9 hours per night (Hirshkowitz et al., 2015). Health guidelines recommend a minimum of 7 hours with at least 85% sleep efficiency meaning at least 85% of time in bed is spent asleep—for optimal health benefits (Ohayon et al., 2017). Insufficient or poor-quality sleep has been linked to heightened risks of cardiovascular diseases, obesity, diabetes, impaired cognitive performance, and depression (Li et al., 2022).

For athletes, sleep quality and duration are particularly critical, directly influencing training effectiveness, recovery, mood, and performance (H. H. K. Fullagar et al., 2015). Adequate, high-quality sleep aids both physical and mental recovery, reduces injury risk, and helps athletes maintain peak concentration and performance during competitions (Hossain et al., 2024; Kirschen et al., 2020). Recognizing this, elite athletes and coaches emphasize sleep as an essential element of preparation and recovery, critical to managing the physical and psychological stresses of training and competition (Bonnar et al., 2018). Variations in the body's natural 24-hour rhythms, such as the sleep-wake cycle and hormonal fluctuations, also play a role in an athlete's ability to perform, highlighting the need for structured rest (Fullagar et al., 2023).

However, understanding of sleep health among athletes across different sports in real-world settings remains limited (Mah et al., 2018). Real-life demands, such as intensive training, travel, jet lag, and pre-competition stress, can impact sleep quality and duration, often leading to reduced rest before events (Juliff et al., 2015a; Sargent et al., 2014). These sleep disruptions have become a growing area of concern in sports science, where optimizing sleep hygiene is seen as a means to improve both health and athletic outcomes (Gupta et al., 2017a).

The Pittsburgh Sleep Quality Index (PSQI) is widely used to assess sleep quality across clinical and non-clinical populations. This tool evaluates seven key components of sleep, providing a global score from 0 to 21, where higher scores indicate poorer sleep quality (Al Musharrafi et al., 2023). Evaluating components such as sleep latency, disturbances, and daytime dysfunction offers insights into common sleep issues, such as prolonged sleep onset and frequent awakenings (Bertolazi et al., 2011). Studies show that a PSQI score above 5 effectively distinguishes between good and poor sleepers, including in older populations (Zitser et al., 2022).

Global and South Asian Evidence on Sleep Quality Among Collegiate Athletes

Studies from Western countries show that a substantial proportion of collegiate athletes report suboptimal sleep often driven by academic workload, evening training, and competition stress with reported prevalence estimates frequently in the range of 40–60% for short sleep or poor sleep quality (Fullagar et al., 2015; Juliff et al., 2015a). East Asian studies report similar concerns, frequently attributing short sleep to academic pressures and cultural norms (Gupta et al., 2017a). Research from South Asia is comparatively sparse: a handful of studies from India and Pakistan report inadequate sleep duration, irregular sleep-wake patterns, and poor sleep hygiene among university athletes, but these studies generally do not stratify results by sport type or examine environmental contributors such as dormitory conditions and training schedules. Notably, there are no published, systematic investigations using standardized tools like the PSQI among collegiate athletes in Bangladesh.

Sleep disturbances are common in competitive settings and are often linked to poorer physical health and mood (Biggins et al., 2021). Athletes in some sports, such as swimming, may face increased vulnerability to sleep disturbances before competitions. Comprehensive assessments of sleep, fatigue, and overall health are essential to developing recovery strategies that enhance both performance and well-being (Costa et al., 2022). Olympic-level athletes, for instance, have shown poorer sleep quality than non-athletes, underscoring the need for targeted interventions.

The demands of different sports can also influence athletes' sleep needs (Erlacher et al., 2011; Juliff et al., 2015a; Leeder et al., 2012). For example, nighttime competitions can elevate cortisol levels, reducing sleep quality and duration (O'Donnell et al., 2018).Research on collegiate athletes has shown that increasing sleep duration from less than 7 to more than 8 hours per night can improve mood, alertness, and physical performance (Mah et al., 2011).

Although several studies have explored sleep among athletes, important gaps remain. Many investigations do not differentiate sleep quality across different sport types, despite evidence that endurance, team, and skill-based sports may influence sleep demands differently. Likewise, limited attention has been given to contextual factors such as sleeping environment, dormitory conditions, training schedules, and psychosocial stressors variables particularly relevant in low- and middle-income countries. Importantly, no prior study from Bangladesh has evaluated sleep quality among collegiate athletes using standardized tools, leaving a critical gap in understanding the sleep-health needs of this population.

Therefore, the present study aims to answer the research question: What is the overall sleep quality, duration, and daytime functioning of collegiate athletes in Bangladesh, and what factors contribute to poor sleep within this population?.

Study objectives and hypothesis

Estimate the prevalence of poor sleep quality (PSQI >5) among collegiate athletes in Bangladesh. Compare sleep quality and key PSQI component scores across sport types (team, individual, endurance/skill). Identify training, scheduling, and environment factors associated with poor sleep (e.g., evening training, shared dormitory, academic load).

Primary hypothesis: We hypothesise that a substantial proportion (>40%) of Bangladeshi collegiate athletes will report poor sleep quality (PSQI >5), with higher prevalence among athletes in sports with evening training/competition and among those living in shared or noisy accommodation.

Methods

Participants

The data collection took place between June 16 and July 20, 2024. A sample of athletes was recruited from an elite

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cohort of athletes from Bangladesh who engage in both national and interuniversity sports across various institutions (18 universities) using a systematic random process. The individual being assessed was positioned on the platform of the portable stadiometer (SECA Stadiometer 213 Japan). The height (in centimeters) and weight (in kilograms) of each selected individual were measured using a standard procedure, and the BMI of each subject was computed. Measurement with a high-quality stadiometer, which has a precision of 0.1 cm (equivalent to ⅛th of an inch), was utilized. The stadiometer is stable and equipped with a horizontal headpiece that may touch the topmost part of the head (Azim et al., 2024). Data collection from subjects during the research was conducted through face-to-face and survey-based methods. Informants were specifically selected to obtain relevant data and knowledge on the study topics.

Participant Selection

To provide a representative sample of collegiate athletes from Bangladesh, a systematic random sampling procedure was used. The selecting procedure included the following steps:

Inclusion Criteria:

Athletes were eligible if they were actively involved in university-level sports and had undergone consistent training and competition for a minimum of 6 months before the study. Only those who provided voluntary consent for participation were deemed eligible for inclusion in the study.

Exclusion Criteria:

Athletes who have sleep disorders, those on pharmacological treatment impacting sleep, or individuals with chronic health issues that could substantially alter sleep patterns were eliminated. This was implemented to eliminate biases that could distort the study's findings.

Sampling Process:

A rigorous random sampling method had been used to choose participants. A comprehensive list of all qualified athletes from the 18 participating universities was prepared. Athletes were subsequently chosen at random from these lists, guaranteeing diverse representation from various universities. A random number generator was utilized to choose athletes from the pool, thereby minimizing bias and ensuring unpredictability in the selection process.

Gender Balance Strategy:

Equal representation of all genders in the sample was attempted to be achieved. Their participation in each sport at the collegiate level was reflected in the number of male and female athletes chosen. In order to ensure that both male and female athletes were fairly represented in the study, the gender distribution of athletes within each sport served as a reference for participant selection.

Sport Diversity:

Participants were chosen from nine different sports, including both team and individual sports, ensuring diversity in sport representation. To make sure that every sport has sufficient representation for cross-sport comparisons, the selection process was stratified by sport type. Meaningful comparisons between various sports (e.g., team sports, individual sports, and endurance sports) were made possible by the stratification process.

Attrition and Participant Approach:

The initial pool included 310 athletes from the 18 universities. Of these, 52 declined to participate or were excluded based on the exclusion criteria.

Questionnaire

We designed a comprehensive questionnaire for individuals that inquired about their family status, dietary habits, specific sports participation, academic information, and health issues (Tabassum & Azim, 2024).

The PSQI stands as a widely utilized self-reported tool designed to evaluate sleep quality. Comprising 19 questions, including seven components such as subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, use of sleep medication, and daytime dysfunction, the PSQI assesses various aspects of sleep quality experienced over the preceding month (Buysse et al., 1989a). Each component is equally weighted on a scale from 0 to 3. The global PSQI score, indicative of overall sleep quality, is derived by summing the scores of the seven components, resulting in a range from 0 to 21. A higher score signifies poorer sleep quality, while a lower score indicates better sleep quality (Buysse et al., 1989a). In this study, the validated Bangla version of the PSQI was employed to evaluate sleep quality, consistent with previous research conducted in Bangladesh(Mondal et al., 2018). A PSQI score exceeding 5 served as the threshold for identifying poor sleep quality (Islam et al., 2021a).

For data collecting, we considered the following issues: a) Taking any medications, sleeping pills, or supplements. b) Addiction to drugs or beverages. a) Serious illness or disease. f) Sleep quality and disruptions (such as insomnia or sleep apnea). g) Routines and habits leading up to sleep, as well as sleep patterns. j) Sleep-related dietary intake (for example, coffee and late-night eating). h) The frequency of late-night training or competition.

Questionnaire Validation and Administration

The study's questionnaire was designed to evaluate the quality of sleep, taking into account variables like sleep length, disruptions, and sleep-related behaviors. Expert evaluation, in which experts in sports medicine and sleep science assessed the questions' comprehensiveness, relevance, and clarity, verified the questionnaire's content validity. The association between questionnaire responses and the Pittsburgh Sleep Quality Index (PSQI), a reliable indicator of sleep quality, provided evidence for construct validity. (Buysse et al., 1989b).

Face-to-face interviews were conducted to administer the questionnaire instead of self-administered surveys for the following reasons. clarification of questions, greater response rate, and oversight of environmental variables

Reliability of the PSQI

The reliability of the Bangla version of the Pittsburgh Sleep Quality Index (PSQI) was assessed using Cronbach's alpha, an indicator of internal consistency among the seven components of the PSQI. This study revealed a Cronbach's alpha value of 0.383, signifying a modest degree of internal consistency. Despite this score being below the commonly accepted criterion of 0.7, which is generally regarded as indicative of good reliability (Cronbach, 1951), it indicates that a few components of the PSQI may exhibit weaker correlations among this particular population of collegiate athletes. This moderate dependability may be affected by the distinct characteristics of this population. Future research should

further assess the tool's dependability in other cohorts and potentially refine it to improve internal consistency across distinct groups.

Ethical standard

All procedures were approved by the Ethical Committee of the Institute of Biological Sciences at Rajshahi University, Bangladesh (Approval No: 72(22)/320/IAMEBBC/IBSc, Serial Number: #00019). The study was conducted in accordance with the World Medical Association's Declaration of Helsinki for human research (Islam et al., 2021b).

Statistical analysis

Statistical analyses were conducted using SPSS (IBM Corp. Released 2017. IBM SPSS Statistics for Windows, Version 25.0. Armonk, NY: IBM Corp.). The data are reported as mean ± (SD) and percentage for both male athletes, female athletes in following variable like PSQI, sleep rate on campus, time of going to sleep after dinner, disturbances of sleep, aids of sleep, napping habits of athlete's, poor sleep and good sleep. The differences in categorical variables (sex and sports events) and continuous variables (age, height, weight and BMI) of the participants were analyzed by a chi-square test and an independent sample t-test, respectively. The data's normality has been assessed using the Kolmogorov-Smirnov test. With the exception of the total BMI among females ($D = 0.124$, $p = 0.115$), which was normally distributed, the test revealed that the majority of variables did not follow a normal distribution ($p < 0.05$). In view of these findings, variables who met the normality assumptions had been put to parametric testing, whilst those that did not were taken to non-parametric tests. Linear regression was employed to assess the associations between Pittsburg sleep quality index and after dinner going to sleep with Body mass index of the participants before and after adjusting for age and sex. Results were reported using adjusted odds ratios, 95% confidence intervals and P values below 0.05 were considered statistically significant.

Results

Socio-demographic characteristics of participants

The study examined 258 athletes who participated in various sporting activities. Most of the sample is male (84.1%) with an age range between 19 and 27 years old. Male athletes were the predominant group across all age categories, especially at ages 22 (35, 13.6%) and 24 (47, 18.2%). On the other hand, women were less represented, with their largest participation occurring at ages 20 and 25 years (each 8, 3.1%). The athletes' mean height was 167.36 ± 8.39 cm and there was a significant ($p<0.001$) correlation between the heights of male and female athletes. Male athletes differ considerably ($p<0.05$) from female athletes in terms of weight. Both groups of male and female athletes had a BMI within the normal range (18.5-24.9 kg/m2), with male athletes having an average BMI of 22.55 ± 4.21 kg/m² and female athletes having an average BMI of 22.38 ± 4.42 kg/m².

Table 1. Participant demographics characteristics

	Total n (%)	Men n (%)	Women n (%)
Age (years)			
19	23 (8.9)	22 (8.5)	1(0.4)
20	20 (7.8)	12 (4.7)	8 (3.1)
21	24 (9.3)	20 (7.8)	4 (1.6)
22	38 (14.7)	35 (13.6)	3 (1.2)
23	32 (12.4)	26 (10.1)	6 (2.3)
24	51 (19.8)	47 (18.2)	4 (1.6)
25	36 (14)	28 (10.9)	8 (3.1)
26	17 (6.6)	16 (6.2)	1 (0.4)
27	17(6.6)	11 (4.3)	6 (2.3)
Total athletes	258 (100)	217 (84.1)	41 (15.9)
Height (m)	167.36± 8.39	168.45± 7.81	161.59± 9.10*
Weight(kg)	62.75± 10.53	63.51± 9.55	58.71± 14.14**
BMI(kg/m²)	22.52± 4.24	22.55± 4.21	22.38± 4.42

Values are presented as mean ± standard deviation (SD) for continuous variables and as frequencies (n) and percentages (%) for categorical variables. BMI = Body Mass Index. p values were from the independent sample t-test and chi-square test, respectively (* $p<0.05$; ** $p<0.01$).

Sleep quality and daytime sleepiness assessments

Table 2 shows the assessments of sleep quality and daytime drowsiness among male and female athletes. All participants had an overall PSQI score of 5.52±2.75; males scored somewhat higher (5.58±2.79) than women (5.24±2.52). On campus, the sleep score was similar for men average 6.65±1.07 and women averaging 6.54±0.90. Men took 2.63±1.25 hours and women took 2.45±1.00 hours, the average time spent falling asleep following dinner.

Evaluating by varsity team, male athletics had a PSQI of 6.52±2.84 while female athletics had a PSQI of 4.10±2.13 with significant ($P = 0.01$). Men in basketball had a PSQI of 5.94±3.05, while the female player had a PSQI of 6.25±2.05. Men's cricket had a PSQI of 5.16±3.08; women's cricket had a PSQI of 5.33±2.78. Other activities like hockey, martial arts and badminton showed various PSQI scores, typically reflecting a trend of good sleep quality ($PSQI < 0.05$). Especially, every athlete mentioned good quality and length of sleep, which emphasizes the frequency of adequate sleep in this population.

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Table 2. Sleep quality and daytime sleepiness assessments (n=258)

	Total n (%)	PSQI Mean (SD)	Sleep rating On campus Mean (SD)	Time of going to sleep after dinner
Range	----	0.0-14.0	4.0-12.0	0.1-7.0
All participants	258 (100)	5.52± 2.75	6.63± 1.04	2.60± 1.21
Sex				
Men	217 (84.1)	5.58± 2.79	6.65± 1.07	2.63±1.25
Women	41 (15.9)	5.24±2.52	6.54±0.90	2.45±1.00
P-value		0.47	0.52	0.39
Varsity team				
Men Athletics	31 (75.6)	6.52± 2.84	6.58± 0.81	2.52± 0.85
Women Athletics	10 (24.4)	4.10± 2.13	6.50± 0.85	2.00± 0.82
P-value		.01	0.78	0.10
Men Cricket	55 (85.9)	5.16± 3.08	6.69± 1.06	2.45± 1.27
Women Cricket	9 (14.1)	5.33± 2.78	6.78± 0.83	2.67± 0.71
P-value		0.87	0.81	0.61
Men Badminton	8 (100)	4.50± 1.77	6.50± 1.20	2.88± 1.89
Men Volleyball	13 (59.1)	5.85±2.12	6.46±2.13	3.48±1.48
Women Volleyball	9 (40.9)	5.33±3.28	6.56±0.88	2.00±0.71
P-value		0.65	0.83	0.006
Men Handball	8 (61.5)	6.13± 2.42	6.25± 1.28	2.37± 0.92
Women Handball	5 (38.5)	5.60± 1.82	6.20± 1.30	3.00± 1.00
P-value		0.68	0.94	0.27
Men Basketball	17 (68)	5.94± 3.05	6.29± 0.92	3.35± 1.32
Women Basketball	8 (32)	6.25±2.05	6.50±.93	2.94±1.42
P-value		0.79	0.60	.48
Men Martial arts	15 (100)	4.20±2.78	7.13±0.74	2.27±0.96
Men Football	41 (93.2)	6.59± 2.63	6.44± 1.03	3.12± 1.12
Men Hockey	29 (100)	4.45± 2.06	7.19± 1.33	1.55± 0.71

Sleep quality, sleep latency after dinner, sleep rating on campus, and daytime sleepiness among male and female collegiate athletes. PSQI = Pittsburgh Sleep Quality Index. A PSQI global score > 5 indicates poor sleep quality. "Sleep rating on campus" refers to the athletes' self-reported sleep satisfaction while residing in university dormitories (higher scores indicate better sleep).

Sleep environment factors and aids to help sleep

Table 3 displays statistics regarding sleep-disrupting causes and sleep aids among male and female athletes. The prevalence of sound as a sleep disturbance was highest among athletes, affecting 27.1% of the whole population (27.6% of males and 24.4% of females). The temperature was the second most prevalent component, affecting 24.0% of the entire sample (23.5% of males and 26.8% of females). Additional significant disruptions were observed in the form of roommates (12.4% overall; 13.4% males and 7.3% females), bathroom demands (7.4% overall; 6.9% males and 9.8% females), exposure to sunlight (7.8% overall; 7.4% males and 9.8% females), relationship tension (7.0% overall; 7.4% males and 4.9% females) and other unspecified factors (14.3% overall; 13.8% males and 17.1% females). The most commonly used sleep aid among athletes was a fan, which was effective for 42.6% of participants (44.7% of males and 31.7% of females). Additional forms of assistance included the utilization of music (15.5% overall; 16.1% among males and 12.2% among females) the implementation of unidentified methods (31.4% overall; 29.0% among males and 43.9% among females), the use of white noise (4.7% overall; 5.1% among males and 2.4% among females) and the application of eye masks (5.8% overall; 5.1% among males and 9.8% among females). Female athletes had a much larger proportion (43.9%) of utilizing different methods to enhance sleep compared to male athletes (29.0%).

Napping habits of athletes

Table 4 displays data regarding the sleep patterns also Chi-square test results to examine the association between gender and the frequency of napping habits among athletes, including categories such as, nap time, never, everyday etc. When it comes to how often athletes take naps, 39.1% of them stated that they never nap. Among those who never nap, a larger proportion of males (42.4%) than females (22.0%) were included. Among athletes, 24.0% reported napping daily, with 26.3% of males and 12.2% of females engaging in this habit. However, napping twice a week was more prevalent among females (61.0%) than males (20.3%). The amount of time of naps shown variation, with 39.1% of athletes avoiding from napping entirely (42.9% males and 19.5% females) There is a strong significant relationship between gender with napping habit ($p<0.0001$). The most prevalent duration for naps was between 10 and 30 minutes, accounting for 34.9% of the total. Both males and females had similar proportions, with 34.6%

Table 3. Chi-Square analysis of sleep environment factors and aids to help sleep by gender (n=258)

	Total n (%)	Male n (%)	Female n (%)	Chi-Square Value	Degrees of Freedom (df)	p-value
Disturb during sleep						
Bathroom	19(7.4)	15(6.9)	4(9.8)			
Roommates	32(12.4)	29(13.4)	3(7.3)			
Sound	70(27.1)	60(27.6)	10(24.4)			
Sunlight	20(7.8)	16(7.4)	4(9.8)	2.503	6	0.86
Temperature	62(24.0)	51(23.5)	11(26.8)			
Tension	18(7.0)	16(7.4)	2(4.9)			
Others	37(14.3)	30(13.8)	7(17.1)			
Thing that helps to sleep						
White noise	12(4.7)	11(5.1)	1(2.4)			
Eye mask	15(5.8)	11(5.1)	4(9.8)	5.954	4	0.20
Fan	110(42.6)	97(44.7)	13(31.7)			
Music	40(15.5)	35(16.1)	5(12.2)			
Others	81(31.4)	63(29.0)	18(43.9)			

Environmental sleep-disrupting factors and sleep aids used by athletes, presented by gender. Sleep disturbances include noise, temperature, roommates, sunlight exposure, relationship stress, and other factors. Sleep aids include fans, music, white noise, eye masks, and other methods. Values represent frequencies (n) and percentages (%). Statistical comparisons were performed using chi-square tests.

and 36.6% respectively. 15.9% of athletes (13.4% males and 29.3% females) reported taking longer naps of 30-60 minutes, while 9.3% (8.3% males and 14.6% females) napped for 1-2 hours. However, there is also a significant relation build up in between gender and length of sleep ($p<0.05$). Prior to important competitions, 45% of athletes engaged in a period of rest, with a greater proportion of females (58.5%) as opposed to males (42.4%). The duration of pre-game naps dif-

Table 4. Chi-Square Analysis of Napping Habits of Athletes by Gender (n=258)

	Total n (%)	Male n (%)	Female n (%)	Chi-Square Value	Degrees of Freedom (df)	p-value
How often do you nap?						
Never	101(39.1)	92(42.4)	9(22.0)			
Every day	62(24.0)	57(26.3)	5(12.2)			
Once in a week	3(1.2)	1(0.5)	2(4.9)	38.01	4	0.0001
Twice in a week	69(26.7)	44(20.3)	25(61.0)			
Once a month	23(8.9)	23(10.6)	0(0.0)			
Length of naps						
Don't nap	101(39.1)	93(42.9)	8(19.5)			
Less than 10 min	1(0.4)	1(0.5)	0(0.0)			
10-30 min	90(34.9)	75(34.6)	15(36.6)	12.20	5	0.03
30-60 min	41(15.9)	29(13.4)	12(29.3)			
1-2h	24(9.3)	18(8.3)	6(14.6)			
2+h	1(0.4)	1(0.5)	0(0.0)			
Do you nap before big game?						
Yes	116(45)	92(42.4)	24(58.5)	3.63	1	0.056
No	142(55)	125(57.6)	17(41.5)			
Length of naps before big games						
Don't nap	142(55)	125(57.6)	17(41.5)			
Less than 10 min	6(2.3)	4(1.8)	2(4.9)			
10-30 min	37(14.3)	30(13.8)	7(17.1)	4.495	5	0.405
30-60 min	42(16.3)	33(15.2)	9(22.0)			
1-2h	26(10.1)	21(9.7)	5(12.2)			
2+h	5(1.9)	4(1.8)	1(2.4)			

Distribution of napping habits among athletes, including frequency of naps, nap duration, and pre-competition napping behaviour, stratified by gender. Values represent frequencies (n) and percentages (%). Chi-square tests were used to assess associations between gender and napping patterns.

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fered across athletes. Specifically, 55% of athletes did not nap at all, with 57.6% of males and 41.5% of females abstaining from napping. Additionally, 16.3% of athletes napped for 30-60 minutes, with 15.2% of males and 22.0% of females falling into this category. Finally, 14.3% of athletes napped for 10-30 minutes, with 13.8% of males and 17.1% of females in this group. 10.1% of athletes, consisting of 9.7% males and 12.2% females, took longer pre-game naps lasting 1-2 hours.

Associations between Pittsburg sleep quality index and after dinner going to sleep with Body mass index

Table 5 indicates the associations between the PSQI and the duration of time it takes to go to sleep after dinner, in relation to BMI, among male and female athletes. Before the adjustment, the PSQI demonstrated a notable positive correlation with BMI (β = 0.142, 95% CI: 0.033 to 0.406, p = 0.021), suggesting that lower sleep quality is linked to increased BMI. The association remained statistically significant even after adjusting for other factors (β = 0.140, 95% CI: 0.036 to 0.395, p = 0.019). Similarly, sleeping after dinner was found to be positively correlated with BMI before adjustment (β = 0.136, 95% CI: 0.050 to 0.875, p = 0.028) and this correlation remained significant after adjustment (β = 0.140, 95% CI: 0.080 to 0.872, p = 0.019). These findings suggest that athletes who go to sleep later after dinner tend to have higher BMI.

Table 5. Associations between Pittsburg sleep quality index and after dinner going to sleep with Body mass index.

	Before adjustment		After adjustment	
Variables	BMI β (95% CI)	p-value	BMI β (95% CI)	p-value*
Total (PSQI)	0.142 (0.033,0.406)	0.021	0.140 (0.036,0.395)	0.019
After dinner going to sleep	0.136 (0.050,0.875)	0.028	0.140 (0.080,0.872)	0.019

Linear regression models examining associations between sleep quality (PSQI global score), time to fall asleep after dinner, and BMI among athletes. Results are shown as beta coefficients (β), 95% confidence intervals (CI), and p-values. Adjusted models account for age and sex. Higher PSQI scores reflect poorer sleep quality. *p<0.05; β is adjusted for age and sex (male used as a referent group)

The study of sleep quality ratios across different sports events indicates major trends. In the area of sports, participants in Hockey showed the highest percentage of poor sleep at 62.1%, whereas those engaged in Martial Arts reported the lowest percentage at 25%. In contrast, Martial Arts display the highest percentage of good sleep at 75%, with Volleyball following at 68.2%. Other sports events, including Basketball, Cricket, and Football, demonstrated little variations, with poor sleep percentages ranging from 43.9% in Athletics to 50% in Football. Correspondingly, good sleep percentages varied, with 56.1% in Athletics and 50% in Football. Badminton showed an equal distribution of sleep quality, with 50% classified as poor sleep and 50% as good sleep. Participants in handball demonstrated a greater incidence of poor sleep (53.8%) relative to good sleep (46.2%).

The data indicates that individuals involved with, hockey and handball are likely to experience poorer sleep quality, while those participating in martial arts and volleyball tend to have better sleep quality.

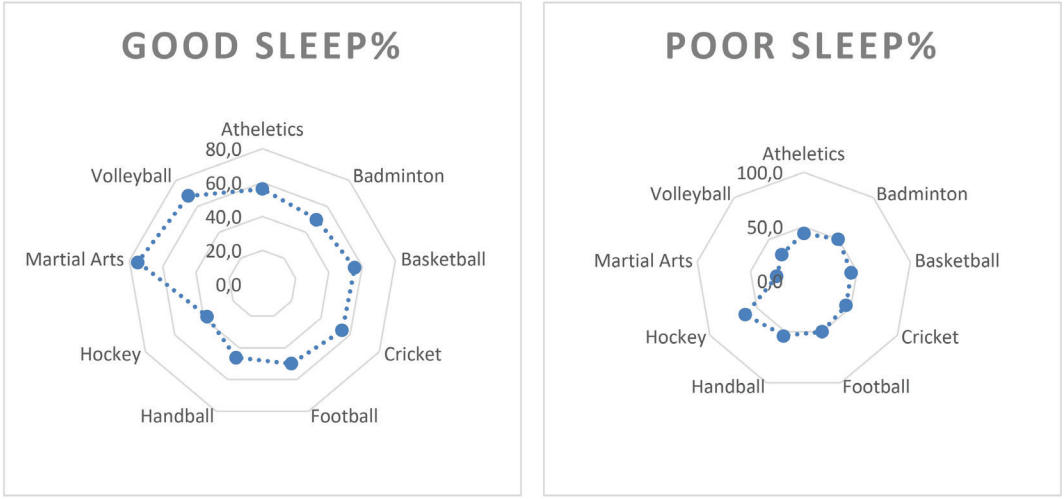

Figure 1. Distribution of Pittsburgh Sleep Quality Index (PSQI) categories across sport modalities among collegiate athletes. The figure illustrates the proportion of athletes classified as having good sleep quality (PSQI ≤ 5) and poor sleep quality (PSQI > 5) across nine sport modalities. PSQI = Pittsburgh Sleep Quality Index.

Discussion

The current study assessed the sleep patterns, quality, and duration of collegiate athletes in Bangladesh across both individual and team sports. It also explored factors such as the time athletes go to bed after dinner and the environment in which they sleep.

The primary findings reveal that male and female athletes in Bangladesh generally suffer from poor sleep quality, as evidenced by their PSQI scores. Males exhibited higher PSQI scores than females, indicating poorer sleep quality. Notably, a significant association was found between sleep quality and BMI, with a higher BMI correlating with lower sleep quality. Moreover, a longer time to fall asleep after dinner was linked to higher BMI, suggesting that athletes who go to bed later

tend to have higher BMI levels. These results highlight the widespread occurrence of sleep disturbances among collegiate athletes in Bangladesh and the urgent need for tailored interventions aimed at improving sleep quality, which could enhance both athletic performance and general well-being. Sleep patterns among athletes are often influenced by stress, anxiety, mood disorders, and inadequate social support, all of which can contribute to poor sleep quality (Leduc et al., 2020). Future studies should explore the underlying factors contributing to sleep deprivation and investigate effective strategies to address these challenges.

This study included 258 athletes from 18 universities across Bangladesh, representing 9 sport modalities. The participants reported subpar sleep quality, with an average PSQI score of 5.52 ± 2.75. The athletes in this study, particularly those living in campus accommodations, experienced poor sleep quality and tended to go to bed late after dinner. This study is among the most comprehensive to examine sleep quality across a broad range of sports, providing valuable insights into the sleep patterns of collegiate athletes. The findings align with previous research, such as a study involving 628 athletes from 29 sports, which found a similar average PSQI score of 5.38 ± 2.45, indicating poor sleep quality (Mah et al., 2018). Furthermore, another study examining athletes in 20 Olympic sports found that 52% of athletes had a global PSQI score greater than 5, suggesting poor sleep quality (Halson et al., 2022).

Several factors can contribute to the lack of adequate sleep in athletes. The physical demands of their sports, psychological stress, competition-related tension, and intensive training schedules often disrupt normal sleep patterns (Cook & Charest, 2023). Additionally, balancing academics and athletics can further exacerbate sleep deprivation, as athletes struggle to maintain regular sleep patterns (Copenhaver & Diamond, 2017). Environmental factors, such as the quality of sleep accommodations in dormitories and disruptions caused by travel, also negatively affect sleep quality (Mao et al., 2018). Environmental factors, such as the quality of sleep accommodations in dormitories and disruptions caused by travel, also negatively affect sleep quality (Silva et al., 2022). These challenges create an environment where athletes struggle to achieve adequate and restorative sleep.

Despite these challenges, many athletes reported sleep disturbances due to noise, roommates, temperature, and stress. To mitigate these disruptions, some athletes have turned to sleep aids such as white noise machines, eye masks, fans, and relaxing sounds to improve their sleep quality. This highlights the need for practical solutions to help athletes optimize their sleep environment and address the specific causes of their sleep disturbances.

Research conducted on Australian athletes supports the findings of this study, further emphasizing the prevalence of inadequate sleep among athletes. In that study, 64.0% of participants reported experiencing a decline in sleep quality at least once in the evenings leading up to a major competition. The most common sleep issue was insomnia (82.1%), particularly difficulties with sleep initiation. Contributing factors included pre-competition cognitive rumination (83.5%) and anxiety (43.8%). Notably, team sport athletes were less likely to adopt sleep management strategies (59.1%) compared to individual sport athletes (32.7%) (Juliff et al., 2015b).

In this study, 60.9% of athletes reported taking naps at least once a week, with a third of them napping for 10-30 minutes. Additionally, 45% of athletes took a pre-game nap, with 14.3% napping for 10-30 minutes and 16.3% napping for 30-60 minutes. Napping, when done properly, can have beneficial effects on athletic performance. A brief 15-20 minute nap in the early to mid-afternoon is shown to improve cognitive performance, reduce stress, and enhance mood, which are essential for sports performance(George et al., 2024). A pre-game nap can also have significant advantages, such as improving sprint performance, response times, and endurance (Romdhani et al., 2020). Furthermore, naps can help alleviate pre-game anxiety and provide mental relaxation, promoting focus and calmness before competition. The optimal length of a pre-game nap is generally considered to be 20-30 minutes (Lastella et al., 2021).

In our study, a positive correlation was found between PSQI scores and both post-dinner sleep duration and BMI. Specifically, athletes with lower sleep quality tended to have higher BMI scores, with this association remaining significant even after adjusting for age and sex. Additionally, the time it took athletes to fall asleep after dinner was positively correlated with BMI. These results suggest that poor sleep habits, such as going to bed late after dinner, may contribute to higher BMI levels. This underscores the importance of improving sleep quality for athletes, not only to enhance their health but also to optimize their athletic performance.

Various factors contribute to the link between sleep quality and BMI. Sleep deprivation negatively impacts metabolic functions, leading to reduced energy expenditure and increased fat storage. Hormonal imbalances caused by poor sleep can disrupt appetite-regulating hormones such as leptin and ghrelin, leading to increased hunger and overeating (Markwald et al., 2013). Moreover, lifestyle behaviors such as reduced physical activity and late-night eating can further contribute to higher caloric intake and poorer dietary choices, ultimately raising BMI (Günal, 2023).

The examination of the Pittsburgh Sleep Quality Index (PSQI) findings disclosed major differences in sleep quality across athletes participating in different sports. Table tennis, swimming, and handball had the largest proportion of athletes who reported having good sleep quality, as indicated by a PSQI score of less than 5. In contrast, cricket players, football players, and hockey players had a significant prevalence of poor sleep quality (PSQI > 5), underscoring the necessity for focused interventions aimed at enhancing sleep quality among these populations.

The analysis of PSQI scores revealed notable differences in sleep quality across athletes from different sports. Athletes in sports such as table tennis, swimming, and handball reported better sleep quality (PSQI scores < 5), while those in cricket, football, and hockey experienced poorer sleep quality (PSQI scores > 5). This emphasizes the need for targeted interventions aimed at improving sleep among athletes in these sports. The type of sport may influence sleep quality, with athletes in team sports generally reporting worse sleep quality compared to those in individual sports. Factors such as competition scheduling, travel commitments, and training intensity all play a role in disrupting sleep (Gupta et al., 2017b; Roberts et al., 2019). Sports such as rugby and cricket, with their physically demanding schedules and unpredictable timings, may further exacerbate sleep problems (Swinbourne et al., 2016). Tailored interventions are essential to address these challenges and improve sleep quality, which will, in turn, enhance athletic performance.

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Our study suggests that athletes, coaches, and sports managers should familiarize themselves with the various components of the PSQI, including sleep latency, sleep duration, sleep disturbance, daytime dysfunction due to sleepiness, and overall sleep quality. Understanding these components can help in comprehensively assessing an athlete's sleep patterns and identifying factors that may impair their performance. This research provides valuable insights into the sleep habits of Bangladeshi collegiate athletes and emphasizes the importance of optimizing sleep to improve both health and athletic outcomes.

Limitations, strengths, and future directions

The current study utilized self-reported assessments to gauge sleep quality and duration. It's noteworthy that these self-reports may deviate from objective sleep measures, with self-reported sleep duration potentially being overestimated. Furthermore, the study was conducted during late winter to pre- monsoon, spanning both in-season and off-season periods for collegiate teams, potentially yielding varying sleep outcomes across these phases. Moreover, the PSQI used in the study may have limited alignment with clinical assessments of sleep quality, and it only inquired about weekday sleep duration for the global score, omitting weekend sleep patterns. Another potential weakness of this study is recollection bias, which may impair the accuracy of participants' self-reported data on sleep quality and behaviors. Because the Pittsburgh Sleep Quality Index (PSQI) is retroactive, participants must recollect their sleep patterns from the previous month, which may result in reporting inaccuracies due to memory lapses or subjective interpretation of their sleep experiences.

Despite these limitations, it is important to highlight some strengths. This study encompasses athletes from 18 universities in Bangladesh. The comprehensive analysis of sleep quality and duration among athletes provides valuable insights into the sleep patterns of this population. Additionally, the use of self-reported assessments offers a practical and accessible method for collecting data on sleep-related parameters. Furthermore, the inclusion of athletes from various sports disciplines in the study enhances its relevance and applicability to a diverse athletic population.

Future research could explore several avenues for enhancement. Integrating objective sleep measures alongside self-reported assessments could offer a more comprehensive understanding of sleep patterns among collegiate athletes. Longitudinal studies across multiple seasons could elucidate how sleep outcomes evolve over time in response to varying training and competitive schedules. Additionally, investigating the association between sleep quality and performance metrics could shed light on the impact of sleep on overall athletic performance and well-being, guiding evidence-based recommendations for optimizing performance through sleep management strategies.

Conclusions

This study offers valuable insights into the sleep quality, duration, and daytime functioning of collegiate athletes in Bangladesh, emphasizing the importance of sleep for overall health and athletic performance. The findings indicate that both male and female athletes experience poor sleep quality, with males showing worse outcomes as evidenced by their higher PSQI scores. The study also identifies common sleep disturbances such as noise and temperature, with fans emerging as the most commonly used sleep aid among athletes. Interestingly, female athletes tend to use more methods to improve sleep quality compared to their male counterparts.

Napping habits of athletes reveal that a significant portion avoids naps altogether, while those who do nap generally prefer shorter durations. Pre-competition rest patterns highlight the importance of adequate rest for performance, particularly among female athletes. The study also uncovers a significant correlation between sleep quality and BMI, suggesting that athletes with poorer sleep quality tend to have a higher BMI, a relationship that persists even after adjusting for age, sex, and other variables. Additionally, the time taken to fall asleep after dinner is positively correlated with BMI, with athletes who sleep later tending to have higher BMI.

Our study suggests that athletes, coaches, and sports managers should familiarize themselves with the various components of the PSQI, including sleep latency, sleep duration, sleep disturbance, daytime dysfunction due to sleepiness, and overall sleep quality. Understanding these components can help in comprehensively assessing an athlete's sleep patterns and identifying factors that may impair their performance. This research provides valuable insights into the sleep habits of Bangladeshi collegiate athletes and emphasizes the importance of optimizing sleep to improve both health and athletic outcomes.

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Institutional Review Board Statement

All procedures were approved by the Ethical Committee of the Institute of Biological Sciences at Rajshahi University, Bangladesh (Approval No: 72(22)/320/IAMEBBC/IBSc, Serial Number: #00019). The study was conducted in accordance with the World Medical Association's Declaration of Helsinki for human research.

Informed Consent Statement

Informed consent was obtained from all subjects involved in the study.

Data Availability Statement

Data analyzed here will be shared on reasonable request to the corresponding authors.

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Conflicts of Interest

The authors declare no conflicts of interest.

References

Al Musharrafi, S. A. S., Muthukrishnan, A., Tayyib, N. A., Lathamangeswari, C., Lindsay, G. M., Pandurangan, H., Asfour, H. I., Ahmed, E. E., Khamis, H. M., & Nomani, I. (2023). PITTSBURGH SLEEP QUALITY INDEX: EXPLORING QUALITY OF SLEEP AMONG OMANI OLDER ADULTS. *JP Journal of Biostatistics*, *23*(2), 107–123.

Azim, A., Hossain, J., Mauwa, J., Hanif, K., & Lobo, J. (2024).

Impact of the COVID-19 Pandemic on Weight, Height and BMI Percentiles in Urban School Girls: A Case Study Using US Centers for Disease Control and Prevention Growth Charts. *1*, 28–37. https://doi.org/10.5281/zenodo.12593233

Baranwal, N., Phoebe, K. Y., & Siegel, N. S. (2023). Sleep physiology, pathophysiology, and sleep hygiene. *Progress in Cardiovascular Diseases*, *77*, 59–69.

Bertolazi, A. N., Fagondes, S. C., Hoff, L. S., Dartora, E. G., da Silva Miozzo, I. C., de Barba, M. E. F., & Barreto, S. S. M. (2011). Validation of the Brazilian Portuguese version of the Pittsburgh sleep quality index. *Sleep Medicine*, *12*(1), 70–75.

Besedovsky, L., Lange, T., & Haack, M. (2019). The Sleep-Immune Crosstalk in Health and Disease. *Physiological Reviews*, *99*(3), 1325–1380. https://doi.org/10.1152/physrev.00010.2018

Biggins, M., Purtill, H., Fowler, P., Bender, A., Sullivan, K. O., Samuels, C., & Cahalan, R. (2021). Sleep, health, and well-being in elite athletes from different sports, before, during, and after international competition. *The Physician and Sportsmedicine*, *49*(4), 429–437. https://doi.org/10.1080/00913847.2020.1850149

Bonnar, D., Bartel, K., Kakoschke, N., & Lang, C. (2018). Sleep Interventions Designed to Improve Athletic Performance and Recovery: A Systematic Review of Current Approaches. *Sports Medicine*, *48*(3), 683–703. https://doi.org/10.1007/s40279-017-0832-x

Buysse, D. J., Reynolds, C. F., Monk, T. H., Berman, S. R., & Kupfer, D. J. (1989a). The Pittsburgh sleep quality index: A new instrument for psychiatric practice and research. *Psychiatry Research*, *28*(2), 193–213. https://doi.org/10.1016/0165-1781(89)90047-4

Cook, J. D., & Charest, J. (2023). Sleep and Performance in Professional Athletes. *Current Sleep Medicine Reports*, *9*(1), 56–81. https://doi.org/10.1007/s40675-022-00243-4

Copenhaver, E. A., & Diamond, A. B. (2017). The Value of Sleep on Athletic Performance, Injury, and Recovery in the Young Athlete. *Pediatric Annals*, *46*(3). https://doi.org/10.3928/19382359-20170221-01

Costa, J., Figueiredo, P., Nakamura, F. Y., & Brito, J. (2022). The Importance of sleep in athletes. In *Exercise Physiology*. IntechOpen. https://www.intechopen.com/chapters/80371

Erlacher, D., Ehrlenspiel, F., Adegbesan, O. A., & Galal El-Din, H. (2011). Sleep habits in German athletes before important competitions or games. *Journal of Sports Sciences*, *29*(8), 859–866. https://doi.org/10.1080/02640414.2011.565782

Fullagar, H. H. K., Skorski, S., Duffield, R., Hammes, D., Coutts, A. J., & Meyer, T. (2015). Sleep and Athletic Performance: The Effects of Sleep Loss on Exercise Performance, and Physiological and Cognitive Responses to Exercise. *Sports Medicine*, *45*(2), 161–186. https://doi.org/10.1007/s40279-014-0260-0

Fullagar, H. H., Vincent, G. E., McCullough, M., Halson, S., & Fowler, P. (2023). Sleep and sport performance. *Journal of Clinical Neurophysiology*, *40*(5), 408–416.

George, A. S., George, A. H., & Shahul, A. (2024). The Science and Timing of Power Naps: Investigating the Cognitive and Physical Benefits of Brief Daytime Sleep. *Partners Universal Innovative Research Publication*, *2*(1), 70–84.

Günal, A. M. (2023). Sleep, activity, and diet in harmony: Unveiling the relationships of chronotype, sleep quality, physical activity, and dietary intake. *Frontiers in Nutrition*, *10*. https://doi.org/10.3389/fnut.2023.1301818

Gupta, L., Morgan, K., & Gilchrist, S. (2017a). Does Elite Sport Degrade Sleep Quality? A Systematic Review. *Sports Medicine*, *47*(7), 1317–1333. https://doi.org/10.1007/s40279-016-0650-6

Gupta, L., Morgan, K., & Gilchrist, S. (2017b). Does Elite Sport Degrade Sleep Quality? A Systematic Review. *Sports Medicine*, *47*(7), 1317–1333. https://doi.org/10.1007/s40279-016-0650-6

Halson, S. L., Johnston, R. D., Appaneal, R. N., Rogers, M. A., Toohey, L. A., Drew, M. K., Sargent, C., & Roach, G. D. (2022). Sleep Quality in Elite Athletes: Normative Values, Reliability and Understanding Contributors to Poor Sleep. *Sports Medicine*, *52*(2), 417–426. https://doi.org/10.1007/s40279-021-01555-1

Hirshkowitz, M., Whiton, K., Albert, S. M., Alessi, C., Bruni, O., DonCarlos, L., Hazen, N., Herman, J., Katz, E. S., & Kheirandish-Gozal, L. (2015). National Sleep Foundation's sleep time duration recommendations: Methodology and results summary. *Sleep Health*, *1*(1), 40–43.

Hossain, J., Azim, A., & Author, M. H. (2024). Kinetics and kinematic analysis of different phases in 100m sprints. *International Journal of Physical Education, Sports and Health*, *11*(3), 183–190.

Islam, Z., Hsan, K., Islam, S., Gozal, D., & Hossain, M. (2021a). Assessment of sleep quality and its association with problematic internet use among university students: A cross-sectional investigation in Bangladesh. *Sleep Science*, *14*(S 01), 8–15. https://doi.org/10.5935/1984-0063.20200069

Islam, Z., Hsan, K., Islam, S., Gozal, D., & Hossain, M. (2021b). Assessment of sleep quality and its association with problematic internet use among university students: A cross-sectional investigation in Bangladesh. *Sleep Science*, *14*(S 01), 8–15. https://doi.org/10.5935/1984-0063.20200069

Juliff, L. E., Halson, S. L., & Peiffer, J. J. (2015a). Understanding sleep disturbance in athletes prior to important competitions. *Journal of Science and Medicine in Sport*, *18*(1), 13–18.

Juliff, L. E., Halson, S. L., & Peiffer, J. J. (2015b). Understanding sleep disturbance in athletes prior to important competitions. *Journal of Science and Medicine in Sport*, *18*(1), 13–18.

Kirschen, G. W., Jones, J. J., & Hale, L. (2020). The impact of sleep duration on performance among competitive athletes: A systematic literature review. *Clinical Journal of Sport Medicine*, *30*(5), 503–512.

Lastella, M., Halson, S. L., Vitale, J. A., Memon, A. R., & Vincent, G. E. (2021). To Nap or Not to Nap? A Systematic Review Evaluating Napping Behavior in Athletes and the Impact on Various Measures of Athletic Performance. *Nature and Science of Sleep*, *Volume 13*, 841–862. https://doi.org/10.2147/NSS.S315556

Leduc, C., Tee, J., Weakley, J., Ramirez, C., & Jones, B. (2020). The Quality, Quantity, and Intraindividual Variability of Sleep Among Students and Student-Athletes. *Sports Health: A Multidisciplinary Approach*, *12*(1), 43–50. https://doi.org/10.1177/1941738119887966

Leeder, J., Glaister, M., Pizzoferro, K., Dawson, J., & Pedlar, C. (2012). Sleep duration and quality in elite athletes

 DOI 10.26773/mjssm.260308

measured using wristwatch actigraphy. *Journal of Sports Sciences*, *30*(6), 541–545. https://doi.org/10.1080/02640414.2012.660188

Li, J., Cao, D., Huang, Y., Chen, Z., Wang, R., Dong, Q., Wei, Q., & Liu, L. (2022). Sleep duration and health outcomes: An umbrella review. *Sleep and Breathing*, *26*(3), 1479–1501. https://doi.org/10.1007/s11325-021-02458-1

Mah, C. D., Kezirian, E. J., Marcello, B. M., & Dement, W. C. (2018a). Poor sleep quality and insufficient sleep of a collegiate student-athlete population. *Sleep Health*, *4*(3), 251–257.

Mah, C. D., Kezirian, E. J., Marcello, B. M., & Dement, W. C. (2018b). Poor sleep quality and insufficient sleep of a collegiate student-athlete population. *Sleep Health*, *4*(3), 251–257.

Mah, C. D., Mah, K. E., Kezirian, E. J., & Dement, W. C. (2011). The effects of sleep extension on the athletic performance of collegiate basketball players. *Sleep*, *34*(7), 943–950.

Mao, Z., Yang, Y., & Wang, M. (2018). Sleepless nights in hotels? Understanding factors that influence hotel sleep quality. *International Journal of Hospitality Management*, *74*, 189–201.

Markwald, R. R., Melanson, E. L., Smith, M. R., Higgins, J., Perreault, L., Eckel, R. H., & Wright, K. P. (2013). Impact of insufficient sleep on total daily energy expenditure, food intake, and weight gain. *Proceedings of the National Academy of Sciences*, *110*(14), 5695–5700. https://doi.org/10.1073/pnas.1216951110

Mondal, H., Mondal, S., & Baidya, C. (2018). Comparison of perceived sleep quality among urban and rural adult population by Bengali Pittsburgh Sleep Quality Index. *Advances in Human Biology*, *8*(1), 36–40.

O'Donnell, S., Bird, S., Jacobson, G., & Driller, M. (2018). Sleep and stress hormone responses to training and competition in elite female athletes. *European Journal of Sport Science*, *18*(5), 611–618. https://doi.org/10.1080/17461391.2018.1439535

Ohayon, M., Wickwire, E. M., Hirshkowitz, M., Albert, S. M., Avidan, A., Daly, F. J., Dauvilliers, Y., Ferri, R., Fung, C., & Gozal, D. (2017). National Sleep Foundation's sleep quality recommendations: First report. *Sleep Health*, *3*(1), 6–19.

Roberts, S. S. H., Teo, W.-P., & Warmington, S. A. (2019). *Effects of training and competition on the sleep of elite athletes: A systematic review and meta-analysis*. https://doi.org/10.1136/bjsports-2018-099322

Romdhani, M., Souissi, N., Chaabouni, Y., Mahdouani, K., Driss, T., Chamari, K., & Hammouda, O. (2020). Improved physical performance and decreased muscular and oxidative damage with postlunch napping after partial sleep deprivation in athletes. *International Journal of Sports Physiology and Performance*, *15*(6), 874–883.

Sargent, C., Lastella, M., Halson, S. L., & Roach, G. D. (2014). The impact of training schedules on the sleep and fatigue of elite athletes. *Chronobiology International*, *31*(10), 1160–1168. https://doi.org/10.3109/07420528.2014.957306

Silva, S. S. da, Silveira, M. A. C. da, Almeida, H. C. R. de, Nascimento, M. C. P. do, Santos, M. A. M. dos, & Heimer, M. V. (2022). Uso de telas digitais por adolescentes e associação com a qualidade do sono: Uma revisão sistemática. *Cadernos de Saúde Pública*, *38*, e00300721.

Swinbourne, R., Gill, N., Vaile, J., & Smart, D. (2016). Prevalence of poor sleep quality, sleepiness and obstructive sleep apnoea risk factors in athletes. *European Journal of Sport Science*, *16*(7), 850–858. https://doi.org/10.1080/17461391.2015.1120781

TABASSUM, N., & AZİM, A. (2024). Active & Healthy Aging. *Health*, *2*(2), 53–59.

Zitser, J., Allen, I. E., Falgàs, N., Le, M. M., Neylan, T. C., Kramer, J. H., & Walsh, C. M. (2022). Pittsburgh Sleep Quality Index (PSQI) responses are modulated by total sleep time and wake after sleep onset in healthy older adults. *PloS One*, *17*(6), e0270095.