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Association of dietary habits with sleep quality among collegiate athletes

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ABSTRACT

Background: College-level athletes face unique lifestyle challenges that could adversely affect sleep patterns and dietary behaviors, which have significant implications. Both factors are crucial for maintaining optimal performance, facilitating recovery, and promoting overall health. However, limited research in the Indian context has addressed how sleep-related challenges influence dietary patterns in this population.

Objective: The purpose of this study is to examine the relationships among dietary habits, sleep quality, and sleep disturbances in college athletes.

Materials & Methods: A cross-sectional research design was employed involving a sample of 255 university athletes. The assessment of dietary behaviors such as meal frequency, fast food consumption, hydration status, snacking patterns, and meal skipping was carried out using a validated questionnaire. Additionally, sleep quality was evaluated using the Modified Pittsburgh Sleep Quality Index and perceived barriers to sleep (e.g., academic stress, use of electronics, training schedule).

Results: Electronics use (40%) and social activities (36%) were the most common sleep barriers, followed by academic stress (16%) and training schedule (7%). Forty-one percent of participants reported regular meal skipping, and frequent fast-food intake (>2 times/week) was prevalent. Sleep scores (Modified PSQI) were modestly but significantly correlated with dietary habit scores ($\rho = 0.170$, $p = 0.016$). Linear regression indicated sleep quality significantly predicted dietary habits ($\beta = 0.173$, $p = 0.014$), explaining 3% of variance.

Conclusion: Sleep quality is modestly associated with dietary behaviors among Indian collegiate athletes. Interventions targeting sleep hygiene and nutrition could enhance health and performance in this population.

KEYWORDS

Circadian rhythms; College students; Athletic performance; Sleep; Nutrition; Dietary habits.

INTRODUCTION

Collegiate student-athletes face the challenge of managing both academic responsibilities and athletic commitments, which can adversely affect their sleep patterns and nutritional intake. Ensuring sufficient sleep and proper nutrition is crucial for effective recovery, metabolic health, cognitive functioning, and athletic success[1].

Disruptions in sleep patterns are known to influence appetite-regulating hormones, increasing cravings for energy-dense foods and impairing dietary decision-making[2]. Conversely, high consumption of ultra-processed and low-nutrient foods may contribute to poor sleep quality, creating a bidirectional relationship between diet and sleep[3]. Among young athletes, irregular meal patterns, meal skipping, and increased fast-food consumption are frequently reported[4]. These behaviors are frequently influenced by various lifestyle factors like academic workload, circadian misalignment, electronic device use, and psychosocial stress[5]. In India, evidence on the interplay between sleep quality, lifestyle barriers, and dietary behaviors in collegiate athletes remains limited. Limited research has explored sleep barriers in this population, despite the transitional phase of late adolescence and early adulthood being critical for establishing lifelong health habits[6].

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This study aimed to examine the association between sleep quality and dietary behaviors among Indian collegiate athletes and to identify key behavioral and environmental barriers to sleep. Our study outcomes may support the design of integrated interventions targeting both sleep hygiene and nutritional practices to enhance health and performance in this population.

MATERIALS & METHODS

Study Design and Participants

A cross-sectional analytical study was conducted to examine the association between dietary habits, sleep quality, and barriers to sleep among collegiate athletes. Participants were recruited from multiple universities across the Delhi-NCR region, representing various sports disciplines, including athletics, football, volleyball, swimming, basketball, and other collegiate-level sports. The purpose of selecting this region was the concentration of higher education institutions and active college-level athletic programs, which provided a relevant sampling frame for the research purposes. Eligible participants were 18–25 years old, enrolled in undergraduate or postgraduate programs, and engaged in structured sports training at least three times per week. Athletes with diagnosed sleep disorders, eating disorders, or those using sleep medications or performance-enhancing dietary supplements were excluded.

Out of the initial cohort of two hundred fifty-five athletes, a total of two hundred participants completed the survey in its entirety and were subsequently incorporated into the final analytical dataset. The sampling technique used was purposeful sampling, which allowed the researcher to target participants who met specific inclusion criteria that aligned with the objectives of the study.

Participants included both male and female athletes (67% male, 33% female) from seven sports disciplines (kabaddi, cricket, basketball, running, table tennis, swimming, and tennis). This distribution was considered to evaluate potential gender or sport-related differences.

Inclusion criteria were clearly defined to ensure a homogenous and relevant study sample. Participants were required to be student-athletes who were enrolled in either undergraduate or postgraduate programs. Actively engaged in physical activity and sports (e.g., athletics, football, volleyball, swimming, basketball, or other collegiate-level sports) at least three times a week. A Willingness to provide informed consent to participate in the study. Participants were excluded if they had been diagnosed with sleep disorders (e.g., insomnia, sleep apnea) or eating disorders (e.g., anorexia, bulimia nervosa). The use of prescribed sleep medication and performance-improving dietary supplements could potentially influence sleep quality and dietary behavior. Participants who submitted incomplete responses or those whose survey data contained missing variables were removed from the final analysis to maintain the integrity and reliability of the dataset. After excluding answers with missing data, the final sample consisted of two hundred participants.

Ethical approval for the study was obtained from the Institutional Review Board. Participants were informed in detail about the purpose, procedures, and voluntary nature of the study. Confidentiality was assured, and participants retained the right to withdraw from the study at any stage without any consequences. All collected data were stored securely and used for academic and research purposes only.

Dietary Behavior Assessment

The dietary habits of participants were evaluated using a structured questionnaire adapted from a validated nutritional behavior instrument (Food Frequency Questionnaire), with modifications to align with the cultural context[7]. The assessment encompassed six distinct domains:

Meal frequency (main meals per day).

Fruit and vegetable intake.

Fast-food consumption.

Water intake (glasses/day).

Snacking frequency (chips, sweets, carbonated beverages).

Meal skipping (breakfast, lunch, or dinner).

Each item contributed equally to the composite dietary behavior score. No differential weighting was applied to variables. Internal consistency of the index was verified (Cronbach's $\alpha = 0.78$), indicating acceptable reliability. Responses were categorised using a frequency scale (daily, 3–4 times per week, rarely, or never). These responses were then combined to create a dietary behavior score, where higher scores indicate healthier dietary patterns.

Sleep Quality Assessment

The quality of sleep was evaluated utilising the Pittsburgh Sleep Quality Index (PSQI)[8]. This evaluates seven domains: sleep quality, latency, duration, efficiency, disturbances, medication use, and daytime dysfunction. The global score ranges from 0 to 21.

In this research, participants reported mean sleep duration, difficulty initiating sleep, nighttime awakenings, and daytime fatigue. The scoring system was adjusted so that higher scores indicate better sleep quality. Scores below four were categorised as poor sleep. For this study, five parameters were selected as the most relevant to the research objectives.

Average sleep duration (e.g., <5 h, 5–6 h, 7–8 h, >8 h).

Feeling refreshed upon waking (Never, Sometimes, Most of the time, Always).

Difficulty falling asleep (Never, Occasionally, Frequently, Almost every night).

Waking up during the night (Never, Occasionally, Frequently, Almost every night).

Daytime fatigue (Never, Occasionally, Frequently, Almost every night).

Each parameter was scored on a scale reflecting severity, and summed to generate a total sleep score ranging from 0 to 14.

Based on the total score, participants were classified into three categories of sleep quality:

Poor sleep quality: 0–4.

Moderate sleep quality: 5–9.

Good sleep quality: 10–14.

Sleep Barriers

Behavioral and environmental sleep barriers were assessed using a predefined checklist including:

Academic stress.

Training schedule conflicts.

Late-night social activities.

Excessive electronic device use.

An "Other" option was included, but responses in this category were minimal and therefore excluded from analysis due to their low frequency[9,10].

Statistical Analysis

Data examination was conducted utilizing Microsoft Excel 2021 (Microsoft Corporation, USA). Descriptive statistics, including means, standard deviations, and percentages, were used to characterize participant attributes, dietary behaviors, and sleep patterns. The Shapiro-Wilk test indicated that the data did not follow a normal distribution.

To evaluate the relationships between sleep quality and dietary habits, Spearman's rank correlation coefficient was employed.

Simple linear regression evaluated sleep quality as a predictor of dietary behavior.

Statistical significance was set at $p < 0.05$.

Assumptions for linear regression were examined, including checks for homoscedasticity and absence of multicollinearity using residual plots and variance inflation factors (VIF < 2). Residuals were visually inspected and found to be normally distributed, confirming the adequacy of the regression model.

RESULTS

Participant Characteristics

Of the 255 collegiate athletes enrolled, 200 completed the survey (response rate 78.4%). Participants were predominantly male (n = 134, 67%), with a mean age of 21.8 ± 2.2 years (range 18–25). Sports representation included kabaddi (n = 43, 21.5%), cricket (n = 40, 20%), basketball (n = 28, 14%), running (n = 27, 13.5%), table tennis (n = 27, 13.5%), swimming (n = 21, 10.5%), and tennis (n = 14, 7%) (Table 1).

Dietary and Sleep Behavior

Most athletes (n = 84, 42%) reported consuming ≥3 meals/day, while 41.5% (n = 83) reported 1–2 meals/day. Fruit and vegetable consumption was suboptimal: 22% consumed >1 serving/day, 18.5% daily, and 6% rarely or never.

Fast-food intake was high, with 33% consuming it daily/almost daily and 29.5% 3–4 times/week. Only 32.5% consumed ≥10 glasses of water/day, while 37.5% consumed ≤4 glasses. Snacking was common: 44.5% 1–2 times/week and 30.5% 3–4 times/week. Meal skipping was frequent, with 41.5% skipping meals daily and 27% 3–4 times/week.

Sleep scores (Modified PSQI) averaged 7.13 ± 3.24, with 21% classified as good sleep, 58.5% moderate, and 20.5% poor. Mean sleep duration was 5.57 ± 1.13 hours/night, below the recommended 7–9 hours (Table 2).

Table 1. Participant Demographics

Demographic Variable	Category	n (%)
Gender	Male	134 (67%)
	Female	66 (33%)
Age Group	18–20	62 (31%)
	21–23	78 (39%)
	24–25	60 (30%)
Sport Type	Basketball	28 (14%)
	Kabaddi	43 (21.5%)
	Running	27 (13.5%)
	Cricket	40 (20%)
	Table Tennis	27 (13.5%)
	Tennis	14 (7%)
	Swimming	21 (10.5%)

Distribution of gender, age groups, and sport types among collegiate athletes (N = 200); Mean age = 21.8 ± 2.2 years.

Table 2. Descriptive Statistics for Dietary Habits and Sleep Scores (Modified PSQI)

Variable	Mean	SD	Min	Max	Shapiro Wilk	p-value
Dietary Habit Score	10.03	5.142	2	20	0.93	<0.001
Sleep Score (modified PSQI)	7.125	3.236	0	14	0.905	<0.001

Mean, standard deviation (SD), range, and normality test (Shapiro-Wilk) for dietary habit scores and sleep quality scores.

Training Hours / Competition Level

Athletes trained an average of 8.6 ± 3.4 hours per week. The majority (72%) competed at the university level, whereas 28% represented their state in intercollegiate tournaments.

Sleep Barriers

Several participants reported experiencing multiple sleep barriers. Primary sleep barriers included screen exposure (n = 81, 40.5%) and social distractions (n = 72, 36%). Academic stress (n = 32, 16%) and training schedule (n = 15, 7.5%) were less common.

Correlation Between Sleep and Dietary Behavior- Spearman's correlation indicated a modest positive association between sleep and dietary scores ($\rho = 0.17$, $p = 0.016$), suggesting healthier diets with better sleep (Table 3).

Predictors of Dietary Behavior- Simple linear regression (Table 4) demonstrated that sleep score (modified PSQI) significantly predicted dietary behavior ($\beta = 0.173$, $p = 0.014$), accounting for 3% of variance ($R^2 = 0.03$).

Table 3. Spearman's rho (ρ) correlation between dietary and sleep scores (Modified PSQI)

Variable	Dietary Habit Score	Sleep Score (Modified PSQI)
Dietary Habit Score	-	0.17
p-value	-	0.016

Spearman's correlation coefficient and p-value showing the association between dietary habit score and sleep score (Modified PSQI).

DISCUSSION

Our study explored how sleep quality and dietary habits among collegiate athletes are associated, revealing a statistically significant yet modest positive correlation. Athletes with better sleep quality are prone to report healthier dietary behaviors. This association aligned with existing evidence suggesting that sleep and nutrition are interrelated characteristics of athlete health and performance[6,19]. The mean dietary behavior score of 10.03 (SD = 5.142) and the high prevalence of fast-food consumption and meal skipping indicate suboptimal dietary patterns within this population. These behaviors mirror the findings of earlier studies, who noticed that even university athletes with poor sleep patterns tended to ate energy-dense foods and preferred vegetables[11]. Similarly, short sleep duration was associated with increased calorie intake and frequent meal skipping among college students[12]. Regression analysis showed that sleep scores accounted for approximately 3% of the variation in dietary habit scores. Although the effect size is small, it is statistically significant. These findings are consistent with studies that have reported modest but meaningful associations between sleep and nutritional behaviors in young adults[13,14].

Importantly, the most common sleep-related barriers were screen time and blue light exposure (40.5%) and social distractions (36%). Similar findings were reported that prolonged screen time delayed sleep onset and increased unhealthy food choices the next day[15]. Similarly, the bidirectional nature of circadian disruption and dietary timing in student-athletes, noting that late-night social activities or screen use often result in both sleep debt and irregular eating patterns[16].

The average sleep score in athletes (mean = 7.125) indicates a predominance of moderate sleep quality among athletes,

Table 4. Linear Regression Analysis Predicting Dietary Habits from Sleep Score (N=200)

Predictor	B (Unstd.)	SE(B)	β (Std.)	95% CI for B	t	p
Constant	8.067	0.87	–	6.35, 9.78	9.27	<.001
Sleep score	0.276	0.111	0.173	0.057, 0.495	2.48	0.014

Model fit: $R^2 = 0.03$; Adjusted $R^2 = 0.025$; $F(1,198) = 6.14$; $p = 0.014$; RMSE = 5.14.
SE = Standard Error; β = Standardized Coefficient; CI = Confidence Interval; RMSE = Root Mean Square Error.

which may compromise recovery and efficiency. Furthermore, increased sleep duration not only improved athletic performance but also contributed to better dietary adherence[17]. Interestingly, the training schedule was not a major sleep barrier in our study (7.5%), which contrasts with previous findings that reported that training intensity and post-exercise cortisol elevation can delay sleep onset[18]. This discrepancy might be due to differences in sport disciplines or training programs in our group.

These findings underscore the need for integrated wellness interventions targeting both sleep hygiene and nutrition among collegiate athletes.

Limitations and Recommendations for Future Research

This research acknowledges certain limitations. Primarily, the use of a cross-sectional study design restricts the ability to infer causal relationships between sleep quality and dietary habits. Second, reliance on self-reported measures introduces potential recall and social desirability biases. Future research should employ longitudinal designs and incorporate objective sleep assessments, such as actigraphy or wearable devices, to enhance accuracy. Additionally, including other behavioral and psychosocial factors, such as mental health and nutritional knowledge. This may provide a more comprehensive understanding of the determinants of dietary behavior in collegiate athletes.

CONCLUSION

This study demonstrates a notable and statistically significant positive correlation between sleep quality and dietary habits among Indian collegiate athletes. Despite active participation in sports, many athletes exhibited suboptimal dietary behaviors characterized by frequent meal skipping, high fast-food consumption, and low fruit and vegetable intake. Sleep quality was predominantly moderate, with screen exposure and social distractions as the primary barriers.

Even small improvements in sleep hygiene may lead to healthier dietary patterns, promoting better recovery and performance. Integrated interventions that focus on sleep hygiene, screen-time reduction, and structured meal planning could enhance both nutritional adherence and athletic outcomes.

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