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THE RELATIONSHIP BETWEEN SLEEP QUALITY AND DIETARY HABITS IN APPRENTICE JOCKEYS

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ABSTRACT

Introduction: Adequate sleep is vital for young athletes, and diet may play a role in sleep quality. This is especially relevant for apprentice jockeys who face unique physical and nutritional demands. Objective: To examine the relationship between dietary habits and sleep quality in apprentice jockeys at the Turkish Jockey Club Ekrem Kurt Apprentice Training Center. Materials and Methods: Twenty-four male apprentice jockeys (15-18 years) completed 7-day food and fluid intake records. Sleep quality was evaluated using the Pittsburgh Sleep Quality Index (PSQI). Anthropometric measurements were collected. Associations between nutrient intake and PSQI components were analyzed with Spearman's correlation. Results: The mean PSQI score was 4.96 ± 2.84, and 41.7% of participants were poor sleepers. Total energy and macronutrient intake were not associated with overall PSQI. However, certain nutrients showed meaningful relationships with specific sleep components. Higher zinc intake, especially in the evening, was linked to better subjective sleep quality, while higher evening fat intake was associated with poorer sleep. Protein and fat intake showed negative correlations with subjective sleep quality. Evening carbohydrate proportion was related to fewer sleep disturbances. Conclusions: Although overall dietary intake did not affect global sleep quality, selected nutrients and meal timing were associated with specific aspects of sleep.

Key words: Apprentice jockeys. Sleep quality. Nutrition habits. Pittsburgh Sleep Quality Index (PSQI). Athletic performance.

RESUMO

A relação entre a qualidade do sono e os hábitos alimentares em aprendizes de jóquei

Introdução: O sono adequado é essencial para jovens atletas, e a alimentação pode desempenhar um papel na qualidade do sono. Isso é especialmente relevante para aprendizes de jóquei, que enfrentam exigências físicas e nutricionais particulares. Objetivo: Examinar a relação entre os hábitos alimentares e a qualidade do sono em aprendizes de jóquei do Centro de Treinamento de Aprendizes Ekrem Kurt do Jockey Club da Turquia. Materiais e Métodos: Vinte e quatro aprendizes de jóquei do sexo masculino (15-18 anos) registraram sua ingestão de alimentos e líquidos durante 7 dias. A qualidade do sono foi avaliada por meio do Pittsburgh Sleep Quality Index (PSQI). Medidas antropométricas foram coletadas. As associações entre ingestão de nutrientes e componentes do PSQI foram analisadas com a correlação de Spearman. Resultados: A pontuação média do PSQI foi de 4,96 ± 2,84, e 41,7% dos participantes apresentaram má qualidade de sono. A ingestão total de energia e macronutrientes não se associou ao PSQI global. No entanto, alguns nutrientes mostraram relações significativas com componentes específicos do sono. Maior ingestão de zinco, especialmente à noite, esteve associada a melhor qualidade subjetiva do sono, enquanto maior ingestão noturna de gordura esteve relacionada a pior qualidade. A ingestão de proteína e gordura apresentou correlações negativas com a qualidade subjetiva do sono. A maior proporção de carboidratos no período noturno esteve ligada a menos distúrbios do sono. Conclusão: Embora a ingestão alimentar total não tenha afetado a pontuação global do PSQI, nutrientes específicos e o horário das refeições mostraram associação com aspectos particulares do sono.

Palavras-chave: Aprendizes de jóquei. Qualidade do sono. Hábitos nutricionais. PSQI. Desempenho atlético.

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INTRODUCTION

Adolescence is a critical period marked by rapid growth and development, along with significant physiological, psychological, and social changes (Mason et al., 2023).

Establishing healthy lifestyle habits during this phase is vital for long-term physical and mental well-being, as these habits can profoundly impact the overall quality of life in adulthood (Hirshkowitz et al., 2015).

Among these habits, nutrition and sleep patterns play an essential role, particularly in general health and athletic performance, where even small adjustments can lead to significant improvements in outcomes (Watson, 2017).

Sleep quality is not only crucial for recovery in athletes but also directly influences both physical and mental performance (Roberts et al., 2019).

Insufficient or irregular sleep has been associated with hormonal imbalances, a weakened immune system, and a decline in physical performance. Specifically, among adolescent athletes, poor sleep quality can result in low academic achievement, increased injury risk, and suboptimal physical performance (Pandi-Perumal et al., 2020).

Recent studies emphasize that 60% of athletes report poor sleep quality, often linked to factors such as stress, competition anxiety, and irregular schedules (6).

A study by Borghi et al., (2025) evaluated chronotype, sleep hygiene, and sleep characteristics among Italian athletes, highlighting significant differences between team and individual sports, elite and non-elite athletes, and gender differences. It was found that individual-sports athletes exhibited better sleep quality and more morning-oriented chronotypes, with elite athletes showing greater sleep efficiency and shorter sleep latency (Borghi et al., 2025).

Additionally, significant correlations were observed between sleep quality (PSQI) and sleep hygiene (SHI) ($r = 0.43$, $p < 0.001$), indicating that good sleep hygiene practices could enhance sleep quality.

Furthermore, Day et al., (2024) emphasized the importance of sleep not only for general health but also for reducing injury risk and maintaining athletic performance.

The study highlighted that sleep disorders are common in athletes, and proper assessment through methods such as polysomnography, actigraphy, and sheet sensors is crucial.

The researchers also noted that treatment options for sleep disorders include sleep hygiene, cognitive behavioral therapy, medication, and addressing underlying factors like mental health. Moreover, for athletes, additional factors such as travel fatigue and jet lag can significantly impact sleep quality, necessitating targeted interventions (Day et al., 2024).

In parallel, nutrition is equally vital for maintaining performance and supporting physical development in athletes (Heaton et al., 2017). Adolescent athletes have higher energy needs, and balanced nutrition is necessary to support their metabolic demands.

Beyond performance, research shows that nutritional habits also significantly impact sleep patterns, with factors such as inadequate energy intake, high caffeine consumption, and irregular meal habits being associated with poor sleep quality (St-Onge et al., 2016).

Moreover, specific nutrients, including tryptophan-rich proteins, may improve sleep quality, suggesting that dietary interventions could be a practical approach to enhancing sleep patterns in athletes (Hudson et al., 2005; Afaghi et al., 2007a).

This study hypothesizes that there is a significant relationship between the nutrition habits and sleep quality of apprentice jockeys. By focusing on apprentice jockeys-an underrepresented group of adolescent athletes with unique physical and mental demands-this study aims to address a notable gap in the literature.

While numerous studies have investigated the effects of nutrition and sleep in general athletic populations, few have examined these relationships specifically in jockeys, whose weight-control behaviors, intense training regimens, and high injury risk distinguish them from other adolescent athletes (Silva et al., 2016; Kirschen et al., 2020a).

Existing research often overlooks how these factors interact to influence sleep quality in this group, making targeted investigation necessary (Day et al., 2024).

The study's strengths include its focus on a specific age and professional group, the use of validated measurement tools like the Pittsburgh Sleep Quality Index (PSQI), and the detailed assessment of nutritional habits through a 7-day food and fluid consumption questionnaire.

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In conclusion, this study aims to provide insights into how nutrition affects sleep quality among apprentice jockeys.

The findings may contribute to developing targeted strategies to improve the well-being and performance of young athletes.

We hypothesized that specific dietary components, particularly micronutrient intake and meal timing, would be significantly associated with individual sleep quality components, including subjective quality and sleep duration.

MATERIALS AND METHODS

Study Design

The sample for this study consisted of 24 male apprentice jockeys, aged 15-18, who were active at the Turkish Jockey Club Ekrem Kurt Apprentice Training Center.

This study was approved by th with the decision number 5/11, dated 10/03/2023. The study was conducted in accordance with the principles of the Declaration of Helsinki. All participants and, where applicable, their legal guardians provided written informed consent prior to participation.

The study focused on examining the overall relationship between nutritional habits and sleep quality in apprentice jockeys.

This approach aimed to capture general trends across the population, providing a broad perspective on how dietary intake may be associated with sleep quality in young athletes.

Participants

Participants were recruited through official collaboration with the Turkish Jockey Club (TJK). Coaches and club officials provided a list of eligible athletes, who were then invited to participate in the study. All licensed apprentice jockeys aged 15-18 years actively training and competing during the study period were considered for inclusion.

To ensure the validity of the findings, several exclusion criteria were applied: athletes with a history of sleep disorders diagnosed by a healthcare professional, those using medications that could affect sleep patterns or nutrition habits and who did not provide complete data for the 7-day food and fluid consumption questionnaire or the Pittsburgh Sleep Quality Index (PSQI). All participants and their legal guardians (for minors) provided written informed consent before data collection. Anthropometric measurements, including height, weight, and BMI, were recorded, followed by the PSQI. Participants completed a 7-day food and fluid intake diary to evaluate dietary habits, verified through individual interviews.

Data collection tools

Personal information form

At the beginning of the study, participants provided information regarding their age, height, and body weight, birth, educational background, health status, use of medications, alcohol, and tobacco consumption. Based on the height and weight measurements, body mass index (BMI, kg/m^2) was calculated.

Pittsburgh Sleep Quality Index (PSQI)

The Pittsburgh Sleep Quality Index (PSQI) was used to assess the participants' sleep quality. Developed by Buysse et al., (1989), the PSQI is a self-assessment tool providing information on sleep quality, types of sleep disorders, and their intensity over the past month.

The index consists of 24 items, five completed by the participant's sleep partner or roommate. The PSQI generates scores for seven components: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleep medication, and daytime dysfunction. Each item is scored between 0 and 3, and the total score from the components provides the overall PSQI score. The total score ranges from 0 to 21, with five or below indicating "good sleep quality" and scores above 5 indicating "poor sleep quality." A PSQI score above 5 suggests that the participant experiences severe problems in at least two components of sleep or mild to moderate problems in three or more components. The Turkish version of the PSQI was adapted by Ağargün et al., (1996).

Nutrition and fluid intake analysis

Participants recorded their food and fluid consumption for seven days. They were asked to photograph their meals at each sitting and send them to the researchers. These

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records were confirmed through in-person interviews after one week.

The participants' daily energy and nutrient intake were calculated using these data. The number of daily meals, the types of food consumed during meals, and energy intake rates were also determined. The collected data were analyzed using the Nutrition Information System (BEBIS) software.

Statistical analysis

The data obtained from the study were analyzed using SPSS 20.0 software (Statistical Package for Social Sciences for Windows v.20.0).

Descriptive statistics were presented as mean (±), standard deviation, minimum-maximum, median, frequency, and percentage. The normality of the data was assessed using the Shapiro-Wilk test.

The Mann-Whitney U test was used to compare non-normally distributed quantitative data between groups, while the Independent Samples t test was used to compare normally distributed data. Relationships between variables were examined using Spearman's Correlation Analysis. A statistical significance level of $p<0.05$ was accepted. To interpret the strength of associations derived from Spearman's correlation coefficients, the following cut-off values were used: $|r| = 0.00–0.29$ was considered weak, $|r| = 0.30-0.49$ moderate, $|r| = 0.50-0.69$ strong, and $|r| \geq 0.70$ very strong correlation (journal & 2012, 2012). These thresholds were applied consistently in the interpretation of results in both the Results and Discussion sections.

RESULTS

A total of 24 apprentice jockeys participated in the study. The mean age of the participants was 15.80 ± 0.95 years.

Their average body weight was 46.62 ± 5.07 kg, average height was 160.27 ± 7.39 cm, and average body mass index (BMI) was calculated as 18.12 ± 1.24 kg/m^2.

The jockeys' daily energy and macronutrient intake were as follows: 2468.46 ± 375.16 kcal energy, 262.16 ± 69.47 g carbohydrates (43.38 ± 7.93%), 124.69 ± 46.75 g protein (20.83 ± 7.04%), and 97.39 ± 16.32 g fat (35.63 ± 5.78%).

Micronutrient intake levels were also measured, with average daily intake values including: 1084.22 ± 261.74 µg vitamin A, 20.77 ± 6.24 mg vitamin E, 1.05 ± 0.24 mg vitamin B1, 1.85 ± 0.44 mg vitamin B2, 2.35 ± 0.92 mg vitamin B6, and 130.35 ± 53.76 mg vitamin C, among others. Full details are presented in quadro 1 and 2.

Quadro 1 - The athletes' daily and night Macronutrient intake values.

	Daily Intake Mean ± SD Min-Max (Median)	During And After Dinner Mean ± SD Min-Max (Median)
Energy (kcal)	2468.46 ± 375.16 1923.26-3597.39 (2449.46)	530.74 ± 133.38 262.57-874.57 (514.41)
Water (ml)	3105.92 ± 724.01 2304.43+5204.83 (2882.96)	465.91 ± 80.16 323.62-617.85 (456.12)
Carbohydrate (%)	43.38 ± 7.93 26-54 (45.5)	38.13 ± 6.34 20-51 (39.5)
Carbohydrate (g)	262.16 ± 69.47 159.14-433.47 (272.14)	51.16 ± 17.27 21.92-109.94 (51.08)
Protein (%)	20.83 ± 7.04 13-42 (19.5)	17.75 ± 2.97 8-23 (17.5)
Protein (g)	124.69 ± 46.75 76.42-263.89 (113.66)	23.63 ± 6.13 7.31-36.57 (23.63)
Fat (%)	35.63 ± 5.78 26-47 (35)	43.96 ± 7.27 31-66 (43.5)
Fat (g)	97.39 ± 16.32 65.57-129.08 (98.54)	26.31 ± 5.08 16.75-35.41 (26.89)

SD: standard deviation.

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Sleep quality was assessed using the PSQI. The average total PSQI score was 4.96 ± 2.84, indicating generally good sleep quality among participants. According to PSQI scoring, 14 athletes (58.3%) had good sleep quality (score 0-4), while 10 athletes (41.7%) were classified as having poor sleep quality (score ≥5).

Quadro 2 - The athletes' daily Micronutrient intake values. SD: standard deviation.

	Daily İntake Mean ± SD Min-Max (Median)	During And After Dinner Mean ± SD Min-Max (Median)
Vitamin A (µg)	1084.22 ± 261.74 623.82-1681.25 (1068.08)	486.17 ± 60.95 344.01-582.42 (498.59)
Vitamin E (mg)	20.77 ± 6.24 8.71-33.29 (20.23)	6.09 ± 1.67 3.56-11.67 (5.98)
Vitamin B1 / Thiamine (mg)	1.05 ± 0.24 0.71-1.56 (1.03)	0.21 ± 0.07 0.11-0.40 (0.19)
Vitamin B2/ Riboflavin (mg)	1.85 ± 0.44 1.24-3.14 (1.75)	0.41 ± 0.17 0.08-0.70 (0.36)
Vitamin B6 / Pyridoxine (mg)	2.35 ± 0.92 1.60-6.45 (2.15)	0.39 ± 0.08 0.19-0.51 (0.39)
Folate (µg)	358.02 ± 65.97 245.87-533.74 (354.56)	62.07 ± 15.37 27.06-84.37 (63.57)
Vitamin C (mg)	130.35 ± 53.76 50.42-236.03 (119.30)	37.19 ± 8.14 17.7-49.67 (37.67)
Sodium (mg)	5432.88 ± 2263.88 3052.9-11041.01 (5088.43)	1365.04 ± 230.55 990.85-1889.14 (1314.65)
Potassium (mg)	3446.50 ± 640.36 2298.08-5196.10 (3413.44)	705.48 ± 167.35 394.64+979.81 (698.93)
Calcium (mg)	1078.45 ± 338.39 646.79-1985.42 (1012.23)	162.74 ± 106.64 56.80-339.14 (97.34)
Magnesium (mg)	418.66 ± 69.80 314.75-541.35 (397.90)	71.07 ± 18.82 33.66-105 (68.6)
Phosphorus (mg)	1803.42 ± 439.91 1164.80-2799.87 (1695.99)	306.33 ± 104.00 87.92-477.97 (307.35)
Iron (mg)	13.68 ± 2.29 9.98-18.43 (13.44)	2.86 ± 0.62 1.33-4.44 (2.91)
Zinc (mg)	15.31 ± 2.42 9.71-21.77 (14.91)	2.56 ± 0.69 1.05-3.68 (2.57)

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Quadro 3 - The athletes' PSQI scores and their statistical evaluation. SD: standard deviation.

Total (n=24)	Mean ± SD Min-Max (Median)
Subjective Sleep Quality	1.25 ± 0.50 0.0-4.0 (0.50)
Sleep Latency	1.13 ± 1.03 0.0-3.0 (1.0)
Sleep Duration	0.21 ± 0.41 0.0-1.0 (0.42)
Sleep Efficiency	0.041 ± 0.20 0.0-1.0 (0.0)
Sleep Disturbance	1.21 ± 0.51 0.0-2.0 (1.0)
Use of Sleep Medication	0.00 ± 0.00 0.0-0.0 (0.0)
Daytime Dysfunction	1.25 ± 1.57 0.0-4.0 (0.50)
Total Score	4.96 ± 2.84 1.0-13.0 (4.0)
Number of individuals scoring 0-4 n (%) (Good Sleep Quality)	14 (58.3)
Number of individuals scoring 5-21 n (%) (Poor Sleep Quality)	10 (41.7)

The breakdown of PSQI subscales showed relatively higher scores in subjective sleep quality (1.25 ± 0.50), sleep disturbance (1.21 ± 0.51), and daytime dysfunction (1.25 ± 1.57), whereas sleep latency (1.13±1.03), sleep efficiency (0.041±0.20), sleep duration (0.21±0.41) and use of sleep medication (0.00±0.00) received lower scores. These results are summarized in quadro 3.

Correlation analyses revealed several statistically significant associations between PSQI subscales and nutrient intake.

According to quadro 4, subjective sleep quality was strongly positively correlated with daily zinc intake ($r = 0.596$, $p = 0.002$) and negatively correlated with fat percentage ($r = -0.513$, $p = 0.010$) and protein percentage ($r = -0.592$, $p = 0.002$). Sleep duration was negatively correlated with zinc intake ($r = -0.585$, $p = 0.003$) and protein percentage ($r = -0.591$, $p = 0.002$). Daytime dysfunction was positively correlated with iron intake ($r = 0.596$, $p = 0.002$).

Table 4 - Correlation between athletes' PSQI subscale scores and daily energy and nutrient intakes

		Zn	Mg	Fe	Energy	%CHO	%PRO	%FAT
Subjective Sleep Quality	r	0.596	0.011	0.178	-0.308	0.129	-0.592	-0.513
	p	0.002**	0.960	0.407	0.144	0.547	0.002**	0.010*
Sleep Latency	r	-0.005	-0.061	0.074	0.037	-0.082	-0.089	0.194
	p	0.980	0.778	0.731	0.864	0.704	0.680	0.364
Sleep Duration	r	-0.585	0.170	-0.082	-0.170	0.319	-0.591	0.104
	p	0.003**	0.460	0.705	0.426	0.128	0.002**	0.628
Sleep Efficiency	r	0.095	-0.105	0.256	-0.015	-0.091	-0.076	0.121
	p	0.680	0.624	0.227	0.944	0.674	0.724	0.573
Sleep Disturbance	r	0.095	0.179	-0.115	0.001	0.170	-0.052	0.058
	p	0.660	0.402	0.592	0.998	0.426	0.809	0.788
Use of Sleep Medication	r	-	-	-	-	-	-	-
	p	-	-	-	-	-	-	-
Daytime Dysfunction	r	0.279	0.396	0.596	0.122	0.365	-0.252	-0.140
	p	0.187	0.055	0.002**	0.569	0.079	0.235	0.513
Total PSQI	r	0.192	0.192	0.037	-0.129	0.206	-0.260	0.195
	p	0.369	0.369	0.862	0.547	0.334	0.219	0.319

Note: r: Spearman's Correlation Coefficient. *p < 0.05; ** p < 0.01. PSQI: Pittsburgh Sleep Quality Index.

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Qaudro 5 - Correlation between PSQI subscale scores and evening/post-dinner energy and nutrient intakes.

		Zn	Mg	Fe	Energy	%CHO	%PRO	%FAT
Subjective Sleep Quality	r	0.865	0.184	0.244	0.080	0.209	-0.245	-0.918
	p	0.000**	0.388	0.250	0.711	0.326	0.250	0.000**
Sleep Latency	r	0.174	0.188	0.280	0.015	0.117	-0.117	0.006
	p	0.415	0.380	0.186	0.945	0.586	0.587	0.980
Sleep Duration	r	-0.215	-0.245	-0.037	-0.185	-0.015	-0.090	-0.082
	p	0.313	0.249	0.864	0.386	0.945	0.675	0.702
Sleep Efficiency	r	-0.196	-0.075	-0.015	0.286	0.212	-0.260	-0.152
	p	0.359	0.727	0.944	0.175	0.350	0.219	0.478
Sleep Disturbance	r	0.150	0.268	0.243	-0.302	-0.437	-0.106	0.363
	p	0.486	0.205	0.252	0.151	0.033*	0.623	0.082
Use of Sleep Medication	r	-	-	-	-	-	-	-
	p	-	-	-	-	-	-	-
Daytime Dysfunction	r	-0.176	-0.096	-0.053	-0.178	0.047	0.003	-0.076
	p	0.412	0.655	0.805	0.407	0.828	0.988	0.724
Total PSQI	r	0.109	0.191	0.307	-0.208	0.009	-0.092	-0.017
	p	0.612	0.372	0.144	0.330	0.966	0.669	0.937

Note: r: Spearman's Correlation Coefficient. *p < 0.05; ** p < 0.01. PSQI: Pittsburgh Sleep Quality Index.

As shown in Table 5, subjective sleep quality was strongly positively correlated with zinc intake during and after dinner (r = 0.865, p = 0.000) and strongly negatively correlated with fat percentage (r = -0.918, p = 0.000). Additionally, sleep disturbance was moderately negatively correlated with carbohydrate percentage (r = -0.437, p = 0.033).

DISCUSSION

This study investigated the link between diet and sleep in apprentice jockeys. Contrary to the hypothesis, no associations were found between energy or macronutrient intake and overall PSQI scores.

Sleep quality is vital for athletes' physical and mental performance. Poor sleep reduces training efficiency, concentration, and motivation, and increases fatigue (Doherty et al., 2019).

Studies show deterioration during intense training and competition, particularly affecting endurance sports (Grandner et al., 2014).

For apprentice jockeys, inadequate sleep may impair focus and decision-making in races, while better sleep could enhance performance and reduce injury risk (Kirschen et al., 2020b).

Insufficient sleep in adolescent athletes is linked to hunger regulation and increased intake of high-calorie foods. Poor dietary habits, such as excess fat or late snacking, can disturb sleep (Grandner et al., 2014).

In the present study, although no significant associations were observed at the global PSQI level, subscale analyses revealed noteworthy relationships with specific nutrients.

Subjective sleep quality was positively correlated with daily zinc intake but negatively associated with fat and protein percentages.

Moreover, sleep duration was inversely related to zinc and protein intake, while iron intake was positively associated with daytime dysfunction.

The literature shows mixed results regarding fat intake and sleep quality. Some studies report that high saturated fat consumption impairs sleep, possibly through metabolic imbalance and glucose intolerance (Kahlhöfer et al., 2016), while others suggest that sleep restriction itself may increase preference for fatty foods. The effect therefore appears multifactorial, depending on both amount and source of fat (Gangitano et al., 2023).

In our study, a strong negative correlation was found between dietary fat percentage and subjective sleep quality, indicating that higher fat intake was linked to poorer perceived sleep.

This is consistent with previous evidence that diets rich in total or saturated fats may disrupt sleep architecture, delay sleep onset, and reduce efficiency, partly via

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thermogenic and circadian mechanisms (Yan et al., 2024).

These results highlight the importance of moderating fat intake and favoring healthier fat sources to support better sleep.

Protein intake, especially from tryptophan-rich foods, has been linked to improved sleep by supporting neurotransmitter synthesis and muscle recovery (Cao et al., 2020).

High-quality proteins such as dairy, fish, and lean meats may therefore benefit sleep, while lower-quality sources appear less effective (Gangitano et al., 2023).

In contrast, our study found significant negative associations between protein percentage and both subjective sleep quality and sleep duration, suggesting that higher protein intake was related to poorer perceived sleep and shorter sleep time.

These findings imply that the effects of protein depend on timing, source, and amount. Excessive or late-day protein consumption may elevate metabolic activity and delay sleep onset, whereas moderate intake could be beneficial (Du et al., 2022).

These findings suggest that micronutrients such as zinc and iron may affect specific aspects of sleep regulation rather than overall sleep quality. In our study, zinc intake was positively correlated with subjective sleep quality, indicating that higher zinc consumption was linked to better perceived sleep. Zinc supports neurotransmitter function and melatonin synthesis, modulates GABAergic activity, and stabilizes neuronal membranes, all of which contribute to sleep regulation and maintenance (Jazinaki et al., 2024).

Consistent with our results, a study in Iranian female students reported that higher zinc intake was associated with better PSQI scores (Hajianfar et al., 2021).

Likewise, a systematic review concluded that adequate zinc levels were linked to longer sleep duration and improved subjective sleep quality across diverse populations (Xiao Peng et al., 2017).

Together, these findings highlight zinc as a key micronutrient for sleep regulation, particularly in physically demanding professions such as jockeying, where sufficient rest is critical for recovery and performance (Xiao Peng et al., 2017; Hajianfar et al., 2021).

Our study also found a significant negative correlation between zinc intake and sleep duration, which may seem contradictory to its positive association with subjective sleep quality.

One explanation is that higher zinc intake could enhance sleep efficiency, enabling individuals to feel rested with shorter sleep times.

Evidence on zinc and sleep duration remains limited and inconsistent, particularly in young populations, suggesting that factors such as chronotype, training load, and sleep habits may moderate this relationship. Given the complexity of micronutrient interactions, further research is needed to clarify how zinc influences sleep duration in athletes with high physiological demands (Xiao Peng et al., 2017; Matsunaga et al., 2021).

A significant positive correlation was observed between iron intake and daytime dysfunction, indicating that higher iron consumption was linked to greater next-day impairment in apprentice jockeys. While iron is vital for oxygen transport and cognitive function, excess intake may increase oxidative stress or disturb nutrient balance, thereby affecting sleep and alertness.

Prior research suggests both iron deficiency and overload can impair sleep, highlighting a non-linear relationship likely influenced by metabolic and training demands in athletes (Silva et al., 2016; Xiao Peng et al., 2017).

In modern lifestyles, late-night eating is common, yet research shows it can impair sleep by delaying sleep onset and increasing awakenings (Barrea et al., 2022b).

The timing of protein is also important: protein consumed earlier in the day supports sleep, while late intake may disrupt circadian rhythms (Magalhães et al., 2023).

imilarly, high-glycemic meals before bedtime hinder sleep onset and reduce quality, partly by suppressing melatonin secretion (Afaghi et al., 2007b).

Thus, avoiding high-calorie, fatty, and high-GI foods at night is critical for maintaining circadian rhythm and sleep quality. In this study, carbohydrate intake after dinner was lower than daily averages, which, although not statistically significant, may have contributed positively to the jockeys' sleep quality.

A strong positive correlation was found between evening zinc intake and subjective sleep quality ($r = 0.865$, $p = 0.000$), indicating that higher post-dinner zinc consumption improved perceived sleep among apprentice jockeys. Zinc supports melatonin synthesis,

stabilizes circadian rhythms, and modulates GABAergic activity, thereby facilitating sleep onset and continuity (Hajianfar et al., 2021).

While most studies emphasize total intake, these results highlight the importance of nutrient timing, with evening zinc intake showing stronger links to sleep quality (Xiao Peng et al., 2017).

A significant negative correlation was found between evening carbohydrate intake and sleep disturbance ($r = -0.437$, $p = 0.033$), suggesting that higher carbohydrate consumption after dinner was linked to fewer disruptions during sleep.

Carbohydrates may facilitate sleep by increasing tryptophan availability and promoting serotonin–melatonin synthesis, while high-glycemic evening meals have been shown to reduce sleep latency and nocturnal awakenings (Afaghi et al., 2007a; Du et al., 2022).

These findings support the role of balanced evening carbohydrate intake in minimizing sleep fragmentation.

A very strong negative correlation was found between evening fat intake and subjective sleep quality ($r = -0.918$, $p = 0.000$), indicating that higher dietary fat after dinner was associated with poorer perceived sleep among apprentice jockeys.

Excessive evening fat consumption, particularly from saturated fats, may impair sleep by slowing digestion, suppressing melatonin secretion, and altering REM and slow-wave proportions, leading to more fragmented and less restorative sleep (Yan et al., 2024).

The main limitation of this study is the small, homogeneous sample of male apprentice jockeys, which restricts generalizability. Reliance on self-reported questionnaires for dietary intake and sleep quality may also have reduced accuracy, as objective measures were not included.

Future studies should recruit larger and more diverse athletic populations and incorporate objective tools such as actigraphy, polysomnography, or biochemical analyses to clarify the relationship between nutrition and sleep.

CONCLUSION

This study examined the relationship between dietary habits and sleep quality in apprentice jockeys.

Although no associations were observed at the global PSQI level, specific nutrients showed significant links with sleep subscales.

Evening zinc intake was positively related to subjective sleep quality, while higher fat and protein percentages were associated with poorer sleep and shorter duration. Iron intake correlated with greater daytime dysfunction, whereas evening carbohydrate intake was linked to fewer sleep disturbances.

These findings suggest that both nutrient type and timing may influence sleep quality. However, given the small sample size and reliance on self-reported data, future studies with larger, more diverse cohorts and objective assessments are needed to better clarify the nutrition-sleep relationship in athletes.

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Recebido para publicação em 28/11/2025
Aceito em 31/01/2026