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# Effect of Perceived Stress on Sleep Quality and Nutritional Status in Professional Female Basketball Players

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## ABSTRACT

Athletes face not only physical strength but also intense psychological stress that leads to sleep problems. It is known that one way to manage stress is to make changes in food intake. This study examined the relationship between perceived stress levels, sleep quality, and nutritional status in professional women basketball players. Eighty adult professional women basketball players (age ≥ 19) in the competitive season competing in the Women's Basketball Super League and the lower league Women's Basketball League affiliated with the Turkish Basketball Federation participated in the study. The survey included player characteristics, anthropometric measurements, food consumption frequency, Perceived Stress Scale (PSS-10), and Pittsburgh Sleep Quality Index (PSQI) sections. The mean score of the basketball players participating in the survey from PSS-10 was 19.3±6.66. The perceived stress level and perception of stress discomfort were significantly higher in the women's league ($p < 0.05$). The mean PSQI total score of the basketball players was 5.9±2.91. In this study, 43.75% of basketball players were found to have good sleep quality, and 56.25% had poor sleep quality. This study's findings showed that the relationship between basketball players' low self-efficacy scores and average daily fiber intake was negative, and sleep quality worsened as perceived stress levels increased ($p < 0.05$). Athletes are affected by stress, sleep quality, and dietary choices, all of which significantly affect their performance. It is essential to monitor individual athletes' energy and nutrient intake. Understanding the impact of stress on sleep disorders and nutritional factors is crucial for assessment and management.



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## INTRODUCTION

Basketball is a high-intensity interval sport, and the preparation of basketball players for competition involves developing their physical, technical, tactical, and psychological qualities (Mancha-Triguero et al., 2019). Stress can be defined as any internal or external stimulus perceived as a threat to an organism's homeostasis and well-being, which triggers a biological response. The body's compensatory responses to these stimuli are called stress responses (Yaribeygi et al., 2017). Stressors can appear in various forms, including physical (environmental and physiological), psychological/mental (cognitive and emotional), or a combination. Physical stress directly induces metabolic or physiological changes in the body (Horner, 2003). Athletes often encounter situations that they perceive as threatening, challenging, or stressful during training and significant competitions. Failure to manage and adapt to stress has been linked to negative consequences such as decreased performance, mood changes, injuries, illnesses, and sleep-related issues (Charmandari et al., 2005).

Sleep is a crucial brain activity regulated by the biological clock and influenced by body activity (Richardson, 2005). As exercise is closely tied to bodily activity, the quality of sleep and alertness levels significantly impact athlete performance (Klerman & Hilaire, 2007). Furthermore, the relationship between sleep and exercise is independent of the biological clock. Athlete performance relies on the quality and quantity of sleep obtained before competition. Sleep deprivation leads to increased insomnia, cognitive impairment, memory issues, reduced alertness, and compromised response capabilities. Therefore, considering sleep quality is vital for athletes to achieve their best performance (Davenne, 2009; Richardson, 2005). While increasing the amount of time spent in bed is a valuable starting point for enhancing sleep, it is crucial to underscore the importance of sleep quality for athletes. Sleep quality pertains to the overall effectiveness of one's sleep (Ohayon et al., 2017). Athletes engage in various behaviors that can impact their competitive performance, and sleep stands out as a critical factor due to its significant influence on physiological and psychological functions, particularly endurance performance (Roberts et al., 2019).

Furthermore, sleep is vital in facilitating optimal performance and recovery (O'Donnell et al., 2018). Achieving optimal performance depends on maintaining a balance between stress and recovery. Sufficient recovery enables individuals to manage stress effectively, while inadequate recovery intensifies pressure (Heaton et al., 2017).

Athletes must consume sufficient energy at the correct times to maintain their health and optimize performance outcomes during high-intensity and long-term training periods. Nutrition's primary goal during competition is to minimize performance-limiting factors related to nutrition that can lead to fatigue and impaired function or concentration (ACSM, 2016). A study on the impact of acute stress on food selection during a meal found that stressed individuals tend to choose sweeter and higher-fat foods compared to non-stressed individuals (Oliver et al., 2000). Female athletes, especially, may experience dietary restrictions during anthropometric measurements and face pressure regarding their body weight, potentially leading to overeating during stressful times (Hamlin et al., 2021).

Dietary factors also influence the sleep status of athletes, with a reported relationship between macronutrient intake and insomnia symptoms. Low protein intake (<16% of energy from protein) has been associated with poor sleep quality and difficulty initiating sleep (Condo et al., 2022).

By contrast, high protein intake (>19% of energy from protein) can lead to difficulty maintaining sleep. Low carbohydrate intake (<50% of energy from carbohydrates) has also been linked to problems in maintaining sleep (Tanaka et al., 2013). Key amino acids related to rest include tryptophan, glutamine, tyrosine, and gamma-aminobutyric acid (Zhao et al., 2020).

Studies have shown a difference between female athletes' professionalism and stress levels (Akgün et al., 2021; Nedelec et al., 2015; Ruiz-Esteban et al., 2020). Athletes experience a lot of physical strength and intense psychological stress, leading to sleep problems (Charest & Grandner, 2022). The fact that female athletes have different hormonal, demographic, and psychological characteristics than males can make their perceptions of stress different. The research has determined that the most important source of stress for female basketball players is the pressure from fans and the stands. In addition, factors such as the referee's attitude, being away, their families being in the stands, and the frequency of matches have been shown as essential sources of stress (Uğurlu, 2018). A recent study conducted in Turkey on professional basketball players determined that 56.70% of basketball players and 41.56% of male basketball players had poor sleep quality (Parlak & Kırşan, 2024). Another study on women volleyball players determined that 53.8% of the athletes had poor sleep quality (Yüksel, 2021).

In this context, the primary aim of our study is to determine the effect of perceived stress on sleep quality and nutritional status in professional female basketball players during

the competition period. In addition, determining the differences in these parameters between basketball players in two different women's basketball leagues is the secondary aim of our study. The study included female basketball players playing in the Super League, the highest level of the women's league affiliated with the Turkish Basketball League, and athletes playing in the Women's League, a lower level of this league. Although both leagues are professional, it is thought that players in the Super League are at a more professional level due to participating in European matches and playing more matches. Therefore, their stress levels may be higher. In this context, the aim was to compare the two leagues. In this context, the research questions of our study are as follows:

*Question 1: How does perceived stress affect the sleep quality of professional female basketball players?*

*Question 2: How does perceived stress influence the nutritional status of professional female basketball players?*

*Question 3: Do perceived stress levels differ between professional female basketball players in the Super League and those in the Women's League?*

*Question 4: Does sleep quality differ between professional female basketball players in the Super League and those in the Women's League?*

*Question 5: Does nutritional status differ between professional female basketball players in the Super League and Women's League players?*

To the best of our knowledge, no prior research has investigated the relationship between stress, sleep, and nutrition among professional female basketball players in Turkey. Additionally, as there is a lack of research evaluating these variables in basketball players competing in two distinct professional leagues, our study is poised to contribute significantly to the existing literature.

## METHODS

*Participants*

The sample of this study consisted of 10 women's basketball teams in Ankara that compete in the Women's Basketball Super League affiliated with the Turkish Basketball Federation and the Women's Basketball League, a lower league of this league, in the 2022-2023 season and that came to Ankara for an away game. The researcher was present at the gym where the basketball players trained and provided detailed information about the study to the basketball players. Eighty professional women basketball players (aged 19 and over) who

volunteered to participate in the study were selected from the women basketball players competing in these teams, and this number was determined according to the power analysis conducted at the beginning of the study.

The power of our study was calculated using the software G*Power (G*Power 3.1. 9.2, Düsseldorf, Germany; Faul et al., 2007). In line with a similar study (Lim et al., 2018), our analysis showed that 80 people should be included in our study with a 95% confidence level (alpha = 0.05), 80% power, and an effect size of 0.4.

Approval for this study was received from Başkent University Medical and Health Sciences Research Board and Ethics Committee on 09/08/2022 (no: KA22/281). Written informed consent forms were obtained from all participants, confirming their voluntary participation.

*Data Collection Tools*

*Survey form*

A survey form designed for the basketball players who volunteered for the study was administered using face-to-face interviews. The survey comprised seven sections covering general characteristics, training information, eating habits, height, body weight, body fat percentage measurements, food consumption frequency, the Perceived Stress Scale (PSS-10), and the Pittsburgh Sleep Quality Index (PSQI).

In order to assess the daily energy and macronutrient intakes of basketball players, a semi-quantitative Food Frequency Questionnaire (FFQ) derived from a (FFQ) validated for measuring dietary intakes in adults was applied (Gunes et al., 2015). Daily average energy, macronutrient, and caffeine intake from food and beverages were analyzed using the Nutrition Information System (BEBIS) 7.2 program. In addition, the use of dietary supplements containing caffeine was addressed through a separate question. It was determined that the basketball players participating in the study did not use such supplements.

The PSQI, a tool for assessing sleep quality, was developed initially by Buysse et al. in 1989. The index is employed to categorize sleep quality as either good or poor. A Turkish version of the scale was developed by Ağargün et al. in 1996 following a validation and reliability study. It assesses sleep quality over the past month and comprises 24 questions. The PSQI is divided into seven components: Component 1, Index; Component 2, subjective sleep quality; Component 3, sleep latency; Component 4, sleep duration; Component 5, habitual

sleep efficiency; Component 6, sleep disturbance; Component 7, use of sleeping pills. PSQI is calculated with seven subcomponent scores, including daytime dysfunction. The total PSQI score is computed from these seven subcomponent scores, ranging from 0-21. A score of less than 5 indicates good sleep quality, and a score of 5 and above indicates poor sleep quality (Ağargün et al., 1996; Buysse et al., 1989).

The PSS-10 was used to assess the stress levels of basketball players. Initially developed by Cohen et al. in 1983, the PSS-10 consists of 14 items and is a self-report-style scale designed to measure perceived stress levels in various situations. Respondents rate each item on a 5-point Likert-type scale. This study utilized a 10-item scale: "perception of inadequacy" and "perception of stress/discomfort"—adapted to Turkish as PSS-10 by Eskin et al. Scores on the scale can range from 0 to 40, with higher scores indicating higher perceived stress levels (Cohen et al., 1983; Eskin et al., 2013).

*Anthropometric Measurements*

Body composition measurement allows us to assess the nutritional status of individuals, optimize competitive performance, and monitor the effectiveness of training outcomes in athletes. However, reference techniques used in body composition measurement are often expensive and/or invasive. Bioelectrical impedance analysis (BIA) is an indirect method to estimate body composition in a simple, fast, economical, non-invasive, accurate, and reproducible way (de la Cruz Marcos et al., 2021).

In the anthropometric measurements section of the survey form, body weight (kg), height (cm), and body fat percentage (%) measurements were made by the researcher and filled in by the researcher. The measurements of the basketball players playing in the teams in Ankara were made before the morning training. The measurements of basketball players who came to Ankara from out of town for an away match were measured at the place where they stayed, similar to the measurements of the other basketball players, with the same device, at the same time, and in the same fasting state. Body weight and composition were measured in the morning on an empty stomach, with light clothing, without shoes or socks, using a 0.1 kg sensitive TANITA MC-780 Black professional body composition device. The manufacturer's protocols were followed in the measurements, and calibration was performed before each use. Basketball players were instructed to avoid breakfast and caffeine before body fat measurements. The height measurements of the basketball players were measured with a stadiometer in the Frankfort plane, standing and with the head upright.

*Data Analysis*

The obtained data were analyzed using the SPSS package program (version 28.0, IBM Inc., Chicago). All analyses determined the statistical significance level as $p<0.05$. Mean ($\bar{X}$), standard deviation (SD), median, and 25th and 75th percentile values were used for descriptive statistics. Sleep quality was defined as number (n) and percentage (%). The data conformity to normal distribution was checked with the Kolmogorov-Smirnov test. Independent sample t-tests were used to analyze participants' general characteristics, anthropometric measurements, and energy/macronutrient intakes based on the leagues they played. At the same time, PSS-10 and PSQI scores were analyzed with the independent sample t-test according to the leagues. The analysis of the leagues according to the sleep quality categories was tested with the chi-square test. The relationship between the scale scores and energy and macronutrient intakes was determined with the Pearson Correlation analysis depending on the normal distribution results. The confidence interval of statistical tests was accepted as 95%, and the significance level was evaluated as $p<0.05$.

## RESULTS

This study was conducted with 80 professional women basketball players with an average age of 25.5±5.96 years. 38.75% of these athletes play in the Super League and 61.25% in the Women's League (Table 1). It was determined that the weekly and daily training hours of basketball players playing in the Super League were significantly higher than those of the women's league ($p < 0.05$). While the average height of basketball players playing in the Super League was 180.5±8.86 cm, the average height of women playing in the Women's League was 175.8±7.79 cm, and this difference was statistically significant ($p<0.05$; Table 1).

**Table 1**
Characteristics and Anthropometric Measurements of Basketball Players

| Features | Super League (n=31) | Women's League (n=49) | Total (n=80) | p* |
|---|---|---|---|---|
| Age (years) | 26.7±4.25 | 24.7±6.75 | 25.5±5.96 | 0.106 |
| Sports age (years) | 14.4±4.15 | 12.7±6.30 | 13.4±5.60 | 0.076 |
| Professional license duration (years) | 9.2±4.32 | 7.9±6.80 | 8.4±5.96 | 0.181 |
| Weekly training time (hours) | 6.5±1.12 | 7.3±1.89 | 7.0±1.67 | **0.036** |
| Daily training time (hours) | 1.9±0.15 | 1.8±0.27 | 1.9±0.23 | **0.018** |
| Number of matches per week | 1.4±0.49 | 1.2±0.42 | 1.3±0.45 | 0.068 |
| **Anthropometric measurements** | | | | |
| Height length (cm) | 180.5±8.86 | 175.8±7.79 | 177.6±8.48 | **0.016** |
| Body weight (kg) | 71.6±11.18 | 67.1±9.03 | 68.8±10.09 | 0.052 |
| Fat percentage (%) | 17.8±3.80 | 18.8±3.84 | 18.4±3.83 | 0.242 |

*Note.* Data are presented as mean ± standard deviation, *independent sample t-test

When nutritional status was examined, it was determined that the daily protein intake per kilogram and animal protein intake of the basketball players playing in the Super League were significantly higher ($p < 0.05$; Table 2).

**Table 2**
Daily Energy, Macronutrients, Tryptophan, Tyrosine, Fatty Acid, and Caffeine Intakes of Basketball Players

| Energy and Macronutrients | Super League (n=31) | Women's League (n=49) | Total (n=80) | p* |
|---|---|---|---|---|
| Energy (kcal) | 2308.9±675.02 | 2025.2±950.91 | 2135.1±861.27 | 0.123 |
| Carbohydrate (g) | 225.3±117.64 | 194.7±103.39 | 206.5±109.43 | 0.226 |
| Carbohydrate (%EI) | 38.0±10.96 | 40.1±8.23 | 39.3±9.37 | 0.226 |
| Carbohydrate (g/kg BW) | 3.2±1.73 | 2.9±1.56 | 3.0±1.62 | 0.476 |
| Protein (g) | 120.7±29.78 | 100.5±45.21 | 108.3±40.94 | **0.031** |
| Protein (%EI) | 22.0±4.43 | 21.3±4.76 | 21.6±4.62 | **0.031** |
| Vegetable protein (g) | 28.3±11.76 | 28.7±15.25 | 28.3±13.92 | 0.885 |
| Animal protein (g) | 92.4±25.07 | 71.7±37.07 | 79.3±34.29 | **0.008** |
| Fat (g) | 100.4±27.99 | 91.3±47.85 | 94.9±41.33 | 0.287 |
| Fat (%EI) | 39.9±8.72 | 38.5±8.66 | 39.0±8.65 | 0.287 |
| **Amino acids** | | | | |
| Tryptophan (mg) | 1316.9±320.15 | 1139.9±505.86 | 1208.5±449.38 | 0.590 |
| Tyrosine (mg) | 4023.0±985.19 | 3533.0±1599.65 | 3722.9±1407.51 | 0.094 |
| **Fatty acids (mg)** | | | | |
| Omega-3 | 2.6±1.76 | 2.3±1.63 | 2.4±1.68 | 0.458 |
| Omega-6 | 13.5±3.96 | 12.0±7.1950 | 12.6±6.38 | 0.235 |
| **Caffeine (mg)** | 187.0±97.32 | 160.7±124.73 | 170.9±114.95 | 0.322 |

*Note.* Basketball players ' daily energy, macronutrients, tryptophan, tyrosine, fatty acid, and caffeine intakes are presented as mean±standard deviation, *independent sample t-test, BW: Body Weight, EI: Energy Intake.

When the stress and sleep quality perceived by the basketball players were examined, it was seen that the PSS-10 mean score was 19.3±5.66, and the PSQI mean score was 5.9±2.91. The perceived stress level and insufficient self-efficacy perception of the basketball players playing in the women's league were significantly higher ($p<0.05$). The sleep duration of basketball players playing in the Women's League was significantly higher than those playing in the Super League ($p<0.05$). In this study, 43.75% of basketball players had good sleep quality, while 56.25% had poor sleep quality. It was also found that basketball players in the Super League (54.8%) had better sleep quality than basketball players in the women's league (42.9%; $p<0.05$; Table 3).

**Table 3**
Basketball Players' PSS-10 and PSQI Subscale Scores

| Parameters | Super League (n=31) | | Women's League (n=49) | | Total (n=80) | | p* |
|---|---|---|---|---|---|---|---|
| | Mean±Standard Deviation | Median (Q1-Q3) | Mean±Standard Deviation | Median (Q1-Q3) | Mean±Standard Deviation | Median (Q1-Q3) | |
| **PSS-10** | | | | | | | |
| Insufficient self-efficacy | 6.9±2.6 | 7(8-5) | 6.8±2.66 | 7(8-5) | 6.8±2.60 | 7(8-5) | 0.859 |
| Stress discomfort | 10.7±3.7 | 10(13-8) | 13.6±4.18 | 13(17-11) | 12.5±4.22 | 12(15-10) | **0.002** |
| **PSS-10 Total** | 17.6±5.15 | 18(21-14) | 20.4±5.75 | 20(24.5-16) | 19.3±5.66 | 19(23.75-15) | **0.029** |
| **PSQI** | | | | | | | |
| Subjective sleep quality | 1.2±0.54 | 1(2-1) | 1.2±0.63 | 1(2-1) | 1.2±0.66 | 1(2-1) | 0.771 |
| Sleep latency | 1.5±0.88 | 2(2-1) | 1.3±0.96 | 1(2-0.5) | 1.4±0.93 | 1(1-2) | 0.562 |
| Sleep duration | 0.3±0.51 | 0(0-0) | 0.5±0.65 | 0(1-0) | 0.4±0.61 | 0(1-0) | **0.041** |
| Sleep efficiency | 0.6±0.76 | 0(1-0) | 0.5±0.71 | 0(1-0) | 0.5±0.69 | 0(1-0) | 0.249 |
| Sleeping disorder | 1.1±0.47 | 1(1-1) | 1.2±0.58 | 1(1.5-1) | 1.2±0.54 | 1(1-1) | 0.388 |
| Sleeping pill use | 0.4±0.88 | 0(0-0) | 0.3±0.69 | 0(0-0) | 0.3±0.77 | 0(0-0) | 0.535 |
| Daytime dysfunction | 0.8±0.65 | 1(1-0) | 1.1±0.77 | 1(-1) | 1.0±0.74 | 1(1-1) | 0.81 |
| **PSQI-Total** | 5.8±2.75 | 5(7-4) | 6.02±3.04 | 5(7.5-4) | 5.9±2.91 | 5(4-7) | 0.751 |
| **Sleep Quality** | **n** | **%** | **n** | **%** | **n** | **%** | **$\chi^2$** |
| Good sleep quality (PSQI<5) | 14 | 54.8 | 21 | 42.9 | 35 | 43.75 | 0.041 |
| Poor sleep quality (PSQI≥ 5) | 17 | 45.2 | 28 | 57.1 | 45 | 56.25 | |

*Note.* Basketball players' PSS-10 and PSQI subscale scores Data are presented as mean±standard deviation, Q1:25th percentile, Q3:75th percentile, * independent sample t-test, $\chi 2$: Chi-Square test, n: number, %: percentage, PSS-10: Perceived Stress Scale, PSQI: Pittsburgh Sleep Quality Index Index

Table 4 evaluates the relationship between basketball players' PSS-10 and its sub-dimensions and their daily energy intake, macronutrients, and PSQI. A negative and weak relationship was found between basketball players' insufficient self-efficacy perception sub-dimension score and daily average fiber intake ($r = -0.284$, $p < 0.05$), and a positive and weak relationship was found between daytime dysfunction ($r = 0.289$, $p < 0.01$). A positive and weak significant relationship was found between stress/discomfort perception and PSQI total score, specific sleep quality, and sleep disturbance ($p < 0.05$). A positive and moderate relationship was found between basketball players' daytime dysfunction and stress level and stress/discomfort perception ($p < 0.001$). As the basketball players' perceived stress level increased, their sleep quality deteriorated ($r = 0.275$, $p < 0.05$). The relationship between PSS-10 scores and specific sleep quality and sleep disturbance sub-dimensions was weak and statistically significant ($p < 0.05$).

**Table 4**
Relationship Between Basketball Players' PSS-10 and its Sub-Dimensions and Daily Energy Intake, Macronutrients, and PSQI

| **Energy and Macronutrients** | **PSS-10** | | |
|---|---|---|---|
| | **Insufficient perception of self-efficacy** | **Perception of stress/discomfort** | **PSS-10 Total** |
| Energy (kcal) | 0.565 | 0.400 | 0.718 |
| Protein (g) | 0.318 | 0.139 | 0.718 |
| Fat (g) | 0.926 | 0.282 | 0.399 |
| Carbohydrate (g) | 0.365 | 0.840 | 0.791 |
| Fiber (g) | **-0.284*** | 0.800 | 0.179 |
| Water (mL) | 0.086 | 0.424 | 0.850 |
| PSQI-Total | 0.226 | **0.284*** | **0.275*** |
| Subjective sleep quality | 0.603 | **0.280*** | **0.236*** |
| Sleep latency | 0.651 | 0.449 | 0.439 |
| Sleep duration | 0.805 | 0.130 | 0.215 |
| Sleep efficiency | 0.975 | 0.819 | 0.876 |
| Sleeping disorder | 0.421 | **0.244*** | **0.224*** |
| Sleeping pill use | 0.707 | 0.652 | 0.611 |
| Daytime dysfunction | **0.289**** | **0.428***** | **0.452***** |

*Note.* *p <0.05, **p <0.01, *** p <0.001; PSS-10: Perceived Stress Scale, PSQI: Pittsburgh Sleep Quality Index

## DISCUSSION

Physical stress can induce physiological changes in athletes' bodies and contribute to sleep-related disorders (Charmandari et al., 2005). Stress levels have also been linked to alterations in food preferences examining the effect of perceived stress on sleep quality and nutritional status in professional female basketball players during the competition period (Kandiah et al., 2006).

Athletes face various stressors during training and competitions, especially at the elite level. They invest considerable time and effort into their sports, and sports-related outcomes can significantly impact their careers and lives, leading to perceptions of threats, challenges, or stress (Öz, 2018). In this study, the average score of all participating basketball players on the Perceived Stress Scale (PSS-10), a widely used psychological instrument for measuring the perception of stress, during the competition period was 19.3±5.66. Like the findings of this study, female athletes preparing for the Tokyo Paralympic Games had an average PSS score of 19.0±7.64 (Yardımcı & Kulunkoglu, 2020). In a study examining perceived stress in the National Collegiate Athletic Association (NCAA) First Division women's volleyball players over an entire calendar year, the PSS-10 score average was highest in the middle of the season (Hyatt & Kavazis, 2019). Female water polo players in a previous study had an average PSS-10 score of 17.8±5.77 (Aydın, 2017). In another study involving female basketball, rowing, hockey, and golf players, the average PSS score was 14.2±6.4 (Terry et al., 2007). A study conducted with ice hockey players in Sweden showed that the mean PSS-10 score of female hockey players was 17.4±5.6 (Wörner et al., 2024). In another survey of female basketball players, the average PSS score was 17.3±4.8 (Güvendi et al., 2016). Compared to these studies, the stress levels observed in this study's participants were higher, likely due to the professional-level competition and increased pressures associated with league matches. Notably, in a study involving professional female basketball players, the PSS-10 score was significantly higher at 30.3±6.28, indicating a perception of insufficient self-efficacy and heightened stress/discomfort (Otter et al., 2016). This extreme result highlights that stress levels may vary widely based on individual and contextual factors, such as team dynamics and personal coping mechanisms.

The study found that the PSS-10 mean score of basketball players playing in the Women's League was significantly higher than those in the Super League. This contrasts with findings from women's football teams, where no significant differences were observed between the total PSS-10 scores of 1st and 2nd League teams (İmamoğlu Kaya et al., 2020). However, similar to our study, the discomfort sub-dimension scores were higher in the lower league team, suggesting that athletes in minor leagues face unique stressors related to limited resources and uncertain career trajectories. This finding supports the notion that the financial and structural limitations faced by teams in the Women's League contribute to increased stress levels. (Cutler & Dwyer, 2020; Pascoe et al., 2022). This may lead to athletes experiencing more difficulties in training and competition. Additionally, minor league athletes may face

uncertainty about the future and increased performance stress due to the pressure to advance to the major league in their careers.

Sleep is a critical factor that significantly influences an athlete's health and performance. During sleep, energy reserves are replenished, immune responses are boosted, and cognitive function is restored (Condo et al., 2022). It has also been noted that sufficient sleep is essential for maintaining a positive mood (Mutsuzaki et al., 2018). Despite the importance of adequate sleep for athletes during training and competition, it has been reported that many athletes struggle to get enough sleep during these periods (Roberts et al., 2019). In our study, basketball players had a mean PSQI score of 5.9±2.91. Similar to our findings, a study of female basketball players on the Japanese national wheelchair basketball team found a mean PSQI score of 5.7±2.85 (Mutsuzaki et al., 2018).

In a more extensive study involving athletes from various sports, the average PSQI score of basketball players was determined to be 4.4±2.6, and this score was determined to be not significantly different from other sports ($p > 0.05$) (Randell et al., 2021). Additionally, data collected from 112 female athletes in Japan showed that 25% of basketball players had poor sleep quality (PSQI≥5), with a mean PSQI score of 4.5±2.2 (Hoshino et al., 2022). In another study examining the prevalence of risk factors for poor sleep quality, drowsiness, and obstructive sleep apnea in rugby players, female rugby players exhibited a mean PSQI score of 8.2±3.3 (Swinbourne et al., 2016). Similarly, another study found that rhythmic gymnasts had a high prevalence of poor sleep quality, with 77.6% of participants classified as having poor sleep (Silva & Paiva, 2019). In another source, female athletes had an average PSQI score of 5.4±2.6 (Zhang et al., 2017). In another study evaluating sleep quality in female athletes according to PSQI scores, it was reported that the average was 5, and 55.8% of women had poor sleep quality (PSQI ≥ 5) (Halson et al., 2022). In another study, as found by Kawasaki et al. (2020) 48.84% of female athletes were reported to have a score of six or above on the PSQI. In a different study focusing on female athletes, Knufinke et al. (2018) determined the mean PSQI score as 4.61±2.04. Similar to the study results in the literature, 56.25% of the female basketball players who participated in our study were found to have poor sleep quality. The findings of this current study support that female athletes have poor sleep quality. It is thought that the intense match schedule of the basketball players participating in our study, frequent away matches, early morning training, and, in some cases, late night training all lead to poor sleep quality (Zhao et al., 2012). A study showed that semi-professional basketball players had less sleep duration on pre-game nights, and the probability of players achieving better-

perceived sleep quality was 88% lower on congested game nights than on pre-game nights (Power et al., 2023). Similar to the findings of our study, the results regarding sleep quality in another study showed no significant difference between amateur and elite athletes in the PSQI total scale and all sleep quality subscales except sleep duration (Taheri et al., 2023). The PSQI subscale sleep duration was significantly higher in the women's league, indicating that their sleep duration was less than that of basketball players in the Super League. The fact that athletes in the women's league struggle to get to the Super League and play tough matches supports the findings of this study. This situation increases the possibility that athletes in the women's league experience more stress and sleep deprivation, explaining the background of the findings.

The bidirectional relationship between sleep and psychological well-being has been linked to increased sleep disturbances and insufficient sleep in conjunction with elevated stress, anxiety, negative mood, and emotional dysregulation (Bonnet & Arand, 2010; Buckley & Schatzberg, 2005). This relationship highlights the critical role of psychological factors in determining sleep quality, particularly in high-stress environments such as competitive sports. Athletes experience physical stress and anxiety during training and competition, which can negatively affect their sleep quality (Richmond&Godard, 2004). This study found a statistically significant relationship between the average PSS-10 score and the average PSQI score of basketball players, indicating that higher perceived stress levels are associated with lower sleep quality. These findings align with previous research, such as a study investigating the connection between pre-competition perceived stress and sleep in endurance athletes, which found that women's perceived stress was directly linked to reduced sleep duration (Roberts et al., 2022). Another study involving professional athletes indicated that those with low stress levels had better sleep quality (Brandt et al., 2017). Similarly, in a study on Irish athletes, those with poor sleep quality scored significantly higher on the stress scale than those with good sleep quality (Roberts et al., 2022). The cumulative evidence underscores the need for targeted interventions to address stress management and improve sleep quality among athletes, as these factors are deeply intertwined with optimal performance and well-being.

Chronic stress has been shown to affect food choices by affecting both homeostatic and hedonic appetite control (Berg Schmidt et al., 2018). The findings of this study showed that the relationship between basketball players' low self-efficacy scores and average daily fiber intake was negative. However, no relationship was found between the PSS-10 total score. Dietary fiber may have a beneficial effect on stress via the gastrointestinal microbiota. The gut

microbiota that improves with dietary fiber intake may play a positive role in the metabolism of neurotransmitters such as serotonin synthesis (Saghafian et al., 2021). A study on badminton athletes reported that probiotic supplementation alleviated anxiety and stress (Salleh et al., 2021). These findings highlight the potential role of dietary interventions, such as probiotics and dietary fiber, in managing stress. However, further studies are required to confirm these effects and understand their mechanisms. Similarly, in a study conducted on female endurance athletes, no significant relationship was found between carbohydrate intake and stress levels among athletes with a PSS-10 mean score of 18.27±6.42 and a daily carbohydrate intake of 258.29±65.34, which is similar to our study (Alex, 2018). Long-chain polyunsaturated omega-3 fatty acids, especially docosahexaenoic acid (DHA) and eicosapentaenoic acid (EPA), have been shown to play a stress-protective role by regulating pituitary adrenal axis (HPA) activity (Barbadoro et al., 2013). A study in the literature reported a significant negative relationship between perceived stress levels and fish consumption in women (Mikolajczyk et al., 2009). However, this study observed no relationship between omega-3 intake and perceived stress, which may be attributed to differences in dietary patterns, sample size, or other confounding variables. These discrepancies underscore the need for further research to elucidate the role of omega-3 fatty acids in stress regulation and its potential impact on athletes.

*Limitations*

A limitation of our study is that more advanced devices cannot be used to determine body composition. While BIA analysis should be used to evaluate nutritional status, biochemical findings and additional anthropometric measurements should also be considered in new and planned studies. Another limitation of our study is that the frequency of the food consumption questionnaire depends on the declaration of basketball players, and it also takes a long time to answer. Another limitation of our study is that the validity and reliability of the PSS-10 and PSQI scales for Turkish athletes have not been determined.

## CONCLUSIONS

In summary, increased perceived stress among basketball players was associated with poorer sleep quality. Our findings support the conclusion that food intake, a key factor affecting athletic performance, affects stress, highlighting the importance of monitoring energy and nutrient intake. The study also highlights the need to assess the impact of stress

levels on sleep disorders and nutrition in female basketball players. Given the limited research on the relationship between stress, sleep, and nutrition in athletes, this study fills a gap by focusing specifically on these factors in high-intensity female basketball players. Additionally, the study contributes to the literature by providing valuable insights for future research on gender, age, and sport-specific differences with larger populations.

## PRATICAL IMPLICATIONS

Improving athletes' performance, especially during competition periods, requires being aware of the stress they experience. The stress athletes face affects their sleep quality, and any sleep disruption can negatively impact performance results. Inadequate and improper nutrition during this period can increase sleep quality and perceived stress. Coaches, sports nutritionists, and psychologists should collaborate to regularly monitor athletes' stress levels, sleep quality, and nutritional intake, especially during high-intensity competition periods. Therefore, it is crucial to identify the causes of stress and poor sleep quality during competition periods and to provide athletes with appropriate support and counseling to address these issues. Individual and/or team training can help athletes understand the importance of proper nutrition and stress management for optimum performance. Consequently, it is essential to understand and evaluate nutritional factors that affect athletes' stress and sleep disorders.

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### Authors' Contributions

Both authors made significant contributions to the concept or design of the article, and first author contributed to the acquisition, analysis and interpretation of the data. Both authors participated in the drafting of the article, and second author revised it critically. Both authors contributed equally, read and approved the final version of the manuscript.

### Declaration of Conflict Interest

The authors certify that there is no conflict of interest with any financial organization regarding the material discussed in the manuscript.

**Ethics Statement**

Approval for this study was received from the Başkent University Medical and Health Sciences Research Board and Ethics Committee on 09/08/2022 (no: KA22/281).

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