Sport Sciences and Health Research

University of Tehran
Faculty of
Physical Education and Sport Science

The role of sleep quality on mental toughness among football players

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Article Info

Original Article

Article history:
Received: 21 January 2023
Revised: 02 March 2013
Accepted: 10 March 2023
Published: 01 July 2023

Keywords:
football,
mental toughness,
sleep,
soccer,
sport psychology.

Abstract

Background: Football players, in their pursuit of optimal physical and mental performance, frequently employ various recovery techniques. Among these, sleep emerges as a consistently highlighted and crucial element in athletes' physical and cognitive performance.

Aim: This study aimed to investigate the correlation between sleep quality and mental toughness (MT), while concurrently exploring the relationship between MT and different football positions.

Materials and Methods: A total of 473 Iranian football players, comprising 287 males and 186 females, were selected through a simple random sampling method by completing two questionnaires that assessed their sleep quality (PSQI) and MT (SMTQ-14).

Results: The findings showed that athletes with higher subjective sleep quality and longer sleep duration demonstrated high levels of MT. Moreover, defenders and attackers exhibited the highest levels of MT compared to other playing positions. Notably, male football players reported higher sleep quality and MT compared to their female counterparts.

Conclusion: This study focused on the relationship between sleep quality and MT among football players. The study revealed that both male and female football players with better sleep quality and longer sleep duration had higher MT, with males scoring higher overall. Moreover, defenders regardless of gender, exhibited the strongest MT.

Cite this article: Esmaeilnejad M, Gharayagh Zandi H, Esmaeilnejad S, Qeisari S. "The role of sleep quality on mental toughness among football players". *Sport Sciences and Health Research*. 2023, 15(2): 193-202. doi: https://doi.org/10.22059/SSHR.2024.371266.1121.

EISSN: 2717-2422 | Web site: https://sshr.ut.ac.ir/ | Email: sshr@ut.ac.ir

 Publisher: University of Tehran, Faculty of Sport Sciences and Health

1. Introduction

Football, recognized globally as a team sport, commands immense popularity across numerous countries. Extensive research across various disciplines is dedicated to enhancing athletes' and sports clubs' success in this field. Physical fitness, such as muscle strength, cardiovascular endurance, agility, and power, plays a pivotal role. Athletes must proficiently execute intricate and demanding tasks inherent to their sport. Furthermore, maintaining optimal mental state to ensure peak performance, particularly in the face of competitive and high-pressure environments [1]. However, psychological pressure is a recurring factor in analyzing player or team performance, with both positive and negative effects on athletes' success [2]. Athletes' achievements depend on various factors, including physical and mental fitness, nutrition, and the ability to recover between training and competitions. Adequate sleep holds equal importance within this framework [3]. Factors such as long journeys, unfamiliar sleeping arrangements, anxiety, intense training, and others can disrupt athletes' sleep patterns, affecting their physical and mental performance.

Sleep is fundamentally a brain process, with the body resting while the brain sleeps. Although the body requires sleep, crucial bodily functions occur exclusively during sleep state of the brain [4]. Undoubtedly, every person spends a third or at least a quarter of his life in sleep. Sleep is the greatest regenerator of forces, which provides rest to the nervous system and causes the physical and mental forces necessary to eliminate fatigue [5].

While sleep is essential for everyone, it holds particular significance for elite athletes in terms of recovery and performance [6]. Research consistently demonstrates that lack of sleep leads to decreased reaction time, slower processing speed, and impaired visual motor performance. In essence, poor sleep quality can impose considerable limitations on athletes in today's competitive world [7]. Despite this knowledge, many athletes still grapple with insufficient sleep, which, in turn, can impact their mental health and psychological skills during training and competition [8]. In sleep literature, it is commonly observed that females show a higher prevalence of sleep disorders, excluding obstructive sleep apnea, and often report more severe insomnia and poorer sleep quality [9]. The findings of Kawasaki and et al. (2020) showed that females had poorer subjective sleep quality than males who played various types of sports [10].

Athletes, coaches, and sports psychologists consistently underscore mental toughness (MT) as a crucial psychological trait correlated with success in sports. It serves as a fundamental factor empowering athletes to navigate through challenging and stressful conditions during both training and competition. Despite its importance, MT remains one of the less clearly understood concepts in applied sport psychology [11].

Researchers and theorists frequently define MT as the effective management of pressure and adversity to minimize the impact on performance. Another perspective regards it as the ability to recover from failure, enhancing the determination to succeed [12]. Insights from athletes, coaches, and sports psychologists reveal that nearly all desirable psychological characteristics associated with success, like self-belief, confidence, attention control, spontaneity,

resilience, and quality of preparation, are intertwined with MT [13]. While genetic factors predominantly can also contribute to its development [14].

Previous research consistently indicated that male athletes generally score higher than females on measures of MT. For instance, studies have found that male basketball players often display higher confidence subscale scores compared to their female counterparts [15].

As previously highlighted, sleep plays a significant role in our daily lives and can profoundly impact athletes during their waking hours. However, there exists a lack of solid evidence to comprehensively understand the connection between sleep and MT among athletes, particularly in the field of football. This lack of evidence tells us that more research is needed. To bridge this gap and better understand how sleep and MT are linked, we need more studies specifically focusing on athletes. That is where our current research comes in. We are diving into the question: Does sleep quality have a notable connection with the MT of football athletes? By exploring this, we hope to provide useful insights into how sleep quality might affect the MT of athletes, especially those in the world of football. Moreover, our aim in conducting this investigation is to provide valuable insights for comparing MT across different football playing positions.

Therefore, in this study, we aim to inspect the role of sleep quality on MT among football players.

2. Materials and Methods

The research method of the present study is correlational research. The Data were collected by the questionnaire and the participants were selected by simple random sampling method.

2. 1. Participation

Participants were 482 semi-skilled Iranian football players using Morgan table, comprising 287 males and 186 females, with ages ranging from 18 to 32 years (Mean age= 24.62 years, SD= 3.98). Participants were selected from Second and third division Tehran Football League. On average, these athletes had 4.47 years of experience in competing at the national level. They exhibited a high commitment to their training sessions, engaging in rigorous training sessions for a minimum of 4.1 hours per week. To be eligible for participation, individuals were required to attend a minimum of three weekly football training sessions, ensuring a level of proficiency and dedication essential for the objectives of our study.

2. 2. Instrument

Participants completed the SMTQ-14 to assess MT and the Pittsburgh sleep quality index (PSQI) to sleep quality.

2. 2. 1. Measurement of sleep quality

The PSQ16 is a comprehensive 19-item self-report questionnaire designed to assess sleep quality and disturbances over a 1-month period. It measures self-reported sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medication, and daytime dysfunction. Each subscale is assigned a score between 0 and 3. The sum of these scores yields the global PSQI score, which ranges from 0 to 21. Higher scores indicate poorer sleep quality. A global PSQI score exceeding 5 has demonstrated high sensitivity in distinguishing between poor and good sleep quality, The Persian version of this index is recognized as a valid and reliable tool [16].

2. 2. 2 Measurement of MT

The second questionnaire utilized in this

study was the Persian version of Sports MT Questionnaire (SMTQ-14) [17]. Specifically, the SMTQ-14 was employed to assess the level of MT in the sports environment. This questionnaire comprises 14 items and measures general mental stability across three sub-scales: confidence, constancy, and control. Respondents provide their responses on a 4-point Likert scale (1= False, 4= Fully true). The Cronbach Alpha values for the original scale's subscales were 0.81 for confidence, 0.74 for constancy, and 0.71 for control, indicating satisfactory internal consistency [17].

Confidence. This pertains to the belief in one's abilities to navigate challenging situations and outperform competitors.

Constancy. This focuses on taking responsibility, maintaining concentration, and persisting in the pursuit of specified objectives.

Control. This involves maintaining composure and ease under pressure or unexpected circumstances.

2. 3. Procedure

After the research with football players was concluded, detailed instructions were provided to ensure a thorough understanding of how to complete the questionnaires. Emphasis was placed on the importance of honesty in responding to the questions. Subsequently, all football players participated in the administration of PSQI and the sports MT questionnaire. A careful review of the submitted questionnaires was conducted, and eight incomplete responses led to the exclusion of the respective questionnaire from the analysis. Throughout this process, athletes were reassured about the confidentiality of the information they provided, further emphasizing the commitment to safeguarding their privacy.

2. 4. Statistic

In this descriptive study, the first step in data analysis was to check the normality of the data through the Kolmogorov-Smirnov test. Subsequently, the relationships between variables were examined using the Pearson correlation. The comparison between groups was assessed through the independent t-test. All statistical calculations were conducted using SPSS version 25, with a significance level set at $\alpha < 0.05$.

3. Results

Descriptive statistics for demographic information provided key characteristics of the measured variables. The results indicated that both males and females, ranged in age from 18 to 32 years (Mean= 25.62, SD= 4.98). They all had a history of more than 3 years of continuous attendance in football training, with positions distributed as follows: goalkeeper (46 people), defender (138 people), midfielder (146 people), and attacker (152 people). Table 1 presents further details regarding the measured variables, encompassing sleep quality and MT.

According to the findings presented in Table 1, the highest mean for sleep quality is related to sleep disturbance (male= 2.12, female= 2.32), while the lowest is related to the use of sleep medication (male= 0.84, female= 1.17). In terms of MT, the highest average was observed in confidence (male= 21.68, female= 20.44), with the lowest seen in constancy (male=12.21, female= 11.36). Notably, an independent t-test indicated that males outperformed females in all components of sleep quality except for sleep duration and daytime dysfunction. To further explore the research objectives, statistics analysis was employed following confirmation of normality through the Kolmogorov-Smirnov test ($P>0.05$).

Subsequently, the Pearson correlation test was utilized to examine the relationships between variables, as detailed in Table 2.

Pearson correlation test revealed significant associations between three components of subjective sleep quality, sleep latency, and sleep duration with MT and its three subscales (confidence, constancy, and control). Conversely, no significant relationships were identified between other variables. Notably, the highest correlation was observed between sleep duration and confidence, while the lowest correlation was noted between sleep disturbance and confidence.

The independent t-test results indicated a significant difference between the positions of defenders and midfielders in both genders (male p-value= 0.0201, female p-value= 0.0172), with defenders demonstrating higher levels of MT. Furthermore, a significant relationship was identified between the positions of midfielders and attackers (male p-value=0.0379, female p-value=0.0487). Upon closer examination of the averages, it was found that attackers exhibited higher MT, but midfielders scored higher than attackers in the control subscale. It is noteworthy that no significant differences were detected between other player positions.

Table 1. Mean, standard deviation of sleep quality and MT for both genders

Genders / Subscales	Male		Female	
	$\bar{x}$	SD	$\bar{x}$	SD
Subjective sleep quality	1.92	0.623	2.07	0.721
Sleep latency	2.16	0.83	2.27	0.780
Sleep duration	1.86	0.421	1.64	0.457
Sleep efficiency	1.75	0.860	1.94	0.821
Sleep disturbance	2.12	3.88	2.32	3.691
Use of sleep medication	0.84	0.559	1.17	0.462
Daytime dysfunction	1.62	0.651	1.20	0.725
Confidence	21.68	4.47	20.44	5.78
Constancy	12.21	3.06	11.36	3.22
Control	14.78	4.23	12.65	4.91

Table 2. Relationship between sleep quality and MT using Pearson correlation test for both genders

Subscales	MT		Confidence		Constancy		Control	
	M**	F***	M	F	M	F	M	F
Subjective sleep quality	0.563*	0.502*	0.547*	0.480*	0.548*	0.517*	0.564*	0.509*
Sleep latency	-0.52*	-0.587*	-0.501*	-0.627*	-0.556*	-0.557*	-0.557*	-0.571*
Sleep duration	0.625*	0.645*	0.659*	0.668*	0.581*	0.645*	0.601*	0.631*
Sleep efficiency	0.358	0.387	0.381	0.365	0.302	0.389	0.373	0.373
Sleep disturbance	0.148	0.226	0.125	0.154	0.188	0.260	0.197	0.232
Use of sleep medication	0.219	0.273	0.227	0.258	0.204	0.265	0.237	0.301
Daytime dysfunction	0.248	0.243	0.216	0.250	0.267	0.244	0.255	0.227

*Significant difference (P<0.05)

** Male

*** Female

Table 3. Comparing two by two MT in different positions of football players

Positions	Male				Female			
	GL*	DF*	MF*	AT*	GL	DF	MF	AT
GL	---	0.0584	0.0673	0.0827	---	0.064	0.061	0.074
DF	---	---	0.0201*	0.0721	---	---	0.0172*	0.0806
MF	---	---	---	0.0379*	----	---	----	0.0487*

* (GL= Goaler, DF= Defender, MF= Midfielder, AT= Attacker)

4. Discussion

The aim of this study was to investigate the correlation between sleep quality and MT in football players, as well as to compare MT among different football playing positions across both genders.

Athletes depend on effective recovery methods to manage the physical and mental stresses of training and competition, with the goal of enhancing both their physical and cognitive capabilities. Among these methods, sleep has gained prominence as a fundamental recovery strategy acknowledged by athletes and coaches alike for optimizing performance [18]. Recognizing the impact of sleep quality on MT, a vital psychological determinant, is essential for enhancing athletes' performance during both training and competitive events.

The findings of this study indicated a significant correlation between subjective sleep quality, sleep duration, and low sleep latency with MT, suggesting that higher subjective sleep quality and longer sleep duration are associated with increased MT. Additionally, individuals with lower sleep latency tend to exhibit higher levels of MT, and vice versa. Consequently, the research hypothesis concerning the relationship between sleep and MT is confirmed.

The finding aligns with previous research, such as study of Brand et al. (2014) involving 284 teenagers, which revealed a significant positive association between MT and subjective sleep quality. Their findings also showed that individuals reporting higher sleep latency tended to have lower levels of MT, supporting the results of the current study [19].

Cooper et al. (2020) similarly conducted a study involving 181 participants and concluded that there is a significant positive correlation between the duration of useful sleep and MT, which is in along with the findings of the present study [20]. We speculate that high sleep quality may influence individuals' cognitive performance, potentially contributing to the relationship between sleep and football players' MT. The findings of Benitez and Gunstad (2012) [21] as well as a study conducted by Grumbach et al. (2020) [22] confirm this concern.

The findings indicated a low correlation between sleep disturbance and MT. Li et al. (2020) conducted a study on Chinese students and similarly found no significant relationship between MT and sleep disturbance [23]. The temporary nature of sleep disturbance in team sports like football, where social interactions can mitigate challenges, may explain this. In addition to the mentioned factor, individual differences in coping mechanisms might also contribute to the limited correlation between sleep disturbance and MT. However, other studies suggest psychological factors, such as heightened arousal, may contribute to increased sleep disturbance [24].

With respect to gender, males scored higher in sleep quality and its subscales than females, except for sleep duration and daytime dysfunction. Hinz et al. (2017) study on 9284 German individuals found

that females reported more sleep problems than males [25]. Reports from 3,778 young adults (20.6±0.86 years) indicated a higher prevalence of poor sleep quality in females than males (65.1% vs. 49.8%) [26]. Furthermore, Burgard et al. (2013) showed women's sleep duration was more than men's, aligning with present results [27].

Similarly, females showed lower levels of daytime dysfunction compared to males, a finding that contrasts with the results of Benjamin et al. (2020) who reported that sleep dysfunction was 55% lower for males than females [28]. The researcher speculates that factors such as testosterone, which is typically more abundant in males [29], may contribute to better sleep quality among males. Additionally, the enhanced sleep duration and reduced daytime dysfunction among females might be attributed to more accommodating match schedules. It is notable that women's leagues often encounter fewer scheduling constraints, allowing for increased opportunities for rest. These gender variations could be significant when planning strategies to enhance sleep among football players.

Males exhibited partly higher scores in MT and its three subscales (confidence, constancy and control) compared to females. This aligns with the findings of Nicholls et al. (2009), who reported that male athletes tend to have higher MT than females [30].

Similarly, Andrews et al. (2014) conducted a study on 478 runners, concluding that MT in males is significantly higher than in females [31]. However, Álvarez, Walker and Castillo (2018) conducted a study on Spanish athletes and their findings indicated that there were no significant differences between males and females in MT [32]. The researcher suggests that greater MT in male football players may be attributed to cultural differences and higher intense levels of the male league, coupled with increased social and media pressures.

Furthermore, the research findings revealed that the defender and midfielder positions exhibited the highest MT, surpassing all other playing positions. In this context, Asamoah (2013) conducted a cross-sectional study involving 263 African male football players to explore the influence of MT on psychological skills. Similarly, his study concluded that midfielders demonstrated higher MT in the control subscale compared to other positions, while defenders excel in the constancy subscale [33].

In contrast, Sulaiman et al. (2021) found attackers to have higher MT than other positions, differing from our results [34]. Our findings suggest that defenders' higher MT may stem from their heavy responsibilities in defense, goalkeeping, timely adaptation to opponents' tactical systems, and higher emotional control in the face of attacks. Ultimately, coaches are recommended to strategically concentrate on both proficient and developing positions, placing emphasis on nurturing MT to fortify players against adversities and enhance overall team dynamics.

This study encountered several potential limitations. First, the questionnaire utilized for data collection introduced the possibility of response bias. The study faced a limitation due to an uneven gender representation in the Iranian football community, resulting in a smaller sample size of female players. This imbalance can be attributed to the lower participation of female football players in Iran, which may have influenced the outcomes of the study. Factors such as

disparities in welfare, sports and financial facilities, and differences in psychological, intellectual, and cultural levels between both genders and stressors or lifestyle factors could influence the data which the mentioned factors are beyond the researcher's control. Acknowledging these limitations is essential for a nuanced interpretation of findings of the study.

5. Conclusions

This study revealed a positive correlation between favorable subjective sleep quality and sleep duration with higher MT among football players. While male football players generally exhibited superior sleep quality, except for sleep duration and daytime dysfunction, compared to their female counterparts, they also demonstrated higher levels of MT. Furthermore, the analysis of different player positions specified that defenders and attackers experienced higher levels of MT.

On this basis, future research endeavors should focus on conducting experimental interventions such as neurofeedback and biofeedback training to examine their effects on sleep patterns, while simultaneously analyzing the impacts of these interventions on MT.

Conflict of interest

The authors declared no conflicts of interest.

Authors' contributions

All authors contributed to the original idea, study design.

Ethical Consideration

The author has completely considered ethical issues, including informed consent, plagiarism, data fabrication, misconduct, and/or falsification, double publication and/or redundancy, submission, etc.

Data availability

The dataset generated and analyzed during the current study is available from the corresponding author on reasonable request.

Funding

This research received no external funding.

Acknowledgment

Grateful for the invaluable contributions and dedication of Meysam Yavari Kateb and Omid Oshaghi to this article. their insights elevated its quality, and we appreciate his collaborative spirit.

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