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The Effect of Rumination on Cognitive Performance and Sports Performance with the Mediation of Sleep Quality

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ABSTRACT

Objective: This study aimed to examine the impact of rumination on both cognitive and sports performance, with sleep quality serving as a mediating factor.

Method: The research was applied and employed a structural equation correlation design, conducted in a field setting. The statistical population consisted of all student athletes who participated in Table Tennis tournaments in Khorasan in 2022, totaling 97 individuals. Sampling was performed using a census method, with 80 participants consenting to take part in the study. Data were collected using the rumination questionnaires developed by Nolen-Hoeksema and Morrow (1991), a sports performance scale by Charbonneau et al. (2001), a cognitive performance assessment by Folstein et al. (1975), and the Pittsburgh Sleep Quality Index (1989). For data analysis, Pearson's correlation coefficient and path analysis modeling were utilized.

Results: The findings indicated that rumination has a direct influence on both cognitive and sports performance (P=0.01). Furthermore, rumination significantly affects these performances indirectly through the mediation of sleep quality (P=0.01) among student athletes.

Conclusions: Based on the results of this study, rumination is correlated with cognitive and sports performance both directly and indirectly via sleep quality. It is recommended to invite sports psychologists to conduct educational workshops on rumination management and to monitor and regulate the sleep patterns of student athletes.

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Introduction

Sports play a significant role in the 21st century, with considerable amounts of money, time, and energy dedicated to them in both the media and daily life. This focus has sparked widespread interest and excitement surrounding the efforts of athletes (Ghorbanejad & Safaei, 2019).

While athletes across various disciplines face unique concerns and challenges, many of these issues are common among all athletes. A key priority for any athlete is their performance and success in their sports career; thus, all athletes strive to enhance their performance and achieve their goals (Ebrahimi et al., 2018).

In addition to physical and technical abilities, cognitive functioning is crucial for athletic performance. Environmental cognition encompasses a wide range of cognitive functions, including executive functions and attention. Executive functions refer to a set of top-down mental processes that facilitate goal-directed behavior, including inhibition, working memory, and cognitive flexibility. These essential functions are supported by fluid intelligence processes, often referred to as executive functioning at a higher cognitive level, including reasoning, problem-solving, and planning (Vona et al., 2024).

Athletes competing in sports events vary in talent, training, motivation, and psychological traits. However, sports performance is often the crucial factor in determining outcomes (Biglari et al., 2019). Sports performance refers to the physical and mental efforts of an individual, a group, or a sports team aimed at achieving specific goals. This definition encompasses all athletic activities, whether undertaken by professional athletes or individuals exercising for health reasons. Specifically, sports performance is defined as the physical and mental effort put forth by an individual or a team during competitive events, to win against an opposing individual or team (Ghorbani-Nejad & Safaei, 2019).

In today's competitive environment, physical fitness alone does not guarantee success; rather, a successful athlete must also possess strong mental fitness. While coaches strive to provide the necessary mental preparation, challenges often remain evident during competitions (Sabzban & Safaei, 2022).

An athlete's desired performance results from various factors, including psychological elements (Zarei et al., 2019). Furthermore, higher sports skills and expertise are closely linked to enhanced cognitive performance, which stems from superior neurocognitive capabilities (Logan et al., 2023).

Optimal performance in sports skills relies on three key areas: physical preparation, skill development, and psychological readiness. Athletes who practice psychological skills can significantly enhance their performance levels, techniques, and overall success. According to Cox et al. (2018), psychological skills are inherent or learned traits that contribute to an athlete's

likelihood of achieving success. These psychological methods or strategies can serve as exercises that help in acquiring these skills (Rezvani et al., 2018).

Weinberg and Gould (2007) noted that psychological factors are primary reasons for daily variations in sports performance. Athletes with a high level of psychological skills can better manage and mitigate the negative impacts of psychological inhibiting factors, thereby maximizing their performance during competitions (Biglari et al., 2019).

Vasconcelos Raposo et al. (2024) highlighted that an athlete's experience is linked to more effective coping strategies and emotional regulation, particularly concerning competitive anxiety and its associated symptoms. More experienced athletes tend to exhibit higher self-confidence and lower levels of negative emotions. Woodman and Hardy (2024) investigated the effects of cognitive anxiety and self-confidence on sports performance, revealing that cognitive anxiety impairs performance while higher self-confidence enhances it.

Additionally, numerous studies indicate that athletes who demonstrate superior cognitive performance—such as cognitive flexibility, working memory, and attention control (including visual-spatial attention and processing speed)—tend to achieve better executive functioning (Fleddermann et al., 2023). Therefore, alongside developing technical and tactical skills and engaging in rigorous physical training, athletes must prioritize mental skills to improve their performance and secure greater success. As skills evolve, the distinguishing factor in athletes' performance lies in their application of psychological strategies.

Moreover, utilizing these mental skills can serve as a solid foundation for both short-term and long-term planning, promoting mental well-being, optimal performance, and success for athletes. Conversely, neglecting psychological skills can lead to issues such as stress, psychological pressure, burnout, and diminished performance (Wagstaff et al., 2018).

Psychologists believe that mental skills, like any other skill, can be taught and practiced. Without utilizing these skills, achieving peak performance becomes challenging. Therefore, professional athletes at various levels, along with their coaches, should understand the practical concepts and methods for developing mental fitness. As a result, today's coaches and athletes are increasingly striving to enhance their performance and achieve greater success by applying scientific advancements and psychological techniques.

Psychology has traditionally focused on two key issues: "psychological health" and "improving sports performance" (Salehian & Qadiri, 2019). In this context, Olofsdotter Lauri et al. (2023) discovered that individuals who acquired effective skills through cognitive interventions to manage stressful situations demonstrated greater flexibility and self-efficacy.

One psychological variable that directly affects athletes' performance is intrusive thoughts, which can disrupt the quantity and quality of their sleep. Adequate sleep quality is defined as high-

quality sleep with sufficient duration, while inadequate sleep quality refers to irregular sleep with frequent awakenings or reduced duration (Cordoza et al., 2021).

Adequate sleep is crucial for overall health and is linked to physical and mental well-being, quality of life, progress, and productivity. Sleep disturbances can occur when sleep is inadequate, poorly timed, or unrefreshing, and this condition is known as a sleep disorder (Ballesio et al., 2020).

Most studies examining the role of cognitive factors, such as intrusive thoughts and sleep disorders, have highlighted the impact of pre-sleep and nighttime cognitions on insomnia (Davoodi et al., 2017). Unwanted thoughts—such as worries about the future or ruminations on distressing events—can infiltrate consciousness and elevate stress levels (Ashton et al., 2023). These thoughts not only contribute to sleep issues among individuals with insomnia but can also affect healthy individuals (Sella et al., 2018). Consequently, this leads to a delay in the onset of sleep, that is, the time required for falling asleep (Heath et al., 2018).

Ballesio et al. (2020) found that mental stimulation and rumination before sleep reduce sleep efficiency, which in turn diminishes cognitive and executive function the following day due to the increased delay between sleep and wakefulness. Importantly, it appears that intrusive thoughts and the quality and quantity of sleep significantly influence cognitive and daily performance. Therefore, individuals who experience rumination and nocturnal insomnia tend to have poorer cognitive performance compared to others (Kalmbach et al., 2018).

The ability of individuals to intentionally control and reduce the frequency of unwanted thoughts related to future fears is influenced by mechanisms similar to those used in controlling past memories. This intentional control helps prevent the negative effects of such thoughts on performance and can serve as an adaptive emotion regulation strategy to suppress, forget, and escape from rumination. Rumination can create acute stress and threaten an individual's integrity and well-being (Quaedflieg et al., 2023).

Schwert et al. (2017) found that cognitive intrusions are linked to poor sleep and reclusive experiences the following day. Therefore, it is plausible to hypothesize that cognitive thoughts before sleep not only predict sleep quality but also influence cognitive performance the next day, particularly executive functions. This hypothesis recognizes that a key feature of intrusive cognitions is the difficulty in disengaging from these thoughts, which can reflect a process related to executive functions (Cox et al., 2018).

Research examining the relationship between sleep quality and athletic performance has shown the effects of sleep interventions on athletic performance (Cunha et al., 2023), the impact of acute sleep deprivation on performance (Gong et al., 2024), sleep patterns of athletes before and after competition (Sim et al., 2023), and the influence of sleep on the performance of college athletes (Wilson, 2024). All these studies acknowledge that sleep quality significantly affects individual

athletic performance. Athletes who enjoy more and better-quality sleep tend to experience less stress and higher training quality (Hamlin et al., 2021).

Adolescence, considered a transitional phase between childhood and adulthood, is often characterized by emotional turbulence and psychological stress. However, contemporary developmental psychologists view this period as one of growth and positivity (Mousavi-Sadati & Sedghian, 2019). Furthermore, adolescence is a dynamic transition from childhood to adulthood, marked by simultaneous growth during puberty and culminating in adulthood. During this period, both the brain and sleep undergo substantial changes and face various risks (Afolabi-Brown et al., 2022). Sleep is an essential human need, crucial for recovery, growth, energy storage for body metabolism, mental performance, neural maturation, learning skills, and memory. Consequently, sleep quality is a significant factor during adolescence (Sahragard & Safaei, 2023). Adolescents need 8 to 10 hours of sleep per night. Insufficient sleep and poor sleep quality can severely impact daily life, social acceptance, emotions, and mental health, leading to poor academic performance, an increased risk of substance use, irritability, and aggressive behavior, which can disrupt relationships with peers, parents, and teachers (Casavi et al., 2021).

Additionally, the short-term consequences of sleep problems include reduced creativity, impaired concentration, and poor performance in daily tasks. Long-term consequences can lead to emotional and behavioral issues, a greater likelihood of unemployment, suicidal ideation, aggression, and sexual violence (Liu et al., 2019). Therefore, it is essential to be vigilant about the effects of persistent poor sleep conditions on mental and cognitive health (Xu et al., 2024). A study by Lim et al. (2021) indicated that poor and irregular sleep quality may reduce the performance of elite athletes. In this context, sleep quality appears to mediate the relationship between rumination and students' athletic and cognitive performance.

Considering the issues discussed above, this study is significant as it presents a mediation model that explores the underlying mechanisms connecting rumination to cognitive performance and sports performance. This integrated model not only explains how rumination affects the cognitive and athletic performance of student-athletes but also illustrates the pathways through which these effects occur.

Additionally, it is crucial to recognize the serious impact of sleep disorders on athletes. Such disorders can lead to negative psychological effects, increased heart rate, decreased peak oxygen consumption during physical activity, a weakened immune system, and various hormonal changes. Research indicates that individuals who enjoy good sleep quality tend to exhibit better concentration and performance than those who have experienced poor sleep (Ballesio et al., 2020). Moreover, Brauer et al. (2019) found that short and low-quality sleep adversely affects athletes' physical, mental, cognitive, and sports performance. It is essential to highlight the need for this study, as professional athletes and individuals who regularly participate in sports may experience

sleep disorders and deprivation due to demanding training regimens, travel for competitions, pre-competition stress, and rumination. These factors can disrupt sleep quality and duration (Simpson et al., 2017), ultimately influencing their circadian rhythm and affecting their sports and cognitive performance.

Given these considerations, this study aimed to answer the question:

> What is the effect of rumination on cognitive performance and sports performance, as mediated by sleep quality?

Based on the aforementioned points, a conceptual model illustrating the relationship between rumination, cognitive performance, and sports performance—along with the mediating role of sleep quality in student-athletes—was developed, as depicted in Figure 1.

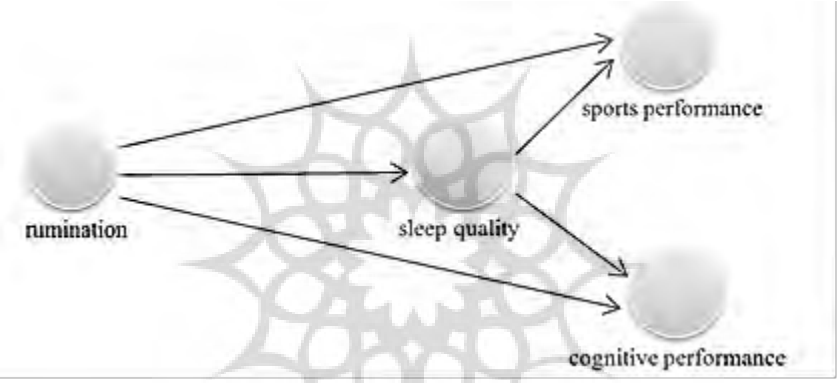

Figure 1. Research conceptual model

Materials and Methods

Design of the Study

This study adopted an applied method using a descriptive correlational research design using the structural equation modeling.

Participants

The statistical population included all student-athletes aged 12 to 17 who participated in table tennis competitions in South Khorasan Province in 2021, totaling 97 individuals. A census method was utilized to select the sample participants. Out of the 97 questionnaires distributed, 80 were suitable for statistical analysis after removing the incomplete or distorted ones. Consequently, the final sample size for this study was 80 participants, consisting of 56 male and 24 female students.

Instruments

In this study, four tools were utilized to measure the four variables of interest as explained below:

Rumination Response Questionnaire: Developed by Nolen-Hoeksema and Maru (1991), this questionnaire consists of 22 questions divided into three subscales: rumination of symptoms (12 questions), reflection (5 questions), and distraction (5 questions). It is scored on a four-point Likert scale, ranging from 1 (rarely) to 4 (almost always). The overall score is derived from the sum of the three subscales, with a total possible score ranging from 22 to 88. A higher score indicates greater rumination. In the present study, both exploratory and confirmatory factor analyses were used to establish the validity of the questionnaire, which showed an internal consistency (measured by Cronbach's alpha) of .81.

Sports Performance Questionnaire: Designed by Charbonneau et al. (2001), this questionnaire contains six questions aimed at assessing athletic performance. It uses a five-point Likert scale, where a score of 1 indicates poor performance and a score of 5 indicates excellent performance. The total score ranges from 6 to 30, with higher scores reflecting better athletic performance. The reliability of this questionnaire was reported as 0.78 in the study by Ghorban Nejad and Safai (2019). For this study, exploratory and confirmatory factor analyses were conducted to verify its validity, resulting in an internal consistency score (Cronbach's alpha) of 0.79.

Cognitive Performance Questionnaire: Developed by Folstein et al. (1975), this questionnaire comprises 30 items that assess various cognitive functions. Its components include orientation, word registration, attention and calculation, short-term memory, and visual-spatial thinking. In the study by Rezaei et al. (2013), the reliability of this questionnaire was found to be 0.85 (Cronbach's alpha). In the current study, both exploratory and confirmatory factor analyses were employed to establish validity, with an internal consistency score of 0.76.

Pittsburgh Sleep Quality Questionnaire: Established in 1989, this questionnaire consists of 19 items (including 10 sub-items in question 5) that are scored on a 4-point Likert scale ranging from 0 to 3. It covers seven subscales: subjective sleep quality, sleep onset delay, sleep duration, sleep efficiency, sleep disturbances, use of sleep medications, and daytime dysfunction. Exploratory and confirmatory factor analyses were used to confirm the validity of this questionnaire, which displayed an internal consistency (Cronbach's alpha) of 0.81.

Data Processing Method

To analyze the data, the Pearson correlation coefficient method and the structural equation approach were employed. The partial least squares method was used to confirm the model, test the

hypotheses, and develop the structural equation model. Statistical analyses were conducted using SmartPLS version 3 and SPSS version 24 software.

Results

A total of 80 questionnaires were collected, with responses from 56 males (70%) and 24 females (30%). The participants' ages ranged from 17 to 19 years. Regarding sports activity history, 12% of respondents had less than one year of experience, 22% had between one and two years, 17% had between two and three years, 25% had between three and four years, and 25% had more than four years of activity history.

Before conducting the main data analysis, the underlying assumptions were examined. The Kolmogorov-Smirnov test was utilized to assess the normality of the data. The results confirmed that sleep quality mediates the relationship between rumination and both cognitive performance and athletic performance among student-athlete.

Table 1. Descriptive Statistics and Pearson's Correlation Coefficient among the Research Variables

Variables	statistics	1	2	3	4
rumination	Pearson	1			
cognitive performance	Pearson	-0.51**	1		
sports performance	Pearson	-0.55**	0.46**	1	
sleep quality	Pearson	0.42**	-0.58**	-0.43**	1

*P<0.05 **P<0.01

The data presented in the table indicates a significant relationship among all research variables. The results of the models testing this hypothesis are illustrated in Figures 1 and 2.

In Figure 1, the t-statistic for the effect of rumination on sleep quality is 12.876, which exceeds the threshold of 1.96, confirming the relationship. Additionally, the t-statistics for the effects of sleep quality on cognitive performance and sports performance are 10.263 and 2.894, respectively, both of which also exceed 1.96, further confirming these relationships. Thus, sleep quality can be considered a mediating variable between rumination and both cognitive performance and sports performance.

Figure 2 reports the effect of rumination on sleep quality as 0.721, indicating a direct and strong effect that is statistically significant. Conversely, the effects of sleep quality on cognitive performance and athletic performance are reported as -0.617 and -0.223, respectively, both signifying statistically significant negative effects.

Table 2. Investigating Research Hypotheses

Hypothesis	t	β	p.value
Rumination sports performance	8.400	-0.697	0.001
rumination sleep quality	12.876	0.721	0.001
sleep quality sports performance	2.894	-0.223	0.001
rumination cognitive performance	6.026	-0.367	0.001
rumination sleep quality	12.876	0.721	0.001
sleep quality → cognitive performance	10.263	-0.617	0.001
rumination sleep quality sports performance	6.73	-0.445	0.001
rumination → sleep quality cognitive performance	3.18	-0.16	0.001

Consequently, the effect of rumination on cognitive performance through sleep quality is calculated as -0.445, indicating a negative and moderate effect. Similarly, the effect of rumination on athletic performance through sleep quality is -0.16, which represents a negative and weak effect.

Moreover, the coefficient of determination for cognitive performance is 0.841, indicating that the rumination variable explains 84.1% of the variance in cognitive performance through sleep quality. The coefficient of determination for athletic performance is 0.759, showing that the rumination variable accounts for 75.9% of the variance in athletic performance through sleep quality.

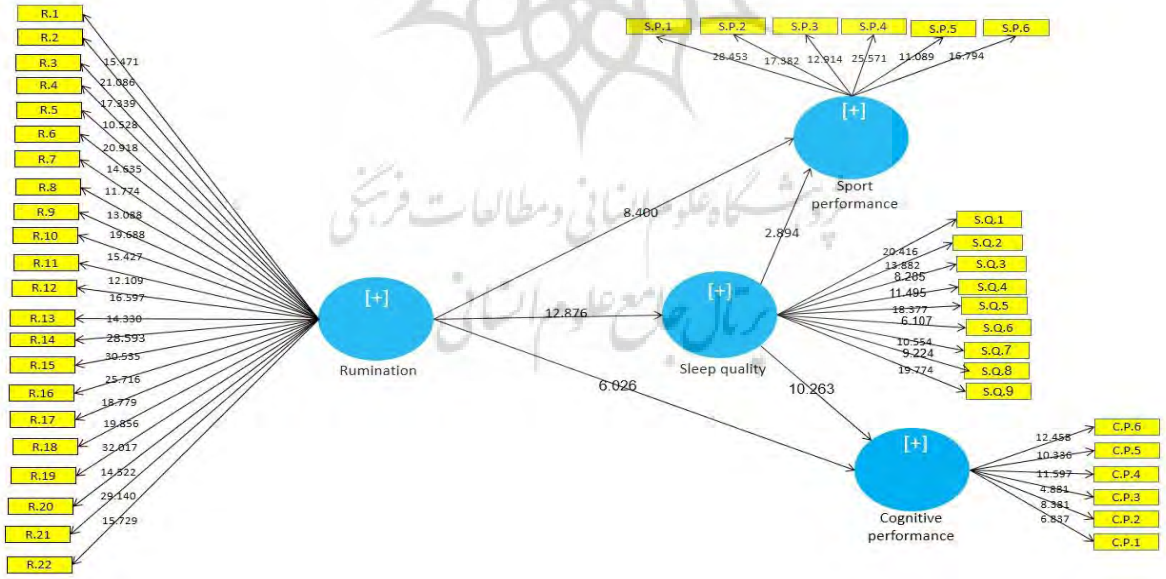

Figure 2. Research model in the standard estimation mode

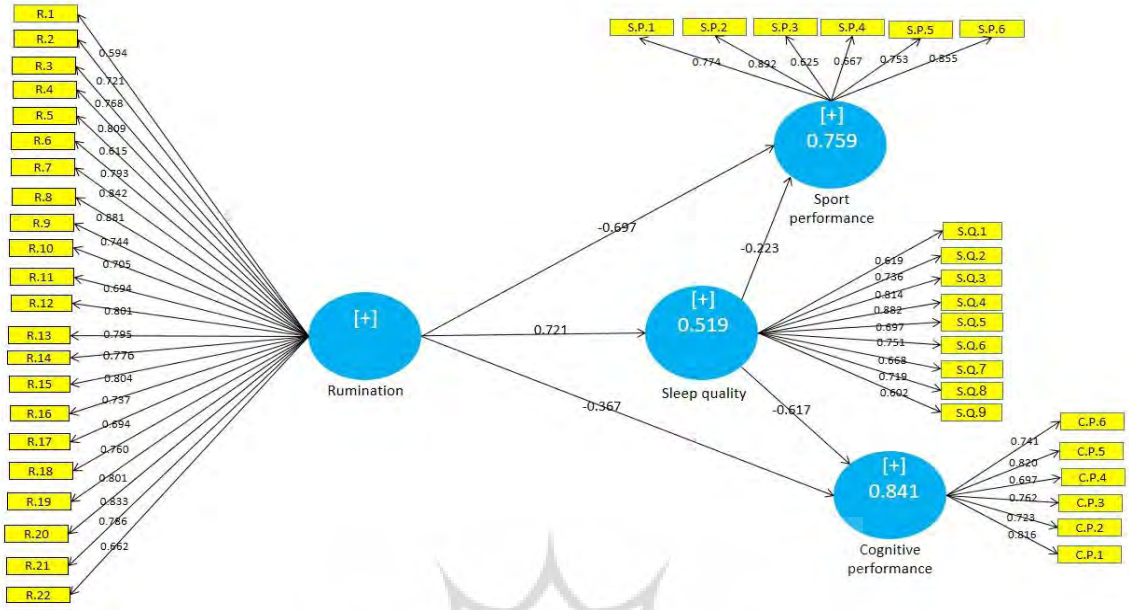

Figure 3. Research model in the mode of the significant numbers

The research model tested, represented by significant numbers, is shown in Figure 3.

In structural equation modeling using SmartPLS 3 software, the fit indices are: SRMR (standardized root mean square residuals), NIF (normalized index of fit), and RMS (root mean square). The values obtained are presented in Table 3.

Table 3. General fit indices of the tested model

Fit Index	Recommended Value	Observed Value	Result
SRMR	≤ 0.08	0.03	Accepted
NIF	≥ 0.90	0.98	Accepted
RMS	≤ 0.05	0.45	Accepted

Discussion

The present study aimed to investigate the effect of rumination on cognitive performance and sports performance, with sleep quality serving as a mediator. The results indicated that sleep quality significantly mediates the relationship between rumination and both cognitive and sports performance. These findings align with those found by Nien et al. (2024), Ballesio et al. (2020), and Slimani et al. (2016).

It is crucial to emphasize that adequate sleep is vital for everyone, but it is particularly important for student-athletes due to its direct impact on their performance. The findings of this study are corroborated by those reported by Canha et al. (2023), Gong et al. (2024), Sim et al. (2023), and Wilson (2024). Sports doctors and physical education experts recommend that athletes, as well as non-athletes, should aim for at least six to eight hours of sleep per night. However, this requirement may vary based on individual genetics and the geographical region in which one lives. Lack of sleep can prevent professional athletes from winning championships and achieving success in competitions.

It's important to note that while sleep is essential, it is not the sole factor for becoming a champion. An athlete who has trained effectively and received adequate sleep, allowing for cellular recovery, will likely perform better than one who is sleep-deprived or stressed before a competition. Executive functions, which are critical cognitive processes, can be negatively affected by insufficient sleep, leading to poor performance (Ballesio et al., 2020).

Research by Canha et al. (2023) highlighted a significant impact of sleep quality on sports performance. Gong et al. (2024) examined how acute sleep deprivation impairs athletic performance. Sim et al. (2024) found that quality sleep before and after competition is essential for cognitive, physiological, and recovery performance, and Wilson (2024) emphasized that sleep is a key factor in athlete performance, recovery, and overall health. Additionally, Brauer et al. (2019) discovered that sleep disorders can negatively affect athletic performance.

Deep sleep is essential for athletes to recover and regain strength. Therefore, any issues or disorders that prevent an athlete from getting adequate or quality sleep will ultimately impact their performance. This includes intrusive thoughts that may arise before bedtime, causing delays in falling asleep or diminishing the quality of sleep.

To understand this phenomenon, it is important to recognize that athletes' performance encompasses two key dimensions: cognitive and athletic. Sleep problems and disorders in athletes negatively affect their sleep quality, which in turn impacts both cognitive and athletic performance. Insufficient sleep decreases an individual's ability to process thoughts and undermines critical cognitive areas in neuropsychological assessments, including intelligence, memory, attention, working memory, executive functions, perception, language, and information processing speed, ultimately leading to diminished psychological performance (Lim et al., 2021). Additionally, poor sleep quality can result in fatigue, as well as physical and mental weakness, disrupting athletic performance both individually and in team settings. Thus, executive functions appear to be among the cognitive processes adversely affected by insomnia, resulting in poor performance following a decline in sleep quality (Ballesio et al., 2020).

Athletes often experience changes in circadian rhythms and, in some cases, insomnia due to various factors such as: emotional stress, travel, altered routines, changes in sleep schedules, and malnutrition. Assleep disorders can have detrimental effects on athletes' performance, quality nighttime sleep plays a crucial role in the preparation and recovery of professional athletes who train intensely (Esteban Cornejo et al., 2014). Deep sleep is particularly necessary for recovery and alleviating physical weakness. Any issue or disorder that prevents athletes from obtaining sufficient or quality sleep ultimately affects their performance. Thus, it can be concluded that executive functions are cognitive processes influenced by insomnia, leading to decreased performance following a reduction in sleep quality (Ballesio et al., 2020).

Moreover, it should be highlighted that rumination, or repetitive negative thoughts about personal concerns and the causes of negative emotions, can hinder a person's ability to fall asleep and affect sleep quality. The consequences of rumination include heightened negative emotions, depressive symptoms, poor coping strategies, impaired problem-solving abilities, disrupted concentration, and increased psychological stress, all of which can adversely impact individual performance. Given that athletes' performance is divided into cognitive and athletic dimensions, sleep problems and disorders that compromise sleep quality negatively influence both aspects. Insufficient sleep diminishes cognitive processing capabilities and impacts essential cognitive areas assessed in neuropsychological evaluations, resulting in decreased psychological performance (Hamlin et al., 2021). Furthermore, reduced sleep quality can lead to physical and mental fatigue, disrupting athletic performance both individually and in teams. Therefore, insufficient and low-quality sleep carries negative consequences for physical, cognitive, and psychological health. It is linked to increased daytime sleepiness and fatigue, as well as negative attitudes toward life and diminished control over mood, attention, and emotions (Short et al., 2018).

On the other hand, improved sleep quality is associated with fewer risky behaviors. Athletes who sleep less than 8 hours are 1.7 times more likely to sustain injuries than those who get 8 hours or more (Milewski et al., 2014). Both lack of sleep and increased training load independently raise injury risk, and their combined effect is particularly significant. Physiological damage from insufficient sleep can lead to altered tissue sensitivity, which in turn causes pain—a critical factor in injury prevention. Adequate recovery after training and competition is essential (Venter, 2014). Short sleep can hinder muscle growth and recovery while raising the risk of injury and impairing overall performance (Hainline et al., 2017).

Moreover, individuals who get enough sleep generally perform better in switching their focus from one task to another, even after a disrupted night compared to their usual sleep routine. However, athletes with sleep issues exhibit significantly lower overall health than their

peers without such problems. Insufficient sleep in professional athletes is associated with a heightened risk of respiratory and gastrointestinal symptoms (Halson et al., 2017).

Conclusion

According to the neurocognitive model of insomnia (Perlis et al., 1997), elevated cortical pressure during sleep can lead to cognitive disruptions, such as increased processing of sensory information. Pre-sleep cognitive intrusions—negative and uncontrollable thoughts about insomnia, personal or environmental stimuli, and worries—significantly contribute to this issue. insomnia is also defined as "the result of the inability to turn off provocative and emotional thoughts and images during sleep" (Ballesio et al., 2020).

Furthermore, psychological symptoms stemming from conflicts, mental struggles, personal matters, and daily tasks can disrupt individuals (Sheikh al-Islami et al., 2023). When mental health is compromised by these cognitive symptoms, it can impact priorities for success, life satisfaction, and the motivation to pursue both internal and external goals (Sabzban & Safaei, 2021). This is particularly important for student-athletes, as such issues can lead to errors in executing tasks and hinder both daily and sports activities. In this context, a study by Vasconcelos-Raposo et al. (2024) indicated that negative psychological symptoms, such as competitive anxiety, can adversely affect sports performance. Furthermore, an athlete's experience can play a crucial role, with more experienced athletes generally exhibiting higher self-confidence and a lower incidence of negative thoughts. The findings from Woodman and Hardy (2024) reinforced the relative effects of cognitive anxiety and self-confidence on sports performance, noting that cognitive anxiety tends to reduce performance levels while high self-confidence enhances them.

Considering the research limitations, it's important to note that this research focused specifically on student-athletes participating in table tennis competitions; therefore, generalizations should be approached cautiously. Additionally, since the study was conducted cross-sectionally, future research should consider examining these variables longitudinally. It is recommended that subsequent studies explore the impact of rumination on sports performance across various disciplines to identify potential differences.

Given the research findings indicating that rumination affects the cognitive and athletic performance of student-athletes, sports team officials and relevant stakeholders should engage an experienced psychologist to work with the team, especially before competitions and during training camps. This professional can provide valuable training, including meditation exercises and techniques for mental relaxation, aimed at helping athletes control intrusive thoughts and reduce rumination, ultimately fostering a greater sense of peace of mind during competitions.

The results of the study indicate that sleep quality significantly impacts the cognitive and athletic performance of student-athletes. Therefore, it is recommended that during sports camps, training sessions, and competitions, coaches, and supervisors establish specific bedtimes for student-athletes. With the collaboration of team coaches and parents, they should monitor and manage the athletes' sleep hours to ensure they receive adequate, high-quality rest.

Additionally, it is advisable to collect electronic devices such as cell phones, tablets, and laptops and prohibit their use in the hours leading up to bedtime. This approach can help student-athletes fall asleep more easily, improve their sleep quality, and ultimately enhance their cognitive and athletic performance.

Conflict of interest

There are no conflicts of interest.

References

Afolabi-Brown, O., Moore, M. E., & Tapia, I. E. (2022). Sleep deficiency in adolescents: The school start time debate. *Clinics in Chest Medicine*, *43*(2), 239-247.

Ashton, S. M., Smeets, T., & Quaedflieg, C. W. (2023). Controlling intrusive thoughts of future fears under stress. *Neurobiology of Stress*, *27*, 100582.

Ballesio, A., Ghezzi, V., Vacca, M., Ottaviani, C., & Lombardo, C. (2020). Effects of presleep cognitive intrusions on subjective sleep and next-day cognitive performance in insomnia. *Behavior Therapy*, *51*(5), 688-699.

Biglari, N., hosseininia, S. R., & Biglari, F. (2019). The effect of mental hardiness on happiness and sport performance among futsal player female students. *Sport Psychology Studies*, *8*(28), 221-238. doi: 10.22089/spsyj.2019.6913.1744

Brauer, A.A., Athey, A.B., Ross, M.J., & Grandner, M.A. (2019). Sleep and Health among Collegiate Student Athletes. *Chest*, 156 (6), 1234-1245.

Casavi, V., Shetty, S., Alva, J., & Nalini, M. (2022). Relationship of quality of sleep with cognitive performance and emotional maturity among adolescents. *Clinical Epidemiology and Global Health*, *13*(100928), 1-11

Cordoza, M., Koons, B., Perlis, M. L., Anderson, B. J., Diamond, J. M., & Riegel, B. (2021). Self-reported poor quality of sleep in solid organ transplant: A systematic review. Transplantation reviews (Orlando, Fla), *Advance Online Publication*, *35*(4), 1-9.

Cox, R.C., Cole, D.A., Kramer, E.L., &Olatunji, B.O. (2018). Prospective associations between. Cognitions in adolescent sleep-onset problems. *Sleep Medicine*, *46*, 117-121.

Cunha, L.A., Costa, J.A., Marques, E.A., Brito, J., Lastella, M., Figueiredo, P. (2023). The impact of sleep interventions on athletic performance: A systematic review. *Sports Med Open*, 9(1),58.

Davoodi, I., Neisi, A., Khazei, H., Arshadi, N., & Zakiei, A. (2017). The roles of some cognitive and emotional factors in predicting insomnia. *Journal of Mazandaran University of Medical Sciences*, *27*(150), 107-121.

Ebrahimi Turkmani, B., Siah Kohian, M., Azizkhah Alanq, S., & Fasihi, A. (2017). Comparison of the relationship between sleep quality with pulmonary function and body biochemical composition in athletic and non-athletic girls. *Health Research Journal*, *3*(3), 195-187.

Esteban-Cornejo, I., Gómez-Martínez, S., Tejero-González, C. M., Castillo, R., Lanza-Saiz, R., Vicente-Rodríguez, G., & Martinez-Gomez, D. (2014). Characteristics of extracurricular physical activity and cognitive performance in adolescents. The AVENA study. *Journal of Sports Sciences*, *32*(17), 1596–1603. https://doi.org/10.1080/02640414.2014.910607

Fleddermann, M. T., Reichert, L., Wieland, B., & Zentgraf, K. (2023). Stop it! Relationship between sport expertise and response inhibition in elite athletes. *Frontiers in Psychology*, *14*, 1192483.

Gong, M., Sun, M., Sun, Y., Jin, L., & Li, S. (2024). Effects of acute sleep deprivation on sporting performance in athletes: A comprehensive systematic review and meta-analysis. *Nat Sci Sleep*., *16*, 935-948.

Hainline, B., Turner, J.A., Caneiro, J., Stewart, M., & Moseley, G.L. (2017). Pain in elite athletes—neurophysiological, biomechanical and psychosocial considerations: A narrative review. *Br J Sports Med*, *51*(17), 1259-1264.

Halson, S., Appaneal, R., Peterson, K., Welvaert, M., Vlahovich, N., & Hughes, D. (2017).High prevalence of poor sleep quality in athletes: Implications to staying healthy and performing. *Journal of Science and Medicine in Sport*, 20, e80.

Hamlin, M.J., Deuchrass, R.W., Olsen, P.D., Choukri, M.A., Marshall, H.C., Lizamore, C.A., Leong, C., & Elliot, C.A. (2021). The effect of sleep quality and quantity on athlete's health and perceived training quality. *Front. Sports Act. Living*, 3,705650.

Heath, M., Johnston, A., Dohnt, H., Short, M., & Gradisar, M. (2018). The role of pre-sleep.

Iacovides, S., George, K., Kamerman, P., & Baker, F.C. Sleep fragmentation hypersensitizes healthy young women to deep and superficial experimental pain. *J Pain*, *18*(7), 844-854.

Kalmbach, D.A., Pillai, V., & Drake, C.L. (2018). Nocturnal insomnia symptoms and stress induced. *Int J Exerc Sci*, *10*(4), 522.

Lau, J. J., Calamari, J. E., & Waraczynski, M. (1996). Panic attack symptomatology and anxiety sensitivity in adolescent. *Journal of Anxiety Disorders*, *10*, 355-364.

Lim, S.T., Kim, D.Y., Kwon, H.T., & Lee, E. (2021). Sleep quality and athletic performance according to chronotype. *BMC Sports Sci Med Rehabil*., *13*(1), 2-13.

Liu, G., Fang, L., Pan, Y., & Zhang, D. (2019). Media multitasking and adolescents' sleep quality: The role of emotional-behavioral problems and psychological suzhi. *Children and Youth Services Review*, *100*(1), 415-421.

Logan, N. E., Henry, D. A., Hillman, C. H., & Kramer, A. F. (2023). Trained athletes and cognitive function: A systematic review and meta-analysis. *International Journal of Sport and Exercise Psychology*, *21*(4), 725-749.

Milewski, M.D., Skaggs, D.L., & Bishop, G.A. (2014). Chronic lack of sleep is associated with increased sports injuries in adolescent athletes. *J Pediatric Orthopaedics*, *34*(2), 129-133.

Mousavi Sadati, S. K., & Sedghyan, A. (2019). The Effect of Cathodal Transcranial Direct-Current Stimulation (c-tDCS) of Dorsolateral Prefrontal Cortex (DLPFC) on learning simple serves in beginner volleyball learners. *Iranian Journal of Learning and Memory*, *2*(7), 43-50. doi: 10.22034/iepa.2020.209265.1141

Nien, J. T., Chen, N. C., Kee, Y. H., Wu, C. H., Ahn, J., Yu, C. Y., … & Chang, Y. K. (2024). Athletes with meditation experience counteract the detrimental effect of mental fatigue on endurance performance and neurocognitive functions. *Journal of Sports Sciences*, *42*(14), 1355–1366. https://doi.org/10.1080/02640414.2024.2391651

Olofsdotter Lauri, K., Aspvall, K., Mataix-Cols, D., Serlachius, E., Rück, C., & Andersson, E. (2023). An online self-guided cognitive intervention for unwanted intrusive thoughts about harming infants in new parents: Initial randomized controlled trial with mediation analysis. *Cognitive Behaviour Therapy*, *52*(6), 585-602.

Quaedflieg, C.W.E.M., Stoffregen, H., & Ashton, S.M. (2022). Cortisol reactivity impairs suppression-induced forgetting. *Psychoneuroendocrinology*, *142*, 105774.

Rezaei, S., Yousefzadeh, S., Moosavi, S. H., Kazemnejad, E., & Khodadadi, N. (2013). Designing a predictive model to determine the risk factors of mental disorders following traumatic brain injury. *Feyz Med Sci J, 17* (1), 40-53 URL: http://feyz.kaums.ac.ir/article-1-1840-fa.html

Rezvani, M., Abdoli, B., & Vaez Mousavi, S. M. K. (2018). The Effect of Psychological Skills on Female Futsal Players' Selected Sport Performance. *Sport Psychology Studies*, *7*(23), 1-16. doi: 10.22089/spsyj.2018.1204

Sabzban, M., & Safaei, I. (2021). Associating psychological symptoms and worshipping national Taekwondo Champions as celebrities: The mediating role of maladaptive daydreaming and desire for fame. *Sport Psychology Studies*, *10*(37), 179-206. doi: 10.22089/spsyj.2021.9537.2051

Safaei, I., & Ghorbaninezhad, M. (2020). Effectiveness of energizing and relaxing music on performance of youth members of the Islamic Republic of Iran's National Judo Team. *Sport Psychology Studies*, *8*(30), 77-98. doi: 10.22089/spsyj.2020.7462.1798

Sahragard, S., & Safaei, I. (2023). The relationship between media multitasking and the sleep quality of adolescent athletes: The mediating role of emotional/behavioral problems. *Sport Psychology Studies*, *12*(44), 159-184. doi: 10.22089/spsyj.2022.12627.2305

Salehian, M. H., & Qadiri, S. (2019). Anticipation of emotion regulation and psychological well-being on athletic performance of professional and semi-professional athletes. *Sport Psychology Studies*, *8*(29), 151-170. doi: 10.22089/spsyj.2019.7244.1770

Sella, E., Cellini, N., Miola, L., Sarlo, M., & Borella, E. (2018). The influence of metacognitive shifting attentional control. *Behavior Therapy*, *49*(1), 21-31.

Sheikh al-Islami, A., Seyedesmaili Ghomi, N., & Mohammadi, N. (2023). Investigating the effectiveness of cognitive rehabilitation on the executive functions of students with specific learning disorder. *Iranian Journal of Learning and Memory*, *6*(23), 43-51. doi: 10.22034/iepa.2023.421809.1452

Short, M.A., Weber, N., & Reynolds, C. (2018). Estimating adolescent sleep need using dose-response modeling. *Sleep*, *41*(4), zsy011.

Sim, J. E., Leota, J., Mascaro, L., Hoffman, D., & Facer-Childs, E. R. (2023). Sleep patterns before and after competition: A real-world examination of elite athletes. *Journal of Sports Sciences*, *41*(22), 2014–2026.

Slimani, M., Bragazzi, N. L., Tod, D., Dellal, A., Hue, O., Cheour, F., & Chamari, K. (2016). Do cognitive training strategies improve motor and positive psychological skills development in soccer players? Insights from a systematic review. *Journal of Sports Sciences*, *34*(24), 2338–2349. https://doi.org/10.1080/02640414.2016.1254809

Schwert, C., Aschenbrenner, S., Weisbrod, M., & Schröder, A. (2017). Cognitive impairments in unipolar depression: the impact of rumination. *Psychopathology*, *50*(5), 347-354.

Vasconcelos-Raposo, Palumbo, Carvalho, A., Borges, J., & Teixeira, C. (2024). Negative Thoughts & self-confidence among athletes with different sports experiences: A meta-analysis. *PsychTech & Health Journal*, *7*(2), 5-19.

Venter, R.E. (2014). Perceptions of team athletes on the importance of recovery modalities. *Eur J Sport Sci*, *14*(1), S69-S76.

Vona, M., de Guise, É., Leclerc, S., Deslauriers, J., & Romeas, T. (2024). Multiple domain-general assessments of cognitive functions in elite athletes: Contrasting evidence for the influence of expertise, sport type and sex. *Psychology of Sport and Exercise*, *75*, 102715.

Wagstaff, C., Hings, R., Larner, R., & Fletcher, D. (2018). Psychological resilience's moderation of the relationship between the frequency of organizational stressors and burnout in athletes and coaches. *The Sport Psychologist*, *32*(3), 178-188.

Weinberg Robert, S., & Gould, D. (2007). *Foundations of sport and exercise psychology*. Fourth Edition.

Wilson, J. (2024). The effect of sleep on athletic performance: A critically appraised topic. *16th annual student research and creative activity fair, university of Nebraska, Omaha*.

Woodman, T., & Hardy, L. (2024). The relative impact of cognitive anxiety and self-confidence upon sport performance: A meta-analysis. *Journal of Sports Sciences*, *21*(6), 443-457.

Xu, L., Gao, Y., Shi, D., Wang, Y., Li, R., & Cai, Y. (2024). Social support moderates the relationship between sleep quality and mental health: A Chinese Fangcang shelter hospital-based study in asymptomatic COVID-19 carriers. *Heliyon*, *10*(11).

Zarei, S., Salman, Z., & Mohebi, M. (2019). The relationship between perfectionism and self-compassion in elite Taekwondo athletes. *Sport Psychology Studies*, *8*(29), 219-239. doi: 10.22089/spsyj.2019.7427.1794.