Padel Scientific Journal, Vol. III (2) (2025) 123-134, ISSN: 2990-2053 ISSN-e: 2952-2218

https://doi.org/10.17398/2952-2218.3.123

EFFECTS OF SLEEP RESTRICTION ON PHYSICAL PERFORMANCE TEST AMONG FORMATIVE YOUTH-ELITE PADEL PLAYERS

EFECTOS DE LA RESTRICCIÓN DEL SUEÑO SOBRE EL RENDIMIENTO FÍSICO EN JUGADORES DE PÁDEL DE ÉLITE EN FORMACIÓN

JESÚS DÍAZ GARCÍA
Department of Psychology, BIND-Behavioral Imaging and Neural Dynamics Centre University G´d Annunzio.
ORCID: 0000-0002-9430-750X

JOSÉ ALBERTO PARRACA
Departament of Sport and Health, Comprehensive Health Research Centre, University of Evora.
ORCID: 0000-0002-5254-7409

NUNO BATALHA
Departament of Sport and Health, Comprehensive Health Research Centre, University of Evora.
ORCID: 0000-0001-8533-7144

RUBÉN LLANOS-MUÑOZ
Faculty of Teacher Training, University of Extremadura.
ORCID: 0000-0003-4961-9376

IVÁN RAMÍREZ-BRAVO
Faculty of Sport Sciences, University of Extremadura.
ORCID: 0000-0002-1319-5287

MIGUEL ANGEL LÓPEZ-GAJARDO
Faculty of Teacher Training, University of Extremadura.
ORCID: 0000-0001-8364-7632

Autor de correspondencia: Jesús Díaz García. Postdoctoral Researcher. University G' d Annunzio, Chieti-Pescara, Italy. jesus.diaz@unich.it

Recibido: 10/12/2024 Aceptado: 08/02/2025

ABSTRACT

It has been shown that playing padel tournaments impairs the quantity and quality of players' sleep during competition weeks. This study checks the effects of sleep restriction on the physical performance of youth padel players. Voluntarily, 18 youth-elite padel players (17.34 ± 1.36) participated in this randomized experimental trial. The Pittsburgh Sleep Quality Index was previously recorded to establish experimental conditions, which were a normal sleep protocol versus a sleep restriction protocol (i.e., 50% of normal sleep time). Following both conditions, reaction time using a psychomotor performance test, upper body power using overhead and lateral medicine ball throws, and specific agility and speed using a previously validated padel-specific test were recorded. Results indicated that sleep restriction significantly impaired visuomotor reaction time ($p < .001$) and padel-specific agility and speed ($p < .001$) but did not cause significant changes in strength compared to normal sleep ($p = 0.34$). Induced sleep restriction impairs two complex tasks such as padel-specific speed and agility as well as visuomotor reaction time. In contrast, the simple strength task was not impaired by this condition. An important practical application derived from the study is that coaches should implement sleep facilitation strategies among players during tournaments.

Keywords: Sleep impairments; physical performance; racket sports; sleep facilitation strategies.

RESUMEN

Se ha demostrado que jugar torneos de pádel perjudica la cantidad y calidad del sueño de los jugadores durante las semanas de competición. Este estudio comprueba los efectos de la restricción del sueño en el rendimiento físico de los jugadores de pádel jóvenes. De forma voluntaria, 18 jugadores de pádel jóvenes-élite (17,34 ± 1,36) participaron en este ensayo experimental aleatorizado. El Índice de Calidad del Sueño de Pittsburgh se registró previamente para establecer las condiciones experimentales, que fueron un protocolo de sueño normal frente a un protocolo de restricción del sueño (es decir, el 50% del tiempo normal de sueño). Siguiendo ambas condiciones, se registró el tiempo de reacción mediante una prueba de rendimiento psicomotor, la potencia del tren superior mediante lanzamientos de balón medicinal por encima de la cabeza y laterales, y la agilidad y velocidad específicas mediante una prueba específica de pádel previamente validada. Los resultados indicaron que la restricción del sueño perjudicó significativamente el tiempo de reacción visomotora ($p < .001$) y la agilidad y velocidad específicas del pádel ($p < .001$) pero no causó cambios significativos en la fuerza en comparación con el sueño normal ($p = 0.34$). La restricción inducida del sueño afecta dos tareas complejas, como la velocidad y la agilidad propias del pádel,

así como el tiempo de reacción visomotora. En cambio, la tarea de fuerza simple no se vio afectada por esta condición. Una importante aplicación práctica derivada del estudio es que los entrenadores deberían implementar estrategias de facilitación del sueño en los jugadores durante los torneos.

Palabras clave: Trastornos del sueño; rendimiento físico; deportes de raqueta; estrategias para facilitar el sueño

Introduction

Padel is a doubles racket sport playing in a 20x10 m pitch enclosed by glass and walls that are allowed during the game (Courel-Ibañez et al., 2019). Since the beginnings of 2020´s a significant increase in the number of scientific publications about padel can be observed (Escudero-Tena et al., 2020; Sánchez-Muñoz et al., 2020). This is presumable caused by the intensive growth in the number of practitioners and its impact around the world (Sánchez-Alcaráz et al., 2021) or the professionalization of this sport (e.g., padel staffs have evolved from a single coach to the presence of psychologists, nutritionists, strength&conditionings…) (Díaz-García et al., 2021). Therefore, it is not surprising that researchers triggered their interest in this sport.

Professional padel is physical as well as mentally fatiguing. Most of the previous studies have focused on the physical and technical-tactical demands of padel games (Courel-Ibañez et al., 2019; García-Benitez et al., 2018; Sánchez-Alcaráz et al., 2020; Ramon-Llin et al., 2020). Padel is a mainly endurance-based sport interspersed with repeated high-intensity effort (Courel-Ibañez et al., 2019; García-Benitez et al., 2018). Indeed, padel implies speed and direction changes, turns, and jumps during the game (Javadiha et al., 2021). The volley and lobs are the most used shots, although, other shots such as drives and backhands, smashes or specific padel shots such as bandejas, also cause mechanical impacts on shoulders, elbows, wrists… (Escudero-Tena et al., 2020; Ramon-Llin et al., 2020; Sánchez-Alcaraz et al., 2021;Torres-Luque et al., 2015). Meanwhile, the mental demands of padel games and competitions seem to be caused by the high cognitive-perceptual demands of the game as well as negative emotions (Díaz-García, González-Ponce, et al., 2021). Padel players must retain their attention on the ball and opponents' tendencies but also remembering their strategies and the

information provided by their coaches (Díaz-García, González-Ponce, et al., 2021). The presence of a teammate also increases the need to maintain a good communication between them (Díaz-García, López-Gajardo, et al., 2021). Padel players also need to maintain a good self-confidence, or anxiety and nervousness may appear on the contrary (Díaz-García, López-Gajardo, et al., 2021). The combination of these physical and mental demands causes a general state of fatigue among players that may have consequences on their wellness, as the demonstrated impairments that professional padel competitions cause on the sleep of padel players during tournaments (Díaz-García et al., 2023).

Sleep has a critical role in human functioning and athletes' performance (Juliff et al., 2015). Indeed, the lack of sleep quantity and quality during sport events and competitions is frequent in professional athletes (Halson, 2014; Walsh et al., 2021). In padel, the sleep impairments during tournaments seems to be caused by the psychological rumination that padel players have about past or future performance in the tournament (Juliff et al., 2015). Previous studies have suggested negative effects on reaction time and sport performance due to sleep impairments (Filipas et al., 2021; Jarraya et al., 2013; Reyner et al., 2013). Indeed, in the study performed in padel, the authors suggested a trend of correlation between sleep impairments and reaction time increases (Díaz-García et al., 2023). Therefore, more studies seem necessary to check possible negative effects of sleep impairments on padel performance.

Based on the sleep impairments that padel tournaments cause on players and the negative effects that have been associated with sleep impairments on other sports, the present study is focused on checking the effects that sleep restriction causes on the physical performance of padel players. We hypothesized that sleep restriction impairs the physical performance of padel players (Hypothesis 1) based on previous studies.

Material and Methods

Participants

A total of 18 youth-elite male Spanish padel players (age: 17.34 ± 1.36 years) voluntarily participated in the study. The parents of all these participants provided written informed consent before the start of the study. The experimental protocol and procedures were approved by the Extremadura´s University Ethics Local Committee (approval number: 93/2020).

Instruments

Medicine ball throws. To assess the upper-limb strength, participants were encouraged to throw a 3 Kg medicine ball as far and fast as possible. Specifically, players performed overhead and side medicine ball throws with dominant and non-dominant hands. This test has shown effectiveness to identify isometric maximal trunk rotation and it has been previously used to measure this variable in padel players (Courel-Ibañez & Llorca-Miralles, 2021).

Psychomotor Reaction Time. A 3-min version of the Psychomotor Vigilance Task (PVT) (Dinges & Powell, 1985) was used to measure visuomotor reaction time. Subjects were encouraged to push the screen of a mobile phone as fast as possible after a visual stimulus (i.e., red circle) had appeared in the center of the screen. If the screen was pushed before the stimulus appeared, a "false start" message was presented. Mean reaction time during the 3-min task were recorded.

Padel Agility and Speed Test. The padel agility and speed was assessed using a previously validated test for this purpose in padel. A 3 x 10 m shuttle run test with 180º turn was performed. The fastest two temps were considered for the analysis as explained by previous authors (Courel-Ibañez & Llorca-Miralles, 2021). After 3 min of recovery, players performed the Tapas 6R test. A total of six balls were placed on six flat cones at the specific positions depicted, placed at 0.45 m. The players started in the center of the serving line in a 1 × 1 m location in which to place the collected balls. Players were to run to each position in the established order, pick up the ball, return to the starting position, and place the ball using the dominant hand. Time stops when the last ball is placed. This instrument was previously validated for this purpose, and it has been previously used (Courel-Ibañez & Llorca-Miralles, 2021).

Procedures

Participants visited the laboratory on three different times. During the first visit (two days before testing sessions started), participants performed a familiarization section with the tests used in the study and they also reported their Pittsburgh Sleep Quality Index. This instrument allows us to know the normal sleep parameters of the players and define the sleep restriction protocol In a randomized order, participants performed the normal sleep condition or the sleep restriction condition at the second and third visit (one week in between them). Participants sleep in their own and normal bed in both times. Researchers contacted participants to mark the time to sleep and

get up. In the normal sleep conditions, participants must replicate as similar as possible their sleep behaviors reported in the PSQI. During the sleep restriction, re-searchers were assured that participants went to bed at the specific time that they marked to do a reduction of the 50% in the sleep time. Experimental sessions were performed at the same hour (9:00 h) to avoid possible effects of circadian rhythms. The food intake by participants was the same in both conditions. Participants did not intake caffeine before the testing sessions. The order of the test during the experimental sessions was: i. Medicine ball throws, ii. Psychomotor Reaction Time, iii. Padel Agility Test.

Data analysis

Data were shown as means ± standard deviation (SD). The Shapiro-Wilk test was used to test the normality of the data; sphericity was verified by Mauchly's test. When the assumption of sphericity was not met, the significance of F ratios was adjusted with the Greenhouse-Geisser procedure. Due to the Shapiro-Wilk test showed non-normal distribution of the data, a Wilcoxon test was performed to check possible differences among conditions. A significance threshold of .05 was applied to all analyses. Analyses were conducted using the SPSS 25.0.

Results

The results obtained by padel players for each test and condition are shown on Table 1. No effects of sleep restriction on any of the medicine ball ($p = .34$ for overhead, $p = .71$ for dominant hand and $p = .86$ non-dominant hand) throws were observed. On the contrary, padel players showed significant impairments on agility ($p < .001$), speed ($p < .001$) and psychomotor reaction time ($p < .001$) in the sleep restriction protocol when compared with the normal sleep protocol.

Table 1. *Physical performance of youth-elite players between experimental conditions*

Variables	Normal Sleep	Sleep Restriction (i.e., 50% sleep time)
Medicine Ball Throws (m.)		
Overhead	7.24 (±1.36)	7.18 (±1.12)
Side dominant	5.66 (±.91)	5.71 (±1.04)
Side non-dominant	4.99 (±.98)	4.87 (±.74)
Ability-Speed (s)		
Agility	16.91 (±3.56)	18.77 (±2.99)*
Time	7.94 (±1.81)	8.92 (±1.59)*
Psychomotor Reaction Time (s)	.361 (±.19)	.398 (±.12)*

*Note. *=p<.05*

Discussion

The main purpose of this study was to check the effects of sleep restriction on the physical performance of youth-elite padel players. The main findings were that agility, speed and reaction time were impaired by sleep restriction. On the contrary, no effects of sleep restriction were observed on strength.

We hypothesized that sleep restriction would impair the physical performance of youth-elite padel players. However, we can only accept partially this hypothesis, due to strength was not impaired by the sleep restriction condition. This suggests that the effects of sleep restriction on physical performance may depend on the nature of the task. Specifically, it seems that complex task such as the psychomotor vigilance task (which implied perception and execution), the speed (which include a 180º turn and self-pacing to do correctly and as fast as possible the turn) or the agility task,

may be negatively affected by the sleep restriction. On the contrary, a single medicine ball thrown was not affected by the sleep restriction.

These results seem of interest, since padel players have reported sleep issues during competitions (Díaz-García et tal., 2023). These authors suggested that padel players impair their sleep during tournaments by rumination and psychological processes over performance. This is of interest for the results of the study because it may explain why complex tasks are affected by sleep restriction meanwhile single tasks are not affected by sleep restriction. I.e., in the case that sleep restriction is caused by psychological processes and these psychological processes are involved to make complex decisions, it seems normal to observe these impairments. Indeed, other previous studies have reported negative effects of sleep restriction on complex tasks (Hurdiel et al., 2014; Queiroz et al., 2020; Vincent et al., 2021). Most of these studies have confirmed negative effects of sleep restriction on a very important psychological process as attention is (Choudhary et al., 2015). This explanation is similar to the observed in the effects of mental fatigue on sport performance. Mental fatigue has been related with impairments in complex task as specific game scenarios or self-pacing (Smith et al., 2015,2016; Van Cutsem et al., 2022). On the contrary, no effects of mental fatigue on single strength have been observed (Martin et al., 2015). Specific psychomotor performance impairments on non-racket (Craven et al., 2022; Fullagar et al., 2015; Watson et al., 2015) and racket sports such as tennis (Vitale et al., 2021) have been observed, suggesting that padel-specific psychomotor performance can be also affected by sleep restriction.

The main practical application derived of this study is for coaches and application. Due to sleep restriction impair the physical performance and players impair their sleep during tournament, they should try to use sleep facilitation strategies as breathing or mindfulness are. Moreover, they can try to train under sleep restriction conditions searching to develop training adaptations versus sleep restriction, although more studies seem necessary to check it. Future studies should also try to include objective measures for sleep, such as smart wristbands, as the main limitation of the present study is the use of self-reported measures for sleep only.

Conclusions

The results of the present study suggest that sleep restriction did not impair the upper-limb strength of youth-elite players when compared with a night of normal sleep. On the contrary, the agility, speed and psychomotor

reaction time of youth-elite soccer players were impaired by the effects of sleep restriction. Sleep restriction is frequent during padel tournaments, but their effects may depend on the nature of the task.

Disclosure statement

The authors report no conflict of interest.

References

Choudhary, A. K., Kishanrao, S. S., Dadarao Dhanvijay, A. K., & Alam, T. (2016). Sleep restriction may lead to disruption in physiological attention and reaction time. *Sleep science*, *9*(3), 207–211. https://doi.org/10.1016/j.slsci.2016.09.001

Courel-Ibáñez, J., & Llorca-Miralles, J. (2021). Physical fitness in young padel players: A cross-sectional study. *International Journal of Environmental Research and Public Health*, *18*(5), 2658. https://doi.org/10.3390/ijerph18052658

Courel-Ibáñez, J., Sánchez-Alcaraz Martínez, B. J., & Cañas, J. (2017). Game performance and length of rally in professional padel players. *Journal of Human Kinetics, 55,* 161–169.

https://doi.org/10.1515/hukin-2016-0045

Courel-Ibáñez, J., Sánchez-Alcaraz Martinez, B. J., & Muñoz Marín, D. (2019). Exploring game dynamics in padel: Implications for assessment and training. *Journal of Strength and Conditioning Research, 33*(7), 1971–1977. https://doi.org/10.1519/JSC.0000000000002126

Craven, J., McCartney, D., Desbrow, B., Sabapathy, S., Bellinger, P., Roberts, L., & Irwin, C. (2022). Effects of acute sleep loss on physical performance: A systematic and meta-analytical review. *Sports Medicine*, 52(11), 2669-2690.

https://doi.org/10.1007/s40279-022-01706-y

Díaz-García, J., González-Ponce, I., López-Gajardo, M. Á., Van Cutsem, J., Roelands, B., & García-Calvo, T. (2021). How mentally fatiguing are consecutive World Padel Tour matches?. *International Journal of Environmental Research and Public Health*, *18*(17), 9059. https://doi.org/10.3390/ijerph18179059

Díaz-García, J., López-Gajardo, M. Á., Ponce-Bordón, J. C., & Pulido, J. J. (2021). Is motivation associated with mental fatigue during padel trainings? A pilot study. *Sustainability*, *13*(10), 5755. https://doi.org/10.3390/su13105755

Díaz-García, J.; Muñoz, D.; Muñoz, J. y Ibáñez, S.J. (2021) Design and validation of an observational instrument for final actions in padel. *Revista*

Internacional de Medicina y Ciencias de la Actividad Física y el Deporte,21(81),197-210 https://doi.org/10.15366/rimcafd2021.81.013

Díaz-García, J., Roelands, B., Habay, J., González-Ponce, I., López-Gajardo, M. Á., García-Calvo, T., & Van Cutsem, J. (2023). A multiday professional padel tournament impairs sleep, mental toughness, and reaction time: A World Padel Tour field study. *Motor control*, *27*(3), 518–533. https://doi.org/10.1123/mc.2022-0083

Dinges, D.F., Powell, J.W. Microcomputer analyses of performance on a portable, simple visual RT task during sustained operations. *Behavior Research Methods, Instruments, & Computers* **17**, 652–655 (1985). https://doi.org/10.3758/BF03200977

Escudero-Tena, A., Fernández-Cortes, J., García-Rubio, J., & Ibáñez, S. J. (2020). Use and efficacy of the lob to achieve the offensive position in women's professional padel. Analysis of the 2018 WPT Finals. *International Journal of Environmental Research and Public Health*, *17*(11), 4061. https://doi.org/10.3390/ijerph17114061

Filipas, L., Ferioli, D., Banfi, G., La Torre, A., & Vitale, J. A. (2021). Single and combined effect of acute sleep restriction and mental fatigue on basketball free-throw performance. *International Journal of Sports Physiology and Performance*, *16*(3), 415–420. https://doi.org/10.1123/ijspp.2020-0142

Fullagar, H. H., Skorski, S., Duffield, R., Hammes, D., Coutts, A. J., & Meyer, T. (2015). Sleep and athletic performance: the effects of sleep loss on exercise performance, and physiological and cognitive responses to exercise. *Sports medicine, 45*(2), 161-186. https://doi.org/10.1007/s40279-014-0260-0

García-Benítez, S., Courel-Ibáñez, J., Pérez-Bilbao, T., & Felipe, J. L. (2018). Game responses during young padel match play: Age and sex comparisons. *Journal of Strength and Conditioning Research*, *32*(4), 1144–1149. https://doi.org/10.1519/JSC.0000000000001951

Halson S. L. (2014). Sleep in elite athletes and nutritional interventions to enhance sleep. *Sports Medicine 44*(1), 13–23. https://doi.org/10.1007/s40279-014-0147-0

Hurdiel, R., Van Dongen, H. P., Aron, C., McCauley, P., Jacolot, L., & Theunynck, D. (2014). Sleep restriction and degraded reaction-time performance in figaro solo sailing races. *Journal of Sports Sciences*, *32*(2), 172–174. https://doi.org/10.1080/02640414.2013.815359

Javadiha, M., Andujar, C., Lacasa, E., Ric, A., & Susin, A. (2021). Estimating player positions from padel high-angle videos: Accuracy comparison of recent computer vision methods. *Sensors (Basel, Switzerland)*, *21*(10), 3368. https://doi.org/10.3390/s21103368

Jarraya, M., Jarraya, S., Chtourou, H., Souissi, N., & Chamari, K. (2012). The effect of partial sleep deprivation on the reaction time and the attentional

capacities of the handball goalkeeper. *Biological Rhythm Research*, *44*(3), 503–510. https://doi.org/10.1080/09291016.2012.721589

Juliff, L. E., Halson, S. L., & Peiffer, J. J. (2015). Understanding sleep disturbance in athletes prior to important competitions. *Journal of Science and Medicine in Sport*, *18*(1), 13–18. https://doi.org/10.1016/j.jsams.2014.02.007

Martin, K., Thompson, K. G., Keegan, R., Ball, N., & Rattray, B. (2015). Mental fatigue does not affect maximal anaerobic exercise performance. *European Journal of Applied Physiology*, *115*(4), 715–725. https://doi.org/10.1007/s00421-014-3052-1

Ramón-Llin, J., Guzmán, J., Martínez-Gallego, R., Muñoz, D., Sánchez-Pay, A., & Sánchez-Alcaraz, B. J. (2020). Stroke analysis in padel according to match outcome and game side on court. *International Journal of Environmental Research and Public Health*, *17*(21), 7838. https://doi.org/10.3390/ijerph17217838

Queiroz, S., Ruiz, F., Prado, J., Silva, A., Frange, C., Narciso, F., Cruz, A., Tufik, S., & de Mello, M. T. (2020). The consequences of partial sleep restriction for habitual sleep duration, sleepiness and reaction time in healthy males. *Sleep health*, *6*(6), 814–821. https://doi.org/10.1016/j.sleh.2020.04.002

Reyner, L. A., & Horne, J. A. (2013). Sleep restriction and serving accuracy in performance tennis players, and effects of caffeine. *Physiology & behavior*, *120*, 93–96. https://doi.org/10.1016/j.physbeh.2013.07.002

Sánchez-Alcaraz, B. J., Martínez-Gallego, R., Llana, S., Vučković, G., Muñoz, D., Courel-Ibáñez, J., Sánchez-Pay, A., & Ramón-Llin, J. (2021). Ball impact position in recreational male padel players: Implications for training and injury management. *International Journal of Environmental Research and Public Health*, *18*(2), 435. https://doi.org/10.3390/ijerph18020435

Sánchez-Alcaraz, B. J., Perez-Puche, D. T., Pradas, F., Ramón-Llín, J., Sánchez-Pay, A., & Muñoz, D. (2020). Analysis of performance parameters of the smash in male and female professional padel. *International Journal of Environmental Research and Public Health*, *17*(19), 7027. https://doi.org/10.3390/ijerph17197027

Sánchez-Muñoz, C., Muros, J. J., Cañas, J., Courel-Ibáñez, J., Sánchez-Alcaraz, B. J., & Zabala, M. (2020). Anthropometric and physical fitness profiles of world-class male padel players. *International Journal of Environmental Research and Public Health*, *17*(2), 508. https://doi.org/10.3390/ijerph17020508

Smith, M. R., Coutts, A. J., Merlini, M., Deprez, D., Lenoir, M., & Marcora, S. M. (2016). Mental fatigue impairs soccer-specific physical and technical performance. *Medicine and Science in Sports and Exercise*, *48*(2), 267–276. https://doi.org/10.1249/MSS.0000000000000762

Smith, M. R., Marcora, S. M., & Coutts, A. J. (2015). Mental fatigue impairs

intermittent running performance. *Medicine and Science in Sports and Exercise*, *47*(8), 1682–1690. https://doi.org/10.1249/MSS.0000000000000592

Torres-Luque, G., Ramirez, A., Cabello-Manrique, D., Nikolaidis, T. P., & Alvero-Cruz, J. R. (2015). Match analysis of elite players during paddle tennis competition. *International Journal of Performance Analysis in Sport*, *15*(3), 1135–1144. https://doi.org/10.1080/24748668.2015.11868857

Van Cutsem, J., Van Schuerbeek, P., Pattyn, N., Raeymaekers, H., De Mey, J., Meeusen, R., & Roelands, B. (2022). A drop in cognitive performance, whodunit? Subjective mental fatigue, brain deactivation or increased parasympathetic activity? It's complicated!. *Cortex; a journal devoted to the study of the nervous system and behavior*, *155*, 30–45. https://doi.org/10.1016/j.cortex.2022.06.006

Vincent, G. E., Onay, Z., Scanlan, A. T., Elsworthy, N., Pitchford, N. W., & Lastella, M. (2021). The impact of self-reported sleep quantity on perceived decision-making in sports officials during a competitive season. *Research Quarterly for Exercise and Sport*, *92*(1), 156–169. https://doi.org/10.1080/02701367.2020.1722309

Vitale, J. A., Bonato, M., Petrucci, L., Zucca, G., La Torre, A., & Banfi, G. (2021). Acute sleep restriction affects sport-specific but not athletic performance in junior tennis players. *International Journal of Sports Physiology and Performance*, *16*(8), 1154–1159. https://doi.org/10.1123/ijspp.2020-0390

Walsh, N. P., Halson, S. L., Sargent, C., … & Samuels, C. H. (2020). Sleep and the athlete: narrative review and 2021 expert consensus recommendations. *British journal of sports Medicine*, Advance online publication. https://doi.org/10.1136/bjsports-2020-102025

Watson, A. M. (2017). Sleep and athletic performance. *Current Sports Medicine Reports*, 16(6), 413-418. https://doi.org/10.1249/JSR.0000000000000418