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Original Article


Differences in sleep quality in amateur and professional karate fighters

Diferenças na qualidade do sono em lutadores de karatê amadores e profissionais

Diferencias en la calidad del sueño entre aficionados y profesionales de karate

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ABSTRACT

Objective: This study aimed to analyze whether there are differences between the sleep quality of amateur and professional karate fighters. **Methodology:** Nineteen male Karate fighters participated in the study, where ten fighters were amateur (regional championships), aged 32.3 ± 11.2 years, the body mass of 79.1 ± 13.1 kg, and nine fighters were professionals (world championships), aged 26.8 ± 10.5 years, the weight of 66.3 ± 8.2 kg. All volunteers answered the PSQI-Br instrument, validated to Brazilian Portuguese. The Mann-Whitney U non-parametric test was used for statistical analysis, p-value, U value, Z score, and effect size. **Results and discussion:** There was a statistically significant difference in bedtime and sleep duration, indicating worse results for professional karate fighters. There were no differences in overall sleep quality; however, both groups are classified as poor sleepers. **Conclusion:** Therefore, amateur and professional karate fighters have poor sleep quality, generating several factors that negatively affect health and performance.

Keywords: Martial arts. Sleep. Sports.

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RESUMO

Objetivo: Este estudo teve como objetivo analisar se existem diferenças na qualidade do sono entre lutadores de karatê amadores e profissionais. **Metodologia:** Dezenove lutadores de karatê masculinos participaram do estudo, sendo dez lutadores amadores (campeonatos regionais), com idade média de $32,3 \pm 11,2$ anos e peso médio de $79,1 \pm 13,1$ kg, e nove lutadores profissionais (campeonatos mundiais), com idade média de $26,8 \pm 10,5$ anos e peso médio de $66,3 \pm 8,2$ kg. Todos os voluntários responderam ao instrumento PSQI-Br, validado para o português brasileiro. O teste não paramétrico de Mann-Whitney U foi usado para análise estatística, com valor de p, valor U, escore Z e tamanho de efeito. **Resultados e discussão:** Houve diferença estatisticamente significativa no horário de dormir e na duração do sono, indicando resultados piores para lutadores profissionais de karatê. Não houve diferenças na qualidade geral do sono; no entanto, ambos os grupos foram classificados como tendo má qualidade do sono. **Conclusão:** Portanto, lutadores de karatê amadores e profissionais têm má qualidade do sono, o que gera vários fatores que afetam negativamente a saúde e o desempenho.

Palavras-chave: Artes marciais. Sono. Esportes.

RESUMEN

Objetivo: Este estudio tuvo como objetivo analizar si existen diferencias en la calidad del sueño entre luchadores de karate amateur y profesionales. **Metodología:** Diecinueve luchadores masculinos de karate participaron en el estudio, donde diez luchadores eran amateurs (campeonatos regionales), con una edad de $32,3 \pm 11,2$ años, una masa corporal de $79,1 \pm 13,1$ kg, y nueve luchadores eran profesionales (campeonatos mundiales), con una edad de $26,8 \pm 10,5$ años y un peso de $66,3 \pm 8,2$ kg. Todos los voluntarios respondieron el instrumento PSQI-Br, validado para el portugués brasileño. Se utilizó la prueba no paramétrica U de Mann-Whitney para el análisis estadístico, el valor p, el valor U, la puntuación Z y el tamaño del efecto. **Resultados y discusión:** Se encontró una diferencia estadísticamente significativa en la hora de acostarse y la duración del sueño, indicando peores resultados para los luchadores de karate profesionales. No hubo diferencias en la calidad general del sueño; sin embargo, ambos grupos fueron clasificados como malos durmientes. **Conclusión:** Por lo tanto, los luchadores de karate amateur y profesionales tienen una mala calidad del sueño, lo que genera varios factores que afectan negativamente la salud y el rendimiento.

Palabras Clave: Artes marciales. Sueño. Deportes.

INTRODUCTION

Sleep is a fundamental evolutionary behavior (BIGGINS *et al.*, 2018), which has the role of restoring and regulating several physiological functions (SIMPSON *et al.*, 2020) and psychological (PALMER; ALFANO; BOWER, 2020; SHEN *et al.*, 2018). Thus, sleep quality is essential in the processes previously mentioned. The literature clearly shows that athletes have high rates of poor sleep quality (KHALLADI *et al.*, 2019; SWINBOURNE *et al.*, 2016). This poor sleep quality causes harm to health (BIGGINS *et al.*, 2018) for Athletes Performance (WATSON, 2017).

Several fundamental variables for a good sports performance suffer the negative influence of poor sleep quality, as significant reductions in the levels of strength, aerobic and anaerobic performance (THUN *et al.*, 2015), as well as the executive (SKURVYDAS *et al.*, 2020) and cognitive functions (TAHERI; ARABAMERI, 2012), all these variables being important for combat sports such as Karate.

Karate is a combat sport where your fights (Kumite) last three minutes, which demonstrates an essential role of anaerobic performance (CHAABENE *et al.*, 2012; CHAABÈNE *et al.*, 2013), aerobic performance. In this case, VO₂max also has relevant for karate mainly to improve recovery between training efforts and/or competitions (CHAABENE *et al.*, 2012; CHAABÈNE *et al.*, 2013). In addition to these variables, technical elements, such as executing specific and tactical movements as strategies adopted by each fighter, are fundamental to determining winners or losers in competitions (VIDRANSKI; SERTI, 2015)

Up to now, the literature only presents studies by (BEN CHEIKH *et al.*, 2017; DAALOUL; SOUISSI; DAVENNE, 2019), relating sleep to Karate. One night of sleep deprivation already induces significant reductions in the performance of isometric strength and selective attention in adolescent karate Fighters (BEN CHEIKH *et al.*, 2017). Already in the study with adult karate fighters, a night of partial sleep deprivation generated reductions in cognitive and physical performance, especially during time of exhaustion during the specific test of Karate (DAALOUL; SOUISSI; DAVENNE, 2019), thus making clear the importance of sleep for a good performance in karate, whether for training and competitions or professional and amateur fighters.

However, it is unknown what sleep quality behavior would be like, nor if there are differences between amateur and professional karate athletes since the literature does not offer these findings. Thus, the study aims to analyze whether there are differences between the sleep quality of amateur and professional karate fighters.

METHOD

SUBJECTS

Nineteen male Karate athletes participated in the study, where ten athletes were amateur (regional competitions), aged 32.3 ± 11.2 years, body mass of 79.1 ± 13.1 Kg, and nine athletes were professionals (world competitions), aged 26.8 ± 10.5 years, the body mass of 66.3 ± 8.2 Kg. All athletes, amateurs, and professionals were selected at random, being from different teams and dojos, thus ensuring a diversity of the sample. All volunteers were informed of the study's risks and benefits and signed an informed consent form. The protocol of the present study was approved by the ethics committee of the Valley of Acaraú State University, with the protocol number, 3.196.794.

PROCEDURES

The volunteers completed a questionnaire on training characteristics, where information was obtained on training in years, duration of training sessions, and training days per week. Sleep quality was measured by the Pittsburgh Sleep Quality Index¹⁶, which was Validated for Portuguese (Brazilian version) as PSQI-Br by (BERTOLAZI *et al.*, 2011). The PSQI-Br is composed of 19 questions, presenting results through seven components: subjective sleep quality, sleep latency, sleep duration, sleep efficiency, sleep disorders, sleeping medication, and diurnal dysfunctions. Individuals with values below five scores are classified as good sleepers, and values equal to or greater than five are classified as poor sleepers, emphasizing that the higher the scores, the worse the sleep quality. Amateur athletes answered the instruments in their dojos. We highlight that they were during the competitive period, in the final stage of preparation for the regional championship (Copa Sobral). Professional athletes responded during the world karate tournament held in Fortaleza-Ceará. Both fighters answered the instruments privately. All data were collected before the covid-19 pandemic.

STATISTICAL ANALYSIS

The normality was tested using the Shapiro-Wilk test, where the hypothesis of normality of the data was rejected. The non-parametric Mann-Whitney U test compared the two groups [amateur and professional]. The statistical significance level adopted was $p \leq 0.05$, and the results have exposed the results and reported the U and Z score values. Analyzes were performed on SPSS 23.0. The effect size was calculated using the r test¹⁸, where the calculation occurs by the equation $r = Z/\sqrt{N}$ where Z corresponds to the Z score and N, the total sample used in the study. The effect size is classified as small, -0.2, medium, -0.50, or large, -0.8019.

RESULTS

Table 1 shows the data that characterizes karate athletes' training information, highlighting a significant difference between amateurs and professionals.

Table 1. Characteristics of training among regional and international Fighters

	Amateur	Professional	U	Z escore	p	EffectSize [r]
Training Time (Years)	10	14	31.5	-1.1	0.2	-0.2
Duration of Training Session (Hours)	1	2	9.5	-3	0.002	-0.6
Training per week (Times)	3	5	6	-3.3	0.001	-0.7

The data showing general sleep patterns are contained in table 2. It is worth noting that only the time to go to bed ($p = 0.05$ and $r = -0.4$) and hours of sleep per night ($p = 0.02$ and $r = -0.5$) showed significant differences.

When comparing the median of the total scores of the PSQI-Br, no statistical differences were found, and the effect size was small. However, both groups are classified as poor sleepers, although the score is higher than 5.

Table 2. General sleep patterns among amateur and professional karate athletes

	Amateur	Professional	U	Z escore	p	EffectSize [r]
Bed Time	23:00	00:00	21	-2	0.05	-0.4
Sleep Latency (Minutes)	15	20	38	-0.5	0.6	-0.1
Wake up time	6:15	7:00	45	0	1	0
Total Sleep Time	7:15	5:30	17.5	-2.2	0.02	-0.5
SleepEfficiency (%)	67	66	40	-0.9	0.4	0.0
PSQI-Br total escore	8	10	35.5	-0.8	0.4	-0.2

Only the total sleep time showed a statistically significant difference, with a small effect size (see table 3). It should also be considered that, even without showing a statistical difference, the sleep latency had a medium effect size, which has practical implications for athletes.

Table 3. Components of sleep quality among amateur and professional karate athletes

	Amateur	Professional	U	Z score	p	EffectSize [r]
SubjectiveSleepQuality	1	1	41.5	-0.3	0.7	-0.1
SleepLatency	1	2	37.5	-0.6	0.5	-0.5
SleepDuration	0.5	2	18.5	-2.2	0.02	-0.2
SleepEfficiency	3	3	40.5	-0.9	0.3	0.0
SleepDisorders	1	1	42	-0.2	0.7	-0.3
Sleepingmedication	0	0	36	-1.3	0.1	-0.3
DiurnalDysfunctions	0.5	1	29.5	-1.3	0.1	-0.1

DISCUSSION

This study aimed to analyze whether there are differences between professional and amateur karate athletes' sleep quality using the PSQI-Br instrument. There was a statistically significant difference in the inconsistent total sleep time one of the causes pointed out in the literature for this type of event is the prolonged use of electronic devices close to bedtime or even in bed (JONES *et al.*, 2019), this is due to the blue light emitted by these electronic devices, which has the action of reducing melatonin secretion thus delaying sleep (TÄHKÄMÖ; PARTONEN; PESONEN, 2019).

Sleep duration presents a statistically significant difference and average effect size between amateur and professional karate athletes. This demonstrates a short sleep duration mainly for professionals. This insufficient duration impacts physical and mental health (CHATTU *et al.*, 2018) regardless of being an amateur, professional or non-athlete. In the case of professional Karate athletes, this constantly insufficient sleep duration can lead to a chronic sleep deprivation (MCHILL *et al.*, 2018).

This chronic state of sleep insufficiency can lead to a severe reduction in executive functions and cognitive abilities (MAIRE *et al.*, 2018; ST. HILAIRE *et al.*, 2017), which can generate a reduction in performance either in training or in competitions, which is harmful to both groups of athletes.

When the analysis is done through the components of the PSQI-Br, the sleep quality also presents a statistically significant difference between amateurs and professionals, which only reinforces the findings in the literature of how athletes of a higher competitive level are affected by factors that reduce the sleep quality (GUPTA; MORGAN; GILCHRIST, 2017).

However, despite no statistical difference, another factor that should be mentioned is that in both groups (amateurs and professionals), there is poor sleep efficiency according to the PSQI-Br (BERTOLAZI *et al.*, 2011; BUYASSE *et al.*, 1989). Thus, sleep does not perform its vital role (CHAREST; GRANDNER, 2020), reduced immunity, and increased episodes of illness (COHEN *et al.*, 2009) and for performance such as decreased reaction time, anaerobic power (GÜNEY; IMAMOĞLU, 2022; KIRSCHEN; JONES; HALE, 2018; TAHERI; ARABAMERI, 2012).

When analyzing the total scores of the PSQI-Br, there was no statistical difference between the medians of amateur and professional karate athletes. Nevertheless, it must be considered that values equal to or greater than 5 scores indicate that the fighters are poor sleepers (BERTOLAZI *et al.*, 2011; BUYASSE *et al.*, 1989). Thus, the literature points to several adverse outcomes, both for health and for the performance of amateur and professional athletes.

Poor sleep quality results in poor sleepers, so the volunteers in this study may have an increased perception of fatigue, which is linked to the reduction in the mental and physical performance of karate fighters (DAALOUL; SOUSSI; DAVENNE, 2019) thus being able to harm the training and competition routine.

Recent findings link the increase in the number of musculoskeletal injuries to sleep debt, generated by poor sleep quality and a short sleep duration (CLEMENTE *et al.*, 2021; DE SOUSA NOGUEIRA FREITAS *et al.*, 2020), which places amateur and professional karate athletes who were evaluated in this research, with an increased risk factor for the occurrence of injuries.

The main limitation of the present study is the lack of application of other instruments that measure sleep, such as the sleep regularity index and also sleep diaries, which could generate more accurate information (last week), in addition to offering sleep data, weekly and weekends.

Future research that evaluates the sleep quality, more directly, through polysomnography and actigraphy, should be carried out to deeply understand the differences in sleep between amateur and professional karate athletes. Another suggestion is to analyze data on sleep quality and physical performance data, making it possible to understand the impact of sleep directly on physical performance.

A practical application of this research is to alert the need for amateur and professional karate fighters to improve their sleep habits, thus bringing improvements in the general health and the recovery processes.

FINAL CONSIDERATIONS

The present study can conclude that professional karate athletes have a greater lack of sleep when compared to amateurs, which can directly imply the athletes' post-training recovery capacity. It should also be considered that, although there are no statistical differences (significance and size of effect) in sleep quality through the total scores of the PSQI-Br, amateur and professional karate athletes are classified as poor sleepers, which leaves both groups more susceptible to adverse health outcomes and reductions in sports performance.

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NOTAS

CONFLICT OF INTEREST

Authors have no conflicts of interest, including specific financial interests and relationships and affiliations relevant to the topic or materials discussed in the manuscript.

AUTORIA E COAUTORIA

The authors declare that they participated significantly in the construction and training of this study, having, as author, public responsibility for its content, as they contributed directly to the intellectual content of this work and satisfy the authorship requirements.

Luiz Vieira da Silva Neto - Conception and development (since the idea to the investigation or article, created the hypotheses); Methodological design (planning of the methods to generate the results); Supervision (responsible for the organization and execution of the project and the writing of the manuscript); Collection and treatment of the data (responsible for the experiments, patients, data organization); Analysis/interpretation (responsible for the statistical analysis, evaluation, and presentation of the results); Literature survey (participated in the bibliographical research and the article survey); Redaction (responsible for writing a substantial part of the manuscript); Critic review (responsible for the review of the intellectual content of the manuscript before the final presentation).

Felipe da Silva Reis - Conception and development (since the idea to the investigation or article, created the hypotheses); Methodological design (planning of the methods to generate the results); Collection and treatment of the data (responsible for

the experiments, patients, data organization); Literature survey (participated in the bibliographical research and the article survey); Redaction (responsible for writing a substantial part of the manuscript); Others (list the others specifics contributions).

José Klinger da Silva Oliveira - Methodological design (planning of the methods to generate the results); Collection and treatment of the data (responsible for the experiments, patients, data organization); Analysis/interpretation (responsible for the statistical analysis, evaluation, and presentation of the results); Literature survey (participated in the bibliographical research and the article survey); Critic review (responsible for the review of the intellectual content of the manuscript before the final presentation). Others (list the others specifics contributions).

REFERÊNCIAS

BEN CHEIKH, Ridha; LATIRI, Imed; DOGUI, Mohamed; BEN SAAD, Helmi. Effects of one-night sleep deprivation on selective attention and isometric force in adolescent karate athletes. *The Journal of Sports Medicine and Physical Fitness*, v. 57, n. 6, maio. 2017.

Available in: <https://www.minervamedica.it/en/journals/sports-med-physical-fitness/article.php?cod=R40Y2017N06A0752>. Access at: 8 mar. 2023.

BERTOLAZI, Alessandra Naimaier; FAGONDES, Simone Chaves; HOFF, Leonardo Santos; DARTORA, Eduardo Giacomolli; DA SILVA MIOZZO, Iلسis Cristine; DE BARBA, Maria Emília Ferreira; MENNA BARRETO, Sérgio Saldanha. Validation of the Brazilian Portuguese version of the Pittsburgh Sleep Quality Index. *Sleep Medicine*, v. 12, n. 1, p. 70–75, jan. 2011. Available in:

<https://www.sciencedirect.com/science/article/pii/S1389945710003801?via%3Dihub>. Access at: 8 mar. 2023.

BIGGINS, Michelle; CAHALAN, Roisin; COMYNS, Thomas; PURTILL, Helen; O’SULLIVAN, Kieran. Poor sleep is related to lower general health, increased stress and increased confusion in elite Gaelic athletes. *The Physician and Sportsmedicine*, v. 46, n. 1, p. 14–20, 2 jan. 2018. Available in:

<https://www.tandfonline.com/doi/full/10.1080/00913847.2018.1416258>. Access at: 8 mar. 2023.

BUYSSE, Daniel; REYNOLDS, Charles; MONK, Timothy; BERMAN, Susan; KUPFER, David. The Pittsburgh sleep quality index: A new instrument for psychiatric practice and research. *Psychiatry Research*, v. 28, n. 2, p. 193–213, maio. 1989. Available in:

<https://www.sciencedirect.com/science/article/abs/pii/0165178189900474?via%3Dihub>. Access at: 8 mar. 2023.

CHAABENE, Helmi; HACHANA, Younes; FRANCHINI, Emerson; MKAOUER, Bessem; CHAMARI, Karim. Physical and Physiological Profile of Elite Karate Athletes. *Sports Med*, 2012.

CHAABÈNE, Helmi; MKAOUER, Bessem; FRANCHINI, Emerson; SOUISSI, Nafaa; SELMI, Mohamed Amine; NAGRA, Yassine; CHAMARI, Karim. Physiological Responses and Performance Analysis Difference between Official and Simulated Karate Combat Conditions. *Asian Journal of Sports Medicine*, v. 5, n. 1, 20 out. 2013. Available in: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4009084/pdf/ASJSM-5-021.pdf>. Access at: 8 mar. 2023.

CHAREST, Jonathan; GRANDNER, Michael. Sleep and Athletic Performance. *Sleep Medicine Clinics*, v. 15, n. 1, p. 41–57, mar. 2020. Available in: <https://doi.org/10.1016/j.jsmc.2022.03.006>. Access at: 8 mar. 2023.

CHATTU, Vijay Kumar; MANZAR, Md Dilshad; KUMARY, Soosanna; BURMAN, Deepa; SPENCE, David Warren; PANDI-PERUMAL, Seithikurippu. The Global Problem of Insufficient Sleep and Its Serious Public Health Implications. *Healthcare*, v. 7, n. 1, p. 1, 20 dez. 2018. Available in: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6473877/>. Access at: 8 mar. 2023.

CLEMENTE, Filipe Manuel; AFONSO, José; COSTA, Júlio; OLIVEIRA, Rafael; PINO-ORTEGA, José; RICO-GONZÁLEZ, Markel. Relationships between Sleep, Athletic and Match Performance, Training Load, and Injuries: A Systematic Review of Soccer Players. *Healthcare*, v. 9, n. 7, p. 808, 26 jun. 2021. Available in: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8305909/>. Access at: 8 mar. 2023.

COHEN, Sheldon; DOYLE, William; ALPER, Cuneyt; JANICKI-DEVERTS, Denise; TURNER, Ronald. Sleep Habits and Susceptibility to the Common Cold. *Archives of Internal Medicine*, v. 169, n. 1, p. 62, 12 jan. 2009. Available in: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2629403/>. Access at: 8 mar. 2023.

DAALOUL, Houda; SOUISSI, Nizar; DAVENNE, Damien. Effects of Napping on Alertness, Cognitive, and Physical Outcomes of Karate Athletes. *Medicine & Science in Sports & Exercise*, v. 51, n. 2, p. 338–345, fev. 2019. Available in: https://journals.lww.com/acsm-msse/fulltext/2019/02000/effects_of_napping_on_alertness_cognitive_and.15.aspx. Access at: 8 mar. 2023.

DE SOUSA NOGUEIRA FREITAS, Luísa; DA SILVA, Flavia Rodrigues; ANDRADE, Henrique de Araújo; GUERREIRO, Renato Carvalho; PAULO, Fernanda Viegas; DE MELLO, Marco Túlio; SILVA, Andressa. Sleep debt induces skeletal muscle injuries in athletes: A promising hypothesis. *Medical Hypotheses*, v. 142, p. 109836, set. 2020. Available in: <https://www.sciencedirect.com/science/article/abs/pii/S0306987720304503?via%3Dihub>. Access at: 8 mar. 2023.

GÜNEY, Gamze; IMAMOĞLU, Osman. Investigation of the Effect of Some Parameters Affecting the Sleep Quality of Sports-Trained Students. *Pakistan Journal of Medical and Health Sciences*, v. 16, n. 3, p. 432–436, 31 mar. 2022. Available in: <https://pjmhsonline.com/index.php/pjmhs/article/view/495/490>. Access at: 14 mar. 2023.

GUPTA, Luke; MORGAN, Kevin; GILCHRIST, Sarah. Does Elite Sport Degrade Sleep Quality? A Systematic Review. *Sports Medicine*, v. 47, n. 7, p. 1317–1333, jul. 2017. Available in: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5488138/pdf/40279_2016_Article_650.pdf. Access at: 8 mar. 2023.

JONES, Maddison; DAWSON, Brian; GUCCIARDI, Daniel; EASTWOOD, Peter; MILLER, Joanna; HALSON, Shona; DUNICAN, Ian; PEELING, Peter. Evening electronic device use and sleep patterns in athletes. *Journal of Sports Sciences*, v. 37, n. 8, p. 864–870, 18 abr. 2019. Available in: <https://doi.org/10.1080/02640414.2018.1531499>. Access at: 8 mar. 2023.

KHALLADI, Karim; FAROOQ, Abdulaziz; SOUISSI, Sofiane; HERRERA, Christopher P; CHAMARI, Karim; TAYLOR, Lee; EL MASSIOUI, Farid. Inter-relationship between sleep

quality, insomnia and sleep disorders in professional soccer players. *BMJ Open Sport & Exercise Medicine*, v. 5, n. 1, p. e000498, abr. 2019. Available in: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6539148/>. Access at: 8 mar. 2023.

KIRSCHEN, Gregory; JONES, Jason; HALE, Lauren. The Impact of Sleep Duration on Performance Among Competitive Athletes: A Systematic Literature Review. *Clinical Journal of Sport Medicine*, v. 30, n. 5, p. 503-512, 2020. Available in: <https://journals.lww.com/00042752-900000000-99164>. Access at: 8 mar. 2023.

MAIRE, Micheline; REICHERT, Carolin; GABEL, Virginie; VIOLA, Antoine; PHILLIPS, Christophe; BERTHOMIER, Christian; BORGWARDT, Stefan; CAJOCHEN, Christian; SCHMIDT, Christina. Human brain patterns underlying vigilant attention: impact of sleep debt, circadian phase and attentional engagement. *Scientific Reports*, v. 8, n. 1, p. 970, 17 jan. 2018. Available in: <https://www.nature.com/articles/s41598-017-17022-9>. Access at: 8 mar. 2023.

MCHILL, Andrew; HULL, Joseph; WANG, Wei; CZEISLER, Charles; KLERMAN, Elizabeth B. Chronic sleep curtailment, even without extended (>16-h) wakefulness, degrades human vigilance performance. *Proceedings of the National Academy of Sciences*, v. 115, n. 23, p. 6070–6075, 5 jun. 2018. Available in: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6003377/pdf/pnas.201706694.pdf>. Access at: 8 mar. 2023.

PALMER, Cara A; ALFANO, Candice A; BOWER, Joanne. Adolescent sleep patterns are associated with the selection of positive and negative emotional situations. *Journal of Sleep Research*, v. 29, n. 6, dez. 2020. Available in: <https://doi.org/10.1111/jsr.12917>. Access at: 8 mar. 2023.

SHEN, Lin; VAN SCHIE, Jason; DITCHBURN, Graeme; BROOK, Libby; BEI, Bei. Positive and Negative Emotions: Differential Associations with Sleep Duration and Quality in Adolescents. *Journal of Youth and Adolescence*, v. 47, n. 12, p. 2584–2595, dez. 2018. Available in: <http://link.springer.com/10.1007/s10964-018-0899-1>. Access at: 8 mar. 2023.

SIMPSON, Richard; CAMPBELL, John; GLEESON, Maree; KRÜGER, Karsten; NIEMAN, David; PYNE, David; TURNER, James; WALSH, Neil. Can exercise affect immune function to increase susceptibility to infection? *Exerc Immunol Rev.*, v. 26, p. 8-22, 2020. Available in: <https://pubmed.ncbi.nlm.nih.gov/32139352/>. Access at: 8 mar. 2023.

SKURVYDAS, Albertas; ZLIBINAITE, Laura; SOLIANIK, Rima; BRAZAITIS, Marius; VALANCIENE, Dovile; BARANAUSKIENE, Neringa; MAJAUSKIENE, Daiva; MICKEVICIENE, Dalia; VENCKUNAS, Tomas; KAMANDULIS, Sigitas. One night of sleep deprivation impairs executive function but does not affect psychomotor or motor performance. *Biology of Sport*, v. 37, n. 1, p. 7–14, 2020. Available in: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7075226/pdf/JBS-37-89936.pdf>. Access at: 8 mar. 2023.

ST. HILAIRE, Melissa A; RÜGER, Melanie; FRATELLI, Federico; HULL, Joseph; PHILLIPS, Andrew; LOCKLEY, Steven. Modeling Neurocognitive Decline and Recovery During Repeated Cycles of Extended Sleep and Chronic Sleep Deficiency. *Sleep*, v. 40, n. 1, 1 jan. 2017. Available in: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6084743/pdf/zsw009.pdf>. Access at: 8 mar. 2023.

SWINBOURNE, Richard; GILL, Nicholas; VAILE, Joanna; SMART, Daniel. Prevalence of poor sleep quality, sleepiness and obstructive sleep apnoea risk factors in athletes. *European Journal of Sport Science*, v. 16, n. 7, p. 850–858, 2 out. 2016. Available in:

<http://www.tandfonline.com/doi/full/10.1080/17461391.2015.1120781>. Access at: 8 mar. 2023.

TAHERI, Morteza; ARABAMERI, Elaheh. The Effect of Sleep Deprivation on Choice Reaction Time and Anaerobic Power of College Student Athletes. *Asian Journal of Sports Medicine*, v. 3, n. 1, 1 mar. 2012. Available in:

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3307962/pdf/ASJSM-3-015.pdf>. Access at: 8 mar. 2023.

TÄHKÄMÖ, Leena; PARTONEN, Timo; PESONEN, Anu-Katriina. Systematic review of light exposure impact on human circadian rhythm. *Chronobiology International*, v. 36, n. 2, p. 151-170, 1 fev. 2019. Available in:

<https://www.tandfonline.com/doi/epdf/10.1080/07420528.2018.1527773?needAccess=true>. Access at: 8 mar. 2023.

THUN, Eirunn; BJORVATN, Bjørn; FLO, Elisabeth; HARRIS, Anette; PALLESEN, Ståle. Sleep, circadian rhythms, and athletic performance. *Sleep Medicine Reviews*, v. 23, p. 1-9, out. 2015. Available in: <https://doi.org/10.1016/j.smrv.2014.11.003>. Access at: 8 mar. 2023.

VIDRANSKI, Tihomir; SERTI, Hrvoje. Technical and Tactical Aspects that Differentiate Winning and Losing Performances in Elite Male Karate Fighters. *Coll. Antropol.*, v. 39, Suppl 1, p. 95-102, Jul. 2015. Available in: <https://pubmed.ncbi.nlm.nih.gov/26434016/>. Access at: 8 mar. 2023.

WATSON, Andrew M. Sleep and Athletic Performance. *Curr Sports Med Rep.*, v. 16, n. 6, p. 413-418. Nov./Dec. 2017. Available in: <https://doi.org/10.1249/jsr.0000000000000418>. Access at: 8 mar. 2023.

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