

Efecto de la fatiga en el rendimiento y la toma de decisiones técnico-tácticas en el fútbol

Effects of fatigue on performance and technical-tactical decision-making in soccer

Efeitos da fadiga no desempenho e na tomada de decisões técnico-tácticas no futebol

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Resumen

Los esfuerzos cortos de alta intensidad que se realizan en deportes como el fútbol o el baloncesto podrían fatigar el sistema nervioso central (SNC). Para demostrarlo, se utilizaron los umbrales Flicker Fusion (UFF), un método utilizado para medir la fatiga del SNC y la función cognitiva, luego de una prueba de habilidad para repetir carreras (RSA), en la que se observó una disminución de los UFF, lo que indica fatiga del SNC. Por esta razón, la fatiga no solo se debe a factores musculares sino también a factores que afectan al SNC. Varios estudios han demostrado los efectos de la fatiga inducida por tareas combinadas cognitivas y motoras (Repeated Interval Loughborough Soccer Passing Test, partidos de entrenamiento de 90 minutos), y por tareas aisladas, tanto cognitivas (tarea Stroop de colores) como motoras (cargas físicas de alta intensidad), sobre el rendimiento técnico-táctico del jugador de fútbol. El objetivo de esta investigación es estudiar el efecto de la fatiga inducida mediante la Prueba de velocidad anaeróbica basada en la carrera (RAST) sobre el rendimiento en el tiempo de ejecución (TE) y la toma de decisiones (TD) en acciones técnico-tácticas de fútbol en situación de laboratorio. Se diseñó un estudio

cuasiexperimental, longitudinal y comparativo, con pretest y posttest. Se evaluó a dos grupos de futbolistas (n=34) divididos en un grupo de control (n=18) y un grupo experimental (n=16), en dos ocasiones y en dos momentos diferentes, utilizando el Stroop Task Football Test. Teniendo en cuenta el p valor, el tamaño del efecto y la potencia estadística, se observan diferencias antes y después del RAST en las variables índice total (IT) y tiempo de ejecución (TE), pero no en la toma de decisiones (TD). Por otro lado, el grupo de control permaneció estable en ambos momentos. Se concluye que, aunque la elección sea correcta no es suficiente con demorarse en la TD en este deporte en cualquier circunstancia o condición.

Palabras clave: fatiga, fútbol, rendimiento, sistema nervioso central, tiempo de ejecución, toma de decisiones.

Abstract

Short-term high intensity-efforts in sports such as soccer or basketball could fatigue the central nervous system (CNS). To demonstrate this, Flicker Fusion Thresholds (UFF), a method used to measure CNS fatigue and cognitive function, were used after a Running Repeat Ability (RSA) test, and CNS fatigue was observed due to decreased UFF. Therefore, fatigue is not only due to muscular factors, but also to factors affecting the CNS. Several studies have demonstrated the effects of fatigue induced by combined cognitive and motor tasks (Repeated Interval Loughborough Soccer Passing Test, 90-minute training matches) and by isolated cognitive (Color Stroop task) or motor tasks (high-intensity physical load) on the technical-tactical performance of soccer players. The aim of this research is to study the effect of RAST-induced fatigue on performance in execution time (ET) and decision-making ability (DMA) in technical-tactical actions in soccer in laboratory situation. A quasi-experimental, longitudinal, pretest-posttest comparative study was designed. Two groups of soccer players (n=34), divided into a control group (n=18) and an experimental group (n=16), were evaluated twice at two different times. Taking into account the p-value, effect size and statistical power, there are differences before and after RAST in the variables total index (TI) and execution time

(ET), but not in decision making (DMA). On the other hand, the control group remained stable at both time points. In conclusion, delaying the TD, even if the call is correct, is not sufficient in this sport under any circumstances or conditions.

Keywords: fatigue, soccer, performance, central nervous system, execution time, decision making.

Resumo

Esforços curtos e de alta intensidade no futebol ou no basquete podem causar fadiga no sistema nervoso central (SNC). Para demonstrar isso, foi utilizado o Threshold Flicker Fusion (UFF), método para medir a fadiga do SNC e a função cognitiva, após um teste de capacidade de repetição de corrida (RSA), no qual se observou a fadiga do SNC devido à diminuição da UFF. Por esse motivo, a fadiga não se deve apenas a fatores musculares, mas também a fatores que afetam o SNC. Vários estudos demonstraram os efeitos da fadiga induzida por tarefas cognitivas e motoras combinadas (Repeated Interval Loughborough Soccer Passing Test, partidas de treinamento de 90 minutos) e por tarefas cognitivas isoladas (tarefa de stroop colorido) e por tarefas motoras isoladas (Stroop Task Football Test) ou motoras (cargas físicas de alta intensidade) no desempenho técnico-tático do jogador de futebol. O objetivo desta pesquisa é estudar o efeito da fadiga induzida pelo RAST no desempenho em tempo de execução (TE) e na tomada de decisão (TD) em ações técnico-táticas no futebol em situação de laboratório. Foi criado um estudo quase experimental, longitudinal e comparativo, com pré e pos-testes. Dois grupos de jogadores de futebol (n=34), divididos em grupo de controle (n=18) e grupo experimental (n=16) foram avaliados duas vezes em dois momentos diferentes por meio do Stroop Task Football Test. Levando em consideração o valor de p, o tamanho do efeito e o poder estatístico, há diferenças antes e depois do RAST nas variáveis índice total (IT) e tempo de execução (TE), mas não na tomada de decisão (TD). Por outro lado, o grupo de controle manteve-se estável em ambos os momentos. Em conclusão, atrasar o TD, mesmo que a escolha seja correta, não é suficiente neste esporte em qualquer circunstância ou condição.

Palabras-chave: fadiga, fútbol, desempeño, sistema nervoso central, tiempo de ejecución, tomada de decisión.

Referencias

1. Aquino, M., Petrizzo, J., Otto, R. M., & Wygand, J. (2022). The Impact of Fatigue on Performance and Biomechanical Variables—A Narrative Review with Prospective Methodology, *Biomechanics*, 2(4),513-524.
<https://doi.org/10.3390/biomechanics2040040>
2. Baños, R. V., Torrado-Fonseca, M., y Álvarez, M. R. (2019). Análisis de regresión lineal múltiple con SPSS: un ejemplo práctico. *REIRE Revista d'Innovació i Recerca en Educació*, 12(2), 1-10. <https://doi.org/10.1344/reire2019.12.222704>
3. Bian, C., Ali, A., Nassis, G. P., & Li, Y. (2022). Repeated Interval Loughborough Soccer Passing Tests: An Ecologically Valid Motor Task to Induce Mental Fatigue in Soccer. *Frontiers in Physiology*, 12, 1-11.
<https://doi.org/10.3389/fphys.2021.803528>
4. Bonnet, C. (1994). Psicofísica de los tiempos de reacción: teorías y métodos. *Revista latinoamericana de psicología*, 26(3), 431-444.
<https://www.redalyc.org/pdf/805/80526304.pdf>
5. Calle-Jaramillo, G. A., González-Palacio, E. V., Pérez - Méndez, L. A., Rojas-Jaramillo, A., y González-Jurado, J. A. (2023). Design and Validation of a Test to Evaluate the Execution Time and Decision-Making in Technical–Tactical Football Actions (Passing and Driving). *Behavioral Sciences*, 13(2), 101.
<https://doi.org/10.3390/bs13020101>
6. Clemente Suárez, V. J., Muñoz, V. E., y Martínez, A. (2011). Fatiga del sistema nervioso después de realizar un test de capacidad de sprints repetidos (RSA) en jugadores de fútbol de categoría juvenil. *Apunts Medicina de l'Esport*, 46(172), 177-182. <https://doi.org/10.1016/j.apunts.2011.04.003>
7. Frýbort, P., Kokštejn, J., Musálek, M., & Süß, V. (2016). Does Physical Loading Affect the Speed and Accuracy of Tactical Decision-Making in Elite Junior Soccer

- Players? *Journal of Sports Science & Medicine*, 15(2), 320-326.
<https://pmc.ncbi.nlm.nih.gov/articles/PMC4879447/>
8. Gantois, P., Caputo Ferreira, M. E., Lima-Junior, D. D., Nakamura, F. Y., Batista, G. R., Fonseca, F. S., & Fortes, L. d. S. (2020). Effects of Mental Fatigue on Passing Decision-Making Performance in Professional Soccer Athletes. *European Journal of Sport Science*, 20(4), 534-543.
<https://doi.org/10.1080/17461391.2019.1656781>
 9. Ghozlan, A., & Widlöcher, D. (1993). Ascending-Descending Threshold Difference and Internal Subjective Judgment in CFF Measurements of Depressed Patients before and after Clinical Improvement. *Perceptual and Motor Skills*, 77(2), 435-439. <https://doi.org/10.2466/pms.1993.77.2.435>
 10. Gila, L., Villanueva, A., y Cabeza, R. (2009). Fisiopatología y técnicas de registro de los movimientos oculares. *Anales del Sistema Sanitario de Navarra*, 32(3), 9-26. <https://recyt.fecyt.es/index.php/ASSN/article/view/8334>
 11. Herman, D. C., Zaremski, J. L., Vincent, H. K., & Vincent, K. R. (2015). Effect of Neurocognition and Concussion on Musculoskeletal Injury Risk. *Current Sports Medicine Reports*, 14(supl. 3), 194-199.
<https://doi.org/10.1249/JSR.0000000000000157>
 12. Huijgen, B. C., Leemhuis, S., Kok, N. M., Verburgh, L., Oosterlaan, J., Elferink-Gemser, M. T., & Visscher, C. (2015). Cognitive Functions in Elite and Sub-Elite Youth Soccer Players Aged 13 to 17 Years. *PloS One*, 10(12).
<https://doi.org/10.1371/journal.pone.0144580>
 13. Keir, D. A., Thériault, F., & Serresse, O. (2013). Evaluation of the Running-Based Anaerobic Sprint Test as a Measure of Repeated Sprint Ability in Collegiate-Level Soccer Players. *The Journal of Strength & Conditioning Research*, 27(6), 1671-1678. <https://doi.org/10.1519/jsc.ob013e31827367ba>
 14. Lorient, M. M., Boksem, M. A., & Ridderinkhof, K. R. (2005). Impaired Cognitive Control and Reduced Cingulate Activity during Mental Fatigue. *Cognitive Brain Research*, 24(2), 199-205. <https://doi.org/10.1016/j.cogbrainres.2005.01.018>

15. Manterola, C., y Otzen, T. (2015). Estudios experimentales 2 parte: estudios cuasiexperimentales. *International Journal of Morphology*, 33(1), 382-387. <http://dx.doi.org/10.4067/S0717-95022015000100060>
16. Marcora, S. M., Staiano, W., & Manning, V. (2009). Mental Fatigue Impairs Physical Performance in Humans. *Journal of Applied Physiology*, 106(3), 857-864. <https://doi.org/10.1152/jappphysiol.91324.2008>
17. Nara, K., Kumar, P., Rathee, R., & Kumar, J. (2022). The Compatibility of Running-Based Anaerobic Sprint Test and Wingate Anaerobic Test: A Systematic Review and Meta-Analysis. *Pedagogy of Physical Culture and Sports*, 26(2), 134-143. <https://doi.org/10.15561/26649837.2022.0208>
18. Nédélec M., Mccall A., Carling C., Legall F., Berthoin S., & Dupont G. (2012). Recovery in Soccer Part I-Post-Match Fatigue and Time Course of Recovery. *Sports Medicine*, 42, 997-1015. <https://doi.org/10.1007/BF03262308>
19. Rampinini, E., Bishop, D., Marcora, S. M., Bravo, D. F., Sassi, R., & Impellizzeri, F. M. (2006). Validity of Simple Field Tests as Indicators of match-Related Physical Performance in Top-Level Professional Soccer Players. *International Journal of Sports Medicine*, 28(8), 228-235. <https://doi.org/10.1055/s-2006-924340>
20. Romeas, T., Guldner, A., & Faubert, J. (2016). 3D-Multiple Object Tracking Training Task Improves Passing Decision-Making Accuracy in Soccer Players. *Psychology of Sport and Exercise*, 22, 1-9. <https://doi.org/10.1016/j.psychsport.2015.06.002>
21. Simonson, E., & Brozek, J. (1952). Flicker Fusion Frequency: Background and Applications. *Physiological Reviews*, 32(3), 349-378. <https://doi.org/10.1152/physrev.1952.32.3.349>
22. Smith, M. R., Zeuwts, L., Lenoir, M., Hens, N., De Jong, L. M., & Coutts, A. J. (2016). Mental Fatigue Impairs Soccer-Specific Decision-Making Skill. *Journal of Sports Sciences*, 34(14), 1297-1304. <https://doi.org/10.1080/02640414.2016.1156241>

23. Spencer, M., Bishop, D., Dawson, B., & Goodman, C. (2005). Physiological and Metabolic Responses of Repeated-Sprint Activities. *Sports Medicine*, 35, 1025-1044. <https://doi.org/10.2165/00007256-200535120-00003>
24. Wilke, J., & Vogel, O. (2020). Computerized Cognitive Training with Minimal Motor Component Improves Lower Limb Choice-Reaction Time. *Journal of Sports Science & Medicine*, 19(3), 529-534. <https://www.jssm.org/jssm-19-529.xml%3Eabst#>
25. Williams, A. M. (2000). Perceptual Skill in Soccer: Implications for Talent Identification and Development. *Journal of Sports Sciences*, 18(9), 737-750. <https://doi.org/10.1080/02640410050120113>
26. Zagatto, A. M., Beck, W. R., & Gobatto, C. A. (2009). Validity of the Running Anaerobic Sprint Test for Assessing Anaerobic Power and Predicting Short-Distance Performances. *The Journal of Strength & Conditioning Research*, 23(6), 1820-1827. <http://dx.doi.org/10.1519/JSC.ob013e3181b3df32>
27. Zentgraf, K., Heppel, H., & Fleddermann, MT. (2017) Training in Interactive Sports. A Systematic Review of Practice and Transfer Effects of Perceptual-Cognitive Training. *German Journal of Exercise and Sport Research*, 47(1), 2-14. <http://dx.doi.org/10.1007/s12662-017-0441-8>