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# Title: Impact of Mental Fatigue on Cognitive Performance Among Adolescent Tennis Players.

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## Résumé

**Background:** Mental skills are crucial for achieving optimal performance in sports requiring precise and rapid processing of spatiotemporal information (Russell et al., 2019; Van Cutsem et al., 2017). Athletes must constantly assess and respond to dynamic factors such as speed, position, and movement trajectories within tight time constraints (Williams & Jackson, 2019; Alder et al., 2021).

**Objective:** We aimed to investigate the effects of different levels of mental fatigue on cognitive performance in competitive adolescent tennis players.

**Method:** Twenty-four young athletes (14-16 years) completed different cognitive and perceptual tasks before and after each Stroop task condition (15 and 30 min). Participants watched 21 videos demonstrating seven different tennis techniques (short cross slice, forehand on the line, forehand cross, volley winner, serve, drop shot, and backhand on the line). Each video was presented in a randomized order across three temporal occlusion intervals: i) -480 ms before a tennis ball contact with the racket, ii) 0ms at contact with the ball and the racket, and iii) + 320 ms after a ball contact with the racket. For each clip (- 480, 0, and + 320 s) and condition(15 and 30 min), participants were given 10 seconds to respond, typically by predicting the direction or the outcome of the shot (e.g., forehand to the left or right side of the court). A change blindness task comprising 12 animations, where each sequence of changes involved a progression that included two images: the original version (A) and a modified version (B). Finally, participants performed a mental rotation task on the computer. Mental fatigue was assessed using a subjective visual analog scale (VAS-F) before and after each Stroop task condition. A two-way ANOVA for repeated measures was used to the effect of condition (15 vs 30 min), time (-480,0 and +320 ms) and interaction (condition x time) factors.

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\*Intervenant

**Results:** A two-way ANOVA for repeated measures revealed significant effects of Condition ( $p < 0.001$ ,  $\eta p^2 = 0.40$ ), Time ( $p = 0.001$ ,  $\eta p^2 = 0.90$ ), and a significant Condition x Time interaction ( $p < 0.001$ ,  $\eta p^2 = 0.50$ ) on fatigue levels. Similarly, for energy levels, significant main effects were observed for Condition ( $p < 0.001$ ,  $\eta p^2 = 0.7$ ), Time ( $p = 0.001$ ,  $\eta p^2 = \eta p^2 = 0.3$ ), and the Condition x Time interaction ( $p = 0.007$ ,  $\eta p^2 = 0.5$ ). Additionally, a significant effect of condition was observed on accuracy in the mental rotation task ( $p = 0.001$ ,  $\eta p^2 = 0.7$ ). In addition, in the Stroop task, a significant condition effect was observed ( $p < 0.001$ ,  $\eta p^2 = 0.9$ ). The Bonferroni post hoc analysis revealed significantly higher fatigue levels ( $p < 0.001$ ) and lower energy levels ( $p = 0.02$ ) in the 15-minute condition compared to the 30-minute condition. Although a significant effect of condition was observed for response times in both the anticipation task ( $p < 0.001$ ,  $\eta p^2 = 0.90$ ) and the change blindness task ( $p < 0.001$ ,  $\eta p^2 = 0.80$ ). Regarding accuracy in the anticipation task, a significant effect of condition was found ( $p < 0.001$ ,  $\eta p^2 = 0.10$ ), along with a significant condition x accuracy interaction ( $p = 0.02$ ,  $\eta p^2 = 0.10$ ). The Bonferroni post hoc showed higher values in 15 min and 30 min conditions when comparing post-intervention to pre-intervention values ( $p < 0.001$  for both).

**Conclusion:** The performance decline observed in young male tennis players following exposure to mental fatigue may, in part, be attributed to the involvement of the inhibitory control system. This system plays a central role in modulating the allocation of cognitive and physical resources by limiting effort when the perceived cost exceeds the anticipated benefit.

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