Effects of Open- Versus Closed-Skill Sports on Cognitive Functions During Early Adolescence

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Résumé

Background: Motor skills are classified as open- and closed-skills, with open-skills requiring adaptive responses to dynamic environments and closed-skills performed in stable, predictable settings. This study examined the effects of long-term participation in open- versus closed-skill sports on cognitive functions during early adolescence.
Methods: Fifty-seven adolescents (age = 12.9 ± 1.01 years; 28 females) were categorized based on regular sports participation into three groups: taekwondo (open-skill), swimming (closed-skill), and sedentary controls. The mean duration of sports participation was 4.0 ± 1.56 years for taekwondo athletes and 6.2 ± 1.8 years for swimmers. Cognitive performance was assessed using Corsi's Block-Tapping Test (visuospatial working memory), Stroop Test (inhibitory control), and D2 Attention Test (selective attention). Group differences were examined using rank-based ANCOVA, adjusting for education, sex, and years of sports experience.

Results: Taekwondo athletes outperformed both swimmers ($\beta = 1.00$, $p < .001$) and sedentary participants ($\beta = 1.00$, $p < .001$) on the Corsi span task, whereas no significant differences were observed between swimmers and sedentary adolescents. No significant group differences were found on Stroop Test or D2 Attention Test.

Discussion: Our findings suggest that participation in an open-skill sport may be associated with enhanced cognitive performance in adolescents, particularly in visuospatial working memory. The observed superiority in visuospatial working memory among taekwondo athletes may be attributable to the more complex motor repertoire required by open-skill activities and the potential transfer of these skills to cognitive domains. Considering higher cognitive function is a critical prerequisite for academic achievement, engaging in cognitively demanding physical activities may promote greater cognitive benefits compared to participation in repetitive, low-cognitive-load sports such as swimming. No significant group differences were observed for inhibitory control or attention tasks, indicating that the cognitive advantages associated with open-skill sports may be domain-specific.

Conclusion: The findings suggest that participation in cognitively demanding and interacting activities, such as open-skill sports, may positively influence cognitive development

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during critical periods of adolescence. However, given the relatively small sample size and the cross-sectional design of the study, future research employing larger cohorts and longitudinal designs across a broader range of open- and closed-skill sports is needed to confirm and extend these findings.