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Multi-domain assessments of cognitive functions in elite athletes according to their sport type and sex: preliminary results

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Cognition is crucial for high performance sports. Consistent evidence has demonstrated that cognitive abilities, in particular executive functions (EF), are superior in experts. These studies have been recently challenged for the magnitude of their effect, contradictory evidence towards a superior development of EF in experts, and their rapid endorsement of cognitive evaluation for talent identification. Similarly, considering that different sports require variable cognitive demands, cognitive performance between sports has been explored with inconsistent findings, which can be mostly attributed to poor classification. Lastly, there is a general lack of female representation and assessments of multi-domains of cognitive functions in the literature. Therefore, the objectives of this study were to compare multiple domains of cognitive functions: 1) between a homogenous sample of expert athletes and representative norms; and 2) between sport types and sex.

Two hundred and thirty athletes (F=124, M=106; mean age 21.35 ± 3.8 years) classified as elite level (Tier 4) from a national sport institute were divided across three sport categories (team [n=91], precision-skill dependent [n=63], speed-strength [n=76]) according to a clear classification framework. Athletes were tested on a validated computerized neuropsychological test battery (Vienna Test System, Schuhfried) during pre-season by a sport neuropsychologist in standardized conditions. Six multi-domain assessments were performed including tests of EF (cognitive flexibility, planning, inhibition, working memory), selective and sustained attention. Reaction time and accuracy were used to measure test performance. T-scores were employed to compare athletes to a representative normative sample of the general population. Two-way ANOVAs were performed on each test (factors: Sex, Sport category) and Bonferroni corrections were used for multiple comparisons. The significant level was set at $p < 0.05$.

Experts performed in the average range compared to a normative sample on all six domains of cognitive functions. There was no significant interaction between factors but a significant main effect of Sport category on cognitive flexibility accuracy ($F[2, 204]=4.621, p=0.011, \eta^2=0.045$) and selective attention reaction time ($F[2, 228]=3.265, p=0.040, \eta^2=0.029$) where speed-strength sports performed better than team sports ($p=0.010$ and $p=0.035$ respectively). There was a main effect of Sex on reaction time of selective ($F[1, 228]=30.078, p<0.001, \eta^2=0.119$) and sustained attention ($F[1, 224]=12.916, p<0.001, \eta^2=0.056$) where males performed faster compared to females.

The advantage of experts on general multi-domain cognitive tests was not evident from these preliminary results in this sample of 230 elite athletes. However, sport-specific demands may place greater demands on specific cognitive functions such as EF and selective attention, especially in sports where high speed and decision making are intertwined.

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