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Comparison of Working Memory in Athletes and Non-athletes: A Systematic Review and Meta-analysis

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ADMINISTRATIVE INFORMATION

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Review Stage at time of this submission - Formal screening of search results against eligibility criteria.

Conflicts of interest - None declared.

INPLASY registration number: INPLASY202420066

Amendments - This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 16 February 2024 and was last updated on 16 February 2024.

INTRODUCTION

Review question / Objective The study investigates whether sports expertise positively affects working memory by comparing the working memory of athletes and non-athletes.

Condition being studied Athletes have an advantage in sport-specific working memory, but this does not mean that athletes also excel in general, non-sport-specific working memory. Some studies have shown a positive correlation between general working memory and sports expertise while other studies reported no effect of sports expertise on general working memory. A previous meta-analysis found that athletes performed better on general tests of processing speed and attention, but this study did not address working memory. Another meta-analysis also found a general cognitive advantage effect in athletes, but it did not discuss different types of executive function separately, and did not take into account some potentially important moderators such as type of sports and level of expertise in sports. Considering the amount of research that has accumulated on whether a transfer effect from sport-specific advantage to non-sport-specific exists, conducting a meta-analysis is a meaningful research topic.

METHODS

Search strategy (("Athletes"[Mesh]) OR ((((((((((((((Athletes[Title/Abstract]) OR (Athlete[Title/Abstract])) OR (Professional Athletes[Title/Abstract])) OR (Athlete, Professional[Title/Abstract])) OR (Athletes, Professional[Title/Abstract])) OR (Professional Athlete[Title/Abstract])) OR (Elite Athletes[Title/Abstract])) OR (Athlete, Elite[Title/Abstract])) OR (Athletes, Elite[Title/Abstract])) OR (Elite Athlete[Title/Abstract])) OR (College Athletes[Title/Abstract])) OR (Athlete, College[Title/Abstract])) OR (Athletes, College[Title/

Abstract])) OR (College Athlete[Title/Abstract])) OR (Players[Title/Abstract])) OR (Player[Title/Abstract]))) AND (("Memory, Short-Term"[Mesh]) OR ((((((((((((((((((Memory, Short-Term[Title/Abstract]) OR (Memories, Short-Term[Title/Abstract])) OR (Memory, Short Term[Title/Abstract])) OR (Short-Term Memories[Title/Abstract])) OR (Short-Term Memory[Title/Abstract])) OR (Memory, Shortterm[Title/Abstract])) OR (Memories, Shortterm[Title/Abstract])) OR (Shortterm Memories[Title/Abstract])) OR (Shortterm Memory[Title/Abstract])) OR (Working Memory[Title/Abstract])) OR (Working Memories[Title/Abstract])) OR (Memory, Immediate[Title/Abstract])) OR (Immediate Memories[Title/Abstract])) OR (Immediate Memory[Title/Abstract])) OR (Memories, Immediate[Title/Abstract])) OR (Immediate Recall[Title/Abstract])) OR (Immediate Recalls[Title/Abstract])) OR (Recall, Immediate[Title/Abstract])) OR (Recalls, Immediate[Title/Abstract]))) (("Athletes"[Mesh]) OR ((((((((((((((Athletes[Title/Abstract]) OR (Athlete[Title/Abstract])) OR (Professional Athletes[Title/Abstract])) OR (Athlete, Professional[Title/Abstract])) OR (Athletes, Professional[Title/Abstract])) OR (Professional Athlete[Title/Abstract])) OR (Elite Athletes[Title/Abstract])) OR (Athlete, Elite[Title/Abstract])) OR (Athletes, Elite[Title/Abstract])) OR (Elite Athlete[Title/Abstract])) OR (College Athletes[Title/Abstract])) OR (Athlete, College[Title/Abstract])) OR (Athletes, College[Title/Abstract])) OR (College Athlete[Title/Abstract]))) AND (("Memory, Short-Term"[Mesh]) OR ((((((((((((((((((Memory, Short-Term[Title/Abstract]) OR (Memories, Short-Term[Title/Abstract])) OR (Memory, Short Term[Title/Abstract])) OR (Short-Term Memories[Title/Abstract])) OR (Short-Term Memory[Title/Abstract])) OR (Memory, Shortterm[Title/Abstract])) OR (Memories, Shortterm[Title/Abstract])) OR (Shortterm Memories[Title/Abstract])) OR (Shortterm Memory[Title/Abstract])) OR (Working Memory[Title/Abstract])) OR (Working Memories[Title/Abstract])) OR (Memory, Immediate[Title/Abstract])) OR (Immediate Memories[Title/Abstract])) OR (Immediate Memory[Title/Abstract])) OR (Memories, Immediate[Title/Abstract])) OR (Immediate Recall[Title/Abstract])) OR (Immediate Recalls[Title/Abstract])) OR (Recall, Immediate[Title/Abstract])) OR (Recalls, Immediate[Title/Abstract]))).

Participant or population Studies with healthy athlete and non-athlete participants. Inclusion of studies with athletes who participate in competitive sports and meet Tier 2 criteria or above, i.e., identify with a specific sport and train for the purpose of competition. Non-athletes are those who meet Tier 0 or Tier 1 criteria, i.e. those who do not meet the World Health Organization physical activity standards (Tier 0) or who meet the physical activity standards for recreational purposes and do not focus on competition (Tier 1).

Intervention No intervention studies are included.

Comparator Athletes vs. non-athletes.

Study designs to be included Cross-sectional studies of working memory with group comparisons (athletes vs. non-athletes).

Eligibility criteria 1. Original (empirical) study; 2. Cross-sectional study; 3. Assessment of working memory with a behavioral measure (e.g., accuracy, capacity); 4. Healthy participants; 5. Both athlete and non-athlete populations investigated. Inclusion of studies with athletes who participate in competitive sports and meet Tier 2 criteria or above, i.e., identify with a specific sport and train for the purpose of competition. Non-athletes are those who meet Tier 0 or Tier 1 criteria, i.e. those who do not meet the World Health Organization physical activity standards (Tier 0) or who meet the physical activity standards for recreational purposes and do not focus on competition (Tier 1); 6. Studies published within 20 years (2004-2024); 7. Language of the report being English.

Information sources PubMed, Web of Science, MEDLINE, APA PsycInfo/PsycArticles, Scopus, Proquest, Embase.

Main outcome(s) The main outcomes are accuracy, scores, and reaction time in a behavioral working memory test.

Data management EndNote and Excel.

Quality assessment / Risk of bias analysis The quality of included studies is rated by the NIH study quality assessment tool (https://www.nhlbi.nih.gov/health-topics/study-quality-assessment-tools). Risk of Bias Assessment Tool for Nonrandomized Studies.

Strategy of data synthesis The data synthesis and statistical analysis will be performed using RevMan and STATA. The random-effects model will be used for all analyses. Continuous variables will be analyzed using random-effects model and will be expressed as standard mean differences (SMD). A 2-tailed P value of 50% being considered substantial. Publication bias will be assessed by

visual estimate of funnel plot and by the Egger's test and Begg's test.

Subgroup analysis Subgroup analysis will be performed by type of sports (team sports vs. individual sports, open-skilled vs. close-skilled, high-collision vs. low-collision), level of expertise in sports (Tier 4 vs. Tier 3 vs. Tier 2), age (older adulthood vs. adulthood vs. adolescence vs. late childhood), and metabolic characteristics of sports (aerobic vs. anaerobic exercise).

Sensitivity analysis The sensitivity analysis tests whether deleting any one of the articles (one by one) significantly affects the results.

Language restriction English.

Country(ies) involved Chenxiao Wu, China, University of Jyväskylä, Finland; Chenyuan Zhang, China, Dalian University of Technology, China; Chaoxiong Ye, China, University of Jyväskylä, Finland; Piia Astikainen, Finland, University of Jyväskylä, Finland.

Keywords Athletes, Working Memory, Sports Expertise.

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