

Effect of Caffeine on Sport-Specific Endurance Performance: A Systematic Review

ABSTRACT

Endurance athletes often ingest caffeine because of its reported ergogenic properties. Although there are a vast number of studies quantifying caffeine's effects, many research studies measure endurance performance using a time-to-exhaustion test (subjects exercise at a fixed intensity to volitional exhaustion). Time-to-exhaustion as a performance measure is not ideal because of the high degree of measurement variability between and within subjects. Also, we are unaware of any endurance sports in which individuals win by going a longer distance or for a longer amount of time than their competitors. Measuring performance with a time-trial test (set distance or time with best effort) has high reproducibility and is more applicable to sport. Therefore, the purpose of this review was to critically and objectively evaluate studies that have examined the effect of caffeine on time-trial endurance (>5 minutes) performance. A literature search revealed 21 studies with a total of 33 identifiable caffeine treatments that measured endurance performance with a time-trial component. Each study was objectively analyzed with the Physiotherapy Evidence Database (PEDro) scale. The mean PEDro rating was 9.3 out of 10, indicating a high quality of research in this topic area. The mean improvement in performance with caffeine ingestion was $3.2 \pm 4.3\%$; however, this improvement was highly variable between studies (-0.3 to 17.3%). The high degree of variability may be dependent on a number of factors including ingestion timing, ingestion mode/vehicle, and subject habituation. Further research should seek to identify individual factors that mediate the large range of improvements observed with caffeine ingestion. In conclusion, caffeine ingestion can be an effective ergogenic aid for endurance athletes when taken before and/or during exercise in moderate quantities (3-6 mg·kg⁻¹ body mass). Abstaining from caffeine at least 7 days before use will give the greatest chance of optimizing the ergogenic effect.