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Even at very low dose, caffeine improves vertical jump performance in a dose-independent manner

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INTRODUCTION:
As we have recently reported (1), moderate doses (i.e., 3–6 mg/kg) of caffeine enhance various athletic performances (1,2), including jumping (3) which is one of the critical components for many sports. Yet, low dosage (i.e., ≤3 mg/kg) caffeine's ergogenicities have also been discussed (4). Lower dose caffeine may become a safe and effective ergogenic strategy, but it is unclear whether the ergogenic effect of caffeine on jump performance is dose-response. Therefore, we examined the effect of very low (i.e., 1 mg/kg) to moderate doses of caffeine, including the upper and lower limits of commonly utilized ergogenic doses (i.e., 3 and 6 mg/kg [5]), on vertical jump performance.
METHODS:
Thirty-two well-trained collegiate sprinters and jumpers performed three countermovement jumps (CMJs) and squat jumps (SJs) on a force platform in a double-blind, counterbalanced, randomized, crossover design. Participants ingested a placebo or 1, 3, or 6 mg/kg caffeine 60 min before jumps. Jump heights were calculated by the velocity at jump takeoff using impulse and body mass, given from ground reaction force. Comparisons of jump performance among conditions were performed with one-way repeated-measures ANOVA and a paired Student's t-test with a Bonferroni correction. Relationships between jump height changes in each caffeine dose and interindividual factors were analyzed by the Spearman correlation test.
RESULTS:
Compared with the placebo, 6 mg/kg caffeine significantly enhanced CMJ ($P < 0.001$) and SJ ($P = 0.012$) heights; moreover, 1 and 3 mg/kg caffeine significantly increased CMJ height (both $P < 0.01$) but not SJ height (both $P > 0.05$). There were no significant differences among all caffeine doses in both jumps (all $P > 0.05$). Furthermore, ergogenic effects of any caffeine dose on jump heights did not relate to plasma caffeine concentration immediately after jumps and habitual caffeine intake significantly (all $P > 0.05$). However, the ergogenic effects of 1 and 3 mg·kg-1 caffeine were negatively associated with jump height at the placebo condition (i.e., baseline performance level) in both CMJ (1 mg/kg: $\rho = -0.46$, 3 mg/kg: $\rho = -0.44$, both $P < 0.05$) and SJ (1 mg/kg: $\rho = -0.55$, 3 mg/kg: $\rho = -0.53$, both $P < 0.01$), whereas 6 mg/kg caffeine was not (both $P > 0.05$).
CONCLUSION:
Even at a dose as low as 1 mg/kg, caffeine improved vertical jump performance in a dose-independent manner. Additionally, these enhancements were independent of plasma caffeine concentration and habitual caffeine intake. However, the ergogenic effects of lower dose caffeine were dependent on athletes' baseline performance. This study is the first to show the ergogenicity of 1 mg/kg caffeine on jump performance and provides new insight into the safe and effective ergogenic strategy in sports science.
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