

The Effect of Caffeine Supplementation on Endurance Performance in Multi Sprint Sports

Kenney, S.A. Konstantaki, M.

Introduction

- Over the last 25 years, caffeine has been one of the most widely studied ergogenic aids by sports scientists. During this time there has been indisputable support for the beneficial effects of oral caffeine ingestion on prolonged submaximal endurance exercise (Graham and Spriet, 1991; Bell and McLellan, 2002)
- Recently there is growing evidence that caffeine can improve performance in short term high intensity exercise, lasting from several seconds up to ~ 7 minutes (Spriet, 1995; Graham, 2001)
- To date, there are no published findings into the effects of caffeine on performance of an intermittent nature with altering intensities as experienced during multi sprint sports.
- Historically fitness testing in multiple sprint sports has involved the completion of a multistage fitness tests to estimate maximum oxygen uptake VO_{2max} as a measure of aerobic fitness (Gore 2000). Individuals with high VO_{2max} values can be said to possess endurance fitness or cardiorespiratory fitness, however in multiple sprint sports VO_{2max} is not the sole component of fitness.
- Recently the JAM test has been developed (Martin and Jones, 2001) to identify the physiological variables important in executing intermittent exercise. It combines them in a manner, which simulates the activity pattern of multiple sprint sports players.
- The JAM test was used to investigate the effects of caffeine supplementation on multiple sprint performance.

Purpose

- To determine whether caffeine supplementation (3 mg/kg body mass) can significantly improve time to exhaustion in the JAM test compared to a placebo treatment.

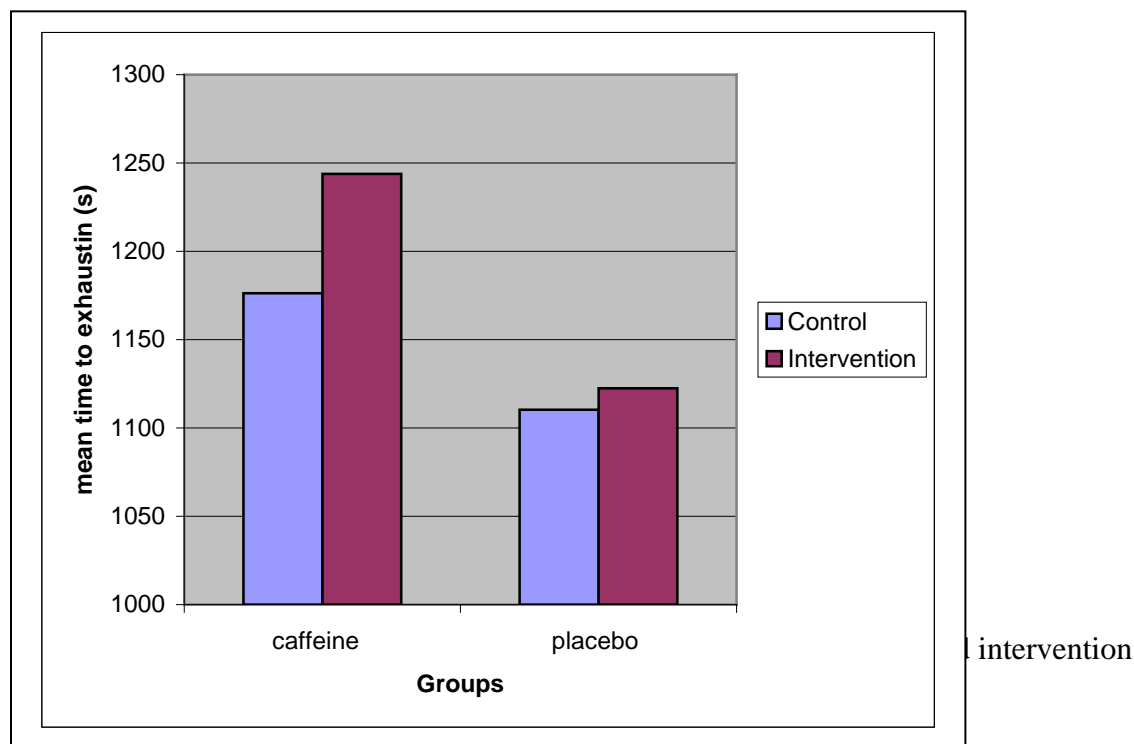
Method

- Twelve trained male university rugby players of first team standard (mean \pm SD; age: 21.5 \pm 1.3 years, body mass: 85.4 \pm 6.9 kg, stature:) provided informed consent and participated in the study.
- Subjects were equally divided into either a caffeine (C) or placebo (P) group and performed the JAM test on two separate occasions (control and intervention). The C group performed the test after taking caffeine tablets (intervention; Pro Plus) of approximately 3 mg/kg body mass and without taking caffeine (control), whereas the P group performed the test after taking a placebo tablet (intervention; mints) and without the placebo (control). The order of the tests was randomised.
- The test involved the subjects advancing around a triangular circuit performing walk, jog and run shuttles of different distances (see fig 1) the speed of which was

controlled by audio signals and increased every two minutes (the walk shuttle remained at a constant speed throughout). A maximal sprint bout was incorporated approximately every two minutes. This was used to reverse the direction of the test. The test was designed to elicit maximal responses within 22 minutes, but subjects could withdraw at voluntary exhaustion. Time to exhaustion was measured for each subject.

Figure 1. Schematic representation of the modified JAM test.

Results



Discussion

- It appears that administration of caffeine supplements (3 mg/kg bm) is sufficient to significantly increase time to exhaustion in the JAM test ($P < 0.05$).
- Differences in the placebo group between the control and intervention conditions showed a slight increase in time to exhaustion however this did not reach significance ($P > 0.05$).
- Increases in time to exhaustion for the caffeine group could be explained by the reported effects of caffeine on glycogen sparing, ion handling and effects on the central nervous system (Bahrke and Yesalis, 2004).
- Although the results show that caffeine has an effect on intermittent performance experienced in multiple sprint sports the test only lasts a maximum of 22 minutes. It might be the case that the magnitude of increase in time to exhaustion would be

- greater than 5% in a game situation, as matches in multiple sprint sports last 80 minutes (Rugby) – 90 minutes (Football).
- The JAM test seems to address most of the requirements of multiple sprint sport, but still does not take into account the contact element (mainly for rugby, such as tackling, rucking, mauling, scrummaging), which requires muscular endurance and may contribute to early fatigue during matchplay.

Conclusion

- Caffeine has a significant effect on time to exhaustion in the JAM test suggesting that caffeine supplementation would have a positive effect on endurance performance in multiple sprint sports. In particular, an amount of approximately 3 mg/kg body mass of caffeine in tablet form significantly increases time to exhaustion ($P < 0.05$).
- Further evidence needs to be collected with tests not only simulating the activity pattern of multi sprint sports but also duration of the games. This could be done with the harder to administer Loughborough intermittent shuttle test (Nicholans *et al.* 1999).
- This evidence needs to be collected before caffeine can be recommended to players, coaches and nutritionists for optimising performance in multiple sprint sports.

References

Bahrke, M.S. and Yesalis, C.E. eds. (2002) *Performance Enhancing Substances in Sport and Exercise*. Champaign: Human Kinetics.

Bell, D.G. and McLellan, T.M. (2002) Exercise endurance 1, 3 and 6 hours after ingestion of caffeine users and non-users. *Journal of Applied Physiology*, **93**, 1227 – 1234.

Gore, C.J. (2000) *Physiological Tests for Elite Athletes*. Champaign: Human Kinetics.

Graham, T.E. (2001) Caffeine and exercise: metabolism, endurance and performance. *Sports Medicine*, **31**, 785 – 807.

Graham, T.E. and Spriet, L.L. (1991) Performance and metabolic responses to a high caffeine dose during prolonged exercise. *Journal of applied physiology*, **71**, 2292 – 2298.

Martin, J.A. and Jones, A.M. (2001) *Intermittent Sports Performance Assessment*. Rugby Football Union.

Nicholas, C.W. *et al.* (1999) The Loughborough intermittent shuttle test. *Journal of Sports Sciences*, **18**, 97 - 104

Spriet, L.L. (1995) Caffeine and Performance. *International Journal of Sports Nutrition*, **5**, 84 – 89.