Effect of Carbohydrate and Caffeine Ingestion on Badminton Performance Following Fatiguing Exercise

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Introduction

To successfully compete in sports such as badminton, players must accelerate, decelerate, change direction, move quickly, maintain balance, and repeatedly generate optimum stroke production. However, the mechanism by which fatigue influences badminton performance largely relates to a decrease in shot accuracy combined with weak positional play.

The addition of carbohydrate to the fluid ingested prior to and during exercise can improve exercise performance, possibly due to the sparing of muscle glycogen and maintaining blood glucose and carbohydrate oxidation during intermittent exercise. In addition, previous studies suggest that compared with fluid alone, carbohydrate ingestion is able to maintain badminton serve accuracy following fatiguing exercise (Bottoms et al., 2012). Similarly, caffeine supplementation has been reported to increase tennis serve velocity, specifically during the final stages of the simulated match (Hornery et al., 2007). Furthermore, the combined effect of a caffeine and carbohydrate solution has been show to improve sprinting performance, jumping, and the subjective experiences of players during intermittent exercise (Gant et al., 2010).

Therefore, the aim of the present study was to investigate the effect of ingesting carbohydrate and caffeine on measures that are central to success in badminton.

Method

Following institutional ethical approval, 12 male badminton players (mean±SD age: 28±9 y, height: 178±5 cm, mass: 78±9 kg) participated in this study. One hour before exercise participants consumed 7 ml·kg body mass^{-1} of either water (PLA), 6.4% carbohydrate solution (CHO), a solution containing a caffeine dose of 4 mg·kg^{-1} (CAF) or 6.4% carbohydrate and 4 mg·kg^{-1} caffeine (C+C). All solutions were flavoured with orange-flavoured concentrate and artificial sweetener. During the 33 min fatigue protocol, participants were provided with an additional 3 ml·kg body mass^{-1} of solution, which was ingested before the end of the protocol.

Before ingesting the solutions a heart rate monitor was attached and a capillary blood sample was drawn from the index finger for the determination of blood glucose and lactate and was followed by a sport-specific warm-up. A badminton serve accuracy test, consisting of 10 short serves and 10 long serves towards a target (50 x 50 cm), with the number of successful hits recorded was then performed. The targets were positioned in the far left corner behind the net and in the back tramline next to the ‘‘T’’ for determining long and short serve accuracy respectively. In order to assess the coincidence anticipation timing (CAT) an anticipation timer was used. Finally, a choice reaction time test was performed which involved reacting to a flashing beacon, and then sprinting 5 m. As soon as the 33 min fatigue protocol was completed, all measures were recorded again.

Results

Short serve accuracy was improved following the ingestion of carbohydrate and carbohydrate and caffeine compared with placebo (P<0.005; Table 1). Long serve accuracy was improved following the ingestion of carbohydrate and caffeine compared with placebo (P<0.005; Table 1). Measures of CAT demonstrated smaller deteriorations following the ingestion of carbohydrate and caffeine compared with placebo (P<0.05). Choice reaction time, measured by total sprint time, followed a similar pattern, although carbohydrate and caffeine ingestion also demonstrated significant improvements (P<0.005; Figure 1). No differences between the experimental trails were observed (P>0.005).

Table 1: Number of successful short and long serves pre- and post-exercise.

Serve Distance	Pre				Post			
	PLA	CHO	CAF	C+C	PLA	CHO	CAF	C+C
Short	5±2	5±1	5±1	5±1	2±1	5±1	3±1	6±1
Long	4±2	4±1	4±1	4±1	2±1	3±1	3±1	6±2

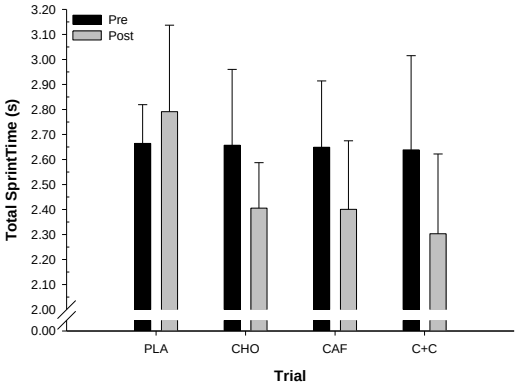

Figure 1: Total sprint time (s) pre- and post-exercise.

Discussion

The key findings of the present study demonstrate that the ingestion of a caffeinated carbohydrate solution improves short and long serve accuracy, as well as CTA compared with placebo, suggesting improved shot performance. Furthermore, ingesting a caffeinated carbohydrate solution can preserve reaction time and 5 m sprinting speed.

Conclusion

These findings suggest that the ingestion of a caffeinated carbohydrate solution before and during a badminton match can maintain serve accuracy and sprinting actions around the court.

References

Bottoms, L., Sinclair, J., Taylor, K., Polman, R. & Fewtrell, D. (2012). The effects of carbohydrate ingestion on the badminton serve after fatiguing exercise, *Journal of Sports Sciences*, *30*, 285-293.

Hornery, D. J., Farrow, D., Mujika, I. & Young, W. B. (2007). Caffeine, carbohydrate, and cooling use during prolonged simulated tennis. *International Journal of Sports Physiology and Performance, 2*, 423-438.

Gant, N., Ali, A. & Foskett, A. (2010). The influence of caffeine and carbohydrate coingestion on simulated soccer performance. *International Journal of Sport Nutrition and Exercise Metabolism, 20*, 191-197.