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Effect of post-exercise drink composition on appetite and energy intake

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A liquid protein preload has generally been shown to decrease energy intake at an *ad libitum* meal compared to water[1] or an isoenergetic carbohydrate preload[2]. However this has not been investigated in conjunction with exercise. Ingestion of protein and carbohydrate drinks post-exercise has become common practise amongst athletes and physically active individuals and their effects on appetite and energy intake is of interest, particularly to those on a weight management programme. To investigate whether protein induced satiety was evident when drinks were ingested in a post exercise context; the present study compared two isoenergetic drinks, differing in macronutrient content, and a low energy placebo drink.

Using a randomised double blind, counterbalanced design, 9 healthy males completed 30 min continuous cycling exercise at 63 (4) % VO_2 max, followed by five, 3 min intervals at 86 (4) % VO_2 max, separated by 2 min rest. 10 min post-exercise, subjects ingested 500 ml of one of three drinks each made up with low-energy lemon squash: a placebo drink (PLA) (15 kJ, 0.3 g protein, 0.6 g carbohydrate); a whey protein isolate drink (PRO) (528 kJ, 30.3 g protein, 0.6 g carbohydrate, 0.1 g fat); a sucrose drink (CHO) (528 kJ, 0.3 g protein, 30.8 g carbohydrate). This drink was ingested from an opaque bottle and through a straw. 60 min post-drink ingestion, subjects were provided with a homogenous *ad-libitum* lunch, consisting of pasta, cheese, tomato sauce and olive oil (1.88 ± 0.03 kcal·g^{-1}). Visual analogue scales of appetite ratings (hunger, fullness, desire to eat, prospective food consumption, satisfaction) were completed pre-exercise, post-exercise, post-drink, pre-meal, post-meal, 30 min post-meal and 60 min post-meal. Drinks were rated for sensory characteristics (pleasantness, after taste, saltiness, bitterness, sweetness, creaminess, refreshing, thickness, stickiness, fruitiness) immediately post-ingestion.

Energy consumed at the *ad libitum* lunch was lower after PRO ingestion (5732 (959) kJ) than PLA ingestion (6398 (497) kJ) ($P = 0.025$), but was not different after CHO ingestion (6137 (1041) kJ) compared to either PRO ($P = 0.747$) or PLA ($P = 0.889$) ingestion. When the energy content of the drink ingested was added to the energy consumed at the *ad libitum* meal there was no difference between the trials (PRO: 6270 (959) kJ, PLA: 6413 (497) kJ, CHO: 6665 (1041) kJ; $P = 0.302$). There were no main effects of trial ($P > 0.05$) interaction ($P > 0.05$) for any of the measured subjective appetite ratings. With the exception of sweetness, which was rated greater for the CHO drink compared to the PRO drink ($P = 0.038$), there were no differences in the sensory characteristics of the drinks ($P > 0.05$).

These results demonstrate that the addition of whey protein isolate to a drink ingested 10 min post-exercise reduces energy intake at a subsequent post-exercise meal. This effect was not observed with the ingestion of a sucrose drink. Protein ingestion immediately post-exercise might enhance the adaptive response to an exercise training programme (e.g. myofibrillar/mitochondrial protein synthesis) and the present findings suggest that this adaptation might be possible without effecting gross energy intake relative to ingesting nothing post-exercise.

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2. Bertenshaw EJ, Lluch A & Yeomans MR (2008) Satiating effects of protein but not carbohydrate consumed in a between-meal drink context. *Physiology and Behaviour* **27**, 427–36.