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The effect of morning and evening exercise on appetite, energy intake, performance and metabolism, in lean males and females

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Appetite and energy intake demonstrate circadian variability, with hunger typically lowest in the morning and peaking in the evening[(1)]. This corresponds with western eating behaviours, whereby energy intake tends to be lowest in the morning and greatest in the evening[(2)]. Exercise affects appetite and energy balance responses[(3)], but whether the timing of exercise can influence appetite and energy intake differently remains to be elucidated. The aim of this study was to compare the effects of morning and evening exercise on appetite, energy intake, performance, and metabolism, in healthy males and females. Sixteen (8 female) participants (age: 25 ± 3 y, BMI: 23 ± 2 kg·m^2, body fat: 20 ± 7 %) completed two trials, performing an exercise session at either 10:30 (AMEx) or 18:30 (PMEx), in randomised, counterbalanced order. Participants consumed a standardised evening meal (20:30; 814 ± 129 kcal) and breakfast (08:30; 543 ± 86 kcal) in both trials. Exercise commenced two- hours after breakfast during AMEx (10:30). During PMEx, lunch (11:30; 814 ± 129 kcal) and an afternoon snack (16:30; 543 ± 86 kcal) were consumed, followed by exercise commencing two-hours after the snack (18:30). Exercise consisted of 30 min steady-state cycling (60% $\dot{V}O_{2peak}$), and a 15- min performance test. Substrate oxidation and energy expenditure were assessed pre-exercise at rest and during steady-state cycling. *Ad-libitum* energy intake was assessed 15 min post-exercise.

Subjective appetite sensations of hunger, fullness, desire to eat (DTE) and prospective food consumption (PFC) were measured 2 h before, immediately before, and immediately after exercise, as well as immediately and 2 h after the *ad-libitum* meal. Data was checked for normality of distribution. Paired samples *t*-test or Wilcoxon Signed-Rank tests were used to analyse one-factor variables. Repeated measures ANOVAs were used to analyse two-factor variables, followed by *post- hoc* tests. Statistical significance was accepted at $P < 0.05$. Data are presented as mean ± SD. Energy intake was 152 ± 126 kcal greater during PMEx ($P < 0.001$). Hunger and DTE were greater ($P < 0.05$), PFC tended to be greater ($P = 0.054$), and fullness was lower ($P < 0.01$), two-hours pre-exercise during AMEx ($P < 0.05$), but appetite was not different between trials immediately pre-exercise ($P \geq 0.160$) or at any time-point after exercise ($P \geq 0.096$). Resting energy expenditure ($P < 0.01$) and carbohydrate oxidation ($P < 0.05$) were greater during AMEx, but there were no differences in substrate oxidation or energy expenditure during exercise. Exercise performance was not different between trials ($P = 0.628$). Acute morning and evening exercise elicits similar effects on appetite, indicating that positioning of exercise in the evening can offset the circadian-related increase in appetite[(1)]. Energy intake, however, was greater after evening exercise, demonstrating a disconnect between subjective appetite and energy intake[(3)]. Longer-term studies are needed to determine whether exercise timing influences adherence and weight management outcomes to exercise interventions.

References

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