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Research Report

Acute effects of a single exercise class on appetite, energy intake and mood. Is there a time of day effect?

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Abstract

This study aimed to investigate the acute effects of a single exercise class on appetite sensations, energy intake and mood, and to determine if there was a time of day effect. Twelve healthy, young, normal weight females, who were non-regular exercisers, participated in four trials: morning control, morning exercise, evening control and evening exercise. Exercise trials were a one-hour class of aerobic and muscle conditioning exercise of varying intensities, to music. Control trials were a one-hour rest. Ratings of perceived exertion were significantly greater during the warm-up and muscle conditioning parts of the morning exercise trial compared to those of the evening exercise trial. Although both exercise trials, compared to control trials, produced an increase in appetite sensations, they did not alter energy intake and produced a decrease in 'relative' energy intake. In relation to mood, both exercise trials increased positive affect and decreased negative affect. These results suggest that a single exercise class, representative of that offered by many sports centres, regardless of whether it is performed in the morning or evening produces a short-term negative energy balance and improves mood in normal weight women. However, when this type of exercise was performed in the morning it was perceived to require more effort.

Keywords: Appetite; Exercise; Mood; Energy intake; Energy balance; Aerobic class

Introduction

The prevalence of obesity is reaching epidemic proportions in western countries (Must, Spadano, Coakley, Field & Colditz, 1999) and 19% of the adult population in the United Kingdom (National Audit Office, 2001) are now reported to be obese (BMI $\geq$ 30). Physical activity seems to play an important role in the prevention of overweight and obesity (Erlichman, Kerbey & James, 2002) as it may prevent unhealthy weight gain directly by increasing energy expenditure or indirectly by modulating appetite and energy intake (King, Tremblay & Blundell, 1997a).

A number of studies (George & Morganstein, 2003; King et al., 1997a; Tsofliou, Pitsiladis, Malkova, Wallace & Lean, 2003) have investigated the effects of exercise on appetite control following exercise of varying types and intensities. Most of these studies found that exercise did not modify the subjective feelings of appetite (Hubert, King & Blundell, 1998; Imbeault, Saint-Pierre, Almeras & Tremblay, 1997; King, Snell, Smith & Blundell, 1996; King, Lluch, Stubbs & Blundell, 1997b; Lluch, King & Blundell, 1998) and energy intake (George & Morganstein, 2003; Hubert et al., 1998; Imbeault et al., 1997; King et al., 1996, 1997b; Lluch et al., 1998; Tsofliou et al., 2003), while some studies have found a suppression of appetite (King & Blundell, 1995; Tsofliou et al., 2003; Westerterp, Verwegen, Ijedema, Wijckmans & Saris, 1997) and two studies have found a decrease in energy intake after exercise (Kissileff, Pi-Synyer, Segal, Meltzer & Foelsch, 1990; Westerterp et al., 1997). On the other hand, two other studies have found an increase in energy intake after exercise (Verger, Lanteaume &

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Louis-Sylvestre, 1992, 1994). Duration, intensity, type of exercise, subjects' characteristics or other differences in study design may account for this inconsistency.

Although most individuals are aware of the health benefits of being physically active, levels of physical activity are disappointingly low, and western populations are becoming increasingly sedentary. It has been reported that in the United Kingdom, only 33% of men and 21% of women (Teers, 1999) meet the physical activity guidelines which recommend that adults should take part in five or more occasions a week of activity of at least moderate intensity, of 30 min or longer duration (Pate et al., 1995).

In addition, even when individuals do start exercising, low adherence to exercise programs is an issue of concern with approximately 50% of individuals who take up an exercise program dropping out within 6 months (Dishman & Buckworth, 1997). Thus, identifying a type of exercise that increases positive mood and consequently may be associated with lower dropout rates would be of great interest. Since the effect of exercise on mood is increased by social interaction (Plante, Coscarelli & Ford, 2001) and music (Hayakawa, Miki, Takada, & Tanaka, 2000), and because of the known positive effects of social support on exercise adherence in general (Biddle & Fox, 1998), exercise classes with music may be an attractive mode of exercise and may increase adherence to exercise. Moreover, in the UK there are more than 4000 health and fitness centres, where exercise classes are popular (Strategy Unit, 2002). Most exercise classes in these centres last for 45–60 min, including a warm-up, aerobic exercise, a muscle conditioning component and a cool-down period.

To the best of our knowledge there have not been any other published studies that have investigated the effects of an exercise class on appetite and energy intake. We feel that this is an important issue since one of the main benefits that many individuals would like to gain from exercise participation is weight control, which is dependent on energy intake, which is in turn influenced by the feeling of appetite. Moreover, as far as we are aware, no other study has investigated the time of day effects of exercise on appetite and energy intake. We conducted a literature search to find out if previously published studies on the effects of exercise on appetite and energy intake reported timing of exercising and if differences were reported depending on timing of exercising. However, in many studies, time of exercise is not reported.

Therefore, the main purpose of this study was to investigate the acute effects of an exercise class, which is representative of that offered by many health and fitness centres, on appetite and energy intake and to determine if these effects were different when exercise was performed in the morning or evening. We chose morning and evening times since these times are probably most convenient for people to exercise, i.e. before going to work or after work. In addition we investigated the acute effects of participating in this exercise class on mood, which may be important for exercise adherence.

Methods

Subject inclusion criteria for the study were as follows: female, healthy, aged 18–45 years, body mass index (BMI) of between 19 and 25 kg/m^2. The exclusion criteria were contraindication to aerobic exercise, pregnancy, smoking, taking part in regular exercising ($\geq$3 times per week), and being on a special diet. Twelve volunteers meeting the appropriate criteria were recruited to the study. These subjects had previously taken part in similar exercise classes, although they were not regular exercisers. The experimental protocol was approved by the Ethics Committee at the University of Glasgow and subjects gave informed consent. Prior to the start of the study, height (stadiometer, Holtain, UK), weight (Seca-Scales) and skinfold thickness were measured and recorded, and percentage body fat was estimated using the equations of Durnin & Womersley (1974). Moreover, maximal heart rate (HR max) was estimated using the equation HR max = 220 − age (years) (American College of Sports Medicine, 1995). Also during this visit, subjects were given both oral and written instructions on the completion of appetite and mood questionnaires, activity diaries and diet records.

The appetite, energy intake and mood responses to each trial were investigated. A 2×2 repeated measures design was used, with subjects acting as their own controls. The level of activity (rest or exercise) and the time of activity (morning or evening) were the repeated factors. During the morning (ME) and evening exercise (EE) trials subjects were asked to participate in an aerobic and muscle conditioning exercise class from 0815 to 0915 h and from 1915 to 2015 h, respectively, and to refrain from any other vigorous activity on those days. During the morning (MC) and evening (EC) control trials subjects were asked to sit quietly and to remain at rest from 0815 to 0915 h and from 1915 to 2015 h, respectively, and to refrain from any vigorous activity on those days. On trial days, subjects were instructed to consume a light breakfast before the morning trial and to consume their evening meal after the evening trial. Subjects were asked to complete the mood and appetite questionnaires 15 min before and 15 min after each trial. There was no instruction as to the order in which questionnaires should be completed. Subjects were also asked to complete a 24-hour diet record on each trial day. In addition, subjects were asked to maintain similar food intake and activities for each of the two days prior the exercise and control trials. The exercise and control trials were carried out on the same day of the week to account for any particular food habits.

Appetite was assessed using a self-administrated, validated questionnaire that comprised four questions in the form of visual analogue scales of 100 mm line