Immediate Increase in Food Intake Following Exercise Messages

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Communications to stimulate weight loss include exercise-promotion messages that often produce unsatisfactory results due to compensatory behavioral and metabolic mechanisms triggered by physical activity. This research investigated potential automatic facilitation of eating immediately after exercise messages in the absence of actual exercise. Two controlled experiments demonstrated greater than control food intake following exposure to print messages typical of exercise campaigns as well as subliminal presentation of action words associated with exercise (e.g., "active"). These inadvertent effects may explain the limited efficacy of exercise-promotion programs for weight loss, particularly when systematic dietary guidelines are absent.

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Alarming rates of overweight and obesity in the United States have led to the development of preventive communications and interventions to promote weight loss (1). As weight loss is contingent on energy expenditure exceeding caloric intake, one popular approach comprises promotion of physical activity (2). Media and community campaigns often encourage audiences to increase their physical activity by engaging in structured exercise or active routines (1). The present research was designed to explore potential effects of such campaigns on eating behavior.

One unexplored consequence of exercise-promotion messages concerns inadvertent effects on food intake even before people engage in exercise. Motivational mechanisms associated with the use of action words and images are likely to automatically unfold when exercise-promotion messages are presented (3). For example, words such as "active" and "go" may produce a generalized desire for motor output that can be satisfied by eating. Moreover, hard-wired, survival-relevant automatic behavioral mechanisms (4) may elicit compensatory food intake as an immediate response to energy expenditure prompts. Such effects could explain the limited efficacy of exercise-promotion programs, particularly when not accompanied by systematic dietary recommendations to reduce energy intake (5).

Two laboratory experiments were conducted using direct presentation of messages from actual exercise campaigns (vs. control messages), and subliminal presentation of action words common in exercise messages (vs. control words). In Experiment 1, 53 college students (72% male; mean age = 18.90, s.d. = 1.11; mean BMI = 22.20, s.d. = 3.85; 17% with BMI >25) were first exposed to a series of five experimental or control print advertisements with the ostensible objective of rating the appeal and likely efficacy of the ads (see **Figure 1**). Immediately after the ad viewing, participants were informed that they would also taste and rate raisins that were preserved in a microfiber plastic container. Twenty raisins were offered to the participants in styrofoam bowls with instructions to eat as many as they wanted. This small amount was selected to maintain consistency with the framework of a food tasting study. At the end, participants viewed each poster again and provided ratings to evaluate message comparability. As experimental sessions were distributed during the day, it was important to first examine whether time of day was similar across sessions. Analyses indicated that the experimental and control conditions were run at similar times (military time Ms =12.86, s.d. = 2.16, vs. 12.62, s.d. = 2.38); $F(1, 52) = 0.14$, ns. The posters did not vary in likeability, perceived efficacy, or perceived design quality, nor did they produce mood differences (in all cases, $F < 1$). As predicted, however, recipients of the exercise message ate an average of 18.421 kcal (s.d. = 11.87) relative to 11.98 kcal (s.d. = 11.40) in the control condition, $F(1, 52) = 4.04$, $P < .05$.

Although Experiment 1 provided important evidence for the hypothesized effects, replicating the effects with prompts outside of awareness is critical to rule out demand effects and confirm the mechanism's automaticity. Experiment 2 included 51 college students (46% males; mean age = 19.26, s.d. = 1.16; mean BMI = 22.80, s.d. = 4.25; 17% with BMI >25) randomly assigned to exposure to action words common in exercise ads or to control words. As part of an ostensible hand-eye coordination task, participants were subliminally presented with eight action words ("active," "go") or eight neutral words ("pear," "moon") presented in random order. Each word was presented

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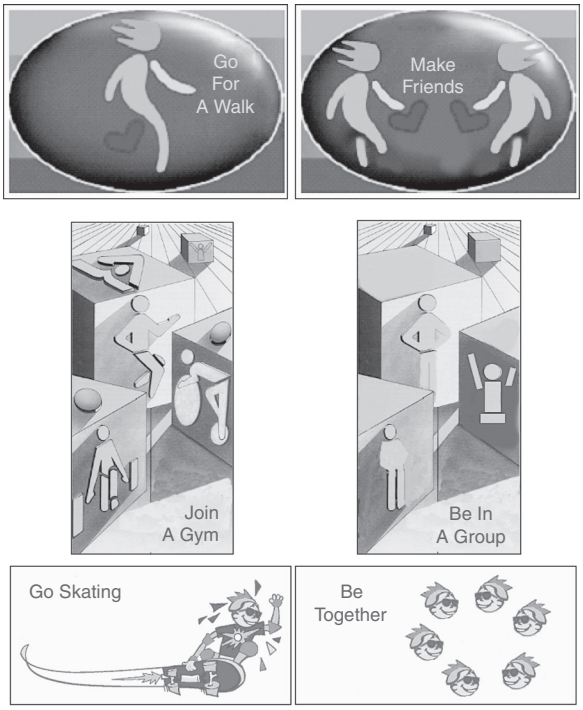

Figure 1 Sample messages from Experiment 1. Experimental messages appear on the left panel and control messages on the right panel.

for 15 ms in a way that ensured lack of conscious awareness of the stimuli. Using the same methods as in Experiment 1, participants then received bowls containing 15 M&Ms, 15 raisins, and 15 peanuts, along with instructions to eat as many as they wanted before rating the foods. At the end of the study, the research assistant counted the number of items left in each bowl, which was subtracted from the initial number of items to obtain a measure of food intake (see **Supplementary Methods and Procedures** online).

As before, the time of day was similar across experimental conditions (military time Ms = 13.82, s.d. = 1.94 and M = 13.98, s.d. = 1.83 for experimental and control conditions). The results from this study supported the hypothesis that the action words typical of exercise messages elicit greater food intake than the control words. Participants ate 108.65 kcal (s.d. = 34.33) when exposed to action words vs. 87.77 (s.d. = 35.50) when exposed to control words, $F(1, 50) = 4.23$, $P < 0.04$.

Overall, the findings from these two experiments are suggestive in demonstrating that exercise messages can exert inadvertent immediate effects on food intake. Such consequences may not be apparent if exercise is the only measured outcome, but could potentially jeopardize weight loss (5). Limitations of these studies include sampling college students with a normal BMI, and examining only immediate effects on consumption of limited amounts of food. Future research should examine the stability and generalizability of these effects and their applicability to conditions outside the laboratory, clinical populations, and larger amounts of food that might either hinder weight loss or promote weight gain.

SUPPLEMENTARY MATERIAL

Supplementary material is linked to the online version of the paper at http://www.nature.com/oby

DISCLOSURE

The authors declared no conflict of interest.

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