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Nutrition Labels Decrease Energy Intake in Adults Consuming Lunch in the Laboratory

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ABSTRACT

Increased visibility of food labels is a potential method to reduce the rate of obesity. However, few empirical studies have investigated the impact of nutrition labeling on food selection or energy intake. This study tested the hypothesis that nutrition labeling in combination with nutrition label education would promote reductions in energy intake using a laboratory-based paradigm. Forty-seven male (n=24) and female (n=23) participants visited the Nutrition and Health Research Laboratory for a single lunch session during the months of May through August 2009. Participants were randomly assigned to one of two video groups (Nutrition Labeling Education or Organic Food Movement) and one of two labeling conditions (Nutrition Labels or No Labels). Participants watched a short educational video and then consumed a buffet lunch. Data were analyzed using a three-way analysis of covariance with sex, video condition, and labeling group as the between-subject factors and age and race as covariates. There were main effects of sex and nutrition label condition on lunch energy intake with females consuming less than males and people with nutrition labels consuming less energy than those without, regardless of sex or video condition. Examination of energy intake from low-energy-density and high-energy-density foods showed that the nutrition labeling group consumed less energy from both low-energy-density and high-energy-density food sources. These data support the use of nutrition labels as a way to reduce energy intake.

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STATEMENT OF POTENTIAL CONFLICT OF INTEREST: See page S55.

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The Nutrition Facts Label was initiated by Congress in 1990 under the Nutrition Labeling and Education Act as an attempt to help consumers make healthier dietary choices (1). Studies report that between 75% and 80% of consumers use nutrition labels at least some of the time to make choices about food purchases (2-4), and that people who use nutrition labels consume a diet that is lower in fat, higher in fruit and vegetable intake, and higher in fiber and iron than people who report never using nutrition labels (3,5). Studies examining food selection in cafeterias and restaurants show that providing nutrition information results in only slight reductions in energy of meals purchased (6,7). When laboratory-based designs are used, similar findings result. For example, a study by Harnack and colleagues found that calorie and/or price information had no influence on food purchases and energy intake in the laboratory (8). By contrast, another laboratory-based study found that women selected lower-calorie meals when calorie information was provided; however, men were unaffected (9). When taken together, these studies suggest that data on the influence of nutrition label information on food selection and energy intake are equivocal and may depend on the amount of information provided and on the context in which food selection and intake are measured.

The purpose of the present study was to examine the influence of nutrition labels on energy intake during a buffet lunch in male and female adults. A secondary objective was to determine whether the impact of nutrition labels could be enhanced by providing education on how to read nutrition labels. This study is among the first to directly examine the effects of nutrition labels on energy intake. These results provide empirical evidence of the effects of nutrition labeling and education on energy intake and help to determine the most effective way to convey information about the nutritional content of foods to consumers in order to improve healthy eating, reduce energy intake, and decrease the rates of obesity.

METHODS

Participants

Participants were males and females between the ages of 18 and 50 years (n=47) recruited from flyers posted around the University at Buffalo North and South campuses and screened by telephone for eligibility. Exclusionary criteria included smoking, self-reported current dieting, a dislike for more than half of the potential study foods, presence of medical conditions, or intake of medications that affect appetite (eg, methylphenidate).

Procedures

Participants were scheduled to visit the laboratory for a single session lasting approximately 1 hour between the hours of 11:00 AM and 2:00 PM during the months of May through August 2009. Participants were told to refrain from eating and drinking anything other than water for 3 hours prior to their laboratory visit. All procedures were conducted using National Institutes of Health guidelines for the ethical conduct of research in human subjects and with the approval of the Social and Behavioral Sciences Institutional Review Board at the University at Buffalo.

Upon arrival to the laboratory, all participants were given a consent form to read and sign. The form was written at an eighth-grade (approximate age range=13 to 14 years old) level and stated that the purpose of the study was "to determine how watching videos about food and food labels affect eating." Participants then completed a demographic questionnaire and were interviewed about their food and beverage intakes the morning of the study and the previous day by using a five-step, multipass interview style (10).

Educational Video and Nutrition Labeling Groups

Before arrival at the laboratory, participants were randomly assigned to one of two video groups. One of the groups watched a video about how to read nutrition labels, and the other group viewed a video about the organic food movement. The videos were identical in format and similar in length (8 to 9 minutes). Once the video watching was completed, participants took a four-question quiz corresponding to the assigned video to determine how well the participant paid attention to and understood the video.

Participants were also randomly assigned to one of two nutrition labeling groups. Half of the participants had nutrition labels on all of the foods they were offered during lunch and the other half did not have any labels. Labels were made using the standard US Department of Agriculture format that conformed to our serving sizes.

Buffet Lunch

Once the video watching and quiz were complete, participants were taken to an adjacent room where a buffet lunch of preportioned, preweighed foods was provided. The foods available at lunch were chosen because they had been previously used in the Nutrition and Health Research Laboratory, were commonly consumed lunch foods in the United States, were acceptable to both men and women, and provided a range of energy densities. The buffet lunch consisted of a small salad bar with regular and fat-free dressing options and a variety of vegetables; a sandwich bar with different types of bread, rolls, and a variety of meats and cheeses; and several side items and desserts, including potato chips, candy bars, cookies, yogurt, fruit, and pudding. Beverages offered consisted of water, soft drinks, white and chocolate milk, and juice.

Participants completed hunger and fullness questionnaires just prior to and immediately after eating. Hunger and fullness were assessed using 100-mm visual analog scales anchored by "not at all hungry/full" and "extremely hungry/full." Participants were asked to draw a line along the 100-mm continuum to indicate how they felt at that time. These types of scales have been shown to be both reliable and valid when used in eating experiments (11). Once questionnaires were completed, participants were instructed to take and eat as little or as much food as they liked and told that they would have 20 minutes to consume lunch. The experimenter left the room while the participant was eating and returned 20 minutes later. The participants completed hunger and fullness questionnaires again, had height and weight measured, and were debriefed and provided payment. The remaining food was then weighed and energy intake calculated.

Demographic and Anthropometric Characteristics

The general demographics questionnaire used assessed education status, annual income, profession, race, and ethnicity. Height (cm) and weight (lb) were measured at the end of the session using a stadiometer and digital weight scale (both from SECA Corp, Hanover, MD) and body mass index was calculated as kg/m^2.

Analytic Plan

Participant characteristics and energy intake were analyzed using three-way analyses of covariance with sex, labeling group, and video group as between-subject factors and race and age as covariates. Hunger and fullness were analyzed using a mixed analyses of covariance with sex, labeling group, and video group as between-subject factors and pre/post as the within-subject factor. Data were considered significantly different if $P<0.05$. All analyses were conducted using SYSTAT (version 11.0, 1994, SYSTAT Software Inc, Chicago, IL).

RESULTS AND DISCUSSION

Forty-seven males (n=23) and females (n=24) were tested in this experiment. They had an average body mass index of 25.9±0.6 and age of 29.9±1.5 years. This population was well-educated, with the majority (91%) completing some college. More than half of the participants were part- or full-time students (59.5%). Income levels were broadly distributed, with 43% earning <$10,000, 30% earning between $10,000 and $50,000, and $27% earning >$50,000 per year. There was a significant sex difference in the proportion of minority participants, with females comprising 26% (6 of 23) and males accounting for 58% (14 of 24) ($\chi^2(1)=5.7$; $P=0.017$). There was a main effect of sex on age ($F_{1,36}=11.4$; $P=0.002$), with female participants being older than male participants. There was no difference by sex, labeling, or video group for body mass index, education, income, same or previous day energy intake; or baseline hunger or liking of either high-energy-density or low-energy-density foods (all $P>0.05$).

The primary finding was a main effect of labeling group on total energy consumed at lunch ($F_{1,36}=4.51$; $P=0.04$; Figure 1). These differences remained significant when energy from beverages was removed from the analysis ($F_{1,36}=6.05$; $P<0.05$; Figure 1). This cannot be attributed to differences in hunger, as both labeling groups had similar baseline hunger and similar reductions in hunger after consuming lunch (all $P>0.10$). These findings are similar