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Do Social Activities Substitute for Food in Youth?

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Abstract

Background—Behavioral economics offers a framework to understand choice among alternatives. There is no research on the interrelationship between food and social activity in overweight and non-overweight children.

Purpose—The purpose of this study is to test the substitutability of food and social interactions using behavioral economic methods in overweight and non-overweight youth.

Methods—Fifty-four (24 males and 30 females) overweight and non-overweight youth aged 9 to 11 years old were tested using a behavioral choice paradigm which involved participants responding to earn points exchangeable for food and/or social activity.

Results—Youth substituted food for social activities when the cost of social time with an unfamiliar peer increased ($p<0.05$) and substituted food for social activities with an unfamiliar peer when the cost of food increased ($p<0.05$). However, when interacting with a friend was the alternative, participants did not substitute food for social interactions.

Conclusions—Social interactions can serve as a substitute for food in both lean and overweight youth.

Keywords

Food reinforcement; Social activity; Children; Behavioral economics

Introduction

Food is a powerful primary reinforcer. However, research using behavioral choice theory shows that eating occurs in the context of a wide variety of other behaviors and that the motivation to eat depends in part on the alternatives available [1–4]. Individuals may be more likely to eat than to engage in other behaviors not only because they find food and eating more reinforcing but also because they find other activities less reinforcing [5,6]. If access to the alternatives is equal, then the relative reinforcing value of the alternatives usually determines choice. However, when the cost of an alternative increases, such as it is harder to obtain, or costs more, then the person must make a choice to determine which alternative to engage in.

There are three ways in which alternative behaviors can be related. First, when placed in a choice situation in which the behavioral cost of activity A is increasing, a participant may choose to engage in behavior B, which shows that B substitutes for A. Consider a person who usually comes home alone after school and eats out of boredom, but on this day, she has a play date with a friend and socializes instead of eating. In this case, socializing is acting as a

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substitute for eating. It is also possible that the direction of the two behaviors is similar. For example, assume that someone usually watches television and has a late evening snack every night. Reducing television watching could result in a reduction in snacking, and as such, these behaviors would be complements [7]. Alternatively, it is possible that the two behaviors are unrelated, and changing the rate of one behavior will have no effect on the other behavior. In this case, they are independent. Understanding what behaviors substitute for other behaviors represents an important theoretical contribution to behavior change, as identifying substitutes provides a potential way to reduce behavior.

Conceivably, social activities can substitute for eating, and eating can substitute for social activities. There are many ways in which constraints are placed on social activities, and children may have to decide what to do instead of socializing. For example, peer rejection and ostracism are obvious costs imposed on social interactions. Even the unavailability of one's peers or friends can limit youth's access to social settings and situations. As a result, youth may substitute powerful and easily accessible reinforcers (e.g., food) for social activities. To our knowledge, no research has assessed the substitutability of food and social interactions in children. This choice of alternatives is similar to choices children make in their natural environment as they may choose to engage in eating and sedentary activities when social alternatives are unavailable.

The primary aim of this research was to test the substitutability of social interactions and food in overweight and non-overweight children as a function of acquaintance (friends vs unfamiliar peers) using behavioral economic methods. We predicted that children would substitute food for the opportunity to socialize with an unfamiliar peer, but that socializing with a friend would be a more powerful alternative, and that children would not shift to eating as access to socializing with a friend is made more costly.

Increasing the cost of a good or activity may also paradoxically influence preference for this same good or activity, especially if the alternative behavior is not a complete substitute for the constrained commodity. Several studies have shown that restricting access to food can increase children's preferences and intake of these foods [8–11]. Similarly, increasing the cost of social activities may result in greater desire to relate to others. We have previously argued that eating conformity, or modeling of others' food intake, can be used to relate to others [12]. This is consistent with a self-presentational account of conformity [13,14]. The idea is that matching the eating behavior of a companion has a similar function than attitude conformity and is used to relate or bond with others (e.g., [15,16]. In the first stages of a relationship, individuals generally tend to put forward similarities in terms of interests and activities in order to foster relatedness, and we contend that eating conformity can have a similar ingratiating function. Thus, a secondary aim of this research was to assess the impact of increasing the cost of food or social interactions on subsequent energy intake and modeling of intake (i.e., relationship between eating partners' food intake) in an adlib eating situation. After the substitution task had been completed, participants were provided an additional 15 min of free-play with an unfamiliar peer or a friend while they had free access to the experimental food. We hypothesized that increasing the cost of food would result in greater food consumption during the free-play period, whereas increasing the cost of the social activity would result in greater modeling of eating (i.e., relationship between eating partner's food intake). Empirically, this would translate into greater correlations between eating partners' food intakes (friends and unfamiliar peers) when the cost of the social alternative was increased compared to correlations between eating partners when the cost of food was increased.

Method

Overview and Design

The design of this study is a 2×2 between-subjects design with acquaintance (unfamiliar peer vs friend) and substitution task (food substitutes for activity vs activity substitutes for food) as between-subject factors and participants' weight as covariates in the analyses. All participants were required to come to the laboratory for one session to work on the substitution task and enjoy free-play time with an unfamiliar peer or friend. The task involves children pressing a computer mouse to earn points exchangeable for food or for social playtime with an unfamiliar peer or a friend (described below). For half of the sample, the cost of food points increased, while the cost of time playing with another child remained constant. For the other half of the sample, the cost of points for social play increased, while the cost of food points remained constant.

Participants

Participants for this study included 21 overweight and 33 non-overweight males and females (Table 1). Participants were tested with either a friend (n=35) or an unfamiliar peer (n=19). Participants were excluded if they were below the 15th body mass index (BMI) percentile; had a cold or upper respiratory distress; had current psychopathology or developmental disability; and/or if they were on medications, or had conditions that could influence their sense of smell or taste, and mobility or activity level (e.g., methylphenidate). Weight and height were assessed by a trained staff member at the end of the session so that these measurements did not influence the experimental data. Weight was assessed with a digital scale daily, and height was assessed using a SECA stadiometer. On the basis of the height and weight data, BMI was calculated (BMI = kg/m2). BMI percentiles (zBMI) were used to classify participants. Youth were considered overweight or at risk for overweight if they were above the 85th BMI percentile for their age and gender, and were considered normal-weight if they were at or below the 85th BMI percentile. The Children and Youth Institutional Review Board of the University at Buffalo approved all procedures used in this study, and all applicable institutional and governmental regulations concerning the ethical use of human volunteers were followed during this research.

Recruitment and Randomization

Families were recruited from newspaper ads, flyers, and from our database of families who have volunteered for previous laboratory studies. Parents were screened by phone for their child's height, weight, a brief medical history, and ethnic background. If they met basic entry criteria, they were scheduled to come to the laboratory. Participants were randomly assigned to either the friend or the unfamiliar peer condition. Youth assigned to the peer condition were scheduled with another participant of same age (within 1 year) and gender. Parents of the participants assigned to the friend condition were informed that the experiment required their child to bring a friend for one experimental session. If the family agreed to participate, a parent was asked to give the investigator's contact information to the parent of their child's friend to preserve the confidentiality of the friend's family. While scheduling, participants were also randomized to one of two schedules of reinforcement: (1) social increase/food constant or (2) food increase/social constant (described below). Participants were randomized into these two schedules of reinforcement to counterbalance the reinforcement schedules across participants and to eliminate experimenter bias. All participants were reminded of their appointments by phone. In the event that appointments needed to be cancelled by the participants, new appointments were rescheduled at the participants' convenience.

Procedure

During the phone screening, parents were told that the study assessed youth's choices of activities and that their child would have the opportunity to work on a computer task for points exchangeable for (1) McCain Tasti Tater® Shaped Potatoes (i.e., tater tots) and/or (2) time playing games with a friend or an unfamiliar peer. They were also informed that their child would be given a preload composed of a Kellogg's® Rice Krispies Treats® Original bars and a glass of water before starting the study session in order to standardize youth's food intake prior to the experimental task. They were instructed that the study required participants to abstain from eating for at least 1 h but not more than 3 h before the experiment. The nutritional information of the preload and experimental food was provided to parents.

Upon arrival to the laboratory, participants (as well as friends and peers) completed a same-day food recall to insure they had abstained from eating prior to the study session. All children heard an “assent” script and were asked if they were willing to take part in the study. Parents were asked to read and provide written consent before their child could participate in the study. The parents of the friends did not attend the experimental session; rather, they were mailed the documentation, and they had to provide consent for their child to participate in the study prior to the study session. The signed informed consent forms of both children were required before running the study session. After the consent procedures were completed, participants were shown the experimental room and were provided with a detailed demonstration of the computer task which involved clicking a computer mouse to earn points for food or for time to spend time with a friend or with an unfamiliar peer (described below). Friends and unfamiliar peers were asked to wait in the waiting room while the participants were completing the task. In order to remove the pressure of having to play with the other youth, it was made clear to the participants that if they did not want to interact with the unfamiliar peer and/or friend, nobody would know about their choice. Before starting the task, participants were instructed (but not required) to eat their preload (described below). All participants followed the instruction.

After the computer task was completed, the participants were given the tater tots they earned during the substitution task. Then, the participant and either the unfamiliar peer or the friend were accompanied into the experimental room to play together. At this time, the experimenter informed the children that they had 15 min of playtime and brought in two bowls of pre-weighted tater tots. At the end of the 15-min free-play the remaining food was reweighed to determine the participants' food intake in kilocalories. Next, youths' height and weight were assessed, followed by debriefing about the purpose of the study. Participants, friends, and unfamiliar peers were compensated for their time with a $20 gift card to a local store.

Laboratory Environment

The experimental room was equipped with an intercom and a video camera for communication. The laboratory used for this experiment was specially constructed for eating experiments. The laboratory is equipped with an air delivery system that circulates new air through each room approximately ten times per hour and HEPA air purifiers containing a carbon, permanganate, and zeolite filter to remove airborne odorants. The room included two areas located at opposite sides: a computer area and a play area. The computer area included two computer monitors with mouse on desks and two chairs. The play area included two beanbag chairs, a television monitor, a video game console, and a variety of video games (described below).

Food and Games

Kellogg's® Rice Krispies Treats® Original bars and a glass of water before starting the study session were used as a preload. Each bar weighed 22 g, yielding an average of 90 kcal (±0.3 g). McCain Tasti Tater® Shaped Potatoes were used as the food reward in this study. Each tater tot weighed approximately 8.7 g yielding an average of 16.9 kcal (±0.3 g). During the

reinforcement task, the participants chose an average of 3.4 tater tots, producing 29.6 kcal (±0.3 g). Tater tots that were not consumed were counted, weighed, and discarded.

The alternative activity included a variety of X-box video games (Fable®: The Lost Chapters™, Microsoft Game Studios; The Sims™, Electronic Arts; Forza Motorsport™, Microsoft Game Studios; and Sonic Heroes, SEGA®).

Measurement

Substitution Task—The substitution task is adapted from behavioral economic approaches to choice. The substitution task requires participants to click a computer mouse button to earn points exchangeable for activities. On one computer, subjects worked to earn social activity points, and on the other computer, they worked to earn food points. Each computer screen displayed three boxes varying in shape and color. The boxes rotated and changed color each time the mouse button was pressed. One point was awarded each time the shapes matched. In a typical substitution task, subjects are provided with the choice of responding for one of two alternatives.

Participants were randomly assigned to one of two substitution tasks. Half of the participants were provided a food substitution task, in which as the cost of social points increased following a progressive-ratio schedule, the price of food points followed a fixed-ratio schedule. The other half of the participants were provided the socialization substitution task, in which as the cost of food increased, the price of social interactions were constant. When points were delivered on the progressive-ratio schedule, the response requirements to gain points increased at a fixed rate of four from trial to trial within the course of the session (e.g., FR4, FR8, FR16, FR32, FR64… mouse-pressing). For example, on the first trial, participants had to mouse-press four times to earn five points exchangeable for food or social points. On the second trial, participants had to press eight times to earn the same amount of social or food points. When points were delivered on the FR schedule, the response requirements to gain points remained constant from trial to trial within the course of the session (e.g., FR4, FR4, FR4, FR4… mouse-pressing). The two schedules of reinforcement were independent; an increase in response cost of one schedule had no impact on the other schedule. The uneven number of trials (i.e., nine trials) forced the participants to choose which activity they wanted to work for the most as they were unable to earn an equal number of points for both activities.

Analytic Plan

Individual Characteristics—Double data entry and quality check were performed prior to statistical analysis to ensure accuracy. Preliminary analyses of variance were performed on baseline variables (food intake prior to the session, hunger, or liking of the study food) to determine whether there were differences between conditions. A Levene's test of equality of variance was performed to test the assumption of homogeneity of variance across conditions.

Trials Completed to Earn Points for Social Activity and Food—This research examines the effects of increasing the cost of social activities and food on youth's demand for food and social activities as a function of acquaintance between participants. Because the two alternatives were on different schedules of reinforcement (food increases/social fixed cost vs social increases/food fixed cost), we used the number of trials completed to earn points for social activity and food as dependent variables (i.e., common denominator) for both reinforcers. A 2×2 (unfamiliar peer vs friend×schedules of reinforcement) multivariate analysis of covariance (MANCOVA) with zBMI as covariate was performed on the number of trials youth completed to gain access to social activity and food points.

Food Intake During the Free-choice Period—A secondary aim of this research was to assess the effect of increasing the cost of food during the substitution task on participants' subsequent food intake during the free-play period. A 2×2 (unfamiliar peer vs friend×schedules of reinforcement) analysis of covariance (ANCOVA) with zBMI as a covariate was performed on participants' food intake.

Matching of Intake—A third aim was to examine matching of intake, or modeling, between participants after the substitution task was completed. A useful approach to test whether people eating together match each other's energy intake involve assessing the relationship between co-eaters' intakes. Matching of intake can be indexed by Pearson *r* correlation coefficients between the partners' (friends and unfamiliar peers) food intakes, and Fisher Z-transformation tests were used to compare correlations coefficients.

All statistical analyses were performed using Statistical Package for the Social Sciences (SPSS) software (version 16, SPSS Inc., Chicago, IL, USA). The significance was set at $p<0.05$.

Results

Individual Characteristics

Characteristics of the study population are presented in Table 1. There were no significant differences between groups in food intake prior to the session, hunger, or liking of the study food (all *p*'s >0.15).

Trials Completed to Earn Points for Social Activity and Food

Results of the MANCOVA indicated an interaction of acquaintance by schedule of reinforcement on the number of trials completed to earn points for social activity, $F(1,49)=5.15$, $p<0.05$, and food, $F(1,49)=4.97$, $p<0.05$ (Fig. 1). When the cost of food was increased, participants tested with an unfamiliar peer completed more trials to earn points for social activity than for food points. By contrast, when the cost of the social activity was increased, participants tested with an unfamiliar peer completed more trials for food points than for social activity. Manipulation of the cost of social play and food had no effect on the demand for time playing with a friend (Fig. 1). Participants responded to earn more time to play with a friend than to eat in both conditions. There was no effect of zBMI on trials completed for food ($p=0.54$) or social activity ($p=0.63$).

Food Intake During the Free-Choice Period

Results of the ANCOVA indicated that participants in the condition where the cost of food increased over time (social substitution condition) consumed more food than participants in the condition where the cost of social activity was increased, $F(1,49)=6.35$, $p<0.05$ (Fig. 2). This suggests that the higher cost of food led to greater intake later when food was freely available and that social interactions were not complete substitutes for food. There was no effect of acquaintance ($p=0.6$) and no effect of zBMI ($p=0.33$) on energy intake.

Matching of Intake

Table 2 depicts the correlation coefficients between partners' food intake as a function of the task (schedule of reinforcement) and acquaintance. Matching of food intake was high among friends and unfamiliar peers in conditions in which the cost of social activity was increased. Correlations were greater when the cost of social activity was increased than when the cost of food was increased for both friends, $Z=2.43$, $p<0.05$, and unfamiliar peers, $Z=2.41$, $p<0.05$.

Discussion

This study examined the substitutability of food and social interactions. When the cost of social activity with an unfamiliar peer increased, youth completed more trials for food than for social activity, whereas when the cost of eating was increased, participants completed more trials for social activity than for food. When the social commodity was spending time with a friend, however, youth's demand for social activity was insensitive to the increase in effort required, and this pattern of responding was similar across the range of zBMI tested in this study. These findings are important as developmental models of risk and adaptation emphasize the interaction between individual characteristics and environmental risk and/or protective factors when predicting adjustment outcomes during childhood and adolescence [17]. Applications of these models have shown that friendships can function protectively for children and adolescents considered at-risk due to their individual child characteristics [18]. Overweight children are often rejected and victimized by the larger peer group [19–27]. Children and adolescents tend to hold negative attitudes toward obese individuals and believe that overweight children have more negative personalities and behavioral characteristics than non-overweight children [28, 29]. Given that overweight children's peer environments are often rejecting, hostile, and critical, they often avoid situations involving peers, such as gym class [30] and other types of group exercise [25]. The social “cost” of these activities may decrease the reinforcing value of social activities and increase the reinforcing value of sedentary activities that can be completed alone such as television watching and eating [31]. The present study suggests that increased cost of peer activities may increase the reinforcing value of eating, in the absence of other reinforcers. Conversely, friendship may function protectively in decreasing the reinforcing value of superfluous eating.

Increasing the cost of food and social activity not only modified participants' responses for these alternatives but also altered youth's eating behavior and matching of intake. Participants in the condition in which food cost was increased consumed more food during the free-play period. Further, modeling of eating was greater in the conditions in which the cost of social activity was increased regardless of the familiarity between participants. These findings are consistent with the disequilibrium model of reinforcement [32,33]. According to the disequilibrium model, reinforcement effects can be produced by constraining access to the contingent activity. Alternatively, the constraints put on these alternatives may focus attention on the limited access object [34]. Increased attention to food may subsequently cause individuals to choose eating instead of participating in non-eating activities, or may predispose individuals to be more susceptible to eating when exposed to eating cues [35]. Similarly, increased attention to social activity may subsequently increase awareness to social eating and co-eaters' food intake and result in greater normative conformity through eating (see [12] for a discussion matching of eating and ingratiating motives).

It is important to acknowledge some limitations of our study. First, although our overall sample of participants included 54 dyads of friends and unfamiliar peers, our experimental cells were not perfectly balanced due to recruitment logistics. This limitation may have obscured differences between groups, and studies with larger samples are clearly needed. A second limitation relates to the choice of experimental food. As we were designing the study, we contemplated using highly palatable snack items (e.g., chocolate-coated candies or chips) as food reinforcers. However, we believe that using a meal food was more consistent with our objective to compare the reinforcing value of “food” and social activity. Conceivably, a foodstuff with steeper preference curves [36] or relying more on hedonic hunger [37] may have revealed a different pattern of results. Finally, the methodology used in this study provided only two choices of activities. However, youth interacting in their natural environment are presented with a variety of choices in terms of foods and activities. Studies providing several more substitutes and alternatives are clearly needed.

Despite these limitations, the present study increases our understanding of the ways children respond to food when the alternative involves social activities. Previous studies on food reinforcement in youth and adult populations have shown that food is a powerful reinforcer that is difficult to substitute [1–4]. The present findings indicate that social reinforcers can substitute for food and that the demand for friendship, a preferred reinforcer, is difficult to modify and change very little with comparable increases in its cost. These findings underscore the importance of considering the child social network in studying food reinforcement.

There is emerging evidence that youth's social network may be uniquely relevant and influential to eating behavior and choice of activities. Individuals are influenced by the eating and activity norms set by those around them (e.g., [38–42]), and the results of the present study suggest that friendship can provide an alternative to eating. Drawing from these findings and from the work of others [25,30], we contend that decreasing sedentary behavior and increasing active leisure activities may require the social structure of meaningful relationships with friends, as friendship may help to promote or “socialize” active lifestyles. Attempts to substitute physical activity for sedentary behavior may not be effective if problematic peer relationships persist, in part because sedentary activities are more reinforcing, easily accessible, easily performed alone, and less threatening for socially isolated youths. Conceivably, the involvement of children's social ecology in prevention efforts is a promising approach to set the stage for health trajectories.

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References

1. Epstein L, Leddy J. Food reinforcement. Appetite 2006;46:22–25. [PubMed: 16257474]
2. Epstein L, Leddy J, Temple J, Faith M. Food reinforcement and eating: A multilevel analysis. Psychol Bull 2007;133:884–906. [PubMed: 17723034]
3. Epstein L, Wright S, Paluch R, et al. Relation between food reinforcement and dopamine genotypes and its effect on food intake in smokers. Am J Clin Nutr 2004;80:82–88. [PubMed: 15213032]
4. Temple J, Legierski C, Giacomelli A, Salvy S, Epstein L. Overweight children find food more reinforcing and consume more energy than non-overweight children. Am J Clin Nutr 2008;87:1121–1127. [PubMed: 18469229]
5. Doell S, Hawkins R. Pleasures and pounds: An exploratory study. Addict Behav 1982;7:65–69. [PubMed: 7080886]
6. Jacobs S, Wagner M. Obese and nonobese individuals: Behavioral and personality characteristics. Addict Behav 1984;9:223–226. [PubMed: 6741685]
7. Epstein LH, Roemmich JN, Paluch RA, Raynor HA. Influence of changes in sedentary behavior on energy and macronutrient intake in youth. Am J Clin Nutr 2005;81:361–366. [PubMed: 15699222]
8. Birch LL, Zimmerman SI, Hind H. The influence of social-affective context on the formation of children's food preferences. Child Dev 1980;51:856–861.
9. Fisher JO, Birch LL. Restricting access to foods and children's eating. Appetite 1999;32:405–419. [PubMed: 10336797]
10. Fisher JO, Birch LL. Restricting access to palatable food affects children's behavioral response, food selection, and intake. Am J Clin Nutr 1999;69:1264–1272. [PubMed: 10357749]
11. Lepper MR, Sagotsky G, Dafoe JL, Greene D. Consequences of superfluous social constraints: Effects on young children's social inferences and subsequent intrinsic interest. J Pers Soc Psychol 1982;42:51–65.
12. Salvy SJ, Jarrin D, Paluch R, Irfan N, Pliner P. Effects of social influence on eating in couples, friends and strangers. Appetite 2007;49:92–99. [PubMed: 17296248]

13. Deutsch M, Gerard HB. A study of normative and informational social influences upon individual judgment. J Abnorm Psychology 1955;51:629–636.
14. Jones, EE.; Pittman, TS. Toward a general theory of strategic self-presentation. In: Suls, J., editor. Psychological Perspectives on the Self. Vol. 1. Hillsdale: Lawrence Erlbaum Associates, Inc; 1982. p. 231-262.
15. Sunnafrank, M. Interpersonal attraction and attitude similarity: A communication-based assessment. In: Anderson, JA.; Anderson, JA., editors. Communication Yearbook/14. Thousand Oaks: Sage Publications, Inc; 1991. p. 451-497.
16. Sunnafrank M, Ramirez A Jr, Metts S. At first sight: Persistent relational effects of get-acquainted conversations. J Soc Pers Relatsh 2004;21:361–379.
17. Magnusson, D.; Stattin, H. The person in the environment: Towards a general model for scientific inquiry. In: Lerner, RM., editor. Theoretical Models of Human Development Handbook of Child Psychology. Vol. 1. Hoboken: Wiley; 2006. p. 400-464.
18. Fordham K, Stevenson-Hinde J. Shyness, friendship quality, and adjustment during middle childhood. J Child Psychol Psychiatry Allied Discipl 1999;40:757–768.
19. Allon, N. The stigma of overweight in everyday life. In: Wolman, B., editor. Psychological Aspects of Obesity: A Handbook. New York: Van Nostrand Rheinhold; 1982. p. 130-174.
20. Janssen I, Craig WM, Boyce WF, Pickett W. Associations between overweight and obesity with bullying behaviors in school-aged children. Pediatrics 2004;113:1187–1194. [PubMed: 15121928]
21. Latner JD, Stunkard AJ. Getting worse: The stigmatization of obese children. Obes Res 2003;11:452–456. [PubMed: 12634444]
22. Latner J, Stunkard A, Wilson T. Stigmatized students: Age, sex, and ethnicity effects in the stigmatization of obesity. Obes Res 2005;13:1226–1231. [PubMed: 16076992]
23. Puhl R, Brownell K. Bias, discrimination, and obesity. Obes Res 2001;9:788–805. [PubMed: 11743063]
24. Puhl R, Latner J. Stigma, obesity, and the health of the nation's children. Psychol Bull 2007;133:557–580. [PubMed: 17592956]
25. Storch E, Milsom V, DeBraganza N, et al. Peer victimization, psychosocial adjustment, and physical activity in overweight and at-risk-for-overweight youth. J Pediatr Psychol 2007;32:80–89. [PubMed: 16601255]
26. Strauss RS, Pollack HA. Social marginalization of overweight children. Arch Pediatr Adolesc Med 2003;157:746–752. [PubMed: 12912779]
27. Warschburger P. The unhappy obese child. Int J Obes (Lond) 2005;29:S127–S129. [PubMed: 16385764]
28. Cramer P, Steinwert T. Thin is good, fat is bad: How early does it begin. J Appl Dev Psychol 1998;19:429–451.
29. Sigelman C, Miller T, Whitworth L. The early development of stigmatizing reactions to physical differences. J Appl Dev Psychol 1986;7:17–32.
30. Faith M, Leone M, Ayers T, Moonseong H, Pietrobelli A. Weight criticism during physical activity, coping skills, and reported physical activity in children. Pediatrics 2002;110:e23. [PubMed: 12165622]
31. Francis L, Lee Y, Birch L. Parental weight status and girls' television viewing, snacking and body mass indexes. Obes Res 2003;11:143–151. [PubMed: 12529497]
32. Timberlake W. Behavior regulation in learned performance: Some confusions and misapprehensions. J Exp Anal Behav 1984;41:355–375. [PubMed: 16812374]
33. Timberlake W, Farmer-Dougan VA. Reinforcement in applied settings: Figuring out ahead of time what will work. Psychol Bull 1991;110:379–391. [PubMed: 1758916]
34. Stewart SH, Samoluk SB. Effects of short-term food deprivation and chronic dietary restraint on the selective processing of appetitive-related cues. Int J Eat Disord 1997;21:129–135. [PubMed: 9062836]
35. Epstein, L.; Saelens, B. Reframing health behavior change with behavioral economics. In: Bickel, W.; Vuchinich, R., editors. Behavioral Economics of Obesity: Food Intake and Energy Expenditure. Mahwah: Lawrence Erlbaum Associates; 2000. p. 293-311.

36. Siegel PS, Pilgrim FJ. The effect of monotony on the acceptance of food. Am J Psychol 1958;71:756–759. [PubMed: 13627287]

37. Lowe MR, Butryn ML. Hedonic hunger: A new dimension of appetite? Physiol Behav 2007;91:432–439. [PubMed: 17531274]

38. Salvy SJ, Bowker JW, Roemmich JN, et al. Peer influence on children's physical activity: An experience sampling study. J Pediatr Psychol 2008;33:39–49. [PubMed: 17525088]

39. Salvy SJ, Howard M, Read M, Mele E. The presence of friends increases food intake in youth. Am J Clin Nutr 2009;90:282–287. [PubMed: 19535431]

40. Salvy SJ, Kieffer E, Epstein LH. Effects of social context on overweight and normal-weight children's food selection. Eat Behav 2008;9:190–196. [PubMed: 18329597]

41. Salvy SJ, Roemmich JN, Bowker JC, et al. Effect of peers and friends on youth physical activity and motivation to be physically active. J Pediatr Psychol 2009;34:217–225. [PubMed: 18617572]

42. Salvy SJ, Romero N, Paluch R, Epstein LH. Peer influence on pre-adolescent girls' snack intake: Effects of weight status. Appetite 2007;49:177–182. [PubMed: 17363109]

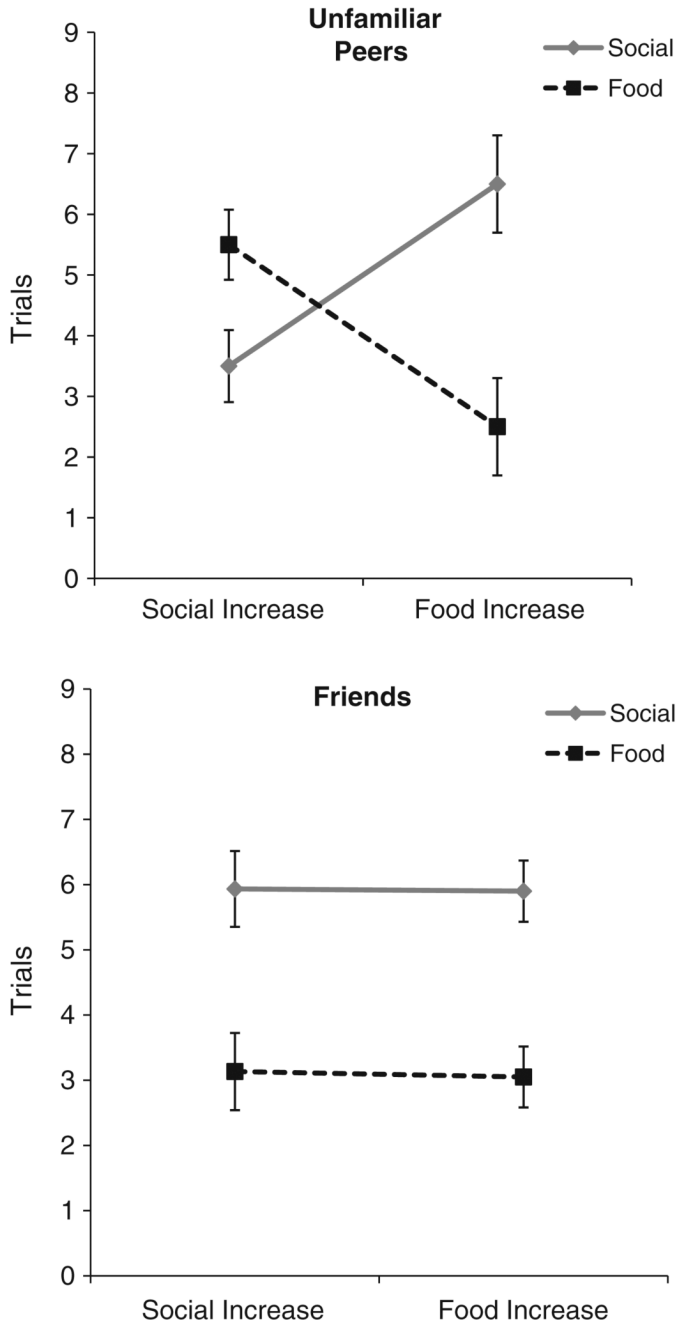

Fig. 1.

Mean number of trials (SE) completed to earn points exchangeable for food and social activity as a function of acquaintance and schedules of reinforcement. *Top graph:* when social points increased in cost, participants tested with an unfamiliar peer (n=11) responded more for food points (p<0.05). When food points increased, participants tested with an unfamiliar peer (n=8) responded more for social points (p<0.05). *Bottom graph:* when participants were tested with a friend, the increased cost of social points had no impact on participants' demand for social points

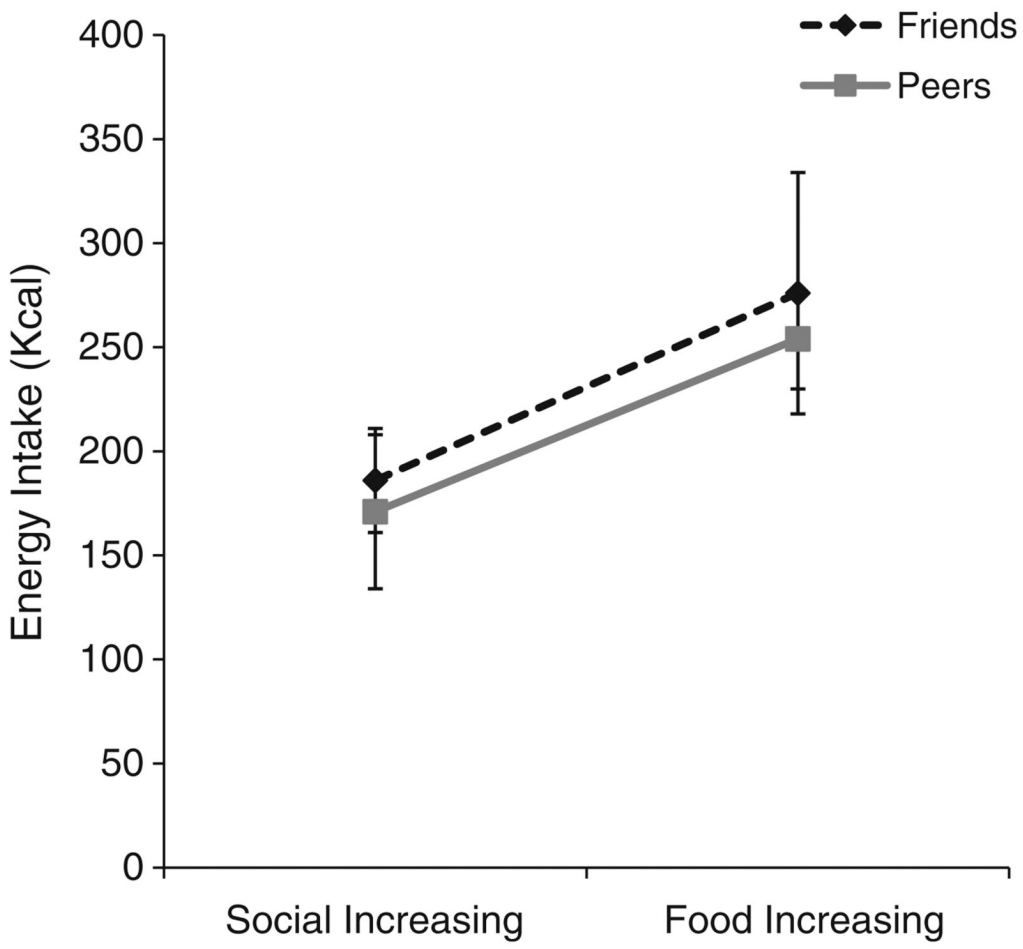

Fig. 2.
Mean food intake in kilocalories (SE) during the free-choice period as a function of acquaintance and schedule of reinforcement. Youth exposed to the increased cost of food subsequently consumed more kilocalories during the free-choice period than participants exposed to the increased cost of social activity ($p<0.05$)

Table 1

Age and body mass index-for-age percentiles (SD) of participants as a function of weight status, acquaintance, and schedule of reinforcement

	Unfamiliar Peer		Friend	
	Overweight	**Lean**	**Overweight**	**Lean**
Food increases/social fixed cost				
n	3	6	7	10
Age	11.8 (0.8)	10.9 (0.9)	10.6 (0.6)	11.3 (0.7)
BMI-for-age percentiles	94.5 (2.7)	47.6 (21.8)	94.2 (3.7)	57.4 (18.3)
Social increases/food fixed cost				
n	6	7	5	10
Age	10.4 (0.9)	10.9(0.9)	10.5 (1.1)	10.9 (0.9)
BMI-for-age percentiles	96 (2.2)	63.5 (18.1)	92.4 (3.2)	44.5 (23.9)

Table 2

Pearson correlation coefficients between participants' food intake as a function of schedule of reinforcement and acquaintance

	Social increasing		Food increasing	
	n	***r***	***n***	***r***
Friends	30	0.78*	40	0.41
Unfamiliar peers	22	0.84*	16	0.35

*$p<0.001$