Eating Behaviors 12 (2011) 309–312

Contents lists available at ScienceDirect

Eating Behaviors

Interactive effects of dietary restraint and adiposity on stress-induced eating and the food choice of children

James N. Roemmich [a,b,*], Maya J. Lambiase [a,b], Christina L. Lobarinas [a], Katherine N. Balantekin [a,b]

[a] Department of Pediatrics, School of Medicine and Biomedical Sciences, University at Buffalo, Buffalo, NY 14214, United States
[b] Department of Exercise and Nutrition Sciences, School of Public Health, University at Buffalo, Buffalo, NY 14214, United States

ARTICLE INFO

Article history:
Received 20 January 2011
Received in revised form 1 June 2011
Accepted 19 July 2011
Available online 24 July 2011

Keywords:
Psychological stress
Dietary restraint
Adiposity
Obesity
Eating
Food choice

ABSTRACT

The Individual Differences Model posits that individual differences in physiological and psychological factors explain eating behaviors in response to stress. The purpose was to determine the effects of individual differences in adiposity, dietary restraint and stress reactivity on children's energy intake and food choices. A total of 40 boys and girls, age 8–12 years, with wide ranges of dietary restraint, adiposity, and stress reactivity were measured for total energy intake and choice of energy dense 'comfort' and lower density 'healthy' foods following reading and speech stressor manipulations. When exploring the interaction of dietary restraint and stress reactivity, lower restraint/lower reactivity and lower restraint/higher reactivity were associated with reductions in energy intake (37–62 kcal) and comfort food (33–89 kcal). Higher restraint/lower reactivity was associated with consuming 86 fewer total kcal and 45 fewer kcal of comfort food. Only higher restraint/higher reactivity predicted increased energy intake (104 kcal) and comfort food (131 kcal). The interaction of dietary restraint and percentage body fat revealed that lower restraint/lower adiposity was associated with consuming 123 fewer kcal after being stressed with the entire reduction due to a decrease in comfort food. Lower restraint/higher adiposity was associated with consuming 116 kcal more after being stressed with 70% (81 kcal) of the increase in the form of comfort foods. Higher restraint/lower adiposity and higher restraint/higher adiposity were associated with smaller changes in total energy intake of 22 kcal and 1 kcal; respectively. Both restraint and adiposity moderated the effect of stress on energy intake and food choice. Children with greater adiposity may be at risk for stress-induced eating to contribute to their obesity.

1. Introduction

Stress may promote weight gain in children by increasing their energy intake, but this is an understudied area. However, some children eat more and others less in response to stress (Roemmich, Wright, & Epstein, 2002). The Individual Differences Model helps to understand how physiological and psychological factors produce varied eating responses to stress (Greeno & Wing, 1994). All obese children may not increase, and all normal weight children may not decrease, their energy intake when stressed. Rather, other individual differences, such as restrained eating may interact with adiposity to moderate stress eating. In the only investigation in this area that has studied children, those with high restraint increased snacking while children with low restraint decreased snacking when stressed (Roemmich et al., 2002). The same has been found in adults (Oliver & Wardle, 1999; Roberts, Troop, Connan, Treasure, & Campbell, 2007; Zellner et al., 2006).

Psychological stress may also shift children's food choices toward more energy dense sweet and fatty foods. It does in adults (Habhab, Sheldon, & Loeb, 2009; Wardle, Steptoe, Oliver, & Lipsey, 2000; Zellner et al., 2006), but there is only correlational evidence in children (Cartwright et al., 2003). The purpose of this study was to determine whether children change food choices when stressed and whether shifts in food choice are moderated by individual differences in children's adiposity, restraint or stress reactivity.

2. Methods

2.1. Participants

Forty children [20 boys (19 Caucasian) and 20 girls (14 Caucasian)], age 8–12 years participated. Inclusion criteria included no current illness or use of medications that would alter stress reactivity or appetite. Children ranged in adiposity from normal weight to obese. The average child was 11.0 ± 1.4 years with a BMI of 21.7 ± 4.8 kg/m^2 and BMI %ile of 74.9 ± 25.2. Parents provided written consent and children provided assent to participate. The study was

* Corresponding author at: State University of New York at Buffalo, Department of Pediatrics, Farber Hall, Room G56, 3435 Main Street, Building #26, Buffalo, NY 14214-3000, United States. Tel.: +1 716 829 3400; fax: +1 716 829 3993.
E-mail addresses: roemmich@buffalo.edu (J.N. Roemmich), ml62@bufalo.edu (M.J. Lambiase), clkuo@buffalo.edu (C.L. Lobarinas), kb62@buffalo.edu (K.N. Balantekin).

1471-0153/$ – see front matter © 2011 Elsevier Ltd. All rights reserved.
doi:10.1016/j.eatbeh.2011.07.003

approved by the University at Buffalo Children and Youth Institutional Review Board.

2.2. Procedure

Children were tested on stress and non-stress control days, in counterbalanced order. For 15 min, children rested by reading and coloring, and baseline perceived stress was collected using a 100 mm visual analog scale, anchored by "Not stressed"/"very stressed". On the stress day, children had 5 min to prepare and 5 min to deliver a speech about their qualities that make them a good friend. Children were told the speech would be recorded and judged by others. Once finished, they were prompted for 60 s to include any *ad lib* information to help convince others that they would make a good friend. Ego threatening stressors promote consumption of comfort foods (Lattimore & Maxwell, 2004). On the control day, children read and colored for 10 min. Perceived stress was measured immediately after both manipulations and then children were presented with 500 kcal portions of 4 foods. Two choices were 'comfort' foods, with one salty (potato chips, 5.4 kcal/g) and one sweet (M&M's®, 5.0 kcal/g) food. Two choices were 'healthier' with one salty (pretzels, 3.7 kcal/g) and one sweet (red seedless grapes, 0.6 kcal/g) food. Children completed a restraint questionnaire (Hill & Pallin, 1998) and had their height and weight measured at the end of the second visit.

2.3. Measures

2.3.1. Anthropometrics and body composition

Subscapular, triceps, abdominal, and mid-calf skinfolds were measured with a caliper to the nearest 0.5 mm. Percentage fat (%fat) was estimated from skinfolds using validated equations (Slaughter et al., 1988).

2.3.2. Food choice and dietary intake

All foods were weighed to 0.01 g. Energy consumed was determined using the information on the food labels.

2.3.3. Dietary restraint

Dietary restraint was measured with a modified and validated version of the Dutch Eating Behavior Questionnaire (DEBQ) (Hill & Pallin, 1998).

2.4. Statistical analysis

Stress reactivity was calculated as the change in perceived stress after stress. Differences in stress reactivity and total energy and food intake across control and stress days were assessed using repeated measures ANOVA. Linear regression was used to test the three-way interaction of %fat by restraint by stress reactivity on energy intake and food choice. Regression was also used to test each of the three lower-level two-way interactions, with the variable not included in the two-way interaction serving as a covariate. For instance, perceived stress reactivity served as a covariate in the model testing the interaction of %fat by restraint. All variables were added in one step. The regression models approximate ANOVA results except that the independent variables are maintained as continuous.

3. Results

3.1. Participant characteristics and stress reactivity

All study foods were rated ≥7.5 with no differences ($P>0.15$) between foods. Perceived stress ($P>0.001$) decreased 19% during the control manipulation and increased 40% during the stress manipulation.

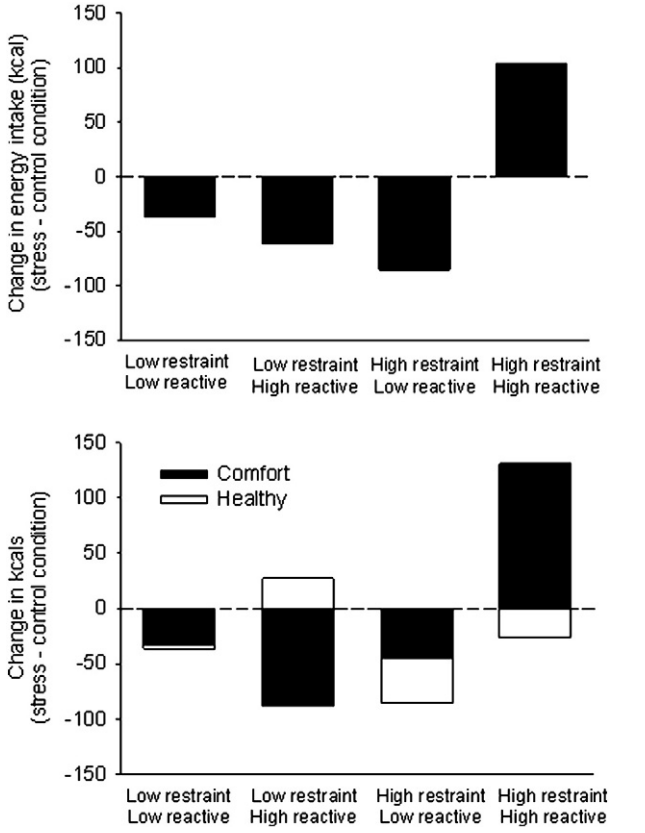

Fig. 1. Predicted changes in total energy intake (top panel) and of comfort food kcal and healthy food kcal (bottom panel) between the stress condition and the control condition in children with lower or higher dietary restraint and lower or higher stress reactivity.

3.2. Food intake

There were no differences ($P\geq0.27$) in total energy consumed, or energy of comfort or healthier foods consumed between the control and stress conditions. Neither ($P>0.62$) perceived stress reactivity, % fat nor their interaction predicted changes in energy intake. Likewise, neither ($P>0.54$) stress reactivity, % fat nor their interaction predicted changes in comfort food or healthier food energy intake.

3.3. Interaction of dietary restraint and stress reactivity

Changes in total energy consumed ($P<0.02$) and kcal of comfort food ($P<0.02$), but not healthy food consumed ($P>0.63$), were dependent on the interaction of restraint and perceived stress reactivity. As shown in Fig. 1, children with lower restraint/lower reactivity were predicted to consume 37 fewer kcal (−33 kcal comfort, −4 kcal healthy) after being stressed. Children with lower restraint/higher reactivity were predicted to consume 62 fewer kcal (−89 kcal comfort, +27 kcal healthy). Children with higher restraint/lower reactivity were predicted to consume 86 fewer kcal (−46 kcal comfort, −40 kcal healthy) after stress. Only children with higher restraint/higher reactivity were predicted to increase (104 kcal, +131 kcal comfort, −27 kcal healthy) their energy intake.

3.4. Interaction of dietary restraint and adiposity

Changes in total energy consumed ($P<0.006$) and of comfort food consumed ($P<0.02$), but not healthy food consumed ($P>0.33$), were dependent on the interaction of restraint and %fat. As main effects, both restraint and adiposity positively predicted changes in total energy intake ($P<0.005$, $P<0.003$; respectively) and healthy food intake ($P<0.007$, $P<0.02$; respectively). As shown in Fig. 2, children with lower restraint/lower %fat were predicted to consume 123 kcal