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# Emotion-Induced Eating and Sucrose Intake in Children: The NHLBI Growth and Health Study

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**Abstract: Objective:** Emotion-induced eating has been implicated as a risk factor for the development of obesity, yet no research has been done on emotion-induced eating in children. The National Heart, Lung, and Blood Institute Growth and Health Study (NGHS), a multicenter collaborative study of risk factors for obesity, developed an instrument for measuring emotion-induced eating in children and tested hypotheses regarding the association of emotion-induced eating with food intake and adiposity in preadolescent children. **Method:** Subjects were 1,213 black girls and 1,166 white girls who were 9 and 10 at study entry. Baseline data were utilized in this report. Girls were assessed by trained female health examiners who recorded height, weight, and indices of sexual maturation. Girls kept a 3-day food diary. Dietary data were coded and analyzed for total caloric and macro nutrient intake. A measure of emotion-induced eating was derived from seven questions about eating in response to emotions (Cronbach's  $\alpha = .78$ ). **Results:** Black girls had significantly higher emotion-induced eating scores than white girls (10.8 vs. 9.7,  $p < .0001$ ). For white girls, but not for black girls, emotion-induced eating was associated with increased intake of sucrose. In both races, a modest inverse association was found between body mass index and emotion-induced eating. **Discussion:** Prospective studies are needed to explore further the role of emotion-induced eating and food intake and the role of emotion-induced eating in the development of obesity. © 1999 by John Wiley & Sons, Inc. *Int J Eat Disord* 25: 389–398, 1999.

**Key words:** emotion-induced eating; obesity; food intake; race differences

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## INTRODUCTION

The prevalence of overweight and obesity in female adolescents has increased during the past decade, more so among black girls compared to white girls (Troiano, Flegal, Kuczmarski, Campbell, & Johnson, 1995). This race difference in the prevalence of obesity is remarkable because prior to pubescence, rates of obesity do not differ between black and white girls. However, after puberty, black girls are significantly heavier and more likely to be obese than white girls. The Coronary Artery Risk Development in Young Adults Study (CARDIA) confirmed the greater prevalence of obesity in black women following adolescence. Black women were heavier and more obese in every 2-year age group from age 18 to 30 years (Burke et al., 1992). This finding suggests that the divergence in body mass between the races occurs in adolescence and focuses attention on risk factors for the development of obesity operative during this period.

An extensive volume of literature has explored the role of psychological factors in the development and/or maintenance of obesity (for review, see Friedman & Brownell, 1995). A common theme of this literature has been that obesity may develop when a person's food intake is influenced by emotional states such as anxiety or depression, or when eating serves the function of coping with stressful experiences. Early theories of a link between emotions and eating, as exemplified by psychosomatic theories of obesity (for reviews see Castonguay, Eldredge, & Agras, 1995; Slochower, 1983), have found little empirical support. Recently, however, there has been a resurgence of interest in emotion-induced eating as an important etiologic factor in obesity. This renewed interest has been stimulated in part by research of psychological factors associated with binge eating disorder, a newly recognized syndrome that is particularly common among obese individuals (for review, see Yanowski, 1993). Among normal-weight and overweight binge eaters, negative mood has been found to precipitate eating binges (Arnou, Kenardy, & Agras, 1992, 1995; Davis, Freeman, & Garner, 1988; Wilson, Rossiter, Kleifield, & Lindholm, 1986). In a recent study, Eldredge and Agras (1996) found that compared to obese women who did not binge eat, obese women with binge eating disorder were significantly more likely to report eating in response to negative emotional states. To date, studies of emotion-induced eating among binge eaters have utilized clinic-based samples of obese individuals. Research of population-based study samples is needed for better generalizability.

Several review papers have been published in the past few years, each addressing the question of a relationship between emotional states, eating, and obesity (Allison & Heshka, 1993; Christensen, 1993; Ganley, 1989; Greeno & Wing, 1994). As summarized by Greeno and Wing (1994), two major theories have been formulated to explain the possible role of negative emotions in the development of obesity. According to the psychosomatic theory (Kaplan & Kaplan, 1957), obese individuals are unable to distinguish between hunger and negative emotional states, an inability that leads to eating under stress and results in obesity due to excessive caloric intake. An alternative theory was proposed by Schachter, Goldman, & Gordon (1968) who suggested that negative affective states would cause normal-weight individuals to eat less while having no impact on the eating habits of the obese. Although this theory does not predict overeating in obese individuals, it does predict a differential intake between normal-weight and overweight individuals in the face of stress or negative emotional states. Greeno and Wing (1994) concluded that laboratory studies testing these two theories have produced mixed results. Most importantly, research testing these theories has been limited largely to studying subjects who are already overweight. Although experimental manipulation of emotional states permits

investigators to examine the short-term impact of emotions or stress on food intake, and may thus shed some light on differences between normal-weight and obese individuals, such research does not permit an exploration of the role of emotion-induced eating in the development of obesity. Moreover, the literature has been based on study samples comprised almost exclusively of Caucasian participants. Given the race-related differences in obesity, research needs to explore the role of emotion-induced eating in black individuals.

In light of the fact that race differences in the prevalence of obesity emerge during puberty, as a first step, research on emotion-induced eating and obesity requires research tools for use with children. Using baseline data collected as part of a longitudinal study of risk factors for the development of obesity in girls, we used a brief questionnaire developed to measure emotion-induced eating in children. We sought to examine the correlates of emotion-induced eating in young girls with a particular focus on race, adiposity, and food intake. We hypothesized that emotion-induced eating would be associated with an increase in total caloric intake and with elevated adiposity. We further explored the association between emotion-induced eating and average daily intake of sugar and fat as a percent of calories. Given the complete lack of data about emotion-induced eating in non-Caucasian populations, we did not formulate any specific hypotheses about race and emotion-induced eating.

## METHODS

### Subjects

The National Heart, Lung, and Blood Institute (NHLBI) Growth and Health Study (NGHS) has been described previously (The National Heart, Lung, and Blood Institute [NHLBI] Growth and Health Study Research Group, 1992). Briefly, the NGHS is a collaborative study involving three clinical centers: the University of California at Berkeley, Cincinnati Children's Hospital, and WESTAT, Inc., in Rockville, Maryland. Maryland Medical Research Institute serves as the coordinating center. These clinical centers enrolled a total of 2,379 girls in the study, including 1,213 black and 1,166 white girls. Subjects were 9 and 10 years old at study entry (1987 to 1988). Participation was restricted to girls who declared themselves as either white or black and who had racially concordant parents or guardians. Berkeley and Cincinnati recruited participants from public and parochial schools, whereas WESTAT recruited subjects from the rolls of Group Health Association (now Humana Group Health Plan), a prepaid group practice in Washington, DC. Although the girls were the primary focus of the study, parents or guardians were also interviewed.

### Instruments and Procedure

#### Demographic Information

Parents or guardians were asked to provide information about their own race, their highest level of education, and household income. For all statistical analyses, maximum parental education was collapsed into three categories (high school or less; less than 4 years of college; 4 or more years of college). Household income was collapsed into three categories (less than \$20,000; \$20,000–39,999; \$40,000 or more).

### Physical Development

As previously reported (NHLBI Growth and Health Study Research Group, 1992), assessment of physical development was conducted by female health examiners who were trained at each center by the NGHS's master trainer. Weight and height were measured twice. If the two measurements differed by more than 0.3 kg or 0.5 cm, respectively, a third measurement was taken. Body mass index (BMI) was calculated ( $BMI = \text{weight [kg]} / \text{height [m]}^2$ ). Examiners rated the girls' pubic hair distribution and areolar development and obtained information on the onset of menses (Biro, Falkner, Khoury, Morrison, & Lucky, 1992; Morrison et al., 1994). Only a few girls had achieved an advanced stage of sexual maturation. For the current analysis, two stages of sexual maturation were defined, namely, prepubertal (no signs of pubertal development) and pubertal (pubertal development begun).

### Dietary Assessment

A 3-day food diary method was used based on results from a multicenter NGHS validation study conducted prior to the baseline visit (Crawford, Obarzanek, Morrison, & Sabry, 1994). Study participants received instructions on describing, measuring, and recording food intake. Each was given a set of food diagrams, measuring cups, spoons, and rulers to measure the food, a watch to aid in time recording, and notebooks in which to carry their food diary. Subjects were asked to keep a record for 3 consecutive days, 2 weekdays and 1 weekend day. All completed food diaries were reviewed with the girls by dietary interviewers. Dietary data were coded and analyzed at the Nutrition Coordinating Center at the University of Minnesota. Dietary intake was averaged over 3 days. Detailed results of the nutrient intake at baseline have been reported elsewhere (Crawford et al., 1995). For the purpose of this report, total caloric intake, percent caloric intake from sucrose, and percent caloric intake from fat were used.

### Emotion-Induced Eating Scale

At the time of this study, there were no questionnaires on the eating habits of preadolescent girls. Therefore, a Nutrition Patterns Form was developed specifically for the study.<sup>1</sup> All questions were read aloud to the girls by the health examiners. Girls recorded their answers on a 3-point scale (1 = never or almost never, 2 = sometimes, 3 = usually or always). For the purpose of this report, 18 questions were considered which related to mood eating, eating outside of regular meals, and parental control over eating. As described below, from these 18 questions, a seven-item Emotion-Induced Eating Scale was developed to reduce the number of variables for analysis. Principal components analysis with orthogonal rotation (SAS Institute, 1990) was used, entering 18 questions taken from the Nutrition Patterns Form. Only one component emerged with sufficient reliability, as measured by Cronbach's alpha (Cronbach, 1951), to be used as a scale. This Emotion-Induced Eating Scale (shown in Appendix 1) is composed of seven items concerning emotion-induced eating: eating in response to feeling sad, worried, angry ("mad"), bored, happy, eating when not hungry, and using food as a reward. Inter-item reliability as measured by Cronbach's coefficient alpha was .78 for the total sample and .77 when calculated separately for each of the two racial groups. Responses on each item were

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<sup>1</sup>Some of the questions were based on a questionnaire developed for the Berkeley Longitudinal Nutrition Study, Berkeley, CA.

## Appendix 1. Emotion-Induced Eating Scale

How well do these statements describe you? Put a mark in the box that best describes how often this happens.

	Never or Almost Never	Sometimes	Usually or Always
1. When I am worried I eat more	( )	( )	( )
2. I eat when I am mad	( )	( )	( )
3. When I do something well I give myself a treat	( )	( )	( )
4. When I am sad I eat more	( )	( )	( )
5. When I am happy I eat more	( )	( )	( )
6. When I am bored I eat more	( )	( )	( )
7. I eat between meals even when I am not hungry	( )	( )	( )

summed. A higher score indicated more emotion-induced eating. If a girl left one or more items blank ( $n = 117$ ), she did not receive an Emotion-Induced Eating Scale score.

### Data Analysis

Student  $t$  tests (for continuous variables) and chi-square tests (for categorical variables) were used to compare the black and white girls on the variables of interest. To explore race differences on the Emotion-Induced Eating Scale, a linear multiple regression model was used, entering the categorical variables of race, parental education, household income, and pubertal status, BMI as a continuous variable, and an interaction term for BMI by race. Because the interaction term was not significant ( $p = .11$ ), only the main effects model is reported.

To examine the relationship between emotion-induced eating and reported food intake, three separate regression models were constructed utilizing total caloric intake, percent of caloric intake from fat, and percent of caloric intake from sucrose as the three dependent variables. Multiple linear regression models used the model selection method where all of the independent variables specified in the model statement are fitted to the model. The following independent variables were used in the full model: race, BMI, pubertal status, education, income, emotion-induced eating as well as interaction terms for emotion-induced eating and each of the independent variables, respectively. Tests of the joint hypotheses that the coefficients of the three-level categorical variables, income and education, were equal to zero were performed for each regression model. Because of the considerable number of analyses performed, the significance level was set conservatively at  $p < .01$ .

## RESULTS

Results are presented in four sections. First, we report descriptive information on the variables used in this study. We then report reliability information on the emotion-induced eating scale and descriptive data regarding emotion-induced eating. Next, we examine the relationship between adiposity and emotion-induced eating. Last, we describe the relationship between emotion-induced eating and reported food intake. Due to

missing observations, the sample size varies slightly across the various analyses, as indicated in Tables 1 to 4.

### Sample Description

As summarized in Table 1, the black girls' parents were less well educated and reported significantly lower family incomes than the white girls' parents. Black girls were slightly older and had significantly greater mean BMI than white girls. Significantly more black girls than white girls had begun to show signs of sexual maturation.

As shown in Table 2, comparisons of mean dietary intake of kilocalories or percent of calories derived from sucrose showed no race differences. Black girls consumed more of their calories from fat, however, compared to white girls.

### Emotion-Induced Eating: Race and BMI

Black girls obtained significantly higher scores ( $M = 10.78$ ,  $SD = 3.06$ ) on the Emotion-Induced Eating Scale than white girls ( $M = 9.70$ ,  $SD = 2.59$ ,  $p < .0001$ ). As shown in Table 3, results of a multiple linear regression found that lower parental education and lower family income were associated with higher emotion-induced eating scores; an inverse relationship was found between BMI and emotion-induced eating; sexual maturation was not associated with emotion-induced eating. Even after adjusting for the effects of education, household income, pubertal status, and BMI, black girls still had significantly higher scores (adjusted mean = 10.74,  $SE = .09$ ) than white girls (adjusted mean = 9.80,  $SE = 0.09$ ,  $p < .0001$ ).

### Emotion-Induced Eating and Food Intake

Results of multiple linear regression analyses showed that emotion-induced eating scores were not associated significantly with either total caloric intake or with percent of

Table 1. Demographic and physical characteristics of the study sample

Variable	Black Girls			White Girls		
	<i>M</i>	<i>SD</i>	<i>N</i>	<i>M</i>	<i>SD</i>	<i>N</i>
Age* (years)	10.1	(0.55)	1,213	10.0	(0.55)	1,165
Mean BMI* (kg/m <sup>2</sup> )	19.2	(4.2)	1,201	17.9	(3.3)	1,159
		%	<i>N</i>	%		<i>N</i>
Parental education*						
Less than or equal to high school		37.13	450	24.46		285
Less than 4 years of college		41.75	506	25.92		302
Four or more years of college		21.12	256	49.61		578
Family income*						
Less than \$20,000		47.14	535	17.39		193
\$20,000–\$39,999		29.52	335	32.34		359
\$40,000 or more		23.35	265	50.27		558
Maturation*						
Prepubertal		35.6	425	66.4		762
Pubertal		64.4	769	33.6		386

Note: BMI = body mass index.

\* $p < .0001$ , black girls compared to white girls.

Table 2. Food intake averaged across three days

Variable	Black girls ( <i>N</i> = 1,039)		White Girls ( <i>N</i> = 1,103)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Total caloric intake	1,842	557	1,804	455
Percent kilocalories from fat*	36.64	5.54	35.09	5.25
Percent kilocalories from sucrose	13.12	5.66	13.10	5.10

\* $p < .0001$ .

caloric intake from fat. The full model regression predicting percent of caloric intake from sucrose was significant ( $p < .003$ ). Nonsignificant predictor variables were eliminated in a successive series of regression models, resulting in a final model that included race, BMI, emotion-induced eating score, and the interaction of emotion-induced eating score and race. As shown in Table 4, BMI was inversely associated with percent of caloric intake from sucrose. There was a significant interaction ( $p < .001$ ) between race and emotion-induced eating: higher scores on emotion-induced eating are associated with higher sucrose intake in white girls; in black girls, there is a slight decrease in sucrose intake associated with higher scores on emotion-induced eating but this is not statistically significant. The amount of variance explained by this regression model is very small ( $R^2 = 0.006$ ), indicating that other factors not examined influence consumption of sucrose.

## DISCUSSION

This study introduced a new brief questionnaire for assessing emotion-induced eating for use with children. According to Nunnally (1978), Chronbach's coefficient alpha should be .70 or greater for an instrument to be considered reliable. Using this criterion, our questionnaire had satisfactory inter-item reliability for both black and white girls (.77, respectively). Overall, in this sample of 9- and 10-year-olds, both black and white girls reported low levels of emotion-induced eating. Longitudinal analyses are needed to de-

Table 3. Multiple linear regression model of factors associated with Emotion-Induced Eating Scale scores ( $n = 2,103$ )

Variables	Beta-Estimate	<i>SE</i>	<i>p</i>
Intercept	10.70	0.31	.0001
Race black <sup>a</sup>	0.94	0.14	.0001
Pubertal <sup>b</sup>	-0.21	0.13	.12
BMI	-0.07	0.02	.0001
Parental education <sup>c</sup>			
Less than or equal to high school	0.31	0.18	.079
Less than 4 years of college	0.42	0.16	.009
Family income <sup>d</sup>			
Under \$20,000	0.58	0.18	.001
\$20,000-\$39,999	0.14	0.16	.37

Note: BMI = body mass index.

<sup>a</sup>Reference group: White girls.

<sup>b</sup>Reference group: Prepubertal.

<sup>c</sup>Reference group: 4 years of college or more.

<sup>d</sup>Reference group: \$40,000 or more.



Table 4. Multiple linear regression model of factors associated with percent of caloric intake from sucrose ( $n = 2,070$ )

Parameter	Beta	SE	<i>p</i>
Intercept	14.51	0.585	.0001
Race	0.011	0.245	.9646
BMI	-0.070	0.031	.0253
Emotion-induced eating <sup>a</sup>			
Black girls	-0.066	0.056	.2420
White girls	0.205	0.064	.0013

Note: BMI = body mass index.

<sup>a</sup>Separate coefficients are reported for black and white girls because the interaction term of race by emotion-induced eating was significant ( $p < .0001$ ).

termine whether levels of emotion-induced eating change with increasing age. Adjusting for race differences in education, income, and degree of pubertal status and adiposity, black girls had significantly higher emotion-induced eating scores than white girls. In absolute terms, however, the difference was small: At average levels of the independent variables, black girls scored 0.9 points higher on the emotion-induced eating scale than white girls. The clinical significance of this race difference over time needs to be explored in longitudinal analyses.

In this young age group, only a weak relationship was found between emotion-induced eating and reported food intake. Indeed, total caloric intake and percent of caloric intake from fat were not found to be related to emotion-induced eating. A very modest association was observed for percent of caloric intake from sucrose and this relationship was significant only for white girls and not for black girls. We are intrigued by this race difference. Specifically, in white girls but not in black girls, higher emotion-induced eating scores were associated with higher sucrose intake. Given that there was no significant association between total caloric intake and emotion-induced eating, it appears that emotion-induced eating is associated with a slight shift in food intake patterns for white girls but not for black girls. It is possible that a stronger association between emotion-induced eating and reported food intake will be found as the girls get older. We speculate that in this young age group, food selection and amount of food consumed are still determined in part by factors outside of the child's control (e.g., parental control over food purchase, serving sizes). With increasing autonomy over choice and amounts of food, the relationship between emotion-induced eating and overall food intake or intake of certain foods (e.g., sweets) may become more pronounced.

In this cross-sectional, adjusted analysis, a statistically significant inverse relationship between degree of overweight (as measured by BMI) and emotion-induced eating was found. The strength of this association was very modest. Several explanations of this finding require further investigation. Perhaps being thin is a risk factor for emotion-induced eating. Alternatively, thin girls may feel more comfortable than heavier girls acknowledging that they eat in response to emotions; heavier girls may have internalized already negative social biases against obesity (Crandall, 1997) and may thus be less willing to report emotion-induced eating. Lastly, it is plausible that the relationship between emotion-induced eating and food intake and adiposity may change with age: A strong direct relationship between emotion-induced eating and food intake and adiposity may not be found until girls have considerable autonomy over what and how much they eat.

In conclusion, our study has developed a measure of emotion-induced eating in chil-

dren. This instrument may now be used for exploring developmental changes in emotion-induced eating. Results from our cross-sectional analyses suggest that the relationships between emotion-induced eating and food intake with adiposity are weak at best. Prospective data are needed to further illuminate what role, if any, emotion-induced eating plays in food selection, overall caloric intake, and the development of obesity.

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