

# Emotion Regulation is Related to Children's Emotional and External Eating

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**ABSTRACT:** *Objective:* The objective of this study was to examine the associations between 2 types of emotion regulation (reactivity and inhibition) and 2 types of non-hunger-based eating (emotional eating and external eating). Although emotion regulation and eating regulation problems have both been linked to obesity in previous studies, there is little research examining the link between the two, particularly among children. *Methods:* A total of 782 rural second graders (49% girls, 20% American Indian) were followed longitudinally through third grade. During both data collection points, children participated in face-to-face interviews at school using the Children's Emotion Management Scales and the revised Dutch Eating Behavior Questionnaire. *Results:* Correlational analyses revealed that children's emotion regulation was significantly related to both external and emotional eating within and across grades, with reactivity appearing to be more consistently related to eating regulation than was inhibition. Regression analyses showed that second to third grade increases in external and emotional eating were predicted by increases in reactivity to anger and reactivity to worry. *Conclusions:* Given the established link in previous research between poor behavioral regulation and obesity in children, findings from this study linking child emotional reactivity and emotional and external eating (both forms of behavior dysregulation) are important in informing prevention and treatment programs. Based on these findings, targeting child emotion regulation in addition to behavior regulation skills as part of prevention and intervention programs may improve program effectiveness.

(*J Dev Behav Pediatr* 34:557–565, 2013) **Index terms:** pediatric obesity, emotion regulation, emotional eating, external eating.

Obesity among children has been recently referred to by the World Health Organization as one of the most “serious health challenges of the 21st century.”<sup>1</sup> Public health experts argue that multidisciplinary research is needed to understand and treat pediatric obesity.<sup>2</sup> One discipline that has become increasingly salient for understanding obesity is child development. Researchers in this field bring unique expertise in psychosocial and emotional processes, which are critical to understanding the development and maintenance of pediatric obesity.<sup>3,4</sup> Pediatric obesity can be conceived, in part, as a problem of behavior regulation. There are 2 basic types of behavior regulation likely related to obesity: inhibitory control (stopping a behavior) and activation regulation (starting

a behavior).<sup>5</sup> Eating for reasons other than hunger may be considered a problem of inhibitory control, whereas not engaging in physical activity could be considered as poor activation regulation. In this study, we are interested in what contributes to the development of unhealthy eating habits among children; therefore, we focus on inhibitory regulation of eating.

In the past 20 years, child developmental scientists have identified the regulation of emotion—not just regulation of behavior—as being vital to children's competence.<sup>6</sup> Emotion regulation refers to understanding and managing emotions, including the use of effective skills and strategies for dealing with uncomfortable emotions. Like other forms of self-regulation, it involves overriding natural responses<sup>7</sup> and can lead to problems when out of balance (i.e., when someone is overregulating or underregulating). Poor emotion regulation skills are particularly detrimental because they can lead to self-control problems in other areas.<sup>7</sup> Yet, the relation between the regulation of emotion and eating has not been well studied.

## Links Between Eating Regulation and Unhealthy Eating/Obesity

Two types of eating regulation that have been linked to unhealthy food consumption and weight problem in various populations are emotional eating (eating/overeating in response to emotion rather than hunger) and external eating (eating in response to food cues such as

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smelling or seeing food, rather than responding to physiological hunger cues).<sup>8</sup> We see both of these eating patterns as failures of regulation: in 1 case, children are not regulating eating due to how they feel internally (emotionally); in the other, children are not regulating eating because of what they perceive externally. These behavior patterns fit with 2 existing theories proposed to explain non-hunger-based eating: The psychosomatic theory of obesity conceives dysregulated eating as a way to reduce anxiety, whereas the internal/external theory of obesity explains eating/overeating as a lack of recognition of physiological cues.<sup>9</sup> External eating has become of particular interest in recent years, as children have experienced greater exposure to unhealthy foods and mass marketing strategies; among the current cohort of children, physiological cues of hunger may be overpowered by external societal stimuli.<sup>10</sup>

Emotional and external eating patterns have been linked to obesity and unhealthy eating in adult studies,<sup>9</sup> and in some,<sup>11,12</sup> but not all,<sup>13</sup> studies of adolescents. The likelihood of emotional and external eating appears to increase with age,<sup>14</sup> but we do not know whether emotional/external eating becomes more strongly associated with weight as children get older because their association with obesity has not often been examined among them.

A few studies have used middle/late childhood samples (9–12, 7–12, 9–10, and 7–8 year olds, respectively) to examine the relations between emotional and external eating and either overweight/obesity or the consumption of unhealthy foods.<sup>8,15–17</sup> Together, they suggest that children do engage in emotional and external eating and that those eating behaviors are linked to selected/specific unhealthy eating habits, and at some point, they may negatively influence children's weight status. Since a better understanding of the causes and correlates of emotional and external eating among young children might inform early efforts to prevent obesity development in later years, this study explores emotion regulation as a potential correlate of these 2 types of dysregulated eating patterns among children in the early school years.

Child overweight/obesity has been linked to self-regulation problems other than eating, such as impulsivity, poor delay of gratification, and externalizing.<sup>18</sup> Studies have found that low effortful control<sup>19</sup> and externalizing<sup>20</sup> in toddlers predict overweight longitudinally, as does self-regulation in kindergarten.<sup>21</sup> In the elementary years, poor inhibitory control relates to self-regulated eating problems (not stopping eating when full),<sup>22</sup> and self-regulation in response to chronic stress predicts the development of obesity longitudinally.<sup>23</sup> Among large national data sets, poor self-control in toddlers/preschoolers<sup>24</sup> and at age 9<sup>25</sup> were found to predict body mass index (BMI) *z* scores more than 4 years later. And in an experimental setting, impulsivity was related to overweight and to weight-loss treatment failure among 9-year-old girls.<sup>26</sup> To our knowledge, however, only 1 study has examined how the emotional aspect of

self-regulation relates to pediatric obesity. In this study, the observed poor emotion regulation among toddlers—more so than inhibitory behavioral regulation—predicted BMI-for-age and obesity status in kindergarten.<sup>19</sup>

## Is Emotion Regulation Associated with Eating Regulation?

A fair amount of research across ages has demonstrated a link between the experience (not the regulation) of negative emotions and emotional or external eating.<sup>11,27</sup> The affect regulation model<sup>28</sup> suggests that it is not the level or the frequency of negative emotions, however, but rather the lack of ability to regulate them that leads to maladaptive coping such as turning to food. The model has been supported among adult samples<sup>28</sup> but has yet to be tested in samples of children. Children's poor emotion regulation has been associated with related constructs, such as loss of control over eating<sup>29</sup> and a small body of evidence suggests that emotional eating mediates the relation between negative emotion and loss of control over eating.<sup>11</sup> In this study, we examine the direct link between children's emotion regulation patterns and their emotional and external eating.

## The Role of Age, Sex, and Ethnicity in Children's Regulation Abilities

### Age

We focus on regulation of emotion and eating among second and third graders. Early middle childhood appears to be a period in which regulation issues are salient in both emotional and eating domains. Eating and the reasons for eating change during this period. As children move through elementary school, they have increased opportunities for having autonomy over their own eating.<sup>30,31</sup> Also, satiety responsiveness decreases and food enjoyment increases from age 3 to 8 years.<sup>32</sup> Perhaps more importantly, research and theory suggest that a significant socioemotional task for elementary children is to develop competent decision-making skills, which include better management of emotions and behavior.<sup>33</sup> It may be, then, that the early elementary years are when links between regulation of emotions and eating become evident. Since weight gain and obesity prevalence increase dramatically during the later elementary years,<sup>34</sup> early middle childhood may be a key period for obesity prevention efforts.

### Sex

Some studies found that girls tend to be better self-regulators than boys (see review and analysis<sup>35</sup>). There also is evidence of sex differences in emotion regulation. For example, boys have been found to use more avoidant emotion-coping strategies than girls.<sup>36</sup> Sex differences in the prevalence of emotional/external eating also have been found, wherein adolescent girls engage in emotional eating at higher rates than do boys, and boys engage in external eating at higher rates than do girls.<sup>13,14</sup> Thus, we examine sex differences in all our regulation variables while controlling for sex in our analytic models.

## Ethnicity

Finally, we conducted analyses to determine whether there are ethnic differences in children's regulation. Our sample includes a high proportion of American Indian children (20%). We were particularly interested in examining the patterns of emotion and eating regulation for American Indian children due to their increased risk for obesity,<sup>37</sup> starting in infancy,<sup>38</sup> and due to their higher levels of stress, poverty, and discrimination, given the established relation between stress and emotional eating.<sup>39,40</sup> Also, American Indian children may face high levels of stress due to poverty and discrimination; thus, it is important for them to develop effective emotion regulation skills.<sup>41</sup> Despite the need for better understanding of emotion regulation among American Indian children, there is a lack of studies with this at-risk population, and, therefore, our analyses are exploratory.

## Current Study

In this study, we examine the regulation of specific emotions as they relate to eating regulation. Child developmentalists have come to understand that regulation of emotion may differ depending on what type of emotion is being regulated.<sup>42</sup> We examine the regulation of both anger and worry and ask the exploratory question of whether regulation of these 2 emotions differentially relates to emotional versus external eating.

We also examine 2 types of nonoptimal emotion regulation styles: inhibition and reactivity (overcontrol vs undercontrol, respectively). We propose differential hypotheses about emotion and eating regulation based on the notion of "internalizing" versus "externalizing." Emotion inhibition and emotional eating may be conceptualized as internalizing processes: In both cases, the child is responding internally to an emotion, by holding the feeling in (inhibition) and by "feeding" the feeling

with food (emotional eating). Emotion reactivity and external eating may be conceived of as externalizing processes: emotion reactivity refers to a child's response as acting negatively on the environment and external eating refers to a child responding to the outside environment without socioemotional filtering. Thus, we hypothesize that emotion reactivity will be related to external eating and emotion inhibition will be related to emotional eating.

## METHODS

### Participants and Procedures

Data were gathered as part of the Families & School for Health (FiSH) Project, a longitudinal study of 2 cohorts of children at 29 schools in 20 towns. The sample used in this study consisted of 740 children, 49.3% girls and 50.7% boys. Children's race/ethnicity was 73.0% white, 19.6% American Indian, 3.7% Hispanic/Latino, 2.1% African-American, and 1.5% multiracial/multiethnic. The schools were rural, with all but 2 of the 20 towns having a population <10,000. The average proportion of children on free/reduced price lunch (a proxy for adversity at the school level) was 65%. Children were followed from second grade through third grade, with 740 of the 930 children who participated in second grade remaining in the study at third grade (80% retention rate). Early in both spring semesters, children were interviewed during one-on-one sessions conducted by project research assistants (trained graduate or undergraduate students) in private areas of the elementary school building (e.g., in the library or at the end of a quiet hall). The University Institutional Review Board approved the project. Superintendents provided verbal approval of the project; principals, teachers, and parents provided written informed consent; and children provided assent before participating in the study. Table 1

**Table 1.** Means (Standard Deviations) and Cross-Grade Change for Regulation Variables

Measures	Second Grade		Third Grade	
	Boys	Girls	Boys	Girls
Emotion regulation Variables				
Anger regulation				
Reactivity	1.69 (.60)	1.58 (.53)	1.67 (.56)	1.54 (.52)
Inhibition	1.94 (.51)	1.91 (.53)	1.95 (.49)	1.91 (.51)
Worry regulation				
Reactivity	1.58 (.53)	1.71 (.56)	1.48 (.49)**	1.54 (.49)***
Inhibition	1.99 (.60)	1.91 (.58)	1.94 (.57)	1.89 (.54)
Eating regulation Variables				
External eating	2.28 (.53)	2.24 (.49)	2.11 (.51)***	2.06 (.50)***
Emotional eating	1.52 (.52)	1.62 (.50)	1.46 (.46)*	1.46 (.48)**

All were 3-point scales, range = 1–3. Within-grade *n* values = 740 for all variables except for emotional eating, where *n* values = 619 (second grade) and 650 (third grade). Significant within-child differences across grades (tested through paired *t* tests) are indicated by \**p* < .05, \*\**p* < .005, \*\*\**p* < .0001 in third grade column.

includes the descriptives for each variable described below.

## Measures

### Emotion Regulation: Reactivity and Inhibition as Regulation of Anger and Worry

The Children's Emotion Management Scale (CEMS)<sup>37,43</sup> was used to assess children's self-reported emotion regulation. For each emotion (anger and worry), items representing 2 nonoptimal styles of emotion regulation were assessed: reactivity (or "dysregulated expression"), referring to children's contextually or culturally inappropriate emotional expression, and inhibition, referring to children's suppression of emotional expression (1 item was dropped in this study due to low  $\alpha$ ). See Appendix for subscale items.

Children were asked how often they responded with various strategies when in situations evoking anger or worry (e.g., "When I am feeling mad, I control my temper"). Using a 3-point scale accompanied by a bar graph poster, children indicated frequency of strategy (1 = hardly ever, 2 = sometimes, 3 = often). Four mean subscale scores were computed: anger reactivity, anger inhibition, worry reactivity, and worry inhibition.

Psychometric properties of the CEMS in previous studies of somewhat older samples indicate coefficient  $\alpha$  values that range from .68 to .73 for anger (with a 10-year-old sample<sup>37</sup>) and from .69 to .74 for worry (with a 9-year-old sample<sup>44</sup>). In this study,  $\alpha$  values were relatively low: <sup>45</sup> for second and third grade, respectively,  $\alpha = .58$  and  $.58$  for anger reactivity;  $\alpha = .53$  and  $.59$  for anger inhibition;  $\alpha = .56$  and  $.54$  for worry reactivity; and  $\alpha = .58$  and  $.58$  for worry inhibition. Within-year correlations were all significant except for 2 (anger inhibition/anger reactivity in second grade and worry inhibition/anger reactivity in third grade), and all were positive except for anger inhibition/anger reactivity in third grade. Significant within-year correlation coefficients ranged from  $r = .12$  (anger reactivity/worry inhibition in second grade) to  $r = .46$  (anger inhibition/worry inhibition in third grade).

Cross-year stability was assessed in 2 ways. Correlations indicated moderate but significant stability ( $p$  values  $< .0001$ ):  $r = .26$  for anger inhibition,  $r = .36$  for anger reactivity,  $r = .17$  for worry inhibition, and  $r = .21$  for worry reactivity; and paired  $t$  tests computed using second and third grade scores (Table 1) indicated no significant within-child change across years for 3 of the 4 comparisons (worry reactivity significantly decreased in third grade).

### Eating Regulation: Emotional and External Eating

To accommodate the age of the children in our sample, we used a revised version of the Dutch Eating Behaviour Questionnaire (DEBQ<sup>15</sup>) in an interview format,<sup>46</sup> with simplified wording and a reduced response set (L. Birch, personal communication, June 14, 2005). For each item, children were first asked whether they had felt a particular emotion. If they answered "no,"

the item was scored as "nonapplicable." If they answered "yes," they were then asked to respond on the 1 to 3 scale (1 = no, 2 = sometimes, 3 = yes) indicating how frequently they engage in an eating behavior when they feel that emotion. The subscale scores represent the mean of responses to the items. (See Appendix for all subscale items.) The Emotional Eating subscale included 13 items (e.g., "Do you ever want to eat because you feel lonely?"), with item means ranging from 0.79 ("Do you ever want to eat because someone let you down?") to 1.56 ("Do you ever want to eat because you feel bored?"). The external eating subscale included 10 items (e.g., "If you see or smell something yummy do you wish that you could eat it?"), with item means ranging from 1.68 ("Do you eat a lot when you see other people eating?") to 2.56 ("If you walk past a snack bar, do you wish that you could buy something yummy?"). Nonapplicable responses were coded as missing, and when  $>50\%$  of items on a subscale were missing, the scale was coded as missing; this resulted in a decreased  $n$  for the Emotional Eating scores ( $t$  tests were computed comparing the 8 emotion regulation scores of children who were excluded from the Emotional Eating analyses vs children who were included. In second grade, all 4  $t$  tests were significant [ $p < .001$ ], with the excluded children having better emotion regulation than the other children. In third grade, only the 2 tests for differences in reactivity were significant ( $p$  values  $< .01$  and  $.005$ ), with the excluded children having higher levels of emotion regulations. See Table 1 for final  $n$  values).

The subscales of the DEBQ have been shown to be valid and reliable for children as young as 5 years old.<sup>41</sup> Cronbach's  $\alpha$  values in the present study were, for second and third grade, respectively,  $.84$  and  $.85$  for external eating and  $.90$  and  $.88$  for emotional eating. Within-year correlations between emotional and external eating were significant, second grade  $r = .40$ , third grade  $r = .53$ ,  $p$  values  $< .0001$ . Cross-year stability was suggested by significant correlations ( $p$  values  $< .0001$ ), with  $r = .39$  for emotional eating and  $r = .57$  for external eating; however, cross-year paired  $t$  tests were significant ( $p$  values  $< .0001$ ), indicating that children's responses did change between second and third grade (see Table 1 for results by sex).

## RESULTS

### Data Analysis Overview

Our analysis plan had several prongs. First, we examined if emotional and external eating were related to each other by examining bivariate correlations. We examined our primary hypotheses about the relationships between emotion regulation and eating regulation both within grade and across grade and used several approaches to fully examine hypothesized relationships. For our within-grade analyses, we used regression to predict eating regulation (emotional and external eating separately) from each emotion regulation type while

controlling for the other type and other emotion (i.e., anger reactivity and inhibition were entered simultaneously with worry inhibition and reactivity). Finally, we examined how change in emotion regulation was related to change in eating regulation.

There are several approaches to be taken when looking at change scores (e.g., repeated measures, simple change scores regression, and residualized change scores regression) and there is no one accepted approach (B. Larzelere, personal communication, October 29, 2012). We chose to predict residualized change scores in eating regulation (emotional and external separately) from residualized change scores of emotion regulation (emotional and external eating separately) to decrease the dependency in the scores.<sup>45</sup>

### Sex Differences in Emotion and Eating Regulation

We examined sex as a covariate before conducting the primary analyses because of previous research suggesting sex differences in emotion and eating regulation. A multivariate analysis of variance (MANOVA) computed with sex as the independent variable and the 8 emotion regulation variables (i.e., reactivity and inhibition for both anger and worry for both years) as dependent variables was significant,  $F_{8,719} = 5.31, p < .0001$ . MANOVA was used due to correlations among the dependent variables. Follow-up analysis of variances (ANOVAs) showed that this was due to significant sex differences in anger reactivity in both grades (boys > girls) and, in second grade, worry reactivity (girls > boys) and worry inhibition (trend for boys > girls). The MANOVA testing eating regulation also was significant,  $F_{4,561} = 2.54, p < .04$ , due primarily to a difference in emotional eating (second grade girls > boys). Due to

these patterns, we included sex as a control variable in our primary analyses.

### Ethnic Differences in Emotion and Eating Regulation

Exploratory analyses were conducted to assess whether there were differences in regulation as a function of ethnic group, particularly between American Indian and white children. A series of mixed ANOVAs was computed to examine differences in ethnicity (independent variable, 2 levels) for each set of dependent variables (across time, second to third grade; reactivity and inhibition for both anger and worry; and emotional and external eating). Results showed that the only significant ethnic difference was in anger inhibition ( $F = 3.85, p < .05$ ), with American Indian children scoring significantly higher than white children; there was a trend in the same direction for worry inhibition ( $F = 3.00, p < .08$ ).

### Associations Between Regulation of Emotion and Eating

Next, we explored how the emotion and eating regulation measures were related, both within and across grades. Results from bivariate correlation analyses, presented in Table 2, demonstrate multiple associations between emotion and eating regulation. All measures of emotion reactivity were significantly correlated with eating regulation, whereas measures of emotion inhibition were significantly or marginally correlated with eating regulation in <20% of all tests. Thus, our hypothesis that reactivity would be related to external eating was supported, but reactivity was also related to emotional eating in all cases. Inhibition of worry was related at the trend level to emotional eating in 1 of 8 cases and inhibition of anger was unrelated to emotional

**Table 2.** Bivariate Correlations Between Emotion Regulation and Eating Regulation

Emotion Regulation	External Eating		Emotional Eating	
	Second Grade	Third Grade	Second Grade	Third Grade
Anger regulation				
Reactivity				
Second grade	.26***	.19***	.18***	.17***
Third grade	.19***	.31***	.15***	.22***
Inhibition				
Second grade	.03	-.03	.06	.01
Third grade	.03	.03	.00	.04
Worry regulation				
Reactivity				
Second grade	.21***	.14***	.24***	.15***
Third grade	.14***	.27***	.12*	.26***
Inhibition				
Second grade	.03	-.01	-.05	-.01
Third grade	.12**	.12**	.07†	.05

See *n* values in Table 1. † $p < .07$ , \* $p < .005$ , \*\* $p < .001$ , \*\*\* $p < .0001$ .

eating, however, worry inhibition was related to external eating in 2 of 8 cases.

### Predicting Eating Regulation From Types of Emotion Regulation

To further examine the relation of types of maladaptive emotion regulation to types of maladaptive eating regulation, we examined within-grade data to determine which type of emotion regulation (controlling for the other type, other emotion, and sex) predicted each type of eating regulation. All 4 models were significant, with F values ranging from 10.41 to 24.41 (see Table 3). Note that, in all models, reactivity made a significant independent contribution to the variance in eating regulation.

### Predicting Change in Eating Regulation From Change in Emotion Regulation

The final set of analyses involved computing a series of multiple regression equations to examine whether a change in emotion regulation between second and third grade predicted a change in eating regulation, controlling for child sex. First, cross-year change scores were computed by regressing the third grade scores on second grade scores and standardizing the residuals. Thus, higher scores reflect an increase in dysregulated emotion or eating across years. Then, in each of the 8 equations, change in eating regulation was regressed on change in emotion regulation and sex. For example, in our first model, change in external eating was regressed on sex and change in anger reactivity, with both independent variables entered as 1 step. Table 4 summarizes the 5 models that showed significant prediction of eating regulation from emotion regulation (i.e., sig-

**Table 4.** Regression of Eating Regulation Change on Emotion Regulation Change

Criterion/Predictor	$\beta$	$R^2$
External eating, <i>df</i> (2725)		
Predicting change in external eating		.060***
Sex	.015	
Change in anger reactivity	.242***	
Predicting change in external eating		.058***
Sex	.047	
Change in worry reactivity	.239***	
Predicting change in external eating		.007†
Sex	.036	
Change in worry inhibition	.074*	
Emotional eating, <i>df</i> (2563)		
Predicting change in emotional eating		.014*
Sex	.002	
Change in anger reactivity	.117**	
Predicting change in emotional eating		.054***
Sex	.015	
Change in worry reactivity	.233***	

Change scores are cross-year standardized residual scores (i.e., second grade mean regressed on third grade mean).  $\beta$  values are standardized beta coefficients in the final equation. Sex is coded as 1 = boys and 2 = girls. † $p < .10$ , \* $p < .05$ , \*\* $p < .001$ , \*\*\* $p < .0001$ .

nificant coefficient  $\beta$  values), 3 predicting change in external eating from change in anger reactivity, worry reactivity, and worry inhibition, and 2 predicting change in emotional eating from change in anger reactivity and worry reactivity. Sex was not a significant contributor to the variance in change in eating regulation in any of the equations.

## DISCUSSION

This is the first study of its kind to examine the association between emotion regulation and emotional and external eating among children. In September 2012, Trust for America's Health (TFAH) and the Robert Wood Johnson Foundation released their annual report on obesity rates and consequent costs in health care and lost productivity.<sup>47</sup> The report projects the adult obesity rates to range from 50% to 67% by 2030 in each of the states in the United States. The elementary school-children of the decade from 2002 to 2012 will become many of the adults of 2030. Thus, it is critical to understand the correlates of these children's poorly regulated eating to improve the existing and design new and more effective pediatric obesity prevention programs. A large body of research has demonstrated associations among behavior dysregulation, eating dysregulation, and/or obesity; however, emotion regulation, despite the strong theoretical basis, has not received much attention in relation to eating regulation.

Young elementary school-aged children in our sample clearly reported non-hunger-related eating that was

**Table 3.** Regression of Eating Regulation on Emotion Regulation

Criterion/Predictor	Second Grade		Third Grade	
	$\beta$	$R^2$	$\beta$	$R^2$
External eating, <i>df</i> (5722)				
Predicting external eating		.08***		.15***
Sex	-.04		-.03	
Anger reactivity	.21***		.25***	
Anger inhibition	.00		-.02	
Worry reactivity	.14***		.19***	
Worry inhibition	-.02		.11**	
Emotional eating, <i>df</i> (5604–5635)				
Predicting emotional eating		.08***		.09***
Sex	.06		.02	
Anger reactivity	.13**		.17***	
Anger inhibition	.07		.01	
Worry reactivity	.19***		.21***	
Worry inhibition	-.10		.03	

$\beta$  values are standardized  $\beta$  coefficients. Sex is coded as 1 = boys and 2 = girls. \* $p < .05$ , \*\* $p < .01$ , \*\*\* $p < .0001$ .

correlated with their emotion regulation, specifically with their emotional reactivity. We found that both anger and worry reactivity were linked with emotional and external eating. Thus, our differential hypotheses (linking reactivity with external eating and inhibition with emotional eating) were not supported. Instead, reactivity appears to predict poorly regulated eating in an undifferentiated way, at least at this stage of middle childhood. This extends the findings from a review of studies through 2011,<sup>48</sup> which reported that 2 operational definitions of temperament, negativity and self-regulation, were linked with increased risk of pediatric obesity. Our finding that both emotional and external eating are linked to reactivity suggests that these types of poorly regulated eating may mediate the link between child self-regulation and child weight status identified in the review.<sup>46</sup> Testing this mediation model in other samples and perhaps with a broader range of emotions (e.g., sadness, loneliness) is a critical next step in pediatric obesity prevention research because mediators are the hypothetical proximal causes of weight outcomes. Thus, prevention/intervention efforts targeting immediate causes may be more effective than programs targeting more distal causes of pediatric obesity.<sup>49</sup>

Future research should explore intervention points to target in the path between emotion regulation and emotional/external eating we have identified in this study. Intervention points along the path could include influences that are causal or those that maintain the relation between the two. This research suggests several fruitful avenues to explore, including child temperament,<sup>50</sup> child executive cognitive skills,<sup>34</sup> and parenting attitudes and behaviors (parenting behaviors and their own eating patterns).<sup>51,52</sup> A recent report that early childhood prevention efforts that targeted parenting practices linked to child behavior problems not only reduced those behavior problems but also led to lower rates of obesity.<sup>53</sup> These findings support the possibility that parenting practices and styles are important avenues for intervention, as does our own previous work on the link of poorly regulated eating to parenting styles and parent-child affective patterns.

Strengths of this study are the large sample size, inclusion of children from nonurban centers, and a longitudinal design. One limitation of this study is that there were no measures of actual eating behavior (e.g., self-reports of eating); only attitudes and perceptions were assessed. Another limitation is that, although the design is longitudinal, the change in emotion and eating regulation was assessed from Grade 2 to 3, which represents a relatively short period of time. Also, the low interitem reliabilities on the Children's Emotion Management Scale subscales—perhaps due to the young age of our sample—may have led to attenuation of the correlations and  $\beta$  values. There are other emotions (e.g., loneliness, sadness) we did not assess that are likely related to weight among children that should be included in future research examining the link between emotion and eating regulation in children. Finally, although there

was an interpretable pattern of significant correlations and  $\beta$  values, the magnitude of the coefficients was quite small, and generalization should be made with caution.

## CONCLUSIONS

There is a substantial body of research showing links between negative affect and unhealthy eating patterns. The present study provides support for a mechanism linking the 2 in middle childhood, namely the path from emotion regulation to emotional/external eating, and ultimately to weight status. Future research should focus on testing this path. In addition, emotion regulation and dysregulated eating need to be examined over a longer time span in large samples of young children to identify potential changes in both.

This study provides support for the need for pediatric obesity prevention and treatment programs to expand beyond a focus on child behavioral regulation. A greater focus should be placed on child emotion regulation and providing parents with knowledge and strategies to assist their children in coping with uncomfortable emotions appropriately. Given our cross-year findings, interventions that target emotion regulation strategies have the potential to impact eating behaviors and prevent weight issues among young elementary children over time.

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## APPENDIX: Items for Emotion Regulation and External and Emotional Eating Subscales

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### Subscale items

#### Emotion regulation

##### Anger regulation

###### Inhibition

- I'm afraid to show my anger.
- I hold my anger in.
- I hide my anger.
- I get mad inside but I don't show it.

###### Reactivity

- I do things like slam doors when I am mad.
- I attack whatever it is that makes me mad.
- I say mean things to others when I am mad.

#### Worry regulation

##### Inhibition

- I hold my worried feelings in.
- I hide my worried feelings.
- I get worried inside but don't show it.

##### Reactivity

- I do things like cry and carry on when I'm worried.
- I keep whining about how worried I am.
- I can't stop myself from acting really worried.

#### Eating regulation

##### External eating

- If something tastes really yummy, do you eat a lot of it?
- If food smells and looks yummy, do you eat a lot of it?
- If you see or smell something yummy, do you wish that you could eat it?
- If you have something delicious to eat, do you eat it right away?
- If you walk past a bakery do you wish that you could buy something yummy?
- If you walk past a snack bar, do you wish that you could buy something yummy?
- If you see other people eating, do you wish that you could eat too?
- Can you stop yourself from eating yummy foods?
- Do you eat a lot when you see other people eating?
- Do you wish that you could eat when you see someone cooking something?

##### Emotional eating

- Have you ever felt frustrated? Do you ever want to eat because you feel frustrated?
  - Do you ever feel like you don't have anything to do? Do you ever want to eat because you don't have anything to do?
  - Have you ever felt depressed or discouraged? ("Discouraged" means sad and frustrated about something.) Do you ever want to eat because you feel depressed or discouraged?
  - Have you ever felt lonely? Do you ever want to eat because you feel lonely?
  - Has anyone ever let you down? Do you ever want to eat because somebody has let you down?
  - Have you ever felt angry? Do you ever want to eat because you feel angry?
  - Do you ever feel like something bad is going to happen? Do you ever want to eat because you feel like something bad is going to happen?
  - Do you ever feel worried or anxious? Do you ever want to eat because you feel worried?
  - Have you ever tried really hard and something didn't work? Do you ever want to eat because you tried and it didn't work?
  - Have you ever felt scared? Do you ever want to eat because you feel scared?
  - Have you ever felt disappointed? ("Disappointed" means feeling let down after having your hopes up.) Do you ever want to eat because you feel disappointed?
  - Do you ever get unhappy or upset? Do you ever want to eat because you get unhappy or upset?
  - Have you ever felt bored? Do you ever want to eat because you feel bored?
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