Emotion Regulation Strategies and Childhood Obesity in High Risk Preschoolers

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Keywords: Hispanic preschoolers, child eating self-regulation, child weight status, executive functioning, emotional regulation, delay of gratification

Abstract

The current study examined the relationships between the specific strategies that preschool children use to regulate their emotions and childhood weight status to see if emotion regulation strategies would predict childhood weight status over and above measures of eating self-regulation. 185 4- to 5-year-old Latino children were recruited through Head Start centers in a large city in the southeastern U.S. Children completed both a delay of gratification task (emotion regulation) and an eating in the absence of hunger task (eating regulation). Eating regulation also was assessed by maternal reports. Four emotion regulation strategies were examined in the delay of gratification task: shut out stimuli, prevent movement, **distraction**, and **attention to reward**. Hierarchical linear regressions predicting children's weight status showed that both measures of eating regulation negatively predicted child obesity, and the use of prevent movement negatively predicted child obesity. Total wait time during the delay of gratification tasks was not a significant predictor. The current findings are consistent with studies showing that for preschool children, summary measures of emotion regulation (e.g., wait time) are not concurrently associated with child obesity. In contrast, the use of emotion regulation strategies was a significant predictor of lower child weight status. These findings help identify emotion regulation strategies that prevention programs can target for helping children regulate their emotions and decrease their obesity risk.

Keywords: Hispanic preschoolers, child eating self-regulation, child weight status, executive functioning, emotional regulation, delay of gratification

Introduction

A growing body of research now demonstrates that children's self-regulation plays an important role in the development of childhood obesity (Frankel et al., 2012; French, Epstein, Jeffery, Blundell, & Wardle, 2012; Laing, Matheson, Kaye, & Boutelle, 2014). This research shows that for preschoolers, school age children, and adolescents, eating self-regulation (as assessed by compensation trials, eating in the absence of hunger tasks, and maternal ratings) is negatively associated with childhood obesity (e.g., Butte et al., 2007; Carnell & Wardle, 2008; Fisher & Birch, 1999; Johnson & Birch, 1994; Kral et al., 2012; Shoemaker et al., 2010; Sleddens, Kremers, & Thijs, 2008). Emotion regulation is related to later child weight status as well. Numerous longitudinal studies of delay of gratification—the ability to resist temptation for an immediate reward and wait for a later reward—show that children who can delay gratification longer during the preschool (Francis & Susman, 2009; Schlam, Wilson, Shoda, Mischel, and Ayduk, 2013; Seeyave et al., 2009) or the middle childhood years (Duckworth, Tsukayama, & Geier, 2010; Evans, Fuller-Rowell, & Doan, 2012) have lower BMIs in middle childhood, adolescence, and adulthood. Two recent studies of preschoolers (Hughes, Power, O'Connor, & Fisher, 2015; Pieper & Laugero, 2013), however, found no *concurrent* relationships between delay of gratification and child weight status. Hughes and colleagues (2015) explained these findings by arguing that emotion-regulation may be less important for weight status in the preschool years because parents make most food decisions for their preschoolers, minimizing the role of self-regulation in the development of childhood obesity during this period.

The purpose of this study was to further explore the role of emotion regulation in the development of childhood obesity during the preschool years. Before concluding that emotion regulation plays a limited role during this time period, we thought it would be important to go

beyond examining the *amount* of emotion-regulation that children showed in a delay of gratification task to examining the *strategies* that children used to regulate their emotions. We felt that by examining the *ways* that children attempted to control their emotions in the challenging delay of gratification task (a *process* measure), would be a more sensitive measure of their approach to emotion regulation than simply the total amount of time that they waited (an *outcome* measure). The preschool years are an important period for the development of emotion regulation skills (Zeman, Cassano, Perry-Parrish, & Stegall, 2006), so focusing on specific strategies should provide a more detailed picture of the child's emerging self-regulatory abilities than the total time that the child waited. To more effectively examine the contribution of emotion regulation strategies, we first controlled for children's eating regulation—in particular two measures of satiety—kilocalories consumed in the eating in the absence of hunger task (Fisher & Birch, 1999) and maternal ratings of food responsiveness (Wardle, Guthrie, Snaderson, & Rappoport, 2001), to see if these emotion regulation strategies predicted childhood weight status over and above measures of eating regulation.

Methods

Participants

Participants were 187 low-income, Hispanic mother-child dyads (2 grandmothers) recruited through Head Start centers in a large urban city in southeastern United States. Participants were consented in their language of choice (77% Spanish) and gave permission for their own and their child's participation. Mean child age was 57.4 months (SD = 5.2 months); 48% of the children were female. Additional information on participant demographics can be found in Hughes et al. (2015). The study was reviewed and approved by the Institutional Review Board at Baylor College of Medicine.

Procedures

Detailed information on the study procedures and on the reliability and validity of the measures is provided in Hughes et al. (2015). Mothers and children came to the observation laboratory on two separate days, one week apart, participating in the assessments described below, along with other assessments not relevant to the current paper. All of the assessments used here were completed at the second visit, with the exception of the anthropometrics, which were completed at the first visit. All observational tasks were conducted in either English or Spanish, depending on the participant's preference and audio/videotaped using unobtrusive cameras placed in the testing rooms.

Measures

Eating in the Absence of Hunger Task. This task was developed by Fisher and Birch (1999) to measure child eating beyond satiation. Children were provided with a complete meal accounting for 40% of the daily food requirements for a four to five year old and questioned about their hunger after the meal. They were then left alone for 10 minutes to play with age appropriate toys and to consume a number of palatable foods. Scores on this task reflected the total number of kilocalories eaten in the absence of hunger for each child. Because the final scores were highly positively skewed, the data were recoded into three categories: 1 = less than 20 kilocalories ($n = 37$); 2 = 20 to 125 kilocalories ($n = 74$); 3 = greater than 125 kilocalories ($n = 75$). The first group was defined as children who ate no food or ate a very minimal amount (the distribution showed a natural break at 20 kilocalories); the second and third groups were defined by a median split of the remaining children. High values reflected lower levels of child eating self-regulation.

Children's Eating Behavior Questionnaire (CEBQ). The CEBQ is a 35 item parent-report questionnaire measuring eight dimensions of child eating (Wardle et al., 2001). It measures eight dimensions of children's eating such emotional overeating, enjoyment of food, and food fussiness. The food responsiveness scale (e.g., my child is always asking for food) was used in the current analysis as a measure of satiety. Only one CEBQ subscale was chosen to keep the number of predictors in the regressions to a minimum—this particular scale was chosen, because like the eating in the absence of hunger task, it assessed children's interest in eating food even when they are full. The factor structure, test-retest reliability, and internal consistency of the CEBQ have been established (Wardle et al., 2001). The CEBQ has been used successfully in low-income samples (Frankel et al., 2014).

Delay of Gratification Task. Emotion regulation was assessed with a task developed by Mischel and Ebbesen (1970) to measure the child's ability to resist temptation for an immediate, smaller reward (small pile of snacks) and wait for a later, larger reward (large pile of the same snack). For the snacks, children were given a choice between M&Ms, animal crackers, or pretzels (before offering the choice, the experimenter excluded any foods that the mother did not want her child to eat and replaced the excluded foods with raisins and/or Teddy Grahams). The smaller reward consisted of 3 items of the child's chosen food; the larger reward was 9 items. The child was instructed that if he/she could wait until the staff member returned (total of seven minutes), he/she could have the larger of the two piles; if the child could not wait, he/she must ring a bell and receive the smaller pile of food. Scores reflected the amount of time the child waited before ringing the bell or eating the food. The distribution of scores was bimodal (reflecting a very short wait time versus waiting the entire time); therefore, data were recoded into three categories: 1 = waited less than a minute ($n = 85$); 2 = waited between one and seven

minutes ($n = 28$); and 3 = waited the entire time ($n = 67$). High scores represented higher levels of self-regulation. One minute was chosen as the cutoff because this corresponded to a natural break in the distribution and reflected children who essentially did not wait to ring the bell.

Anthropometrics. Child height and weight measurements were taken by trained staff following procedures described by Lohman, Roche, and Martorell (1988). Children were dressed in light clothing and asked to remove their shoes. Height and weight were measured in duplicate to assure accuracy; the two scores were averaged. Scores were converted to age- and gender- specific BMI z-scores using the revised 2000 growth charts from the Centers for Disease Control and Prevention (Kuczmarski, Ogden, & Guo, 2002).

Coding Stress Behaviors and Emotion Regulation Strategies

Using a computer-based system, Noldus: Observer XT, two graduate students coded stress behaviors and emotion regulation strategies exhibited by the children during the delay of gratification task. The coding system was developed by identifying behaviors studied in previous investigations and conducting pilot observations on 15 children. Emotion regulation strategies were those identified in previous studies using the delay of gratification task (i.e., Funder, Block, & Block, 1983; Mischel & Mischel, 1983; Santucci et al., 2006), as well as some additional behaviors identified in the pilot videos. The emotion regulation behaviors fell into four categories: shut out stimuli (e.g., cover eyes), prevent movement (e.g., restrain hands, put hands under table), **distraction** (e.g., inspect object), and **attention to reward** (e.g., manipulates treats or bell).

The delay of gratification task videos were watched six times, each time coding for a different group of codes (i.e., body, hand, duration, facial, gazing, and verbal). Within the coding scheme, two types of codes were used: frequency and duration. Frequency codes

recorded each occurrence of the behavior and duration codes recoded the length of time in seconds a specific behavior occurred. Inter-coder reliability met acceptable standards (Kappa = .89). Because different behaviors were coded during separate passes through the videos, behaviors were allowed to co-occur.

Statistical Analyses

All statistics were run using the Statistical Package for the Social Sciences (SPSS, Version 20.0, Chicago, IL). Statistical significance was set at p -value <0.05. Descriptive statistics were generated for all variables and used to examine distributions. The non-normal distributions for the eating in the absence of hunger and the delay of gratification task required that these variables be recoded into three levels as described above. Because children who waited longer had a greater chance to engage in the various emotion regulation strategies, the frequency of each frequency code was divided by the total length of the session, which provided a rate of frequency per minute. For the same reason, the duration of the individual duration codes was divided by the total length of the session, which provided a proportion of the session that the behaviors occurred. Because many of the codes were low frequency, after the data were transformed, the emotion regulation strategy codes were combined into the four a priori categories described above: shut out stimuli, prevent movement, distraction, and attention to reward. For those constructs where frequency codes needed to be combined with duration codes, the measures were first standardized before adding them together to give the frequency and duration composites equal weightings.

The main study questions were tested with two linear regressions predicting children's BMI z score. Variables were entered in three steps and the significance of the R^2 change assessed. The first two steps were the same in both regressions: demographics in Step 1 (i.e.,

child sex and age) and eating regulation in Step 2 (eating in the absence of hunger and food responsiveness). The predictor variables in Step 3 differed for the two regressions. In the first regression, the predictor variable in Step 3 was the delay of gratification score (i.e., time waited); in the second regression, Step 3 the four emotion regulation strategy scores were entered simultaneously: shut out stimuli, prevent movement, **distraction**, and **attention to reward**. Preliminary analyses showed no interactions with child sex in predicting weight status, so separate analyses by child sex were not conducted.

Results

Correlations

Presented in Table 1 are the correlations between the study variables. As can be seen in the table, the only significant sex difference was that mothers rated their boys as showing greater food responsiveness than girls. A number of age differences were significant. Older children ate more in the absence of hunger, waited longer in the delay of gratification task, and were more likely than younger children to use two strategies: prevent movement and **distraction**. Three strategies were positively correlated with wait time: shut out stimuli, prevent movement, and **distraction**. BMI Z was positively correlated with maternal ratings of food responsiveness, eating in the absence of hunger, and **attention to reward**. The use of prevent movement strategies was negatively correlated with BMI z. Finally, eating in the absence of hunger was positively correlated with wait time in the delay of gratification task and the four delay of gratification strategy measures showed small to moderate correlations with one another (range of correlations: $r = -.08$ to $r = .37$, mean intercorrelation = .13).

Regressions

The results of the two hierarchical linear regressions are presented in Tables 2 and 3. As can be seen in the tables, for both analyses, the demographics did not significantly account for any of the variance in child BMI z score in Step 1, and both Food Responsiveness and Eating in the Absence of Hunger made positive independent contributions in predicting child BMI z score in Step 2. Finally, wait time in the delay of gratification task did not significantly predict BMI z score in the first regression (see Table 2), but the prevent movement strategy negatively predicted BMI z score in the second regression over and above the contribution of the eating regulation measures. (see Table 3).

Discussion

The current results show that emotion regulation during the preschool years *was* associated with childhood obesity, but only when examining the strategies that children used to regulate their emotions. These studies differ from previous studies that have **looked at concurrent correlations and** simply examined the *amount* of self-regulation (Hughes *et al.*, 2015; Pieper & Laugero, 2013), demonstrating the utility of using *process* over *outcome* measures. Moreover, these emotion regulation strategies predicted childhood obesity even after accounting for measures of eating self-regulation.

Of the four strategies studied (i.e., shut out stimuli, prevent movement, **distraction**, and **attention to reward**), all but **attention to reward** showed positive relationships with child wait time. This is consistent with earlier experimental work by Mischel and colleagues showing that the most effective strategies in this task are those that direct the child's attention away from the reward (Mischel & Ebbeson, 1970; Michel & Mischel, 1983). Also, two of the strategies (prevent movement and **distraction**) were positively associated with child age. Interestingly, only one of these "effective" strategies (i.e., prevent movement) was negatively associated with

child weight status (both in the simple correlations and the regressions), whereas the one “ineffective” strategy (i.e., attention to reward) was positively associated with child weight status in the simple correlations. The prevent movement strategy (usually putting hands under the table or sitting on hands) showed the strongest relationships with both wait time and child weight status. The reason for these relations are not clear. One possibility is that this strategy is the most sophisticated in that it is a proactive attempt by the child to prevent touching the treats or ringing the bell before the experiment returns. Children who successfully employ this strategy may show a wider range of proactive self-regulatory strategies in other situations involving the inhibition of overeating.

The results of this study should be considered in light of its limitations. Only Hispanic children from low-income families were studied. It is not clear whether the same results would have been found in a different population. Also, the cross sectional, correlational design does not allow for causal inferences. Moreover, the amount of variance in BMIz accounted for by the emotion regulation strategies in this study was rather small. Whether the size of these effects is due to the methods we used to assess emotion regulation or due to the multiple factors influencing children’s BMI (e.g., food intake, physical activity, genetics) is a question for future research. Finally, the study focused only on observable coping strategies—it is possible that the children were engaged in a number of unobservable, cognitive coping strategies as well (strategies extraordinarily difficult to assess in young children).

Despite these limitations, the study helps support the importance of emotion regulation processes in the development of obesity in early childhood. The study has numerous strengths including the examination of children from an understudied population at high risk for obesity; detailed observational coding of children’s emotion regulation strategies; and a large sample size

277 with sufficient power to identify significant effects. Further studies should be conducted with
278 larger and more diverse samples, using longitudinal or experimental designs to allow for stronger
279 inferences about causality.

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Table 1. Correlations between demographics, eating-regulation, and emotion regulation strategies.

	Female	Age in Months	Food Responsiveness	Eating in the Absence of Hunger	DOG Shut Out Stimuli	DOG Prevent Movement	DOG Distraction	DOG Attention to Reward	DOG Wait Time	BMI z
Female	--									
Age in Months	.05	--								
Food Responsiveness	-.24**	.01	--							
Eating in the Absence of Hunger	-.12	.34**	.11	--						
DOG Shut Out Stimuli	.05	.09	.05	-.02	--					
DOG Prevent Movement	.14	.25**	.01	.04	.12	--				
DOG Distraction	-.12	.19*	.11	.12	.34**	.37**	--			
DOG Attention to Reward	-.12	.01	.01	.14	-.06	-.08	.07	--		
DOG Wait Time	.10	.31**	.05	.15*	.29**	.66**	.51**	.04	--	
BMI z	-.06	.09	.18*	.21**	-.05	-.22**	-.01	.15*	-.04	--

*p < .05; **p < .01; DOG = Delay of Gratification

Table 2. Hierarchical linear regression predicting child BMI z score from demographics, eating-regulation, and delay of gratification wait time ($N = 185$)

Independent Variables	Model 1	Model 2	Model 3	R^2	R^2 Change	F Change
<u>Step 1</u>	<i>Beta</i>	<i>Beta</i>	<i>Beta</i>	0.01	0.01	$F(2,182) = 1.27$
Child sex (1 = male; 2 = female)	-0.06	0.00	0.01			
Child age in months	0.10	0.04	0.06			
<u>Step 2</u>				0.07	0.06	$F(2, 180) = 5.88^{**}$
Food Responsiveness		0.16*	0.17*			
Eating in the Absence of Hunger		0.19*	0.19*			
<u>Step 3</u>				0.08	0.01	$F(1,179) = 1.09$
DOG Wait Time			-0.08			

* $p < .05$; ** $p < .01$; DOG = Delay of Gratification

Table 3. Hierarchical linear regression predicting child BMI z score from demographics, eating-regulation, and emotion-regulation strategies ($N = 185$).

Independent Variables	Model 1	Model 2	Model 3	R^2	R^2 Change	F Change
<u>Step 1</u>	<i>Beta</i>	<i>Beta</i>	<i>Beta</i>	0.01	0.01	$F(2,182) = 1.27$
Child sex (1 = male; 2 = female)	-0.06	0.00	0.06			
Child age in months	0.10	0.04	.10			
<u>Step 2</u>				0.07	0.06	$F(2, 180) = 5.88^{**}$
Food Responsiveness		0.16*	0.18*			
Eating in the Absence of Hunger		0.19*	0.16*			
<u>Step 3</u>		.		0.15	0.08	$F(4,176) = 3.80^{**}$
DOG Shut Out Stimuli			-0.04			
DOG Prevent Movement			-0.26**			
DOG Distraction			0.04			
DOG Attention to Reward			0.10			

* $p < .05$; ** $p < .01$; DOG = Delay of Gratification