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Predicting Weight Outcomes in Preadolescence: The Role of Toddlers' Self-regulation Skills and the Temperament Dimension of Pleasure

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Abstract

Objective—To investigate the role of toddlers' self-regulation skills and temperament in predicting weight outcomes in preadolescence.

Method—Participants for this study included 195 children (114 girls) obtained from three different cohorts participating in a larger ongoing longitudinal study. At 2 years of age, participants participated in several laboratory tasks designed to assess their self-regulation abilities, including emotion regulation, sustained attention, and delay of gratification, while parents filled out a temperament questionnaire to assess toddlers' pleasure expression. Height and weight measures were collected when children were 4, 5, 7, and 10 years of age. Children also filled out a body image and eating questionnaire at the 10 year visit.

Results—Self-regulation skills in toddlers were associated with both BMI development, pediatric obesity, and body image/eating concerns. The temperament dimension of pleasure was also associated with BMI development and pediatric obesity but not body image/eating concerns.

Conclusion—Self-regulation difficulties across domains as well as temperament based pleasure in toddlers represented significant individual risk factors for the development of pediatric obesity eight years later. Early self-regulation difficulties also contributed to body image and eating concerns that typically accompanied overweight children. The mechanisms by which early self-regulation skills and temperament based pleasure may contribute to the development of pediatric obesity and associated weight concerns are discussed.

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Conflict of interest

The authors declare no conflict of interest.

Keywords

pediatric obesity; BMI; body image; self-regulation; toddlerhood; preadolescence

While childhood obesity rates appear to have plateaued in recent years, its prevalence is still high. Approximately 25% of U.S. children ages 2 to 5 years classified as overweight (BMI between 85th and 95th%ile for age and gender) or obese (BMI > 95th%ile) with that figure increasing to over 35% among school age children [1,2]. The health risks associated with pediatric obesity (e.g., hypertension) are well established [3,4] contributing to high annual public health costs[5]. Psychosocial factors such as body image dissatisfaction and disturbed eating attitudes are also considered etiological risk factors for obesity as well as eating disorders and depression [6–10]. The health and psychosocial costs associated with pediatric obesity along with its high stability highlight the need to identify its early predictors [4,11].

The present study used Rothbart's model of temperament that is comprised of two main components: Reactivity and self-regulation. Reactivity processes emerge during the newborn period and can either be positive or negative. Negative reactivity is defined by expressed and felt distress and behavioral and attentional aversion. Positive reactivity is reflected as expressed and felt positive affect and behavioral and attentional approach. Hence, the tendency to express *pleasure* is considered a temperamental dimension of positive reactivity in toddlers[12,13]. Self-regulation pertains to processes such as attention, approach, avoidance, and inhibition all of which enhance and/or inhibit reactivity [14–16]. One important dimension of self-regulation is behavioral inhibition to novel or intense stimuli (e.g. reward sensitivity) where a child regulates his or her reactivity by inhibiting a dominant response [15,17,18]. As such, an index of self-regulation must take into account both levels of reactivity as well as regulatory strategies or responses used by the child to meet the required contextual demands [19].

The development of self-regulation is a result of increasing control over attentional processes, as well as enhanced inhibitory control over motor behavior [20,21]. Mastery of earlier regulatory tasks becomes an important component of later competencies related to behavioral control, interpersonal processes, and metacognitions [20] and predicts children's adaptive functioning across domains [22–24]. Furthermore, based on observations that hunger and satiety cues are influenced by stress and socioemotional factors, researchers have started focusing on how individual differences in temperament and self-regulation skills relate to eating and subsequent obesity [25,26]. For example, toddlers' poor self-regulation skills, in particular emotion regulation, have been found to predict body mass index (BMI) development and more significant weight problems at age 5 [27]. Children with impaired capacity to delay gratification at 4 years have also been shown to be more likely to be overweight at 11 years [28]. Additionally, Francis and Susman [29] found that children who showed difficulty across a self-control and a delay of gratification task at ages 3 and 5, experienced the most rapid gains in BMI-z scores over a 9 year period compared to children who showed high self-regulation. Within the attentional domain, unmedicated children with Attention-Deficit/Hyperactivity Disorder have been shown to be 1.5 times more likely to be overweight than age-matched controls [30].

Another important mechanism entails the role of early temperament and emerging self-regulation in eating behavior—specifically, with regard to expressions of pleasure and inhibitory control. Interestingly, food intake generally stimulates hedonic pathways in the brain such as the nucleus accumbens (NA) with dopamine neurotransmission mediating the reward feelings of food [31–33]. Animal studies have shown that high fat and sweet foods mobilize greater dopamine levels within the NA compared to healthier/bland food[32] and thus establish craving pathways in adults [34]. However, it remains unclear whether such craving pathways emerge in early childhood, especially given that high fat foods in young children may not have the same deleterious consequences as high fat foods in adults.

Theoretically, there appears to be a reward deficiency syndrome stemming from abnormalities in the dopaminergic system in obese individuals [35]. This underlying biological path may potentially contribute to temperament expressions of low behavioral control via tendencies to experience pleasure. Limited cross-sectional research within the child literature has shown that overweight children score higher on temperament measures of novelty seeking [36] and approach, and exhibit high sensitivity to reward tasks [37]; both of which are thought to tap into enhanced motivation to approach pleasurable activities such as food. However, it remains unclear whether these aspects of early temperament and self-regulation longitudinally predict obesity or if they are a consequence of early overweight status [38].

It is also important to examine whether early self-regulation skills are associated with other weight related factors in preadolescence. Increased BMI has been associated with body image dissatisfaction, negative eating attitudes/behavior, and low self-esteem[6,9,39]. Body image concerns of shape and weight have also been shown to strongly influence eating attitudes and behaviors in normal weight and obese children[7,8,9, 40]. Findings have shown that greater body image dissatisfaction is associated with dieting behaviors [8,40] disordered eating in pre-adolescent and adolescent girls, [8,41,42] and poor self-esteem and depressive mood in obese adolescents [7,8,42] and adults [43]. Despite the importance of body image dissatisfaction in the etiology of obesity and psychosocial problems, there is very little research on the role of early temperament and self-regulation in the emergence of body image dissatisfaction and eating attitudes.

Psychological risk factors such as high negative emotionality and low levels of persistence in toddlers have been associated with risk of body image and eating concerns [44,45]. Childhood temperament may indicate an individual's predisposition for affective vulnerabilities associated with impulsivity toward reward or pleasure and negative emotionality. This in turn may be a risk factor for body image dissatisfaction, eating concerns, and later disordered eating behaviors. Interestingly, a cross-sectional study by Bulik and colleagues[46] has shown that disordered eating in adult women was associated with high harm avoidance and reward dependence. Confirmation that early temperament and/or deficits in early self-regulation are associated with later body image dissatisfaction and increased body mass index would begin to underscore how temperament and self-regulation may be important antecedents for obesity and emotional well-being in preadolescents when outcomes for disordered eating are more prevalent.

In summary, theoretical and empirical data support the need to further examine self-regulation processes and the temperament dimension of pleasure expression in the development of pediatric obesity. We have previously reported that self-regulation skills in toddlers predicted children's BMI and weight problems at age 5. [27] The purpose of the current study was to determine if self-regulation skills in toddlers continue to constitute significant risk factors for the development of weight problems at age 10. In addition, to our knowledge no study to date has assessed the extent to which *toddlers' tendencies to express and respond to pleasure* (e.g., hedonic positive vocalizations, laughter, etc.) predicts weight outcomes. Lastly, we sought to determine whether self-regulation deficits and the temperament dimension of pleasure predict body image concerns in 10-year-olds. We expected that deficits in self-regulation skills in toddlers as well as high temperament levels of pleasure expression would significantly predict higher BMI-z scores and body image/eating concerns at age 10.

Method

Participants

Participants for this study included 195 children (114 girls) obtained from a larger ongoing longitudinal study which was approved by the governing Institutional Review Board. The goal for recruitment was to obtain a sample of children who were at risk for developing future externalizing behavior problems that was representative of the surrounding community in terms of race and socioeconomic status (SES). Four hundred and forty seven participants were initially recruited at two-years of age through child care centers, the County Health Department, and the local Women, Infants, and Children program. The recruitment sample was diverse with 67% percent of the children classified as European American, 27% were African American, 4% were biracial, and 2% were Hispanic. At age 2, the children were primarily from intact families (77%), and families were economically diverse, with Hollingshead (1975) scores ranging from 14 to 66 (M = 39.56).

Of the original 447 participants, 399 participated at 4-years, 365 participated at the 5-years, 356 participated at the 7-years, and 357 participated at the 10-years assessment. At age 10, there were no significant differences between families who did and did not participate in terms of gender, race, SES, or 2-year externalizing T-score. The current study focused on the children for whom laboratory measures at age 2 and height/weight measurements were obtained at age 4 and 10. See Table 1 for participants' ages as there was a range of time in which parents were able to bring their children for the laboratory visit. Complete data was available on 195 children who were racially (70% Caucasian) and economically diverse (Hollingshead scores ranging from 14–66, M = 40.38) while partial data was available on 243 children.

Procedures and Measures

The focus of this study involved several laboratory assessments at the 2-year visit. When children were 2 years of age, children and their mothers were videotaped during several laboratory tasks designed to assess self-regulation skills. Task order was standardized and children were given small breaks at the end of each task to ensure no carry over effects were

experienced from one task to another. The emotion/behavior tasks described below are considered appropriate for use with young children and are typically used to elicit measures of temperament and regulation [47,48].

Two-Year Self-Regulation Measure: Sustained attention—Children were instructed to watch a 5-minute segment of the videotape "Spot," a short story about a puppy exploring a neighborhood. The *overall duration*- proportion of time the child spent looking at the video indexed sustained attention. The reliability among coders for the overall duration was excellent (r = .98).

Two-Year Self-Regulation Measure: Emotion Regulation—Children participated in two tasks designed to elicit emotion regulation: the prize in a box task, where a desirable toy (puppet) was placed in a clear box that the child was unable to open for 2 minutes, and a high chair task, where the child was placed in a high chair without any toys for 5 minutes. These tasks were coded for observed emotion regulation and emotional reactivity [47]. For reactivity, distress was defined as when the child whined, fussed, cried, or had a tantrum. A *global measure of negative reactivity* was coded on a scale from 0, meaning no negative response, to 4, meaning task ended with the child in extreme distress. Regulation was defined as the overall effectiveness of using various strategies (e.g., distraction). A *global measure of regulation* was coded on a scale from 0, meaning dysregulated or no control of distress, to 4, when the child seemed to completely regulate their distress during most of the task. The reliability Kappas for global codes were all above .80. The reactivity and regulation codes were averaged across tasks to produce a separate mean score for each. As expected the measures of emotion regulation and emotional reactivity were highly correlated (r = −.91, p<.001). Consequently, these constructs were combined by creating Z scores of both variables, reverse scoring reactivity, and then averaging these standardized scores to create a single measure of emotion regulation.

Two-Year Self-Regulation Measure: Reward Sensitivity—Children participated in a delay of gratification task in which they were presented with an appealing gift wrapped box and told there was a gift inside for them but that they could not open it for 2 minutes. The *total time touching gift,* combined time the child was in contact with the box, was used to assess reward sensitivity/inhibitory control. There was tremendous variability in this *total time touching gift score* in terms of children waiting longer than others before opening the box and also in terms of touching the box throughout the 2 minutes (e.g., children would touch the box but not quite open it). The overall time was reversed score with higher numbers indicating better inhibitory control/lower reward sensitivity. The reliability among coders was excellent (r = .99).

Two-Year Temperament—While in the laboratory, mothers filled out the Toddler Behavior Assessment Questionnaire-TBAQ [12], a 111-item scale which measures the following temperamental dimensions: Activity Level, Pleasure, Social Fearfulness, Anger Proneness, and Interest/Persistence. Caregivers indicate, on a 7-point rating scale from *never* to *always*, how often they observed the specified behavior during the past month. The TBAQ has been widely used by researchers studying children's temperament and has

adequate reliability and validity [49,50]. For the purposes of the current study, we examined the Pleasure scale (α = .84).

Anthropometrics—Trained research assistants measured children's height and weight (removing shoes and heavy outer clothing) during their 4, 5, 7, and 10-year laboratory visit. Weight was measured to the nearest 0.10 kilogram by using an analog weight scale, and height was measured to the nearest 0.1 centimeter with a measuring tape. BMI z-scores were calculated based on age/gender norms from the Centers for Disease Control [2].

Ten-Year Body Image/Eating Concerns—While in the laboratory children filled out the Body Image and Eating Questionnaire [51] which assesses concerns about being or becoming overweight (Overweight Scale; 8 items), dieting practices (Diet Scale; 3 items), and restraint of food intake (Restraint Scale; 3 items) on a yes-no or a 4- or 5-point Likert scale format. The BIEQ has adequate reliability and validity [9,51,52]. The current study examined all three subscales: Overweight (α= .85), Diet (α = .79) and Restraint (α = .70).

Data analytic strategy

All analyses were conducted using SPSS 18.0. All available data were used for each analysis. First, preliminary analyses were computed. For data reduction purposes, factor analyses were conducted to determine the viability of having a single self-regulation/temperament measure as well as a single body image/eating concern measure. Next, regression analyses were conducted to examine the extent to which early self-regulation/temperament relates to children's BMI-z scores and body image/eating concerns at 10 years of age as well as changes in BMI-z scores from ages 4 to 10. A logistic regression was then conducted to determine whether 2yr self-regulation/temperament significantly related to children's weight status at age 10

Results

Preliminary analyses

Descriptive Statistics—Descriptive statistics for all of the study's variables are presented in Table 1. An analysis of the demographic variables revealed a significant association between racial status and children's 10 yr BMI-z scores, $F(2, 252) = 7.82$, $p < .01$, and body image/eating concerns, $F(2, 287) = 7.23$, $p < .01$ as African-American children had significantly greater BMI-z scores and reported greater levels of concern regarding their body image/eating practices at 10 years of age compared to Caucasian children. Preliminary analyses did not yield any other significant associations between demographic variables (e.g., SES, sex, maternal education, age) and children's weight outcomes.

Data Reduction—A principal component factor analysis with a promax rotation was conducted to determine the feasibility of having a single self-regulation/temperament factor based on the three self-regulation tasks and the temperament dimension of pleasure. From this analysis, two factors emerged with an eigenvalue above 1 (λ =1.55 and λ =1.01), explaining 38.83% and 25.09% of the total variance across measures for this sample. The first factor contained high loadings across all three self-regulation tasks: emotion regulation

(.64), delay of gratification (.75), and sustained attention (.76) but low loading on the pleasure temperament scale (−.04). The second factor only loaded on the pleasure temperament scale (.99) with the three self-regulation tasks yielding loadings of less than .05. Hence, a single self-regulation factor was retained with higher scores being indicative of better self-regulation skills while a separate temperament factor was retained with higher scores indicative of more intensive levels of pleasure expression. Another principal component factor analysis with a promax rotation was conducted to determine the feasibility of having a single body image/eating concern factor based on the three scales of the BIEQ. From this analysis, one factor emerged with an eigenvalue above 1 ($\lambda = 2.13$), explaining 70.96% of the total variance across measures for this sample. This factor contained high loadings across all three subscales of the BIEQ: Overweight (.89), Diet (.76), and Restraint (.87). Given this result, a single factor was retained with higher scores indicative of greater body image/eating concerns.

Early Self-Regulation Skills/Temperament and 10yr Weight Outcomes

As seen in Table 2, regression analyses indicated that after controlling for racial status, self-regulation was significantly associated with 10yr BMI-z score and body image/eating concerns, $\beta = -.17$ ($p < .05$) and $\beta = -.16$ ($p < .05$), respectively. Thus, toddlers with better self-regulation skills at age 2 had lower levels of BMI-z scores and fewer body image/eating concerns at age 10. The temperament dimension of pleasure was marginally related to 10yr BMI-z score, $\beta = .12$ ($p < .07$), but not body image/eating concerns, $\beta = .03$ ($p > .05$). This indicated that toddlers who are reported by parents as having higher levels of pleasure expression at age 2 had higher levels of BMI-z scores at age 10.

Early Self-Regulation Skills/Temperament as Predictors of BMI-z score change

Regression analyses were also conducted to determine whether 2yr self-regulation skills/temperament were associated with changes in children's BMI-z scores from ages 4 to 10. As seen in Table 2, it is first important to note the stability of BMI-z score from 4 to 10 years of age as 4yr BMI was a significant and positive predictor of 10yr BMI, $\beta = .31$, $p < .001$. Most importantly, even after controlling for 4yr BMI and racial status, this analysis revealed a significant effect for the self-regulation/temperament variables on 10yr BMI-z score. Specifically, self-regulation was significantly associated with change in 10yr BMI-z score, $\beta = -.15$, $p < .05$. Thus, toddlers with better self-regulation skills at age 2 were less likely to have increases in BMI-z scores from ages 4 to 10. There also was a significant effect for the temperament dimension of pleasure, $\beta = .13$, $p < .05$, such that toddlers who are reported by parents as having higher levels of pleasure expression at age 2 had higher increases in BMI-z scores from ages 4 to 10.

Early Self-Regulation Skills/Temperament and Pediatric Obesity

Based on CDC age norms [2], children whose BMI were in the 85th percentile or greater were classified as overweight/obese ($n = 116$) while children between the 5th and 84th percentile were classified as normal ($n = 148$). Six children had a BMI < 5th percentile and were excluded from the analyses. Children in the overweight/obese and normal weight groups did

not significantly differ on any demographic variable. Table 3 depicts weight group descriptive statistics.

A logistic regression was conducted to determine whether 2yr self-regulation and temperament were associated with overweight status at age 10. To facilitate interpretation (e.g., measure an increase in the risk of obesity rather than a decrease), our self-regulation factor was reverse scored with higher scores indicative of worse functioning. We also controlled for 4yr BMI-z score. This negative self-regulation factor was significantly associated with weight status (binary outcome, 0 = normal weight and 1 = overweight/obese), odds ratio = 1.74 [1.07–2.86], $p < .05$, suggesting that for each unit increase (i.e., standard deviation) in poor self-regulation, children's odds of being classified as overweight/obese at age 10 increased by 74%. *Temperament-based* p*leasure* also was significantly associated with weight status, odds ratio = 1.47 [1.05–2.04], $p < .05$ with each unit increase in the intensity in pleasure expression corresponding to an increase of 47% in the odds of children being classified as overweight/obese at age 10.

Discussion

This study examined the extent to which individual differences in self-regulation skills and a temperament dimension assessing pleasure expression in toddlers predicted weight outcomes in preadolescence. First and consistent with this study's hypotheses, self-regulation skills in toddlers were associated with both BMI development and pediatric obesity eight years later. In fact, for every one standard deviation increase in poor self-regulation, toddlers' likelihood of being classified as overweight/obese at age 10 increased by 74%, even after accounting for early BMI. Previous longitudinal studies have shown that preschoolers with self-regulation deficits within the behavioral domain (i.e.., delay of gratification) were more likely to experience weight gain across early childhood [28,29]. We had previously reported that self-regulation skills in toddlers were associated with children's BMI and weight problems at age 5.5 [27]. With the completion of further longitudinal assessments, our findings indicated that these very early self-regulation deficits continue to constitute significant risk factors for the development of weight problems eight years later, above and beyond the effects of early BMI. Taken together, these findings showed that broad, generalized self-regulation deficits across domains (i.e., emotion, attention, behavioral) were not merely consequences of obesity but may be risk factors that emerge very early in life.

Second, along with self-regulation deficits, our findings showed that toddlers characterized by high temperament expressions of pleasure had higher odds of being overweight/obese at 10 years of age. Previous research examining the relation between early temperament and weight outcomes primarily focused on expressions of negative affect or soothability as risk factors [53–55]. Our study was the first to longitudinally examine the expression of positive affect, specifically pleasure, as a potential risk factor for the development of obesity. The examination of early pleasure responsiveness is crucial given research in the adult literature suggesting that dopaminergic dysfunction leads to impairments in reward processing that promote obesity [35]. While our study did not examine dopaminergic responses or food specific responsiveness, our findings suggest that oversensitivity to a range of novel and

pleasurable activities may have been present prior to the development of obesity and not merely a consequence of early overweight status. The exact mechanisms by which such oversensitivity to pleasure contributes to obesity in children remain unclear. Perhaps oversensitivity to pleasure interferes with satiety processes that are important in telling children when they are feeling satisfied. This type of pleasure responsiveness may also be related to children's unhealthy food preferences (e.g., high sugar/sweet) which trigger a greater dopaminergic response.

Third, lower self-regulation skills, but not the temperament dimension of pleasure, may be considered a risk factor for later body image/eating concerns in preadolescence. This unique finding was consistent with emotion regulation theories which posit that deficits in self-regulation may increase behavioral and cognitive vulnerabilities [24]. Research conducted on adolescent girls and college men have found a link between difficulties in emotion regulation and body dissatisfaction[56,57]. It may be the case that body dissatisfaction is maintained by limited self-regulatory skills. This in turn, may create deficits in later coping competencies needed to offset negative affective states produced by appearance-related schemas.

In summary, the current study found that higher levels of self-regulation skills at 2 years of age were negatively associated with higher BMI scores at age 10, decreased likelihood of experiencing greater increases in BMI from 4 to 10 years of age, and negatively related to body/image eating concerns at age 10. Conversely, lower levels of self-regulation skills at 2 years of age were associated with overweight status at 10 years of age. The temperament dimension of pleasure was related to an increased likelihood of experiencing higher increases in BMI from 4 to 10 years of age and was associated with weight status at age 10. Strengths of this study included the multidimensional assessment of self-regulation across different laboratory tasks, the inclusion of a temperament measure, and the eight year longitudinal follow-up of children's BMI and body image/eating concerns.

Limitations of the study included not having information on child eating behaviors or parental weight as this was not the primary aim of the study design. It is also important to point out that despite our longitudinal design and attempts in controlling early weight status, we cannot affirm a causal link between self-regulation and the development of obesity. It is possible that the observed association between self-regulation at 2 years and obesity at 10 years of age is a result of an unmeasured variable such as physical activity. Nevertheless, our results do provide further evidence for the importance of examining toddlers' early self-regulation skills and temperament as risk factors for the development of obesity. Given the strong effect of parental weight status on children's weight status [58], future studies should examine the extent to which parenting practices influence child weight status via child deficits in self-regulation and high intensity expression of pleasure.

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Table 1

Descriptive statistics for all variables

	M	SD	Min	Max	N
2yr Self-Regulation/Temperament Measures					
Age 2yr laboratory visit (months)	31.60	3.67	24	45	421
Emotion reactivity (L)	.79	.89	0	4	423
Emotion regulation (L)	3.27	.89	0	4	423
Sustained attention (L)	.80	.18	.16	1	422
Delay of gratification (L)	.81	.31	0	1	274
Temperament: Pleasure (P)	5.45	.65	2.79	6.84	349
4yr Weight Measures					
Age 4yr laboratory visit (months)	53.71	3.72	40	68	374
Height in centimeters (L)	108.2	5.60	91.40	134.6	356
Weight in kilograms (L)	18.95	3.36	12.70	42.18	358
Body mass index (L)	16.19	2.18	9.88	31.18	355
Body mass index Z-score (L)	.31	1.53	−11.55	4.83	355
10yr Weight Measures (months)					
Age 10yr laboratory visit	127.74	3.28	118	143	285
Height in centimeters (L)	147.10	8.00	121.90	175.3	270
Weight in kilograms (L)	45.05	13.37	24.04	122.47	270
Body mass index (L)	20.56	4.72	13.25	39.87	270
Body mass index Z-score (L)	.75	1.11	−2.61	2.73	270
Overweight concerns-BIEQ (S)	.68	.41	.13	2.0	290
Restraint eating-BIEQ (S)	.41	.50	.00	2.33	290
Diet practices-BIEQ (S)	.30	.49	.00	2.0	290

(L) = laboratory measure, (P) = parent report, (S) = self-report

Table 2

Regression Analyses Examining Predictors of 10 year Weight Outcomes, Body Image Concerns, and Change in BMI-z score from 4 to 10 years

	β	R^2
10 yr. BMI-Z score (L)		
Step 1. Racial Status	.15*	.03**
Step 2. 2yr. Self-Regulation (L)	−.17*	.07**
2yr. Temperament: Pleasure (P)	.12+	---
10 yr. Body Image/Eating Concerns (S)		
Step 1. Racial Status	.18**	.04
Step 2. 2yr. Self-Regulation (L)	−.16*	.07
2yr. Temperament: Pleasure (P)	.03	---
Change in BMI-Z score from 4 to 10 years		
Step 1. Racial Status	.11+	.16***
4yr. BMI-Z score (L)	.31***	---
Step 2. 2yr. Self-Regulation (L)	−.15*	.20**
2yr. Temperament: Pleasure (P)	.13*	---

Note.

+ $p < .09$,

* $p < .05$,

** $p < .01$,

*** $p < .001$.

(L) = laboratory measure, (P) = parent report, (S) = self-report. Standardized betas are from final step

Table 3

Demographic & self-regulation/temperament measures according to 10 year weight group

	Normal Weight (n = 148)	Overweight/Obese (n = 116)
Gender		
Male	66[a]	47[a]
Female	82[a]	69[a]
Race		
Caucasian	101[a]	68[a]
African-American	40[a]	38[a]
Other	7[a]	10[a]
Socioeconomic Status (SES)	40.33 (10.75)[a]	38.84 (11.42)[a]
2yr Self-regulation-z score (L)	.16 (.67)[a]	−.10 (.69)[b]
2yr Temperament: Pleasure Scale-z score (P)	−.10 (.97)[a]	.22 (.94)[b]

Note. Values enclosed in parentheses represent standard deviations. Means in the same row that do not share subscripts differ at $p<.05$. Chi-square analyses were conducted to examine gender and racial status differences among normal and overweight/obese groups while a t-test was conducted to examine differences in SES among weight groups. Significance tests presented for self-regulation and temperament z-scores were derived from results of the logistic regression. (L) = laboratory measure, (P) = parent report.