Obesity Pillars 5 (2023) 100049

Contents lists available at ScienceDirect

Obesity Pillars

journal homepage: www.journals.elsevier.com/obesity-pillars

Motivational and self-regulatory processes associated with weight-related parenting behaviors☆

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ARTICLE INFO

Keywords:
Motivation
Self-control
Parenting
Physical activity
Diet

ABSTRACT

Background: Parents play an influential role on their child's eating and physical activity. How maternal personality and individual differences, such as motivation and self-regulation, are associated with their weight-related parenting has yet to be studied. The current study examined relationships of mothers' motivational and self-regulatory characteristics with weight-related parenting practices.

Methods: Mothers ($N = 149$, $M_{Age} = 42.78$ years, 49% Hispanic/Latino) of school-aged children (ages 10-14 years, 55.7% female) completed questionnaires assessing behavioral inhibition system/behavioral activation system (BIS/BAS), self-control, and weight-related parenting practices (i.e., role modeling, food restriction, rule enforcement, limiting, discipline, pressure to eat). Structural equation modeling examined associations of BIS, BAS, and self-control with parenting practices.

Results: Among mothers, higher avoidance motivation was associated with difficulty with rule enforcement. Higher approach motivation was associated with less limiting of unhealthy food and sedentary behavior. Higher self-control predicted more role modeling and less difficulty with rule enforcement.

Conclusion: Findings support associations of maternal motivational and self-regulatory processes with weight-related parenting behaviors. Results may inform tailored strategies based on individual differences for family-based interventions for parenting.

1. Introduction

Childhood obesity is a critical public health problem such that one in five children in the United States (U.S.) are classified as having obesity and over 340 million children and adolescents had overweight or obesity in 2016 [1,2]. Children living with obesity have an elevated risk for metabolic and cardiovascular disorders during adolescence and adulthood [3,4]. Childhood obesity is a complex, multi-faceted chronic condition that involves the interplay between biological, behavioral, familial, social, environmental, medical, and economic factors. Evidence indicates physical activity and dietary behaviors are contributors to maintenance of a healthy weight among children, and behavioral strategies for increasing physical activity and decreasing excess caloric intake are at the foundation in pediatric weight management [4,5]. While a multitude of factors can impact children's activity, eating, and overall weight—such as access and availability, neighborhood environment, medical conditions, and other social determinants of health—parents play an important role and are often the focus of research and childhood obesity prevention programs [6–13]. For example, parenting behaviors and practices such as modeling physical activity [14–17], rewarding children with food [18–20], modeling eating fruits and vegetables [17,21,22], limiting or restricting foods [23–25], and pressure to eat [26,27] have been shown to be associated with physical activity, dietary intake and behaviors, and obesity among children and adolescents.

Parenting behaviors may be shaped by personality traits and characteristics; personality has been posited as a key contributor to individual differences in parenting because personality can relate to the way parents execute the parental role and to the quality of their close relationships [28]. Evidence suggests personality traits (e.g., Extraversion, Openness)

☆ This work was supported by the National Institutes of Health/National Heart, Lung, and Blood Institute (grant numbers R01HL119255 and 3U01HL146327-03S1).

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https://doi.org/10.1016/j.obpill.2022.100049
Received 10 October 2022; Received in revised form 2 December 2022; Accepted 5 December 2022

are associated with supportive and nurturing parenting, whereas Neuroticism is associated with controlling parenting [29,30]. Building upon the literature, distinguishing additional traits and individual differences may further clarify why parents parent in the way they do. Additionally, elucidating individual differences associated with parenting practices could yield efficacious family-based obesity prevention programs.

Personality traits associated with motivational and self-regulatory processes may be important contributing factors to parenting practices. According to Gray's model of reinforcement sensitivity, behavior is mediated by two independent motivational systems: the behavioral inhibition system (BIS) and the behavioral activation system (BAS) [31]. The BIS regulates avoidance motivation and relates to inhibition of movement towards goals by eliciting a greater response to punishment cues. Those with higher avoidance motivation may be more sensitive to anxiety-related cues and worry about consequences of conflict, thus avoid implementing rules (e.g., restricting sweets) that would upset their child [32]. In contrast, the BAS regulates approach motivation and can cause movement towards one's goals through proneness to engage in goal-directed efforts and sensitivity to reward. Individuals with higher approach motivation may be more likely to engage in behaviors such as physical activity to achieve goals of fitness, weight-loss, or other intrinsic and extrinsic rewards. Conversely, previous research suggests increased BAS is related to increased impulsivity and overeating among women [33]. While there is supporting research on BIS/BAS and parenting styles (e.g., authoritative, neglectful), the extent to which these traits relate to specific weight-related parenting practices is lesser known [34,35].

Trait measures related to self-regulation, such as self-control, may also be associated with weight-related parenting. Self-control helps override inner desires and impulses, leading to decisions that align with values, social expectations, or long-term goals [36]. Parents with higher trait self-control may inadvertently role model physical activity and healthy eating to their child by engaging in these behaviors. Research also suggests maternal self-control is associated with punishment (i.e., lower self-control increased the likelihood of ignoring a child's tantrum) and is marginally associated with monitoring children's television viewing [37]. The vast majority of research focuses on how parenting influences children's self-control, whereas whether parental self-control influences parenting is less understood.

This study assessed the relationships between motivational and self-regulatory traits with self-reported parenting behaviors related to children's eating and physical activity. It was hypothesized mothers with higher BIS scores would report more difficulty with rule enforcement and greater food restriction, limiting, and discipline. It was also hypothesized those with higher approach motivation would report more modeling of physical activity, but less role modeling of healthy eating. Lastly, we hypothesized greater self-control would be associated with more role modeling of physical activity and healthy eating, food restriction, and discipline, and associated with less pressure to eat. Given previous evidence for associations between parenting practices and children's behavioral and weight outcomes, gaining insight into potential relationships between motivational and self-regulatory traits with weight-related parenting practices can help develop person-specific models of parenting, assist practitioners in better understanding how these practices may be rooted in personality traits, and inform family-based interventions to prevent and combat childhood obesity.

2. Methods

2.1. Trial design

The current study is a cross-sectional analysis of secondary data from a larger longitudinal study, the Mothers and Their Children's Health (MATCH) study. The MATCH study is a longitudinal study on the effects of maternal stress and parenting practices on children's physical activity and healthy eating behaviors [38]. The larger study consisted of six semi-annual assessments and collected data from mother-child dyads. The current study utilizes the mothers' data from the final assessment of the study, which was the only wave that assessed motivational and self-regulatory traits.

2.2. Patients

Participants included women (N = 149) enrolled in the MATCH study. Participants were recruited through informational flyers and in-person visits by study staff at community centers and elementary schools in the larger Los Angeles, CA, USA area. The inclusion criteria for the MATCH study were: (1) having a child who is 8-12 years old at baseline, (2) custody of the child at least 50% of the time, and (3) able to read and speak English or Spanish. Study exclusion criteria were: (1) having a child who is considered underweight by a BMI percentile <5% at baseline, (2) health issues that limit physical activity, (3) currently taking medications for thyroid functions or psychological conditions such as depression, anxiety, mood disorders, and attention-deficit/hyperactivity disorder (ADHD), (4) currently pregnant, (5) currently using oral or inhalant corticosteroids for asthma, and (6) work away from home more than two weekday evenings per week (5-9 PM) or >8 h on any weekend day.

2.3. Trial visits

During data collection, women completed paper-and-pencil questionnaires either in-person or at home. All questionnaires referred to their child (ages 10-14 years at the time of the final assessment wave) who was also enrolled in the study. Research study staff measured height and weight for both the mother and child: weight was measured to the nearest 0.1 kg with an electronically calibrated digital scale (Tanita WB-11a) and height was measured to the nearest 0.1 cm with a portable statiometer (PE-AIM-101). Monetary compensation was provided for participation in the study (up to 100 USD for the mother). Mothers provided written informed consent and parental permission for their child, and children provided written assent. This study was conducted in accordance with the Declaration of Helsinki and all aspects of the study were approved by the Institutional Review Boards at the University of Southern California (HS-12-00446).

2.4. Measures

2.4.1. Approach and avoidance motivation

Questionnaires assessed differences in responsiveness to the behavioral inhibition system (BIS) and behavioral activation system (BAS) [39]. The BIS gauged reactions and behavioral responses to potentially punishing events (Cronbach's alpha = .72). On the other hand, the BAS (comprised of three subscales) referenced potentially rewarding situations and assessed how people would respond to them. The Drive subscale assessed persistent pursuit of goals (Cronbach's alpha = .78), Reward Responsiveness examined positive responses to the anticipation/occurrence of reward (Cronbach's alpha = .66), and Fun Seeking reflected desire for new rewards and willingness to approach potentially rewarding events (Cronbach's alpha = .60). Response options for all items in the BIS/BAS ranged from 1 (*very true for me*) to 4 (*very false for me*). Higher BIS scores indicated greater avoidance motivation, while higher BAS scores indicated greater approach motivation.

2.4.2. Self-control

The degree of self-control over impulses, thoughts, and emotions was assessed by an adapted 10-item version of the Brief Self-Control Scale [36,40]. The adapted version did not include the following five: "I am lazy", "I do certain things that are bad for me, if they are fun", "I wish I had more self-discipline", "Pleasure and fun sometimes keep me from getting work done", and "I have trouble concentrating". The following two items were added to the adapted version: "I get distracted easily" and

"I do things that feel good in the moment but regret later on". The adapted version also used the items "I refuse things that are bad for me, even if they are fun" and "People would say that I have very strong self-discipline", while the original version used the items "I refuse things that are bad for me" and "People would say that I have iron self--discipline". Response options ranged from 1 (*not at all like me*) to 5 (*very much like me*). Responses were averaged to create self-control scores with higher scores indicating greater self-regulation (Cronbach's alpha = .82).

2.4.3. Parental role modeling

Role modeling of healthy eating and physical activity were measured by two scales from the Home Environment Survey [41]. Role modeling of healthy eating was assessed by a 12-item scale and role modeling of physical activity was assessed by an 8-item scale. The two scales represent the mother's assessment of her child's observation of her eating behaviors and physical activity (e.g., "Does your child see you eat healthy snacks?" and "Does your child see you use physical activity as relaxation?"). Response options for both scales ranged from 1 *(never*) to 5 (*always*). Mean scores were computed, and higher scores indicated greater role modeling for healthy eating and physical activity, respectively (Healthy eating Cronbach's alpha = 0.77; Physical activity Cronbach's alpha = .61).

2.4.4. Difficulty with rule enforcement

Difficulty with rule enforcement regarding children's eating and activity behaviors were assessed by a total of five items [42]. Three items assessed difficulty with rule enforcement regarding unhealthy eating (e.g., "When I feel like I've disappointed my child I'm more likely to give into requests for treats") and two items assessed difficulty with rule enforcement regarding sedentary behavior (e.g., "It is difficult for me to enforce rules about time spent on TV or video games"). Response options for all five items ranged from 1 (*strongly disagree*) to 4 (*strongly agree*). A mean score was computed for the five items; higher scores indicated greater difficulty in rule enforcement (Cronbach's alpha = .87).

2.4.5. Food restriction and pressure to eat

Food restriction was assessed by the 8-item Restriction subscale and pressure to eat was assessed by the 4-item Pressure to Eat subscale of the Child Feeding Questionnaire [43]. Sample items for food restriction included "I have to be sure that my child does not eat too many high-fat foods" and "If I did not guide or regulate my child's eating, he/she would eat too many junk foods". A sample item for pressure to eat is "My child should always eat all of the food on his/her plate". Response options for both subscales ranged from 1 (*disagree*) to 5 (*agree*). Mean scores were computed, with higher scores indicating greater food restriction or pressure to eat, respectively (Food restriction Cronbach's alpha = .84; Pressure to eat Cronbach's alpha = .81).

2.4.6. Limiting and discipline

The Limit Setting and Discipline subscales from the Parenting Strategies for Eating and Activity Scale (PEAS) were used to assess behaviorally-based parenting strategies for diet and physical activity [44]. The Limit Setting subscale consisted of six items: two items regarding limiting unhealthy eating behaviors (e.g., soda) and four items regarding limiting sedentary behaviors (e.g., TV, video games). The Discipline subscale included five items assessing the degree to which the mother disciplines her child for partaking in unhealthy eating or sedentary behaviors. Response options for both subscales ranged from 1 (*disagree*) to 5 (*agree*). Mean scores for each subscale were computed; higher scores indicated more limiting and discipline, respectively (Cronbach's alpha for limiting = 0.88; Cronbach's alpha for discipline = .86).

2.4.7. Covariates

Participants self-reported age, Hispanic/Latino ethnicity (Hispanic/Latino; not Hispanic/Latino), annual household income, educational attainment. Mothers reported their child's biological sex at birth and ethnicity. Height and weight measurements were used to calculate body mass index (BMI; kg/m^2) and age- and sex-specific BMI *z*-scores for children using EpiInfo (CDC, Atlanta, GA). Mothers also completed the Center for Epidemiological Studies Depression Scale [45]. Analyses controlled for depressive symptoms given it is suggested to be characterized by dysfunction in BIS/BAS [46].

2.5. Statistics

Descriptive and bivariate correlations were calculated to summarize study variables. Covariates were tested in bivariate correlations and included if significantly correlated (i.e., mother's age, BMI, and depressive symptoms; child's age, sex, and BMI-*z*). Structural equation modeling with Mplus version 6 analyzed the study hypotheses. A latent variable was created for BAS with the three subscales as indicators; the factor loading of one indicator was fixed to 1. All other variables were observed variables. Two-step procedure with maximum likelihood estimation was utilized. First, we tested the measurement model to demonstrate appropriate fit of the latent variable for BAS. Variables were allowed to freely correlate. Next, we tested the structural model, which included all outcome variables with directional paths added. The following indices were used to assess model fit: comparative fit index (CFI) $\geq$0.95, root mean square error of approximation (RMSEA) $\leq$0.06, and standardized root mean square residual (SRMR) $\leq$0.08 [47]. Significance testing was done using 95% confidence intervals (CIs) generated from 5,000 bootstrap samples for direct effects. The association was significant if the CI did not include 0.

3. Results

Participant characteristics are shown in Table 1. On average, women

Table 1
Participant characteristics (N = 149).

Variable	*n* (%)
Child's sex	
Male	66 (44.3)
Female	83 (55.7)
Ethnicity[a]	
Hispanic/Latino	73 (49.0)
Not Hispanic/Latino	75 (50.3)
Annual household income[a]	
< $34,999	32 (21.5)
$35,000-$74,999	42 (28.2)
$75,000-$104,999	29 (19.5)
> $105,000	44 (29.5)
Household size[a]	
1 person	2 (1.3)
2 people	8 (5.4)
3 people	23 (15.4)
4 people	55 (36.9)
5 people	37 (24.8)
6 people	17 (11.4)
7 or more people	6 (4.0)
BMI category[a]	
Underweight	3 (2.0)
Normal Weight	40 (26.8)
Overweight	50 (33.6)
Obesity	55 (36.9)
Child BMI-*z* category[b]	
Underweight	3 (2.0)
Normal Weight	92 (61.7)
Overweight	24 (16.1)
Obesity	30 (20.1)

[a] Missing data.
[b] Children were excluded from the larger study if they had a BMI percentile in the underweight category at baseline; however, they were not unenrolled if their BMI changed to the underweight category during the study. Data presented here are from the final assessment of the study.

Table 2
Descriptive statistics and bivariate correlations.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1. BIS	-	.02	.003	.19*	-.19*	0.30**	-.04	.07	-.13	-.08	-.11	-.15	.03	.36**	.14	.14	.12	-.02
2. BAS Drive		-	.56**	.49**	.05	-.01	.05	.04	.01	-.03	.06	-.01	.08	-.10	-.01	.06	-.07	-.17*
3. BAS Fun Seeking			-	.43**	-.12	.05	.03	-.001	.09	.03	.04	-.04	.07	-.04	-.06	.11	-.18*	-.15
4. BAS Reward				-	.08	.05	-.05	.16	.11	-.03	-.04	.09	.09	-.02	.12	.03	-.08	-.17*
5. Self-control					-	-.08	.07	.07	-.01	-.09	-.18*	.35**	.20*	-.24**	.01	-.25**	-.09	-.01
6. Depression						-	-.03	.03	.02	.19*	.16	-.19*	-.20	.17*	.05	.12	.05	-.05
7. Child age							-	-.05	-.11	.02	.15	-.08	.05	-.10	-.19*	-.21*	-.16*	-.25**
8. Mother age								-	.01	-.08	-.04	.10	.07	.16*	.01	.04	-.05	-.11
9. Child sex (male)									-	-.10	-.03	.20*	.12	.05	.11	.05	.05	.13
10. Mother BMI										-	.41**	-.24**	-.13	.02	-.21*	.26**	.01	.02
11. Child BMI-*z*											-	-.16*	-.09	-.04	-.45**	.30**	-.08	-.004
12. RMHE												-	.25**	-.19*	.03	-.15	-.01	.09
13. RMPA													-	.003	.03	-.07	-.002	-.02
14. DRE														-	.26**	.42**	-.08	-.07
15. Pressure															-	.05	.11	.09
16. Restriction																-	.21*	.29**
17. Discipline																	-	.53**
18. Limiting																		-
M	19.10	10.76	10.85	16.53	3.82	7.39	12.50	43.78	.44	10.10	.55	2.88	2.10	1.97	2.17	2.76	2.63	3.89
SD	3.29	2.42	1.97	2.09	.65	9.46	.94	5.90	.50	29.39	1.10	.47	.51	.64	1.10	.94	1.01	1.06
Minimum	12	4	5	10	1.70	0	10.55	29.31	0	17.42	-2.46	1.33	1.00	1.00	1.00	1.00	1.00	1.00
Maximum	28	16	15	20	5.00	52	14.57	57.82	1	61.19	2.63	3.83	3.63	3.67	5.00	4.63	5.00	5.00

Abbreviations: BIS = behavioral inhibition system; BAS = behavioral activation system; RMHE = role modeling for healthy eating; RMPA = role modeling for physical activity; DRE = difficulty with rule enforcement.
$^{**}p < .01$, $^{*}p < .05$.

($N = 149$) were 43.78 years old ($SD = 5.90$, range = 29-58). About 56% women had a female child enrolled in the study and the average current age of the child enrolled in the study was 12.50 years old ($SD = 0.94$, range = 10-14). Participant ethnicity and family income were similar to the population from where they were recruited (Los Angeles County), based on the population estimates from 2019 [48]. Descriptive statistics and bivariate correlations among the study variables are presented in Table 2.

The measurement model demonstrated adequate model fit. Observed indicators loaded onto the BAS latent variable (loadings ≥0.64). The structural model estimated with maximum likelihood estimation demonstrated adequate model fit, $\chi^2(48) = 71.40$, $p = .02$, CFI = 0.94, RMSEA 0.06, SRMR = 0.04. Fig. 1 depicts the structural model. Results from the structural equation model are shown in Table 3. BIS was positively associated with difficulty with rule enforcement regarding unhealthy eating and sedentary behaviors; mothers who had higher avoidance motivation had greater difficulty with rule enforcement. BIS was not significantly associated with any of the other weight-related parenting practices. BAS was negatively associated with limiting unhealthy eating and sedentary behaviors, indicating that mothers who had higher approach motivation also reported less limiting of unhealthy foods and sedentary behaviors. BAS was not significantly associated with any other weight-related parenting practices. Self-control was negatively associated with difficulty with rule enforcement, such that those with higher self-control reported less difficulty with rule enforcement for unhealthy eating and sedentary behaviors. Self-control was positively associated with both role modeling for healthy eating and for physical activity; mothers with higher self-control reported more role modeling of healthy eating and physical activity. The remaining associations between self-control and weight-related parenting practices were not significant. Overall, BIS, BAS, and self-control were not associated with the following behaviors: food restriction, pressure to eat, discipline for unhealthy eating and sedentary behaviors.

4. Discussion

The current study examined the associations of motivational and self-regulatory characteristics with various weight-related parenting behaviors among a sample of mothers of school-aged children. In line with our hypothesis, mothers with higher avoidance motivation reported more difficulty with rule enforcement. In addition, mothers with higher approach motivation reported less limiting of unhealthy eating and sedentary behaviors. Higher self-control was also associated with more role modeling of both healthy eating and physical activity. Findings also suggest higher self-control was associated with less difficulty with rule enforcement. To our knowledge, this is one of the first studies to elucidate associations between individual differences in motivation and self-regulation with weight-related parenting. Results provide new insight into important trait variables to consider when developing tailored interventions for parents and families.

Mothers with higher avoidant motivation reported more difficulty with rule enforcement regarding their child's dietary and activity behaviors. Those with higher avoidant motivation have greater tendency to avoid situations that lead to punishment; therefore, mothers may be motivated to avoid conflicting situations that upset their children and thus have greater difficulty with enforcing rules (e.g., limiting TV time) [35]. Growing evidence suggests increased BIS activation raises emotional reaction to interpersonal adversity and resolution [32]. Mothers with higher BIS may seek to avert interpersonal conflict with their child by failing to enforce rules and giving into their children's requests. Future interventions can explore underlying psychosocial determinants of high BIS scores among parents and help them navigate strategies for conflict resolution and re-frame the perception of punishment.

The current study found that approach motivation was associated with limit setting, such that mothers who scored higher on the BAS scale

reported less limit setting for unhealthy foods and sedentary behaviors with their child. Mothers with greater approach motivation may be driven by the intrinsic reward of pleasing their child and as a result fail to limit favorable activities (e.g. eating sweets, watching TV). Individuals with greater trait BAS are sensitive to cues of reward, and studies have shown a positive relationship between BAS and overeating [49]. Thus, those high in approach motivation may have trouble limiting their own food intake, which may extend to failure to limit children's unhealthy eating. Mothers with higher BAS may be a good target group to educate on methods for reducing screen time (e.g., monitoring controls that turn off electronics after certain durations) and alternatives to sweets.

Self-control was associated with the widest range of parenting behaviors. Mothers with higher self-control reported increased role modeling of healthy eating and physical activity. Adults with greater self-control are more likely to engage in health-promoting behaviors (e.g., exercise) and avoid temptations (e.g., overeating) [50]. Therefore, those with higher self-control may engage in these behaviors without intent of role modeling. Given that parental role modeling is implicated in children's obesogenic behaviors [14], implementing strategies to increase self-control may indirectly influence children's activity and dietary behaviors. Family-based programs should consider the parents' personal health behaviors, while also increasing parental self-control. In addition, mothers with higher self-control reported less difficulty with rule enforcement. Those with higher self-control may be less tempted to succumb to their child's requests for fast food or video games; however, additional research should elucidate how self-control translates into parenting practices in order to inform effective interventions (e.g., mediators and moderators). Self-regulatory factors may interact with more proximal processes, such as stress, to predict maternal parenting practices; this should be examined in future empirical research. It is important to note that about 25% of the study sample indicated at least one affirmative answer to food insecurity [51]. Parenting practices may be influenced on whether the household is food secure or insecure; for example, food restriction and limiting practices may be a product of food insecurity (e.g., knowing there is not enough food to last the month) [52, 53]. Future research could examine associations between maternal motivation, self-regulation, and weight-related parenting practices within food secure and insecure households.

Table 3
Path Estimates with bootstrapped SEs and Cis.

Path	β	B	SE	95% CI
BIS → RMHE	-.05	-.01	.01	[-.03, .02]
BIS → RMPA	.14	.02	.01	[-.01, .05]
BIS → DRE	.31**	.06	.01	[.03, .09]
BIS → Pressure	.04	.01	.03	[-.05, .07]
BIS → Restriction	.14	.04	.03	[-.01, .09]
BIS → Discipline	.11	.03	.03	[-.03, .10]
BIS → Limiting	.04	.01	.03	[-.04, .08]
BAS → RMHE	-.01	-.002	.02	[-.05, .05]
BAS → RMPA	.09	.02	.03	[-.03, .09]
BAS → DRE	-.13	-.04	.04	[-.13, .02]
BAS → Pressure	.01	.01	.06	[-.12, .12]
BAS → Restriction	.08	.04	.05	[-.04, .14]
BAS → Discipline	-.15	-.08	.07	[-.23, .05]
BAS → Limiting	-.22*	-.13	.07	[-.28, -.02]
Self-control → RMHE	.32**	.23**	.06	[.12, .34]
Self-control → RMPA	.20*	.16	.07	[.03, .29]
Self-control → DRE	-.19*	-.18	.08	[-.34, -.03]
Self-control → Pressure	-.04	.01	.03	[-.33, .21]
Self-control → Restriction	-.15	-.07	.13	[-.43, .03]
Self-control → Discipline	-.07	-.10	.13	[-.35, .17]
Self-control → Limiting	.03	.05	.16	[-.26, .36]

Abbreviations: BIS = behavioral inhibition system; BAS = behavioral activation system; RMHE = role modeling for healthy eating; RMPA = role modeling for physical activity; DRE = difficulty with rule enforcement.
Covariate paths are not displayed.
**$p < .01$, *$p < .05$.

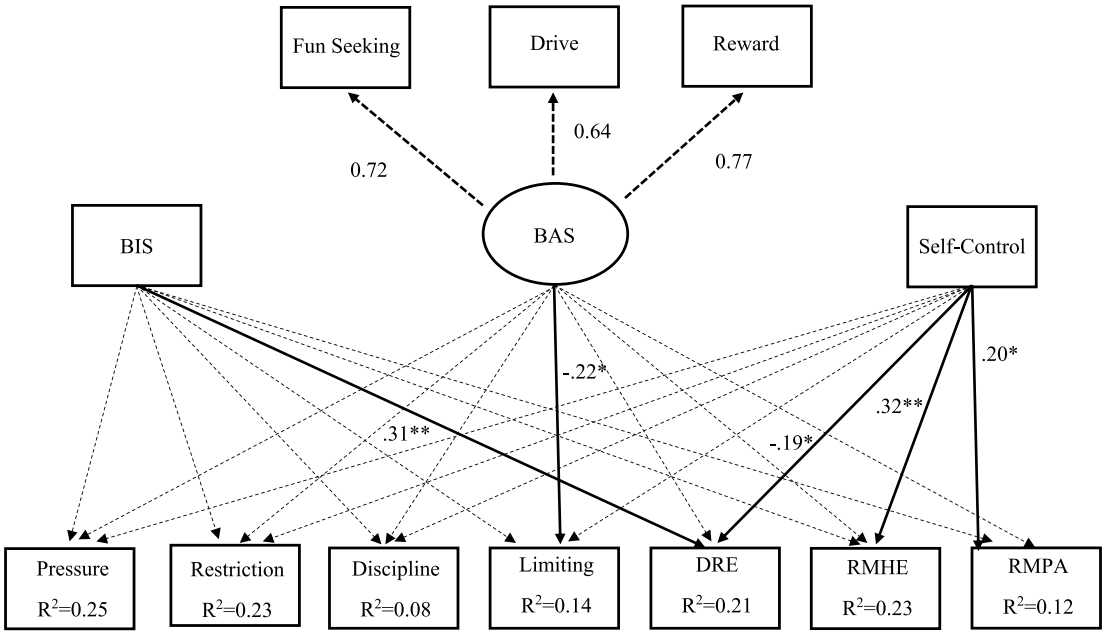

Fig. 1. Fitted structural model for motivation and self-regulation and parenting practices.
Abbreviations: BIS = behavioral inhibition system; BAS = behavioral activation system; DRE = difficulty with rule enforcement; RMHE = role modeling for healthy eating; RMPA = role modeling for physical activity.The model including the following covariates (associations not shown): mother's age, mother's BMI, child's age, child's sex, child's BMI-z, and mother's depressive symptoms.The boxes represent the observed variables. The circles represent latent variables. The dashed lines and corresponding numeric values indicate the factor loadings for the observed variables for the BAS latent variable. The solid lines indicate significant associations between the three predictors (i.e., BIS, BAS, Self-Control) and the weight-related parenting practices; the corresponding numeric values indicate the beta coefficients. The dotted lines indicate non-significant associations between the three predictors (i.e., BIS, BAS, Self-Control) and the weight-related parenting outcomes. The R^2 values indicate the effect size based on the proportion of variance explained in the outcome variable by the set of predictor variables (i.e., BIS, BAS, Self-Control).**$p < .01$, *$p < .05$.

Findings may provide insight for clinicians into why parents may partake in certain behaviors and that weight-related parenting practices can be rooted in a variety of complex reasons, including but not limited to motivational traits, self-regulation, and personality. Addressing parenting behaviors and childhood obesity requires a multidisciplinary approach and team, including specialists in psychology, behavioral counseling, public health, and primary care. The study findings demonstrate that parenting behaviors may partly stem from psychological traits. Assessments for BIS, BAS, and self-control could be incorporated into weight-management programs to elucidate how parenting practices may be influenced by different person-level traits, and what approaches may be most beneficial for the family. Parent involvement is recommended in a staged approach to weight management in children and adolescents, wherein they may play an influential role on activity and dietary behaviors [4].

Recommendations and clinical guidelines for preventing and managing childhood overweight and obesity often highlight modifying activity levels and dietary intake/behaviors [54,55]. Given that parents can play an influential role in helping children meet these recommendations, understanding potential correlates to parenting practices may help with recommendation adherence. Study findings suggest that motivational and self-regulatory traits were associated with different activity- and dietary-related parenting practices. Gained knowledge may help clinicians better understand one of the many complex correlates of parenting, and subsequently help with the development of tailored family-based intervention strategies for childhood obesity. For example, providing strategies for conflict resolution may be useful for a parent with higher avoidance motivation (e.g., greater tendency to avoid situations that lead to punishment) who is trying to limit their child's TV time.

4.1. Strengths and limitations

This study had several strengths including the assessment of multiple weight-related parenting behaviors and the use of previously validated scales of parenting practices. However, there were limitations worth noting. We were unable to determine causality and directionality due to the cross-sectional nature of the study. Furthermore, the self-reported parenting behaviors may have been biased by social desirability and other cognitive self-report biases. In addition, the Cronbach alphas for the BAS Fun Seeking subscale and role modeling for physical activity were slightly below recommendations; a low internal reliability score was also noted in the original validation of the BIS/BAS scales [39]. However, SEM takes into account measurement error through the estimation of latent variables from observed variables [56]. The study also used an adapted version of the Self-Control Scale, in which the reliability was still high (Cronbach's alpha = 0.82). Our unpublished data examining this revised Self-Control Scale in children showed evidence for construct validity. Specifically, higher self-control was positively associated with better behavior regulation (r = 0.53), better emotion regulation (r = 0.48), and better cognitive regulation (r = 0.64) [57]. It should also be noted that children in the study may have had multiple caregivers, aside from the participating mother. There may be other individuals in the home who participate in caregiving (e.g., feeding, rule enforcement); therefore, mothers' reported practices could differ based on each family's situation. This study was also restricted to mothers with a child aged 10-14 years; thus, the results may not be generalizable to other caregivers or to those who care for children of other ages. Future research should examine these associations among different populations and assess whether these parenting practices change over time. The findings may also not be generalizable to other sub-populations given the unique exclusion factors for the overall MATCH study that may co-exist with obesity (e.g., physical limitations, use of medication for depression, use of inhalants for asthma). Additionally, the study was potentially limited by not assessing other potential factors associated with weight-related parenting practices such as food insecurity, adverse life experiences, neighborhood environment, discrimination, or stress. There may be unique cultural differences between different racial and ethnic groups that play an influential role in parenting practices that were not accounted for in the current study. There are cross-cultural similarities and differences in different aspects of parenting, such as control, monitoring, discipline, and physical caregiving [58]. In example, monitoring-related behaviors can differ across cultures due to expectations about how much control parents should have over their children's decisions and activities [59]. Future research alongside developmental psychologists and anthropologists can expand upon this research to examine cross-cultural differences in maternal motivation and self-regulation.

5. Conclusions

The findings provide insight into the associations between mothers' motivational and self-regulatory factors with weight-related parenting behaviors and can improve family-based obesity interventions. Childhood obesity prevention should consider direct parenting behaviors and parental characteristics. Family-based interventions could be tailored based on mothers' motivational and self-regulatory trait profiles—measured through baseline assessments—to reduce children's health behaviors. Understanding mechanisms that govern parenting can lead to the development of more effective, tailored approaches by targeting specific concerns or common scenarios. For example, parents with greater trait BIS may benefit by incorporating conflict resolution techniques whereas others may benefit by practicing self-control.

Author contribution

The concept of the submission was by TBM and BD. Statistical analysis and data curation was performed by BD and TBM. TBM and GFD supervised the current study. Funding was acquired by GFD. BD wrote the first draft. TBM, NVL, and GFD all reviewed, edited, and approved the final submission and publication.

Ethical review

The submission represents original work. Participants provided written signed informed consent and parental permission for their child. The study was conducted in accordance with the Declaration of Helsinki and all study aspects were approved by the Institutional Review Boards at [blinded]. The Editors were not involved in the decisions about the manuscript. The manuscript was not written by Editor family members or colleagues.

Source of funding

This work was supported by the National Institutes of Health National Heart, Lung, and Blood Institute (grant number R01HL119255).

Declaration of competing interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: Genevieve F. Dunton reports financial support was provided by National Institutes of Health. Bridgette Do reports financial support was provided by National Institutes of Health. Tyler B. Mason reports financial support was provided by National Institutes of Health. Nanette V. Lopez reports financial support was provided by National Institutes of Health.

Acknowledgment

Funding for the study was supported by the National Institutes of Health National Heart, Lung, and Blood Institute (grant numbers R01HL119255 and 3U01HL146327-03S1).

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