Maternal Attentional Control Moderates the Association Between Increased Depression and Controlling Feeding Practices During the COVID-19 Pandemic

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Abstract
Parental distress is associated with less healthful child feeding practices. In this preliminary study, we examined how changes in distress from before to during the COVID-19 pandemic were associated with similar changes in feeding practices in a sample of mothers of preschool-aged children. In addition, we examined how pre-pandemic laboratory measures of maternal self-regulation moderated this association. A total of 36 mothers from an ongoing study on parent and child self-regulation completed surveys assessing parental distress (i.e., maternal depression, parenting stress) and child feeding practices during pandemic-related stay-at-home orders in May–June 2020. These mothers had completed the same measures approximately 2 years earlier, along with laboratory assessments of inhibitory and attentional control. Pre-pandemic laboratory measures of attentional control significantly moderated the association between increased maternal depression and use of controlling feeding practices, such that mothers with better attentional, but not inhibitory, control scores did not show an effect of increased depression on feeding practices. These results provide

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preliminary evidence that acute increases in parental distress associated with "stay-at-home" orders affect feeding practices, specifically for mothers with lower levels of attentional control abilities.

Keywords

parenting stress, depression, feeding practices, maternal self-regulation, COVID

Much of the recent effort at reducing obesity rates has focused on early childhood (Kumanyika et al., 2008). The preschool years (ages 3–5) have drawn particular attention, as this is a time in which children develop more autonomy and form eating behaviors that may contribute to high body mass index (BMI; Hughes et al., 2005, 2008, 2011; Wood et al., 2020). To understand eating behaviors among preschoolers, however, it is essential to investigate the feeding behaviors of their caregivers. Parents both provide food for and feed their children, both of which are associated with child eating outcomes and risk of developing a high BMI (Hughes et al., 2005, 2008, 2011, 2015). Because parents play such a pivotal role in shaping the eating behaviors of their children, identifying parental factors that affect child eating behaviors is crucial to informing intervention efforts aimed at the preschool years.

Several types of feeding practices emerge from the literature on parental influences on obesogenic child eating behavior. Here, we focus on two. First, controlling feeding practices (e.g., pressure-to-eat, use of food as a reward) are associated with overweight status (Birch & Davison, 2001; Loth et al., 2013), unhealthy diet quality (Birch & Davison, 2001; Fisher & Birch, 2000; Fisher et al., 2002), lower satiety responsiveness (Birch et al., 2003; Fisher & Birch, 1999), and unhealthy weight control behaviors (Carper et al., 2000; Loth et al., 2014) in children. Second, healthful feeding practices (e.g., healthy food environments, teaching children about nutrition) have been found to promote healthy child eating behaviors and relationships with food (Melbye et al., 2013; Russell et al., 2015). Both controlling and healthful feeding practices are empirically associated with long-term child health outcomes, yet in opposite directions. As such, interventions aimed at improving child health outcomes could aim to decrease controlling feeding practices, increase healthful feeding practices, or both. Therefore, it is important to investigate how individual differences in factors such as parental stress and self-regulation are associated with the use of both types of feeding practices with the goals of improving intervention efficacy and family health outcomes.

The degree to which parents engage in controlling and healthful feeding practices is affected by their mental health (El-Behadli et al., 2015). Research

has shown that parental distress is positively associated with controlling and generally unhealthy feeding practices (Blissett & Farrow, 2007; Farrow & Blissett, 2005; Hurley et al., 2008; Jang et al., 2019; Mitchell et al., 2009). In this work, parental distress is usually operationalized as depressive symptomatology and parenting stress, which can interfere with parents' abilities to provide appropriate parenting and feeding (El-Behadli et al., 2015). A recent study employing ecological momentary assessment found that a greater depressed mood and higher stress earlier in the day predicted pressure-to-eat feeding practices (the degree to which parents attempt to make sure that their children are eating enough; El-Behadli et al., 2015) and fewer homemade foods served at meals the same night (Berge et al., 2017).

A paucity of work has investigated which individual-level factors may buffer the effects of parental distress on feeding practices. Self-regulation, the capacity to alter behaviors in accordance with changing goals or expectations (Baumeister & Vohs, 2007), has emerged as a candidate as it underlies the ability to flexibly adapt to changes while keeping overarching goals in mind (Barros et al., 2015). Applied to feeding, it may be that parents with better self-regulation experience fewer distress-related deteriorations in their approach to feeding their children given their ability to adjust and maintain an emphasis on their food-related values. While often considered as a unitary construct, several different tasks are commonly used to measure self-regulation in the lab. Two common tasks are the Flanker task (Eriksen & Eriksen, 1974), which focuses on visual attentional control, and the Go/NoGo (GNG) task (Berkman et al., 2009), which focuses more on motor inhibitory control. As such, a thorough investigation of self-regulation should assess it across multiple modalities to identify whether effects are task- or modality-specific, or more general to self-regulation capacity.

The COVID-19 pandemic of 2020 provided an opportunity for our research team to take advantage of ongoing data collection to engage in a preliminary investigation of how changes in parental distress may affect changes in feeding practices and whether these associations are moderated by parent self-regulation. In March 2020, the governor of Oregon closed schools and required all adults who could work from home to do so. This placed unprecedented stress on parents, who were suddenly coping with a public health crisis while also trying to educate their children and complete their work and family obligations.

This study sought to investigate how changes in two measures of parental distress, maternal depression and parenting stress, associated with the COVID-19 pandemic affected changes in child feeding practices in a sample of mother–child dyads. We, further, examined how pre-pandemic laboratory assessments of two separate forms of mother self-regulation,

inhibitory and attentional control, moderated these associations. We hypothesized the following:

Hypothesis 1 (H1): Increases in parental distress would be associated with increases in controlling feeding practices and decreases in healthful feeding practices.
Hypothesis 2 (H2): These associations would be moderated by maternal self-regulation.

Method

Participants and Procedure

Data for this study were collected from a cross-sectional investigation of self-regulation in biological mothers and their preschool-aged children ($N = 89$). As part of this study, mothers provided demographic information, completed laboratory assessments of self-regulation, and answered a survey containing measures of depression, parenting stress, and child feeding practices ("baseline"). Of the 71 mothers who provided consent to be recontacted for future research opportunities, 43 indicated an interest in participating in the follow-up survey, and 36 completed the survey between the months of May and June 2020 ("follow-up"; time between sessions: $M = 1.95$ years, $SD = 0.18$). These mothers did not differ from the larger group with regard to baseline demographics, self-regulation, parental distress, or child feeding practices. All procedures were approved by the Institutional Review Board of the University of Oregon.

Demographic data for the families included in these analyses are presented in Table 1. Briefly, children (44.4% female) averaged 3.94 years old ($SD = 0.68$) at baseline and 5.89 years old ($SD = 0.76$) at follow-up. Mothers reported a yearly mean gross family income of US$69,494.47 ($SD = $ US$41,717.34, range $= $ US$23,000–200,000) and an average of 15.69 years of education ($SD = 2.18$). In addition, mothers reported that they were 91.67% White, 2.78% Asian, and 5.56% multiracial and that their children were 83.3% White, 2.77% Asian, and 13.89% multiracial.

Measures

Surveys. Demographic characteristics were self-reported at baseline. Parental distress was assessed using the Center for Epidemiological Studies–Depression scale (CES-D; Radloff, 1977) and the Parent Stress Index–Short Form (PSI-SF; Abidin, 1990) total scores. The CES-D is a 20-item measure of

Table 1. Demographic, Rask, and Survey Data at Baseline and Follow-Up Sessions.

Variable	Baseline				Follow-up	
	M	SD	n	%	M	SD
Demographics						
Child age	3.94	0.68			5.89	0.76
Child sex (female)			16	44.4%		
Family income	US$69,494.47	US$41,717.34				
Mother years education	15.69	2.18				
Maternal self-regulation						
Inhibitory control[a] (GNG: % correct)	0.95	0.04				
Attentional control[b] (Flanker: % correct)	−0.08	0.08				
Parental distress						
Depression (CES-D)	10.42	10.24			15.19	9.78**
Parenting stress Index subscales	73.79	23.53			83.50	23.08**
Parent distress	25.75	9.56			30.69	9.58**
Difficult child	26.72	9.02			30.11	9.67*
Parent–child dyad	20.48	7.70			22.64	7.22
Comprehensive Feeding Practices Questionnaire subscales						
Healthy eating guidance	3.92	0.57			3.82	0.57
Parent pressure	2.03	0.63			1.86	0.44*

Note. No demographic measures were collected at follow-up. Child age at each session was calculated by subtracting the child's date of birth from the date of the session and dividing by 365.25. Measures of maternal self-regulation were also only collected at baseline. Depression was measured using the CES-D scale. GNG = Go/NoGo; CES-D = Center for Epidemiological Studies–Depression.

[a]Inhibitory control was assessed using the GNG task, calculated as percent correct such that a higher score indicates better performance. [b]Attentional control was assessed using the Flanker task, calculated as percent correct on the incongruent trials minus the percent correct on congruent trials such that a higher score indicates better performance.

*p < .05. **p < .01.

depressive symptomatology on which participants rate items such as "I was bothered by things that don't usually bother me," on a scale from 0 (*rarely or none of the time*) to 3 (*most or all of the time*). Items are summed to create an overall depressive symptoms score where higher scores indicate higher depression. The PSI-SF is a 36-item scale designed to measure the overall level of parenting stress experienced by a parent. Almost all of the items, such as, "I feel trapped by my responsibilities as a parent," are rated on a 5-point Likert-type scale from *strongly agree* (coded as a 5) to *strongly disagree* (coded as a 1) and are summed to create a total stress score, such that a higher score indicates more stress. In addition, we explored the three PSI-SF subscales, assessing stress specific to parenting, the child, and the parent–child dyad. All measures of maternal distress demonstrated acceptable reliability at each session (Cronbach's α: .84–.94).

Parent feeding practices were assessed using the Healthy Eating Guidance (9 items) and Parent Pressure (7 items) subscales from the five-factor version of the Comprehensive Feeding Practices Questionnaire (CFPQ; Haszard et al., 2013; Musher-Eizenman & Holub, 2007). All 36 items in the CFPQ are rated on a 5-point Likert-type scale indicating frequency, from *never* (coded as a 1) to *always* (coded as a 5), and items are averaged to create scale scores. The Healthy Eating Guidance subscale includes items such as "most of the food I keep in my house is healthy" and demonstrated acceptable reliability at each session (Cronbach's α: .80–.83). The Parent Pressure subscale includes items describing the use of food as a reward and pressure to eat, such as "I offer my child his or her favorite foods in exchange for good behavior." The reliability for this scale was acceptable at baseline (Cronbach's $\alpha = .79$) but dropped to .66 for the follow-up assessment. Although this is lower than we would have liked, this value is often referred to "adequate" (Taber, 2018). Therefore, we opted to keep it and note this decrease in reliability as a limitation. We chose to use the 5-factor version of the CFPQ as opposed to the original 12-factor version, as it has been shown to have a better fit based on data from a large, diverse sample of children (Haszard et al., 2013).

Maternal self-regulation. Maternal self-regulation was assessed using two separate laboratory tasks performed while participants were undergoing functional magnetic resonance imaging (fMRI): the GNG task and the Flanker task. fMRI results are not reported here as the present hypotheses only focused on behavior. One participant did not complete the scanning session, and a computer error led to GNG data loss for one additional participant.

Inhibitory control. Inhibitory control was measured using the GNG task, which is based on a validated task structure (Berkman et al., 2009) administered via

MATLAB. In this task, participants were presented with blocks of stimuli depicting cups and animals. For half the blocks, participants were instructed to press a button each time they saw a picture of cups (Go [G] trials, 80% of stimuli) and not when they saw a picture of an animal (NoGo [NG] trials, 20% of stimuli). The other half of the blocks were reversed, in which the G stimuli were animals and NG were cups. Each of the 10 blocks began with a 5 s instruction cue, followed by 50 stimuli presented for 1 s each and separated by fixation-cross baseline interstimulus interval that varied in duration from 167 to 500 ms ($M = 333$ ms). Inhibitory control was measured by accuracy, calculated as the percent of trials in which participants correctly pressed a button for the G stimulus and withheld the button press for the NG stimulus.

Attentional control. Attentional control was measured using an adapted arrow version of the Flanker task (Barker et al., 2015; Eriksen & Eriksen, 1974), which was administered using the E-Prime software (Psychology Software Tools, Inc., Sharpsburg, PA, USA). On each trial, participants viewed five horizontal arrowheads and were instructed to press a button with the finger on the hand to which the central arrow was pointing (i.e., < indicates a left index finger button press). On half of the trials, the four outer (or "flanking") arrowheads were congruent with the central arrow (<<<<<, >>>>>), and on the other half the outside arrowheads were incongruent (<<><<, >><>>). The order of presentation of the arrowheads was random. All were presented for 200 ms, followed by an intertrial interval that varied randomly from 700 to 1,100 ms that either followed the response or began 800 ms after stimulus onset (whichever occurred first). Attentional control was measured by accuracy, calculated as the number of correct trials divided by the total number of trials with a response, for incongruent trials minus congruent trials (such that a larger number indicated better attentional control).

Analyses

All analyses were performed in R (R Core Team, 2019). Change scores from baseline to follow-up were calculated for the PSI-SF total and three subscales, the CES-D total, and the Healthy Eating Guidance and Parent Pressure subscales from the CFPQ. Outliers were winsorized at 3 *SD*s from the mean. Variables with skewness values greater than ±1 were transformed using transformTukey from the rcompanion package (Mangiafico, 2019), which follows the Tukey's Ladder of Powers principle to improve the distribution of skewed variables and better meet the

assumptions of regression. These transformed variables were used for all subsequent analyses and are noted in Table 2.

Zero-order associations between demographic measures (i.e., child age, child BMI, maternal BMI, gross family income, and maternal education) and baseline measures of maternal self-regulation, parental distress, and feeding practices were first run using Pearson's correlations, adjusted for multiple tests using the Benjamini–Hochberg correction (Benjamini & Hochberg, 1995); adjusted *p*-values are presented. To address H1, separate multiple regression models investigating associations between each indicator of parental distress (CES-D, PSI-SF total) and changes in each of the two child feeding practices were performed. To address H2, we mean-centered parent distress change scores and self-regulation data and created interaction terms between the two, which were then entered into multiple regression models investigating the moderating effect of each form of self-regulation on associations between change in parental distress and child feeding. All analyses controlled for child sex, which has been found to affect feeding practices (Gholamalizadeh et al., 2013). Missing data were handled using pairwise deletion. While we present full results for significant findings, full results from all models run for these analyses can be found online (https://osf.io/7cmva/).

Results

Baseline Associations

As shown in Table 2, zero-order correlations between baseline measures of family demographics, maternal self-regulation, parental distress, and child feeding revealed that there was a significant positive association between maternal depression and parenting stress, $r(35) = 0.67$, $p < .01$.

Associations Between Changes in Parental Distress and Feeding Practices

As shown in Table 1, paired-samples *t*-tests revealed that there was a significant change from baseline to follow-up for the CES-D, $t(34) = -2.85$, $p = .007$, PSI-SF total, $t(34) = -3.73$, $p < .001$, and CFPQ Parent Pressure subscale, $t(35) = 2.15$, $p = .039$. At follow-up, mothers reported experiencing more depression and parenting stress and using less pressure in feeding their children compared with before the pandemic. The change in the CFPQ Health Eating Guidance subscale was not significant, $t(35) = 1.15$, $p = .26$. Investigation of the associations between changes in measures of parental

Table 2. Zero-Order Correlations Between Family Demographics, Maternal Self-Regulation, Parental Distress, and Child Feeding Practices at Baseline.

Variable	1	2	3	4	5	6	7	8	9	10
1. Child's age										
2. Child's BMI	-.04									
3. Mother's BMI	.14	.15								
4. Gross family income[a]	.13	.09	-.36							
5. Mother's years of education	-.31	.37	-.29	.45						
6. Mother's GNG[a]	-.13	.48	-.27	.19	.42					
7. Mother's Flanker[a]	.18	.39	.04	-.13	.06	.34				
8. Mother's depression (CES-D)[a]	.21	-.27	.32	-.20	-.28	-.03	.05			
9. Mother's parenting stress (PSI-SF)[a]	-.00	-.09	.18	-.29	-.04	.03	.04	.67**		
10. Healthy Eating (CFPQ subscale)	.10	.09	-.31	.36	.45	.13	-.07	-.19	.08	
11. Parent Pressure (CFPQ subscale)[a]	.04	-.11	.06	.16	-.35	-.13	-.18	.10	-.06	-.09

Note. p-values are adjusted for multiple tests using the Benjamini–Hochberg correction (Benjamini & Hochberg, 1995). BMI = body mass index; GNG = Go/NoGo task, measure of inhibitory control; Flanker = Flanker task, measure of attentional control; CES-D = Center for Epidemiological Studies–Depression scale; PSI-SF = Parenting Stress Index–Short Form (total); CFPQ = Comprehensive Feeding Practices Questionnaire.
[a]Indicates that the variable has been transformed to improve the distribution.
**p < .01.

distress and feeding practices showed that, after adjusting for child sex, there were no significant associations between changes in either depression or parenting stress and changes in feeding practices (*p*-values: .20–.90). Exploratory interrogation of the PSI-SF subscales revealed that the strongest association between parent distress and feeding practices was with regard to the positive association between increases in parent-child dyadic stress and increases in CFPQ Parent Pressure, $b = 0.02$, 95% CI = [−0.001, 0.042], $SE = 0.01$, $t(32) = 1.85, p = .07$.

Moderation by Maternal Self-Regulation

Attentional control significantly moderated the association between change in the CES-D total and change in the CFPQ Parent Pressure subscale, $b = −0.002$, 95% CI = [−0.004, −0.001], $SE = 0.001$, $t(29) = −2.38, p = .02$. As shown in Figure 1, only mothers who showed poorer attentional control at baseline displayed a positive association between increases in depression and pressure-to-eat feeding. The moderation of the association between changes in PSI-SF total and CFPQ Parent Pressure by attentional control was not significant, $b = −0.001$, 95% CI = [−0.003, 0.000], $SE = 0.006$, $t(29) = −2.03, p = .052$. Inhibitory control did not significantly moderate the associations between parental distress and child feeding practices (*p*-values: .15–.99).

Discussion

The objective of this study was to investigate how changes in parental distress during the COVID-19 pandemic were associated with changes in child feeding practices and whether baseline measures of maternal self-regulation moderated those associations. This is the first investigation of its kind. In this pilot study, we found that mothers with poorer attentional control evinced a significant positive association between increased maternal depression and controlling feeding, which adds to the extant literature on the role of stress on parent feeding (Berge et al., 2017; El-Behadli et al., 2015; Jang et al., 2019) by suggesting that the degree to which parental distress affects feeding practices may be influenced by certain types of parent self-regulation.

Associations Between Changes in Parental Distress and Obesogenic Feeding

Contrary to our first hypothesis, increases in parent distress were not significantly associated with changes in feeding. There are a few reasons why we
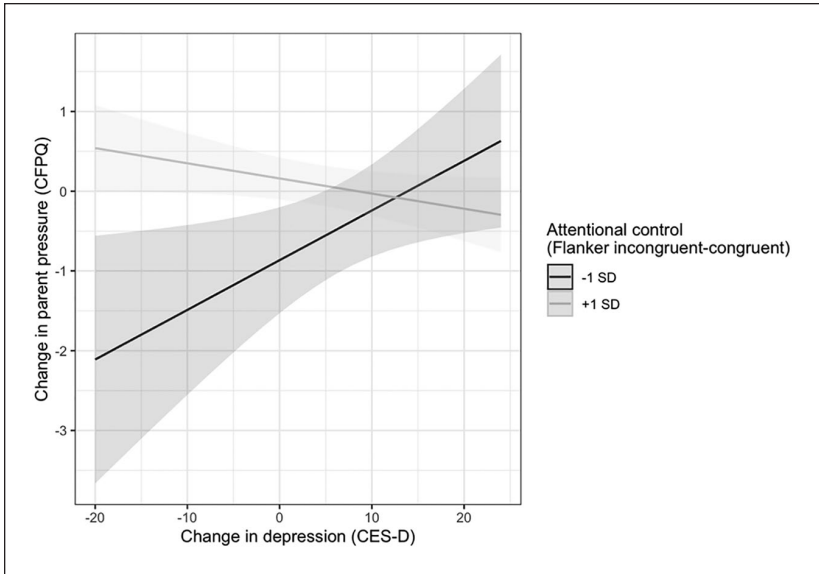
Figure 1. Visualization of the moderation of the association between changes in depression and parent pressure by mother attentional control.
Note. The association between change in depression and change in parent pressure is shown for mothers who displayed performance on the attentional control measure (the Flanker task) at 1 SD above the mean (gray) and 1 SD below the mean (black). Performance on the Flanker task is operationalized as percent correct in the incongruent condition minus percent correct in the congruent condition, such that higher numbers indicate better attentional control. Depression was measured using the CES-D scale and parent pressure was measured using the Comprehensive Feeding Practices Questionnaire Parent Pressure subscale. Gray shading indicates the 95% confidence interval. CES-D = Center for Epidemiological Studies–Depression.

may not have found significant effects. First, this study was not designed to test these hypotheses, as it took advantage of the conditions brought on by a global pandemic and ongoing data collection. Therefore, it was underpowered and subject to response bias. Specifically, highly stressed mothers may not have taken the time to complete our follow-up survey. This is supported by the fact that the mothers who completed the follow-up survey did not show a significant association between baseline parenting distress and obesogenic feeding practices ($p > .27$), which is contrary to what has been shown in the literature (e.g., El-Behadli et al., 2015).

Second, we limited our investigations to controlling and healthy feeding practices, represented by the CFPQ Parent Pressure and Healthy Eating Guidance subscales. Use of each of these feeding practices is associated with

obesity risk in children (Birch & Davison, 2001; Birch et al., 2003; Carper et al., 2000; Fisher & Birch, 1999, 2000; Fisher et al., 2002; Loth et al., 2013, 2014; Melbye et al., 2013; Russell et al., 2015), and the scales showed acceptable reliability. However, each of these scales combines across several of the original CFPQ subscales, with Healthy Eating Guidance including Environment, Modeling, and Teaching about Nutrition and Parent Pressure including Emotion Regulation, Food as Reward, and Pressure to Eat. The original subscales were not reliable enough in this sample to investigate alone, so we may have missed more nuanced effects of increased parental distress on specific feeding practices.

Moderation by Maternal Self-Regulation

Only maternal attentional control significantly affected the association between maternal depression and controlling feeding practices linked to overweight status (Birch & Davison, 2001; Loth et al., 2013) and unhealthy eating behaviors (Birch & Davison, 2001; Birch et al., 2003; Carper et al., 2000; Fisher & Birch, 1999, 2000; Fisher et al., 2002; Loth et al., 2014). Specifically, mothers who showed poorer baseline attentional control demonstrated a strong association between increased depression and increased use of pressure-to-eat as measured by the Parent Pressure subscale of the CFPQ. Interestingly, this effect was specific to attentional control, despite the fact that maternal attentional and inhibitory control were significantly correlated in this sample, $r = .34$, $p = .049$. This effect was also surprising given the known link between inhibitory control and weight-related outcomes (Lavagnino et al., 2016). However, these results suggest that different mechanisms may be involved in feeding oneself versus one's child. Specifically, it may be that attentional control could help mothers resist the urge to control their children's eating during otherwise uncontrollable times of stress (El-Behadli et al., 2015).

While very preliminary, these findings suggest that certain mothers may be more susceptible to the obesogenic feeding practices associated with experiencing increased distress, especially during times of family strain. The exploratory finding that attentional control moderated the association between parenting stress associated with the parent–child dyad (PSI-SF-PCDI) and parent pressure lends credence to these interpretations. Follow-up studies explicitly testing individual differences in how families react to stressors like the COVID-19 pandemic (e.g., death in the family, loss of primary income) would benefit from investigating maternal attentional control as a potential intervention target in addition to parental distress itself.

Limitations

As mentioned above, this study was not designed to test these hypotheses; thus, the sample size was smaller than necessary to be fully powered and as such may not be replicable in a larger sample. However, we believe that these findings are intriguing and meaningful enough to warrant a place in the literature. This study employs strong theories, multiple methods, and a within-subjects design, all of which support its inferential validity (Smith & Little, 2018). Second, the parental distress measures we used were not specific to the challenges experienced by families during this pandemic, and as such may have missed some of the subtleties of their experiences. This may have rendered our measures more conservative than needed, suggesting that the true effects may be greater than those presented here. Third, we only included mothers in this study, which limits generalizability to fathers and other primary caretakers. The generalizability of these results is further affected by the demographics of this sample (e.g., race/ethnicity). Fourth, roughly 50% of the mothers we contacted about the follow-up session provided data regarding parental distress and child feeding during the pandemic. Although these mothers did not differ from the full sample with regard to baseline demographics, self-regulation, parental distress, or child feeding practices, they may have differed in ways we did not measure.

Finally, we did not assess changes in the use of restrictive feeding practices due to the poor reliability of this scale at follow-up. We additionally noticed a drop in internal reliability of the CFPQ Parent Pressure subscale from baseline (0.79) to follow-up (0.66), suggesting that the items used to assess this feeding practice may have been differentially affected by the stressors of the pandemic. Indeed, assessing parental feeding practices is challenging, as evidenced by the multiple sets of factors associated with the CFPQ (Haszard et al., 2013; Musher-Eizenman & Holub, 2007); more work is needed to clarify the characterization of specific parent feeding phenotypes. Relatedly, feeding styles likely change as children age from 3 to 6 years old (the range of ages assessed in this study), and as such it is additionally challenging to isolate pandemic-related changes in these practices from those that naturally occur as children age.

Conclusion

The findings from this study provide preliminary data showing that changes in parental distress and controlling feeding practices associated with coping with a global pandemic are meaningfully moderated by maternal attentional control. These data add to the literature on the effects of external stressors and

parental factors on child eating behavior and suggest that interventions aimed at supporting parents with poor attentional control who are experiencing high levels of depression may be particularly effective in improving child eating and health outcomes.

Declaration of Conflicting Interests

Funding

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