

# Predicting preschool children's emotional eating: The role of parents' emotional eating, feeding practices and child temperament

Rebecca A. Stone<sup>1</sup>  | Jacqueline Blissett<sup>1</sup>  | Emma Haycraft<sup>2</sup>  | Claire Farrow<sup>1</sup> 

<sup>1</sup>School of Psychology and Institute of Health and Neurodevelopment, College of Health & Life Sciences, Aston University, Aston Triangle, UK

<sup>2</sup>School of Sport, Exercise and Health Sciences, Loughborough University, Loughborough, UK

## Correspondence

Claire Farrow, School of Psychology, College of Health & Life Sciences, Aston University, Aston Triangle, Birmingham, B47 ET, UK.  
Email: [c.farrow@aston.ac.uk](mailto:c.farrow@aston.ac.uk)

## Abstract

Emotional eating (EE; defined as overeating irrespective of satiety and in response to emotional states) develops within childhood, persists into adulthood, and is linked with obesity. The origins of EE remain unclear, but parental behaviours (e.g., controlling feeding practices and modelling) and child characteristics (e.g., temperament) are often implicated. To date, the interaction between these influences has not been well investigated. This study explores whether the relationship between parent and child EE is shaped by parental feeding practices, and if the magnitude of this relationship varies as a function of child temperament. Mothers ( $N = 244$ ) of 3–5-year-olds completed questionnaires about their EE, feeding practices, their children's EE and temperament. Results showed that parental use of food to regulate children's emotions fully mediated the relationship between parent and child EE, and using food as a reward and restricting food for health reasons partially mediated this relationship. Analyses demonstrated that the mediated relationship between parent and child EE via use of food as a reward and restriction of food for health reasons varied as a function of child negative affect, where high child negative affect moderated these mediations. These findings suggest child EE may result from interrelationships between greater parent EE, use of food as a reward, restriction of food for health reasons and negative affective temperaments, but that greater use of food for emotion regulation may predict greater child EE irrespective of child temperament.

## KEYWORDS

child feeding, childhood obesity, family influences, parenting, parent, quantitative methods

## 1 | INTRODUCTION

Emotional eating (EE) is defined as over-eating, irrespective of satiety, and in response to emotional states that are typically negative (e.g., Michels et al., 2012). EE in children is commonly reported by parents (Steinsbekk et al., 2016: 65%), develops during preschool

years (Herle et al., 2018), and is moderately stable across childhood (Ashcroft et al., 2008). Those who emotionally eat tend to consume palatable, energy-dense foods (i.e., high in sugar and fat) (e.g., Nguyen-Michel et al., 2007), thus stimulating hedonic pleasure which distracts from the experience that negative emotions can inflict (van Strien et al., 2019).

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Despite the prevalence of EE, such behaviour is biologically paradoxical as the biological response to a high-stress environment is to undereat (Yau & Potenza, 2013). Heinrichs and Richard (1999) suggested that stress promotes the release of cortisol which in turn suppresses appetite, potentially through the stimulation of leptin (Michels et al., 2017). As such, cortisol increases should decrease gut activity rather than induce it. This suggests that EE is a substantially learned behaviour driven by environmental factors (Herle et al., 2018). In adult studies EE is frequently associated with weight gain, obesity (e.g., Gibson, 2012) and poorer mental health (e.g., Ferrer-Garcia et al., 2017). As children's eating behaviours are likely to persist into adulthood (e.g., Nicklaus et al., 2004), it is important to understand how EE develops in early life to identify targets for prevention and intervention.

The exact causal underpinnings of EE remain unclear (e.g., Vervoort et al., 2020), but research has explored the contributions of parenting and child factors. In terms of parenting, parents exert a large influence over their children's eating (Savage et al., 2007) and parents who emotionally eat have been found to have children who emotionally eat as well (e.g., Yelverton et al., 2020). Given that EE in children is learned rather than inherited (Herle et al., 2018), children may emulate EE through parental modelling (Bandura, 1977). In addition, the feeding practices that parents use have been shown to predict the development of child EE. Feeding practices that are more controlling such as using *food for emotion regulation*, *food as a reward* or *restriction of food for health reasons*, may unintentionally 'teach' unhealthy eating behaviours since extrinsic control over a child's food intake may undermine a child's ability to recognise their own hunger and satiety (Farrow et al., 2015). Indeed, longitudinal studies have shown significant associations between these feeding practices and child EE (e.g., Steinsbekk et al., 2018), and this has also been demonstrated experimentally (Blissett et al., 2010) where use of food for emotion regulation, for example, may teach children to use food as a means to regulate their emotional arousal. Likewise, being rewarded with food may encourage children to eat for non-appetitive reasons thus undermining their ability to regulate satiety (Jalo et al., 2019). Overtly restricting food for health reasons has also been shown to promote overconsumption of restricted foods, particularly in times of emotional arousal (Farrow et al., 2015).

Parenting practices and behaviours that have been associated with greater child EE often co-occur, with parents who report greater EE themselves also reporting greater use of emotional feeding practices (Rodgers et al., 2014), greater restriction of food for health reasons and/or greater use of food as a reward (Haycraft, 2020). These non-nutritive controlling feeding practices have been shown to be counterproductive and undermining of appetite regulation (Birch et al., 2003), but they may also be a mechanism through which the relationship between parental and child EE can be explained. These practices have been shown to be particularly influential in children who are at higher risk of weight gain and obesity, highlighting the bi-directional relationships between children's characteristics and the feeding practices that they experience (e.g., Faith et al., 2004).

### Key messages

- Child temperament moderates the significant mediating relationships between parent EE, certain parental feeding practices and child EE.
- Parental use of food as a reward significantly mediates the relationship between parent and child EE only for children who are medium or high in negative affect.
- Parental restriction of food for health reasons significantly mediates the relationship between parent and child EE only for children who are high in negative affect.
- In children who are low in negative affect, parental rewarding and restrictive feeding practices do not mediate the relationships between parent and child EE.
- Models of eating behaviour should consider how child characteristics can shape the expression and influence of behaviours that are known to place children at greater risk of obesogenic eating behaviours.

Indeed, research has demonstrated that individual differences in children, such as temperament, can shape the development of EE (e.g., Haycraft et al., 2011). Rothbart and Bates (2007) define temperament using three overarching dispositions: negative affect (heightened experience of negative emotions), surgency (proneness to being highly sociable and impulsive) and effortful control (increased self-regulation and less emotional reactivity). Negative affect has been consistently linked with child EE in both cross-sectional (e.g., Messerli-Bürgy et al., 2018) and longitudinal studies (e.g., Bjørklund et al., 2019). Steinsbekk et al. (2018, 2020) demonstrated that high negative affect at age 4 positively predicted child EE at 6, 8 and 10-years. This suggests that children who are prone to experience heightened negative emotions may be at increased risk of using food to regulate distress. In addition, lower levels of effortful control (i.e., less self-regulation) at age 6 have been shown to predict greater child EE at age 8. Lower effortful control may place children at greater risk of EE due to the associated lower impulse control (Rothbart & Bates, 2007; Steinsbekk et al., 2020) which may increase the likelihood of reaching for food in situations of emotional arousal. Child surgency has also been shown to predict obesogenic traits such as food responsiveness and enjoyment of food at 6-years (Steinsbekk et al., 2020), although in this study surgency was not predictive of child EE.

Russell and Russell (2018) developed a biopsychosocial model which suggests that the development of children's appetitive traits arises from a complex interaction between the child's environment (e.g., food availability), their caregiving experiences, and their innate dispositions. Similarly, the behavioural susceptibility theory (BST) of obesity posits that specific genetic predispositions make some children more vulnerable to obesogenic environmental conditions (Llewellyn & Fildes, 2017). For example, Stifter and Moding (2018) found that more surgent children at 6 months, whose mothers used

more food for emotion regulation, gained more weight over a one-year period than less surgent children whose mothers used this feeding practice less often. It is possible that children with certain temperamental dispositions (e.g., greater negative affect, surgency or poorer effortful control) may be more susceptible to environmental influences (e.g., controlling feeding practices or modelled parental EE) or more affected by these influences and thus more likely to emotionally eat (Bjørklund et al., 2019). For example, children with higher levels of negative affect may need longer to recover from emotional arousal and may find it more difficult to soothe themselves when distressed. When exposed to parental EE and more controlling feeding practices these children may be more likely to use food to regulate emotion. Research has begun to explore how parental eating, parental feeding, and child characteristics may interact together to shape child EE. For example, Tan and Holub found that the relationship between parent and child EE was mediated by emotional feeding, but that this was only the case for children who were low in self-regulation in eating (Tan & Holub, 2015). Research such as this, which considers the complex interactions that occur between parenting and child behaviours, can elucidate which parent-child behavioural combinations put children at the greatest risk of EE and may help to identify targets for intervention or prevention.

The aim of this study was to explore the inter-relationships between parent EE, parental feeding practices and child temperament in predicting parental reports of child EE. It was hypothesised that (a) there will be a positive relationship between parent and child EE and this relationship will be mediated by greater parental use of food for emotion regulation, food as a reward or restriction of food for health reasons; (b) there will be a positive relationship between parent EE and child EE, mediated via these feeding practices and also moderated by children's temperament such that the mediated relationship will be evident only when children score highest in negative affect or surgency, or lowest in effortful control.

## 2 | METHODS

### 2.1 | Participants

Parents of 258 children aged 3–5-years took part in this cross-sectional online study. Fourteen participants were removed: eight fathers as they only represented 3% of respondents and there are notable differences between mothers and fathers on child feeding practices (Khandpur et al., 2014), and six parents who reported that they rarely ate with their child as they may not be able to accurately report their child's eating behaviour. After data cleaning, the final sample consisted of 244 mothers.

### 2.2 | Procedure and measures

Participants were recruited via social media to complete a questionnaire through Qualtrics. The study was approved by Aston

University's Health and Life Sciences Ethics Committee (#1551) and all participants provided informed consent. All procedures were conducted in accordance with the Declaration of Helsinki as revised in 1983. The questionnaire measures included:

**A demographic questionnaire** about parental age, sex, ethnicity, education level, child age, sex, height and weight. Parents reported how often they ate with their child, the number of children and any nursery attendance for the child. Parents also completed the MacArthur Scale of Subjective Status to measure perception of social status relative to others, with higher scores indicating greater perceived status (Adler et al., 2000).

**The Comprehensive Feeding Practices Questionnaire (CFPQ;** Musher-Eizenman & Holub, 2007) measures parents' use of feeding practices. Three subscales related to child EE were used for this study: food as a reward (3 items:e.g., 'I offer my child his/her favourite foods in exchange for good behaviour'), food for emotion regulation (3 items:e.g., 'Do you give this child something to eat or drink if s/he is upset even if you think s/he is not hungry?'), and restriction of food for health reasons (4 items:e.g., 'If I did not guide or regulate my child's eating, he/she would eat too many junk foods'). These subscales were selected because parental use of food as a reward and food for emotion regulation have been found to mediate the relationships between parent and child EE (Miller et al., 2020; Tan & Holub, 2015), and parental restriction of food for health reasons has been shown to be predictive of child EE over time (e.g., Farrow et al., 2015). The CFPQ has good internal validity and reliability (Musher-Eizenman & Holub, 2007) and in this sample McDonald's Omega ( $\omega$ ) was high for food for emotion regulation (0.74), and moderate for restriction for health reasons (0.63) and food as a reward (0.50) (Hinton et al., 2014).

**The Dutch Eating Behaviour Questionnaire (DEBQ;** van Strien et al., 1986) was used to measure parental EE subscale (e.g., 'Do you desire to eat when you are irritated?'). Items were scored using a five-point Likert scale, where higher mean scores reflected higher EE. This measure has previously demonstrated good internal reliability (Cebolla et al., 2014), and  $\omega$  was high in this sample (0.96).

**The Children's Behaviour Questionnaire—Very Short Form (CBQ-VSF;** Putnam & Rothbart, 2006) assesses child temperament. Negative affect (12 items:e.g., 'My child is quite upset by a little cut or bruise'), surgency (12 items:e.g., 'My child often rushes into new situations') and effortful control (12 items:e.g., 'My child is good at following instructions') were measured as they have been associated with obesogenic eating behaviours (Leung et al., 2014). The CBQ-VSF has acceptable internal reliability (de la Osa et al., 2014) and in the current sample, reliability was acceptable with  $\omega = 0.78$  for surgency and 0.79 for negative affect, and moderate for effortful control = 0.56.

**The Children's Eating Behaviour Questionnaire (CEBQ)** was used to measure child emotional over-eating (e.g., 'My child eats more when worried'). The CEBQ has demonstrated good reliability in previous work (Domoff et al., 2015) and also in the current sample with  $\omega = 0.83$ .

## 2.3 | Data analysis

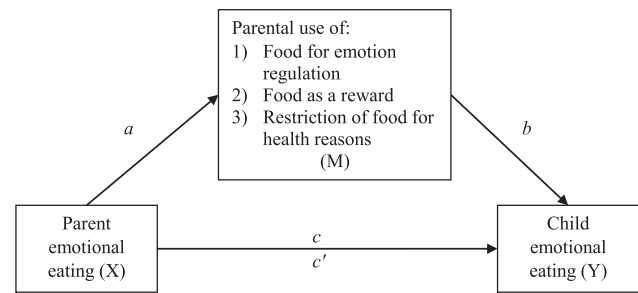
### 2.3.1 | Preliminary analysis of normality and confounding variables

Data were analysed using IBM SPSS Statistics version 26. Preliminary analyses assessed data distribution and identified any confounding variables. Kolmogorov–Smirnov tests showed that the data were skewed, so non-parametric tests were employed. Spearman's correlations revealed that parent BMI was positively and significantly correlated with parent EE ( $r_s = 0.35, p < 0.010$ ) and child EE ( $r_s = 0.18, p < 0.050$ ). Mann–Whitney–U tests indicated that there were no significant differences in parent EE or child EE based on maternal ethnicity or child sex (data not shown). Kruskal–Wallis tests showed that there were no significant differences in parent EE or child EE based on maternal education (data not shown). As a result, only parent BMI was controlled for in subsequent analyses.

### 2.3.2 | Main analysis

For the main analysis, mediation and moderated mediation were employed (due to a lack of alternative non-parametric approaches) using the PROCESS v4 plugin (Hayes, 2017). Any use of causal language (as is typical in mediation analyses [Preacher et al., 2007]) should be interpreted as associations due to the study's cross-sectional design. Mediation assumptions were examined (Hayes, 2017) and only the assumption of normality was violated. Yet, this violation was deemed acceptable as according to the Central Limit Theorem, the current study's large sample size (>200) ensures that the distribution will be approximately normal despite statistical violation (Hayes, 2017).

Mediation analyses were used first to establish whether the relationship between parent EE (antecedent variable 'X') and child EE (outcome variable 'Y') could be explained by parental feeding practices (mediator variable 'M'). Mediation analyses computes the effect of X on M (the *a* path), the effect of M on Y (the *b* path), the effect of X on Y (the *c* path—the total effect) and the effect of X on Y controlling for M (the *c'* path—the direct effect). To determine whether mediation has occurred, an 'indirect effect' is also computed which is the total effect subtracted from the direct effect. This statistic uses 95% confidence intervals to infer significance when the confidence interval does not include zero,—that is, that X predicts Y via M. After determining the presence of mediation, mediation can occur either 'fully' or 'partially'. Full mediation implies that X no longer affects Y after M has been controlled for (i.e., the *c'* path is non-significant). Partial mediation implies that the strength of the relationship between X and Y is less than that of the *c* pathway but is still significant in the presence of M (i.e., the *c'* path is significant). Three models were tested using PROCESS model 4 (simple mediation) using three parental feeding practices (food as a reward, food for emotion

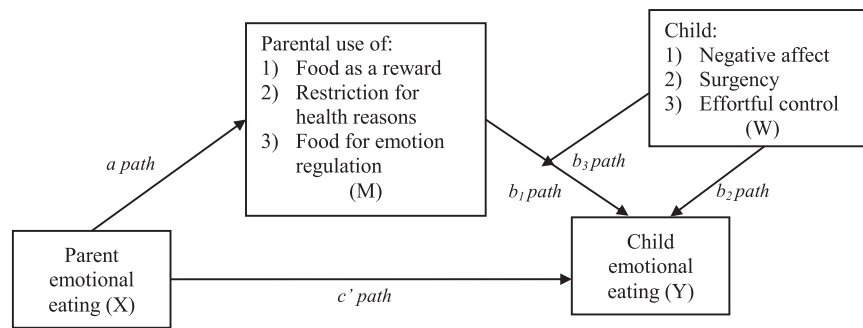


**FIGURE 1** Combined conceptual mediation model (PROCESS #4) of the relationship between parent EE (X) and child EE (Y) with parental use of food for emotion regulation, food as a reward and restriction of food for health reasons as mediators (M). *c* = total effect of X on Y, *c'* = direct effect of X on Y controlling for M, *a* = effect of X on M, *b* = effect of M on Y

regulation, and restriction of food for health reasons) (see Figure 1).

If a mediating relationship was established, moderated mediations were then used to assess whether the mediated relationship between parent EE (X) and child EE (Y) via parental feeding practices (M), varied as a function of child temperament (moderator variable 'W'). In other words, we tested whether the indirect effect was conditional on different levels of child temperament. Nine models were tested using PROCESS model 14 (moderated mediation) using three parental feeding practices (food as a reward, food for emotion regulation, restriction for health reasons) and three indices of child temperament (negative affect, surgency, effortful control) (see Figure 2).

PROCESS Model 14 computes the *a* path (the unconditional effect of X on M; unconditional because the effect of X on M is not contingent on another variable), the *c'* path (the direct effect of X on Y, holding M and W constant), the *b*<sub>1</sub> path (the effect of M on Y), the *b*<sub>2</sub> path (the effect of W on Y), and the *b*<sub>3</sub> path (the conditional effect of M on Y; conditional because the effect of M on Y is contingent on levels of W). Model 14 also computes an 'index of moderated mediation' (Hayes, 2015) which is a statistic that combines all the individual pathways and computes the conditional indirect effect of X on Y via M at levels of W, using unstandardised beta coefficients and 95% confidence intervals to indicate significance. A significant index indicates that the mediating relationship between parent EE (X) and child EE (Y) via parental feeding practices (M) differs depending on the level of child temperament (W). The PROCESS macro automatically 'probes' the conditional indirect effect to determine at what level of temperament the indirect effect is a function of. Levels of child temperament were determined using -1 SD below the mean for 'low,' the mean for 'medium,' and +1 SD above the mean for 'high' as this is standard statistical practice for creating levels of a moderator variable (Hayes, 2015). For negative affect, 'low' reflects a score of 3.1 on the CBQ-VSF (Putnam & Rothbart, 2006) (e.g., 'it is *slightly untrue* that my child is quite upset by a little cut or bruise'), 'medium' reflects a score of 4.0 (e.g., 'it is *neither true nor untrue*' and 'high' reflects a score of 5.0 (e.g., 'it is *slightly true*'). For surgency, 'low' reflects a score of 3.5 on the CBQ-VSF (e.g., 'it is *slightly untrue* that my child often rushes into new



**FIGURE 2** Combined conceptual moderated mediation model (PROCESS #14) between parent EE (X) and child EE (Y) using mediator: parental use of food as a reward, parental use of restriction for health reasons and parental use of food for emotion regulation (M), and moderator: negative affect, surgency and effortful control (W).  $c'$  = direct effect of X on Y holding M and W constant,  $a$  = unconditional effect of X on M,  $b_1$  = effect of M on Y,  $b_2$  = effect of W on Y,  $b_3$  = conditional effect of M on Y

situations'), 'medium' reflects a score of 4.4 (e.g., 'it is *neither true nor untrue*' and 'high' reflects a score of 5.3 (e.g., 'it is *slightly true*'). For effortful control, 'low' reflects a score of 4.5 on the CBQ-VSF (e.g., 'it is *neither true nor untrue* that my child is good at following instructions'), 'medium' reflects a score of 5.1 (e.g., 'it is *slightly true*' and 'high' reflects a score of 6.0 (e.g., 'it is *quite true*').

The  $c$  path in the simple mediations and the  $a$  path in the moderated mediations remained consistent, and so are only described once. For analyses using  $p$ -values,  $p < 0.05$  was used to indicate significance, and for analyses using bootstrapping, confidence intervals were used at 5000 samples.

### 3 | RESULTS

#### 3.1 | Sample characteristics

The final sample of 244 mothers had a mean age of 36 years (SD  $\pm$  3.97), 85.70% described themselves as White British and 86.50% held a degree level qualification. Mothers had a median of two children (IQR  $\pm$  0.73), 93% of children attended nursery/school for on average 25.84 h per week ( $\pm$ SD 8.55). Mothers' subjective social status was 4.97 ( $\pm$ SD 1.59) reflecting a middle-class demographic. Using mother's self-reported BMI data, 69.20% had overweight and 20% had obesity (mean BMI = 25.91  $\pm$  SD 6.85) reflecting percentage proportions similar to UK norms (Moody, 2019). Mean child age was 3.80 years ( $\pm$ SD 0.76) and 52% of children were female. Using mother's self-reported child BMI z-score data, 82.50% of children had a healthy weight (mean BMI z-score =  $-0.13 \pm$  SD 1.56), whereas 7.80% had overweight and 9.70% had obesity (standardised for child age and gender, Child Growth Foundation, 1996).

#### 3.2 | Descriptive statistics

Mean scores and Spearman's Rho correlation coefficients for parent and child EE, parental feeding practices and child temperament are

presented in Table 1. The mean scores for child EE in this sample are similar to other UK/US studies where parents of children in this age range have reported mean scores of 1.70 (Blissett et al., 2010). The mean scores for temperament are similar to Zhou et al. (2019) where parents report mean scores of 3.97 for negative affect, 4.76 for surgency and 5.29 for effortful control. The mean scores for parental feeding practices reflect those of other studies of parents of children in the same age range (Roberts et al., 2018; Russell et al., 2018). This suggests that the sample used are similar in their experiences of child feeding and eating to other published studies in the UK/US.

#### 3.3 | Simple mediation

##### 3.3.1 | Exploring the role of parental feeding practices as mediators between parent EE and child EE

Simple mediations were used to test the hypothesis that there will be a positive relationship between parent EE and child EE via greater parental use of food for emotion regulation, food as a reward or restriction of food for health reasons. Figure 1 presents the three models conceptually to assist in interpretation of mediational analyses.

##### Food for emotion regulation

As seen in Table 2 and illustrated by Figure 1, whilst controlling for parent BMI, parent EE was a significant positive predictor of child EE ( $c$ ). Parent EE was positively and significantly related to greater use of food for emotion regulation ( $a$ ). Use of food for emotion regulation was also positively and significantly related to higher child EE, ( $b$ ). The strength of the relationship between parent EE and child EE scores decreased when food for emotion regulation was held constant and was non-significant ( $c'$ ). The significant indirect effect of parent EE on child EE via use of food for emotion regulation indicated that mediation had occurred. Taking the non-significant  $c'$  pathway and indirect effect together, this analysis demonstrated that full mediation

**TABLE 1** Mean, standard deviation (SD) and Spearman's correlations of measures used to assess parent and child emotional eating, parental feeding practices and child temperament

Measure	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<b>CEBQ<sup>a</sup></b>								
(1) Child emotional eating	-							
<b>DEBQ<sup>b</sup></b>								
(2) Parent emotional eating	0.281**	-						
<b>CFPQ<sup>b</sup></b>								
(3) Food for emotion regulation	0.415**	0.315**	-					
(4) Food as a reward	0.239**	0.162*	0.364*	-				
(5) Restriction for health reasons	0.297**	0.232**	0.356**	0.620**	-			
<b>CBQ-VSF<sup>c</sup></b>								
(6) Negative affect	0.328**	0.289**	0.239**	0.272**	0.190**	-		
(7) Surgency	0.003	0.027	0.069	0.034	0.063	-0.099	-	
(8) Effortful control	-0.094	0.031	-0.149*	-0.044	-0.047	-0.002	-0.165*	-
Mean ( $\pm$ SD)	1.82 (0.66)	2.60 (1.01)	2.00 (0.75)	2.97 (0.96)	2.87 (0.61)	4.04 (0.91)	4.36 (0.89)	5.17 (0.68)
Min/Max	1.00/5.00	2.00/5.00	1.00/5.00	1.00/5.00	1.00/5.00	1.58/6.83	1.92/7.00	2.75/6.58

Note:  $p < 0.01^{**}$ ,  $p < 0.05^{*}$ , two-tailed.

<sup>a</sup> $n = 231$ .

<sup>b</sup> $n = 244$ .

<sup>c</sup> $n = 237$ .

**TABLE 2** Regression coefficients for *a*, *c*, *c'* and *b* pathways of each mediating feeding practice (M)

Antecedent	Food for Emotion Regulation (M)						Child EE (Y)					
	<i>a</i>	<i>B</i>	<i>SE</i>	<i>t</i>	<i>p</i>	<i>df</i>	<i>c</i>	<i>B</i>	<i>SE</i>	<i>t</i>	<i>p</i>	<i>df</i>
Parent EE (X)		0.24	0.05	5.23	<0.001	182	<i>c</i>	0.24	0.05	4.89	<0.001	182
		-	-	-	-	-	<i>c'</i>	0.13	0.05	2.69	0.080	181
Food for emotion regulation (M)		-	-	-	-	-	<i>b</i>	0.46	0.07	6.55	<0.001	181
<i>Indirect effect</i> : $B = 0.11$ , $SE = 0.06$ , 95% CI [0.035, 0.215]												
Antecedent	Food as a Reward (M)						Child EE (Y)					
	<i>a</i>	<i>B</i>	<i>SE</i>	<i>t</i>	<i>p</i>	<i>df</i>	<i>c</i>	<i>B</i>	<i>SE</i>	<i>t</i>	<i>p</i>	<i>df</i>
Parent EE (X)		0.24	0.07	3.36	0.001	182	<i>c</i>	0.24	0.05	4.89	<0.001	182
		-	-	-	-	-	<i>c'</i>	0.19	0.05	4.00	<0.001	181
Food as a reward (M)		-	-	-	-	-	<i>b</i>	0.18	0.07	3.83	<0.001	181
<i>Indirect effect</i> : $B = 0.05$ , $SE = 0.02$ , 95% CI [0.013, 0.090]												
Antecedent	Restriction for Health Reasons (M)						Child EE (Y)					
	<i>a</i>	<i>B</i>	<i>SE</i>	<i>t</i>	<i>p</i>	<i>df</i>	<i>c</i>	<i>B</i>	<i>SE</i>	<i>t</i>	<i>p</i>	<i>df</i>
Parent EE (X)		0.23	0.06	4.17	<0.001	182	<i>c</i>	0.24	0.05	4.89	<0.001	182
		-	-	-	-	-	<i>c'</i>	0.15	0.05	3.30	0.001	181
Restriction for health reasons (M)		-	-	-	-	-	<i>b</i>	0.37	0.06	6.21	<0.001	181
<i>Indirect effect</i> : $B = 0.09$ , $SE = 0.04$ , 95% CI [0.023, 0.175]												

Note: X = antecedent variable, Y = dependent variable, M = mediator variable. *B* = unstandardised regression coefficient, *SE* = standard error, *df* = degrees of freedom, *c* = total effect of X on Y, *c'* = direct effect of X on Y controlling for M, *a* = effect of X on M, *b* = effect of M on Y. Analysis remains unchanged with addition of fathers.

had occurred. This means that the relationship between parent EE and child EE is likely a result of parental use of food for emotion regulation.

#### Food as a reward

As seen in Table 2 and illustrated by Figure 1, parent EE was also positively and significantly related to greater parental use of food as a reward (*a*). Use of food as a reward was significantly and positively related to greater child EE (*b*). The strength of the relationship between parent EE and child EE scores decreased when use of food as a reward was held constant but remained significant (*c'*). The significant indirect effect of parent EE on child EE via use of food as a reward indicated that mediation had occurred. The significant *c'* pathway and indirect effect together demonstrated that partial mediation had occurred. This means that the relationship between parent EE and child EE can be explained in part by parental use of food as a reward.

#### Restriction of food for health reasons

Table 2 (and illustrated by Figure 1) shows that parent EE was positively and significantly related to greater parental restriction of food for health reasons (*a*). Use of restriction for health reasons was significantly and positively related to greater child EE (*b*). The strength of the relationship between parent EE and child EE scores decreased when restriction for health reasons was held constant but remained significant (*c'*). The significant indirect effect of parent EE on child EE via use of restriction for health reasons indicated that mediation had occurred. Taking the significant *c'* pathway and indirect effect together showed that partial mediation had occurred. This means that the relationship between parent EE and child EE is explained in part by parental use of restriction for health reasons.

### 3.4 | Moderated mediation

#### 3.4.1 | Exploring the moderating role of temperament on the mediating relationship of parental feeding practices between parent EE and child EE

To test the hypothesis that there will be a positive relationship between parent EE and child EE, via use of food for emotion regulation, food as a reward or restriction of food for health reasons, but only when children score high in negative affect or surgency, or score low in effortful control, moderated mediation analyses were employed. Two models yielded significant indexes of moderated mediation and so are described fully with a conceptual model to visualise the interaction (see Figure 2). The remaining seven models yielded non-significant indexes of moderated mediation and so are reported briefly in the text (see Table S1).

#### Mediator: Food as a reward, moderator: Negative affect

As seen in Table 3 and illustrated by Figure 2, the direct effect (*c'*) of parent EE scores on child EE scores was significant and positive when controlling for food as a reward. The unconditional effect (*a*) of parent EE on use of food as a reward was significant and positive. The conditional effect (*b<sub>3</sub>*) of parental use of food as a reward and child negative affect on child EE scores yielded a significant positive interaction. Overall, the index for moderated mediation was positive and significant, suggesting that the indirect effect of parent EE scores on child EE scores through the use of food as a reward varied as a function of child negative affect scores (moderated mediation). Probing the indirect effect at low, medium, and high values of child negative affect revealed that scores were positive for all values, but non-significant for low ( $B = 0.01$ ,  $SE = 0.01$ , 95% CI [-0.020, 0.038]), significant for medium ( $B = 0.04$ ,  $SE = 0.02$ , 95% CI [0.009, 0.081]) and significant for children scoring high ( $B = 0.07$ ,  $SE = 0.03$ , 95% CI

**TABLE 3** Regression coefficients for *a*, *c'*, *b<sub>1</sub>*, *b<sub>2</sub>* and *b<sub>3</sub>* pathways of each mediating feeding practice (M) with each moderating temperamental disposition (W)

Antecedent	Food as a Reward (M)					Child EE (Y)						
	<i>a</i>	<i>B</i>	<i>SE</i>	<i>t</i>	<i>p</i>	<i>df</i>	<i>c'</i>	<i>B</i>	<i>SE</i>	<i>t</i>	<i>p</i>	<i>df</i>
Parent EE (X)	<i>a</i>	0.24	0.07	3.36	0.001	182	<i>c'</i>	0.14	0.05	2.89	0.004	179
Food as a reward	-	-	-	-	-	-	<i>b<sub>1</sub></i>	0.16	0.05	3.36	0.001	179
Negative affect (W)	-	-	-	-	-	-	<i>b<sub>2</sub></i>	0.16	0.05	3.02	0.003	179
M × W	-	-	-	-	-	-	<i>b<sub>3</sub></i>	0.13	0.05	2.85	0.005	179
<i>Index of moderated mediation: B = 0.03, SE = 0.02, 95% CI [0.002, 0.076]</i>												
Antecedent	Restriction for Health (M)					Child EE (Y)						
	<i>a</i>	<i>B</i>	<i>SE</i>	<i>t</i>	<i>p</i>	<i>df</i>	<i>c'</i>	<i>B</i>	<i>SE</i>	<i>t</i>	<i>p</i>	<i>df</i>
Parent EE (X)	<i>a</i>	0.23	0.06	4.17	<0.001	182	<i>c'</i>	0.10	0.05	2.10	0.037	179
Restriction for health	-	-	-	-	-	-	<i>b<sub>1</sub></i>	0.28	0.06	4.71	<0.001	179
Negative affect (W)	-	-	-	-	-	-	<i>b<sub>2</sub></i>	0.17	0.05	3.55	<0.001	179
M × W	-	-	-	-	-	-	<i>b<sub>3</sub></i>	0.19	0.05	3.56	0.001	179
<i>Index of moderated mediation: B = 0.04, SE = 0.02, 95% CI [0.004, 0.095]</i>												

Note: X = antecedent variable, Y = dependent variable, M = mediator variable, W = moderator variable, B = unstandardised beta coefficient, SE = standard error, *df* = degrees of freedom, *c'* = direct effect of X on Y holding M and W constant, *a* = unconditional effect of X on M, *b<sub>1</sub>* = effect of M on Y, *b<sub>2</sub>* = effect of W on Y, *b<sub>3</sub>* = conditional effect of M on Y. Analysis remains unchanged with addition of fathers.

[0.015, 0.146] in negative affect. Therefore, parents who reported a greater tendency to emotionally eat also reported a greater use of food as a reward that translated into higher child EE scores, but only amongst those children who scored medium or high in negative affect.

*Mediator: Restriction for health reasons, moderator: Negative affect*  
As seen in Table 3 and illustrated by Figure 2, the direct effect ( $c'$ ) of parent EE scores on child EE scores was significant and positive when controlling for restriction of food for health reasons. The unconditional effect ( $a$ ) of parent EE on use of restriction of food for health reasons was significant and positive. The conditional effect ( $b_3$ ) of parental use of restriction of food for health reasons and child negative affect scores on child EE scores yielded a significant positive interaction. Overall, the index for moderated mediation was positive and suggesting that the indirect effect of parent EE scores on child EE scores through the use of restriction of food for health reasons varied as a function of child negative affect scores (moderated mediation). Probing the indirect effect at low, medium and high values of child negative affect revealed that scores were positive for all values, but non-significant for low ( $B = 0.02$ ,  $SE = 0.02$ , 95% CI [-0.020, 0.073]), significant for medium ( $B = 0.06$ ,  $SE = 0.03$ , 95% CI [0.019, 0.125]) and significant for children scoring high ( $B = 0.11$ ,  $SE = 0.04$ , 95% CI [0.029, 0.200]) in negative affect. Therefore, parents who reported a greater tendency to emotionally eat also reported greater use of restriction of food for health reasons that translated into higher child EE scores, but only amongst those children who scored higher in negative affect.

#### *Non-significant indexes of moderated mediation*

The remaining models yielded non-significant indexes of moderated mediation. This suggested that (i) the indirect effect of parent EE scores on child EE scores through the use of food for emotion regulation did not vary as a function of child negative affect, (ii) the indirect effect of parent EE scores on child EE scores through the use of food for emotion regulation, food as a reward, and restriction of food for health reasons, did not vary as a function of child surgency, and that (iii) the indirect effect of parent EE scores on child EE scores through the use of food for emotion regulation, food as a reward, and restriction for health reasons, did not vary as a function of child effortful control (see Table S1 and Figure 2 for conceptual model).

## 4 | DISCUSSION

This study explored the potential mechanistic underpinnings of the relationship between parent EE and child EE. Our findings replicate previous studies that have demonstrated that feeding practices mediate the parent-child EE relationship (Miller et al., 2020; Tan & Holub, 2015), but this is the first study to report that child negative affect moderates the strength of these associations. The current study's findings demonstrate that the relationships between parent and child EE via parental use of food as a reward and restriction of food for health reasons depend in part on child temperament, and that these feeding practices predict the greatest levels of child EE

with children who are medium-high in negative affect. In contrast, parental use of food for emotion regulation fully mediated the relationship between parent and child EE and there was no evidence of moderation by child temperament on this relationship. These findings add to our understanding about the complex inter-relationships between parental eating behaviour, parental feeding practices and child temperament in shaping parental reports of children's EE.

### 4.1 | Simple mediations

Simple mediation analyses demonstrated that parental use of food for emotion regulation fully mediated the positive relationship between parent EE and child EE. This is consistent with previous research which has shown that maternal experiences of stress have been linked to maternal EE and subsequent child EE via emotional feeding practices (Rodgers et al., 2014). Parents who regularly use food to cope with their own emotions may be more likely to use food to soothe their child's distress, and they may also use food as a tool with their child to regulate their own emotional arousal (Hamburg et al., 2014). The successful reduction in negative affect of both parent and child likely reinforces the use of emotional feeding, and previous interventions that have sought to increase parental responsiveness and reduce emotional feeding have proved successful in lowering child EE over time (Harris et al., 2020).

Simple mediation analyses also indicated that parental use of food as a reward and restriction of food for health reasons both partially mediated the positive relationship between parent EE and child EE. These findings support previous longitudinal studies which have suggested that these feeding practices help to explain how child EE develops (Farrow et al., 2015; Steinsbekk et al., 2016). It is likely that using palatable foods as rewards or restricting these foods for health reasons may increase children's motivation to consume these food types irrespective of hunger and thus increase incidences of obesogenic eating behaviours (Miller et al., 2020). The remaining analyses build upon these models and suggest that characteristics of children, specifically negative affect, also contribute to this mediating relationship between parental eating, parental feeding, and child EE.

### 4.2 | Moderated mediations

Moderated mediation analyses indicated that the mediating effect of parental use of food as a reward and restriction of food for health reasons between parent EE and child EE varied as a function of child negative affect. However, contrary to our predictions, we did not find support for child surgency or effortful control as significant moderators of this relationship, nor evidence of moderated mediation via parental use of food for emotion regulation. These results suggest that the positive relationship between parent EE and child EE that is explained in part by greater use of food as a reward or restriction of food for health reasons is only significant for children who are moderate or high in negative affect.



Parents who have learned to use food to regulate their own emotions may also be more likely to use food as a reward with their children (de Lauzon-Guillain et al., 2009). Our findings indicate that the mediating effect of using food as a reward varies depending on the level of child negative affect. Only those children who were rated as moderate-high in negative affect had significantly higher levels of EE. Our simple mediations revealed that greater use of food as a reward only partially mediated the relationship between parent EE and child EE, suggesting that other factors may contribute to the parent-child EE link. However, when food was used as a reward with a child who was higher in negative affect, this combination was able to explain the parent-child EE relationship. It may be that for children with more frequent and/or intense negative affect, parental use of food as a reward is effective in regulating emotional distress. This may reinforce and increase the incidence of this feeding practice (e.g., Miller et al., 2020), the rewarding effect of food for the child, and reinforce modelling of EE behaviours (Rothbart & Bates, 2007).

Parents who have a tendency to EE may also be more likely to focus on their children's diet and restrict unhealthy foods for health reasons, perhaps in an attempt to avoid their children developing similar unhealthy eating behaviours (Miller et al., 2020). Indeed, moderated mediations revealed that the indirect relationship between parent and child EE via use of restriction of food for health reasons was contingent on a child being moderate or high in negative affect. Previous research has shown that children higher in negative affect are less likely to accept restriction at mealtimes (Farrow et al., 2018), which may result in greater rates of eating conflict. Higher negative affect in children is likely to shape both children's experiences of food restriction and children's responses to restrictive behaviour. A child with greater negative affect may be more likely to argue with their parents if food is restricted or repeatedly request or demand forbidden foods. This may heighten negative affect around foods and exacerbate the risk of children using food as a tool to deal with emotional arousal.

Contrary to our hypotheses, the full mediating effect of parents' use of food to regulate emotion on the relationship between parent EE and child EE did not vary according to levels of child negative affect. It may be that the combination of modelling of EE alongside the use of food for emotion regulation is particularly problematic and is associated with a greater prevalence of child EE irrespective of other child characteristics. In addition, child surgency and effortful control did not moderate any of the models' indirect effects. This may be a result of the age of the children since it has been reported that surgency is only predictive of obesogenic behaviours from 6 to 8 years (Steinsbekk et al., 2020). Similarly, Leung et al. (2014) failed to find that preschool children's effortful control was related to obesogenic eating behaviour. As the current study included children between 3 and 5 years, any influence of surgency or effortful control on eating behaviour may strengthen as children age and autonomy over food intake increases (Scaglioni et al., 2018).

As with other aspects of eating behaviour (Butland et al., 2007), the development of child EE is likely a result from a complex interplay between multiple risk factors. The findings reported align with the

biopsychosocial model and the BST of child obesity and highlight how child characteristics interact with parent behaviours to shape the development of child eating behaviour. Parental feeding practices and parents' own EE behaviours interact together to predict child EE and the relationship between parent behaviours and child EE depends on child levels of negative affect. These findings suggest that children with more negative temperamental dispositions may be the most susceptible to the negative impacts of an environment that is highly controlling around food, or in which EE is a modelled parental behaviour. Given that these controlling and counterproductive feeding practices are modifiable, interventions to support healthy eating in children should seek to reduce the use of these parenting behaviours and increase the prevalence of more responsive feeding practices (Harris et al., 2020). Mealtime interactions can be challenging for families, particularly when children express high levels of negative affect, and further research is needed to understand how parental feeding practices could be tailored to children with greater negative affect to foster a responsive, supportive feeding environment.

#### 4.3 | Limitations, future directions and conclusion

Despite our study having a large sample size, it was constrained by its cross-sectional design. Previous research has documented the existence of bidirectional relationships between child temperament, parental emotional feeding and child EE (Steinsbekk et al., 2018), thus future longitudinal research is needed to assess this in the context of the models identified in this paper. This study also used parent self-reports as measures of child EE and parental feeding practices. These self-reports may not always map onto observable behaviour (Blissett et al., 2019) and can be subject to response bias (Bergmeier et al., 2015). Experimental studies where child EE and feeding practices are objectively measured on multiple occasions may provide a fruitful avenue for further research. Last, the current sample consisted of only mothers and thus we do not yet know whether the findings would apply within father-child relationships.

In conclusion, this study is the first to assess the interactive relationships between parental feeding practices and child temperament in the explanation of the association between parental reports of parent and child EE. In line with the biopsychosocial model and the BST, the findings offer a unique insight into how children's temperamental characteristics create specific vulnerabilities to environmental experiences of parental EE and controlling feeding practices. Our findings highlight how important it is to consider individual differences between children when considering how parenting contributes to the incidence of child EE. As the prevalence of child EE is increasing (e.g., Messerli-Bürge et al., 2018), it is imperative that interventions for child obesity consider the role of parental behaviour alongside individual characteristics of children.

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## CONFLICT OF INTERESTS

The authors declare no conflict of interests.

## AUTHOR CONTRIBUTIONS

The authors' responsibilities were as follows: All authors contributed to the design of the study, RAS oversaw data collection and analysis of the data. All authors have contributed to the writing of the manuscript. RAS was supervised by CF, JB and EH.

## DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

## ORCID

Rebecca A. Stone  <http://orcid.org/0000-0002-8910-8792>

Jacqueline Blissett  <http://orcid.org/0000-0002-0275-6413>

Emma Haycraft  <http://orcid.org/0000-0002-7359-1759>

Claire Farrow  <http://orcid.org/0000-0002-9822-957X>

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#### SUPPORTING INFORMATION

Additional supporting information may be found in the online version of the article at the publisher's website.

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