

# **Emotional Feeding and Emotional Eating: Reciprocal Processes and the Influence of Negative Affectivity**

Silje Steinsbekk, Edward D. Barker, Clare Llewellyn, Alison Fildes, Lars Wichstrøm

## Author note

Silje Steinsbekk, Department of Psychology, Norwegian University of Science and Technology (NTNU), Trondheim, Norway; Edward D. Barker, Department of Psychology, King's College London, UK; Clare Llewellyn, Health Behaviour Research Centre, Department of Epidemiology and Public Health, University College London, UK; Alison Fildes, Health Behaviour Research Centre, Department of Epidemiology and Public Health, University College London, UK; Lars Wichstrøm, Department of Psychology, Norwegian University of Science and Technology, and NTNU Social Science, Trondheim, Norway

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Correspondence concerning this article should be addressed to Silje Steinsbekk, Department of Psychology, Norwegian University of Science and Technology, 7491 Trondheim, Norway. Phone +47 73597931/Fax +47 73597694  
Email: [Silje.Steinsbekk@svt.ntnu.no](mailto:Silje.Steinsbekk@svt.ntnu.no)

## **Abstract**

Emotional eating, i.e. eating more in response to negative mood, is often seen in children. But the origins of emotional eating remain unclear. In a representative community sample of Norwegian 4 year olds followed up at ages 6, 8, and 10 (analysis sample:  $n=801$ ) a reciprocal relation between parental emotional feeding and child emotional eating was revealed: (1) Higher levels of emotional feeding predicted higher levels of emotional eating and *vice versa*, adjusting for BMI and initial levels of feeding and eating; and (2) higher levels of temperamental negative affectivity (at age 4) increased the risk for future emotional eating and feeding.

Children's eating behavior is influenced by a multitude of interacting factors. According to the ecological model, eating behavior is influenced by the individual (e.g. biological); the social environment (e.g. parents); the community (e.g. schools); and factors at the macro level (e.g. media) (Story, Neumark-Sztainer, & French, 2002). To date, the home environment, and parenting behavior are the factors that have received most attention (Vaughn et al., 2016). Parents play a crucial role in shaping children's eating (Savage, Fisher, & Birch, 2007; Vaughn et al., 2016) by being the chief providers of food, modeling eating behavior and through the use of parenting and feeding practices (Cullen et al., 2003; McClain, Chappuis, Nguyen-Rodriguez, Yaroch, & Spruijt-Metz, 2009; Ventura & Birch, 2008; Vollmer & Mobley, 2013). Notably though, children are not passive recipients of their parent's behavior. In accordance with transactional models (Sameroff, 2009), reciprocal processes between the child and his or her environment are the main driver of child development and child effects must also be taken into account when considering the relation between parenting and child eating.

Eating behavior is considered to be a biologically influenced disposition toward food (Carnell, Kim, & Pryor, 2012). A number of eating behavior dimensions have been identified (French, Epstein, Jeffery, Blundell, & Wardle, 2012; Wardle, Guthrie, Sanderson, & Rapoport, 2001), including emotional eating, i.e., the tendency to eat more in response to negative emotions. The most biologically natural response to emotional distress is to eat less because gut activity decreases in the presence of emotional arousal, normally suppressing hunger and eating (Heatherton, Herman, & Polivy, 1991; van Strien & Ouwens, 2007). Yet as children mature they tend to emotionally overeat rather than undereat (Ashcroft, Semmler, Carnell, van Jaarsveld, & Wardle, 2008; Braet et al., 2008; van Strien & Ouwens, 2007). In fact 10 to 63 % of children and adolescents report some kind of emotional overeating (Carper, Fisher, & Birch, 2000; Nguyen-Rodriguez, Chou, Unger, & Spruijt-Metz, 2008; Shapiro et

al., 2007), an eating behavior associated with increased snacking (Sleddens, Kremers, De Vries, & Thijs, 2010), eating high energy-dense foods (Nguyen-Michel, Unger, & Spruijt-Metz, 2007), greater total caloric intake (Braet & VanStrien, 1997) and overweight (Braet et al., 2008; Croker, Cooke, & Wardle, 2011). Notably, other food-approaching behaviors have also been identified, e.g. food-responsiveness (i.e. the tendency to eat in response to food cues such as sight and smell of food), which is positively associated with emotional eating (Ashcroft et al., 2008; Steinsbekk, Belsky, & Wichstrom, 2016). Eating in response to negative emotions is also one pathway in the etiology of bulimia nervosa and binge eating (Allen, Byrne, La Puma, McLean, & Davis, 2008; Pearson, Riley, Davis, & Smith, 2014; Stice, 2001; Stice, Presnell, & Spangler, 2002). But the origins of emotional eating remain unclear.

### **Emotional Feeding**

**Parental emotional feeding predicting child emotional eating.** Because parents are presumed to be the most powerful socialization agents of young children's eating behavior (Savage et al., 2007), we examine the possibility that parents also influence their children's emotional eating. It is not uncommon for parents, some more than others, to use food to regulate their child's distress, i.e. emotional feeding. Parents most likely continue to do so because it works. However, these feeding practices may inadvertently teach the child to apply the same tactics themselves when in distress. According to psychosomatic theory, emotional eating is the result of early learning (Kaplan & Kaplan, 1957). Simply stated, a child that is repeatedly fed when she or he is upset or expresses negative emotions learns that eating helps to regulate such emotions.

This contention is tentatively supported by findings from cross-sectional studies which report positive associations between parental emotional feeding and child emotional eating (Blissett, Haycraft, & Farrow, 2010; Braden et al., 2014). For example, in a study of

overweight 8-12 year olds, emotional feeding was the factor most strongly associated with emotional eating (Braden et al., 2014). Moreover, Blissett et al. (2010) found that 3 to 5 year old children whose parents displayed high levels of emotional feeding consumed more calories when negative mood was induced experimentally, whereas children whose parents were low in emotional feeding showed the opposite pattern of eating; consuming less when emotionally aroused. However, an attempt to replicate this longitudinally failed in a very small scale study (n = 41) (Farrow, Haycraft, & Blissett, 2015). To the best of our knowledge, only one study has examined the prospective relation between emotional feeding and emotional eating in a relatively large sample of children (n= 222). Rodgers et al. (2013) observed that maternal emotional feeding predicted increases in emotional eating over the course of one year in toddlers and preschoolers.

Starting school and increasing autonomy through middle childhood make children less dependent upon their parents, including in relation to food. Thus, findings from preschool cannot necessarily be extrapolated to middle childhood. No previous study has prospectively explored the potential effect of parental emotional feeding on children's emotional eating in school age children, but we will do so in a large community sample of 6 year old Norwegian children, followed up at 8 and 10 years of age.

**Child emotional eating predicting parental emotional feeding.** Children are not merely passive recipients of their parents' behavior; parents also develop their feeding practices in response to their children's emerging characteristics (Webber, Cooke, Hill, & Wardle, 2010). Of importance to the present inquiry, children who are susceptible to the mood enhancing effect of food may elicit and reinforce emotional feeding in their parents – i.e. parents who experience that their child is easily soothed by food may be more likely to emotionally feed their child (Rodgers et al., 2013). Over time, this is hypothesized to strengthen the connection between emotions and food for the child (Braden et al., 2014). This

assumption has received some initial support with respect to early childhood; Rodgers et al (2013) found that toddlers' and preschoolers' emotional eating predicted emotional feeding one year later. Again, parent-child interactions around food may well change as the child grows. Hence, school children's eating may have a different effect on parental feeding than a toddler or preschooler's eating. We will add to the Rodgers et al. study (2013) by examining the reciprocal relation between child emotional eating and parent emotional feeding in middle childhood over multiple time points. Further, given potential reciprocal influences and because developmental cascades have been observed in many areas of development (Masten & Cicchetti, 2010), it is entirely possible that children and parents may engage in escalating or downregulating cycles over time. In other words, parental emotional feeding may increase future child emotional eating, which in turn feeds back to parents who increase their emotional feeding. Of course, the reverse pattern is also equally likely – that child emotional eating increases parental emotional feeding which in turn increases the child's emotional eating even further. However, Rodgers et al (2013) did not examine the bidirectional paths between emotional feeding and emotional eating in one multivariate model, but tested one outcome at a time; they were therefore unable to test for cascading effects. By employing a structural equation framework and examining the relations over multiple time points in middle childhood we will for the first time test whether parents' emotional feeding and child emotional eating display reinforcing cycles over time.

### **Temperament and the Emotional Feeding – Eating Relation**

It is well-known that children's temperamental traits affect parent-child interactions (Rothbart & Ahadi, 1994) and individual differences in temperament have been shown to affect children's eating behavior (Haycraft, Farrow, Meyer, Powell, & Blissett, 2011). Temperament is biologically influenced by differences in reactivity and self-regulation. Negative affectivity is one of three overarching factors of temperament according to

Rothbart's psychobiological model (Rothbart, Derryberry, & Posner, 1994). The negative affectivity dimension is characterized by mood instability, angry reactivity and dysregulated negative emotions (Rothbart, Ahadi, & Hershey, 1994; Rothbart, Ahadi, Hershey, & Fisher, 2001). Because emotional eating is a way of coping with negative emotions, it is reasonable to hypothesize that children high in temperamental negative affectivity are more prone to apply this particular emotion regulation strategy because they experience more negative emotions; in addition, they may have less effective strategies to downregulate when in distress, than children with lower levels of negative affectivity. In accordance with this contention, negative affectivity correlates with emotional eating in young children (Haycraft et al., 2011; Leung et al., 2014). Moreover, a longitudinal study showed that increased emotional eating in middle childhood was predicted by increased reactivity over the same time period (Harrist, Hubbs-Tait, Topham, Shriver, & Page, 2013).

One might also assume that parents of children high in negative affectivity will display higher levels of emotional feeding compared to parents of less reactive children, in attempts to soothe the child's higher than average distress. In a recent review of child temperament and maternal feeding practices (Bergmeier, Skouteris, Horwood, Hooley, & Richardson, 2014), only one study was identified that examined the relation between emotional feeding and children's negative affectivity. McMeekin et al (2013) found that mothers of infants with a more difficult temperament were more likely to use food to sooth the child. To our knowledge, the prospective relation between children's negative affectivity and parental emotional feeding has not been investigated, and no study has been conducted in school aged children. We will address this gap by examining negative affectivity as a predictor of both emotional feeding and emotional eating. Given the well established effects of temperament on child and parent behavior in general, and the aforementioned cross-sectional indications concerning eating in particular, we hypothesize that high negative affectivity will increase the

risk of both parental emotional feeding and child emotional eating and thus potentially contribute to cascading effects between the two.

### **Summary and Aim of the Study**

To enrich our understanding of emotional eating, acknowledging the high number of children displaying emotional eating, the potential health risks associated with it, and the lack of prospective research and consideration of transactional processes, we aimed to examine the relation between parental emotional feeding and children's emotional eating in a representative community sample of Norwegian 4 year olds, followed up at ages 6, 8, and 10 years. We tested the bidirectional relation between emotional feeding and emotional eating (measured at ages 6, 8, and 10), and explored whether children's negative affectivity (measured at age 4) increases the risk of emotional feeding and eating, and thereby drives the potentially cascading effect. Given the above evidence we hypothesize that: (a) greater use of emotional feeding at ages 6 and 8 predicts higher levels of emotional eating at ages 8 and 10, respectively; (b) higher levels of emotional eating at ages 6 and 8 predict greater use of emotional feeding at ages 8 and 10, respectively; (c) children high in negative affectivity at age 4 display higher levels of emotional eating and have parents who apply more emotional feeding two years later. Negative affectivity is also expected to predict the potentially cascading relation between emotional feeding and eating in middle childhood. Because emotional eating is positively related to weight (Braet et al., 2008; Croker et al., 2011), children's body mass index (BMI) was accounted for in our study.

### **Method**

#### **Participants and Procedure**

All children of the 2003 and 2004 birth cohorts (n= 3,456) and their parents living in Trondheim, Norway were invited by letter to participate in the Trondheim Early Secure Study (TESS) (Wichstrøm et al., 2012) and to complete a brief measure of emotional behavioral



problems, the Strengths and Difficulties Questionnaire (SDQ) (Goodman, 1997; Svein, Berg-Nielsen, Lydersen, & Wichstrom, 2013) version 4-16. The SDQ was used because the primary aim of TESS was to assess mental health. Parents brought the completed SDQ when they attended the well-child clinic for the routine health check at age 4 years, where the health nurse described the study and obtained the parents' written consent to participate (5.2% of eligible parents were missed) ( $n = 2,475$ ). As shown in Figure 1, almost all children in the two cohorts (born in Trondheim in 2003 or 2004) appeared at the routine health check-up (age 4) at the city's well-child clinic (97.2%), thus the sample is effectively a community sample. To increase sample variability (due to the primary TESS focus), children with higher scores on the SDQ were oversampled. Children were allocated to four strata according to their SDQ scores (cut-offs: 0-4, 5-8, 9-11, and 12-40), and the probability of selection increased with increasing SDQ scores (0.37, 0.48, 0.70, and 0.89 in the four strata, respectively). The statistical analyses accounted for this oversampling to produce appropriate population estimates (see Results). Additional recruitment and procedure details are described in Wichstrøm et al. (2012). Of the 1,250 children recruited into the Study, 997 (50.9% female, 49.1% male) were successfully enrolled at Time 1 (T1) (Figure 1), and the participants' mean age was 4.7 years ( $SD = .30$ ). Families were followed up two (Time 2 (T2):  $n = 795$ ; mean age = 6.7 years,  $SD = .17$ ), four (Time 3 (T3):  $n = 699$ ; mean age = 8.8 years,  $SD = .24$ ) and six years later (Time 4 (T4):  $n = 702$ ; mean age = 10.51 years,  $SD = .17$ ). Baseline (T1) characteristics showed that the majority of participating parents were ethnic Norwegians (93% of the mothers and 91% of the fathers), they were married or cohabitants (89.1%), and the majority of informants were mothers (84.4%). The sample was comparable with the Norwegian parent population with regard to the parents' level of education (Statistics Norway, 2012; Wichstrøm et al., 2012) and children's BMI (Juliusson et al., 2013). At Time 1, 5.7% of the informants were leaders; 25.7% were higher level professionals, whereas 39%

were lower level professionals; 26% were formally skilled workers; 0.5% were farmers/fishmen and 3.1% were unskilled workers. Statistics Norway provided information on the occupations of all parents of 4-year olds at the time of first assessment (2007) who were born in 2003 and 2004 and living in the city of Trondheim, using the same classification system of occupations as the present study. Differences in rates of occupations between the present sample and the Norwegian parent population were negligible, and never exceeded 3.6%. The greatest difference was found in the largest group of employees, namely lower professionals. All procedures were approved by the Regional Committee for Medical and Health Research Ethics Mid Norway.

## Measures

**Emotional eating** was measured using the emotional overeating subscale of the Norwegian version of Wardle et al.'s (2001) Children's Eating Behaviour Questionnaire (CEBQ). The CEBQ has been validated against behavioral measures of eating (Carnell & Wardle, 2007b), and it has good test-retest reliability (Wardle et al., 2001). The 'emotional overeating' subscale consists of 4 items which were rated on a 5-point Likert scale (from *Never* to *Always*;  $\alpha$  (present sample) = .75). To improve the internal consistency of these items, one item ("My child eats more when s/he has nothing else to do") was removed. The emotional eating outcome of the present study thus contained the following three items: "My child eats more when worried"; "My child eats more when annoyed"; "My child eats more when anxious"), showing good internal consistency at all measurement points (age 6:  $\alpha$  = .81, age 8:  $\alpha$  = .80; age 10:  $\alpha$  = .80).

**Parent's emotional feeding** was assessed using The Parent Feeding Style Questionnaire (PFSQ) (Wardle, Sanderson, Guthrie, Rapoport, & Plomin, 2002), which is among the most widely used parent feeding style questionnaires (Braden et al., 2014; Carnell & Wardle, 2007a; Clark et al., 2008; Damiano, Hart, & Paxton, 2016; Lo, Cheung, Lee, Tam,

& Keung, 2015; Matheson et al., 2015; Monge-Rojas et al., 2010; Rodgers et al., 2013; Rodgers et al., 2014; Saxton, Carnell, Van Jaarsveld, & Wardle, 2009; Steinsbekk et al., 2016; Tate, Trofholz, Rudasill, Neumark-Sztainer, & Berge, 2016; Wardle et al., 2002; Yilmaz, Erkorkmaz, Ozcetin, & Karaaslan, 2013) and the only measure capturing emotional feeding in school-aged children (Vaughn, Tabak, Bryant, & Ward, 2013). The PFSQ shows good test-retest reliability and is validated in different cultures (Ozcetin, Yilmaz, Erkorkmaz, & Esmeray, 2010; Tam, Keung, Lee, Lo, & Cheung, 2014). The original factor structure has also been confirmed, including a one factor solution for 'Emotional feeding' (Tam et al., 2014). The 'emotional feeding' subscale consists of five items (e.g., "I give my child something to eat to make him/her feel better when s/he is feeling upset") (age 6:  $\alpha = .80$ ; age 8:  $\alpha = .81$ ; age 10:  $\alpha = .80$ ) with responses rated on a 5-point Likert scale from *Never* to *Always*.

**Negative affectivity** was measured at age 4 by the Children's Behavior Questionnaire (CBQ) (Rothbart et al., 2001). Negative affectivity is one out of three broad dimensions of temperament captured by the 195 item parent-reported questionnaire, and is based on the following scales: 'Sadness' (12 items); 'Fear' (12 items); 'Anger/Frustration' (13 items); 'Soothability' (13 items) (Rothbart et al., 2001). Internal consistency was  $\alpha = .88$ . A higher score indicates more negative affectivity.

**Children's weight.** Parental feeding practices, children's eating and negative affectivity are associated with children's weight (Bergmeier et al., 2014; French et al., 2012; Ventura & Birch, 2008). In a former study of the present sample, we found increased BMI during middle childhood to predict comparatively higher levels of emotional eating (Steinsbekk & Wichstrom, 2015). We therefore adjust for children's body mass index (BMI) when examining the relation between negative affectivity, feeding and eating. Weight and height were measured by the health care nurse at the ordinary community health checkup for 4-year-olds using stadiometers and analogue scales. At ages 6, 8, and 10, digital scales were used

to measure weight (Tanita BC420MA) and height (Heightronic digital stadiometer: QuickMedical, Model 235A). Correction for light indoor clothing (0.5 kg) was applied and BMI was estimated. According to Cole et al (2005), BMI-z-score is optimal for cross-sectional assessments, whereas BMI is preferable in longitudinal designs, the latter was therefore used in the present study.

## **Results**

Means of all variables are presented in Table 1. At all three measurement times (age 6, 8, and 10 years), approximately 65 % of the children in our sample were reported to display some emotional eating, as only 35% were reported to “never” display emotional eating (score=1). The level of emotional eating and emotional feeding identified is comparable to means reported in other studies (Escobar et al., 2014; Svensson et al., 2011; Wardle, Guthrie, Sanderson, & Rapoport, 2001 (Blissett et al., 2010; Carnell & Wardle, 2007a; Damiano et al., 2016; Hardman, Christiansen, & Wilkinson, 2016; Wardle & Carnell, 2007), and community studies comparable to the present inquiry report the same level of negative affectivity as found in our study (e.g. (Sleddens, Kremers, De Vries, & Thijs, 2013). Bivariate correlations between emotional feeding and emotional eating are displayed in Table 2, showing significant associations at all measurement points. Preliminary analyses also revealed small, but significant associations between emotional eating and children’s BMI (Age 6:  $r=.16$ ,  $p\leq.01$ ; Age 8:  $r=.14$ ,  $p\leq.01$ ; Age 10:  $r=.20$ ,  $p\leq.001$ ).

### **Reciprocal Relations between Emotional Feeding and Eating**

An autoregressive cross lagged model was applied to test our hypotheses that emotional feeding increases emotional eating and *vice-versa*, and that children’s negative affectivity drives this potentially cascading relation. In this model, the autoregressive paths reflect the unique stability of emotional eating, emotional feeding and BMI, whereas the cross-lagged paths estimate the relation between the different variables over time while allowing for within

time associations between the error terms of these variables. More specifically, emotional eating and feeding at ages 8 and 10 were regressed on emotional eating and feeding and BMI at ages 6 and 8, respectively. Emotional eating and feeding at ages 6, 8 and 10 were also regressed on negative affectivity and BMI at age 4. A graphical representation of the model is shown in Supplementary Figure 1. Wald tests of parameter constraint were used to test differences between paths.

The model was fitted in Mplus version 7.0 (Muthèn & Muthèn, 1998-2010), applying a robust maximum likelihood estimator, which is robust to moderate deviations from multivariate normality and provide robust standard errors. A full information maximum likelihood procedure was used to handle missing data in all analyses conducted, which implies that analyses are performed on all available data, provided that cases have at least some values for the dependent variables (i.e. emotional feeding and eating at ages 6, 8, and 10). The analysis sample is therefore  $n = 801$ . We used a screen-stratified sample, all analyses were therefore performed using probability weights; the data were weighted with a factor corresponding to the number of children in the population divided by the number of participating children to produce accurate population estimates (i.e., low screen scorers were ‘weighted up’ and high scorers were ‘weighted down’).

The main results of the model are presented in Figure 2, showing good fit to the data: CFI = 0.96; TLI=0.89, RMSEA =0.06). The full model (i.e. all parameter estimates) is presented in Supplementary Table 1. As can be seen in the Figure 2, there was a bidirectional relation between emotional feeding and emotional eating: greater use of emotional feeding when children were 6 and 8 years of age predicted more emotional eating in children two years later, and higher levels of emotional eating at ages 6 and 8 predicted comparatively greater use of emotional feeding when children were 8 and 10 years, respectively. Note that initial levels of emotional eating and emotional feeding were accounted for in the analysis,

and that the stability is relatively high in both outcomes. Wald test of parameter constraint revealed that there was no difference in the effect from feeding to eating as compared to the effect from eating to feeding (Age 6 to 8 years: Wald=1.40, df=1,  $p=.24$ ; Age 8 to 10 years: Wald=0.67, df=1,  $p=.41$ ).

### **Cascading Effects**

To explore cascading effects we examined the paths in the full structural model via the delta method for assessing indirect effects. All indirect effects estimated are presented in Table 3. As can be seen, several indirect effects were observed. For example, although emotional feeding at age 8 predicted emotional eating at age 10 (Figure 2), emotional feeding at age 6 contributed to this relation as shown by a significant indirect effect (Table 3). Further, initial emotional eating at age 6 contributed to emotional feeding at age 10 via its effect on emotional feeding and eating at age 8. Overall, cascading effects of initial emotional feeding and eating were observed.

As can be seen in Figure 2 negative affectivity at age 4 predicted emotional feeding and eating at age 6. Wald test of parameter constraint revealed that the path from negative affectivity to emotional feeding did not significantly differ from the negative affectivity - emotional eating path (Wald=2.91, df=1,  $p=.09$ ). Because we speculated that negative affectivity also would contribute to any cascading effects between emotional feeding and emotional eating, indirect effects were therefore estimated in the main autoregressive model. As shown in Table 3, several indirect effects were evident, which indicate that negative affectivity indeed contributed to the feeding – eating relation.

### **Discussion**

The present inquiry aimed to test the bidirectional relation between emotional feeding and emotional eating in a representative community sample of Norwegian 4 year olds followed up at ages 6, 8, and 10 years of age. We also explored whether children's negative

affectivity contributes to the potentially cascading association between emotional feeding and emotional eating. As hypothesized, we found that parental feeding at ages 6 and 8 prospectively predicted emotional eating at ages 8 and 10, respectively. Evidence for the opposite direction of influence was also found. Further, negative affectivity at age 4 predicted emotional feeding and emotional eating at age 6, and children displaying higher levels of negative affectivity were at increased risk for the cascading relation between emotional feeding and eating.

### **The Bidirectional Relation between Emotional Feeding and Emotional Eating**

Our study is the first to examine the prospective relation between emotional feeding and emotional eating in school-aged children. In accordance with earlier research (Ashcroft et al., 2008; Stifter & Moding, 2015), the stability was relatively high in both outcomes. Even in the context of high stability, parental emotional feeding increased children's inclination to engage in emotional eating. The level of emotional feeding reported was low, although comparable to earlier findings (Carnell & Wardle, 2007a; Damiano et al., 2016; Hardman et al., 2016; Wardle & Carnell, 2007). However, an experimental study of preschoolers previously found that even low levels of emotional feeding increased the likelihood of children regulating their emotions with food. Thus, although parents are less likely to engage in emotional feeding compared to other feeding practices (Blissett et al., 2010; Carnell & Wardle, 2007a; Hardman et al., 2016; Tam et al., 2014), research suggests emotional feeding does affect behavioral expression of emotional eating. This study adds to existing research and suggests emotional feeding prospectively predicts emotional eating in middle childhood.

As further hypothesized, higher levels of emotional eating in children prospectively predicted greater use of parental emotional feeding practices. Although our study does not reveal the underlying mechanisms, it is reasonable to assume that parents are more likely to

emotionally feed a child who is easily soothed by food; and, as shown, increase the use of such feeding practices over time. The association between emotion and food may be repeatedly reinforced and thus further strengthened through a bidirectional, cascading relation between emotional feeding and emotional eating. The association between food and emotion is presumably not only reinforced in the child, but also in the parent, potentially explaining why emotional eating predicts emotional feeding. Hamburg et al (2014) state that offering food to sooth another person's emotions not only aims to regulate the recipient's emotions, but also the emotions of the provider, in what they call "empathic emotion regulation" (EER): empathy triggers the parent's motivation to regulate the child's emotions. Through food offering, EER reinforces itself: the association between food and increased positive emotions and decreased negative emotions is strengthened every time food is used as a successful regulatory tool (Hamburg et al., 2014). The authors note that due to its physiological and psychological properties, eating is an effective strategy for intrapersonal emotional regulations (Hamburg et al, 2014). Eating has a stress-reducing effect and individuals are shown to prefer palatable foods in times of distress (Dallman, 2010). Evidence suggests that parents usually offer energy-dense foods in the context of emotional feeding (Raaijmakers, Gevers, Teuscher, Kremers, & van Assema, 2014), with the potential aim of downregulating both the child's and their own's negative distress (as caused by the child's negative affect). Thus, the use of food to regulate emotions is not only externally, but also *intrinsically* or neurophysiologically reinforced (Weltens, Zhao, & Van Oudenhove, 2014) because our brain responds to the physiological rewarding properties of food (Dallman, 2010). Notably though, individual differences in children's food responsiveness may also affect whether parents' apply emotional feeding, as highly food-responsive children may respond more promptly to food offers, which might reinforce such parental behavior.



## **Negative Affectivity is a Risk factor for the Cascading Emotional Feeding – Eating Relation**

Based on the above line of reasoning, it is not surprising that our results show children with comparatively higher levels of negative affectivity to be at particular risk for the cascading relation between emotional feeding and emotional eating. Due to their temperamental characteristics, these children will display more negative emotions and thus more often be in emotional states that require regulation, which might trigger both emotional eating and emotional feeding. They may also have more trouble downregulating their negative emotion once activated. Although our study is the first to examine prospectively the link between negative affectivity and emotional feeding in school-aged children, the findings are in accordance with infant studies, showing parents of children with difficult temperament to be more prone to use food for soothing purposes (McMeekin et al., 2013; Stifter, Anzman-Frasca, Birch, & Voegtline, 2011). Finding that negative affectivity predicts emotional feeding - possibly because children with this characteristic display more negative emotions, and so the parents are more prone to apply emotional feeding to downregulate these emotions - is also in accordance with one existing study (Harrist et al., 2013). Earlier research has also demonstrated the association between children's negative affectivity and emotional eating (Haycraft et al., 2011; Leung et al., 2014), but we add to existing studies by showing that negative affectivity is part of the cascading bidirectional relation between emotional feeding and emotional eating. It is reasonable to assume that other factors are also involved in the bidirectional emotional feeding – eating relation, e.g., lack of knowledge or parenting skills potentially impairing parents' ability to deal with their offspring's negative affect by other and more efficient means. Further, some parents may use emotional feeding from the very early months and either increase their child's negative affectivity (by failing to adequately regulate emotion in other more functional ways) or perceive their children as more difficult. And last,

but not least, other temperamental dimensions may also be at play and should be addressed in future studies, including the subcomponents of negative affectivity (i.e., ‘Sadness’; ‘Fear’; ‘Anger/Frustration’; ‘Soothability’).

### **The relation between BMI, emotional feeding and emotional eating**

BMI was only included as a covariate in the present study and was found to be unrelated to parental use of emotional feeding (see Supplementary table 1), which corresponds to a previous study of preschoolers (Rodgers et al., 2013). Emotional eating, on the other hand, was both cross-sectionally and prospectively (although inconsistently so) associated with BMI: Participants with comparatively higher levels of BMI at age 8 displayed more emotional eating at age 10 when emotional eating at age 8 was accounted for. The path between BMI at age 4 and emotional eating at age 6 was also significant, but because emotional eating was assessed from age 6 onwards, emotional eating at age 4 could not be adjusted for. Thus, we cannot conclude that BMI at age 4 predicts increased levels of emotional eating at age 6. Further, BMI at age 6 did not predict emotional eating at age 8. Future research should aim to longitudinally explore the relationship between BMI and emotional eating, while controlling for other food approaching eating behaviors that are known to relate to emotional eating in childhood. Obviously, a range of factors not examined here (e.g. genetics) may predict emotional eating.

### **Limitations**

Even though the present study has several strengths, such as a longitudinal design and a large and representative sample, some limitations should be acknowledged when interpreting the findings. First, parents reported on both emotional feeding practices (parental self-report) and children’s emotional eating (parent proxy report), which potentially increase the risk of respondent bias and hence may have inflated correlations between the two

measures. Because we adjusted for prior measurements in both domains, and thus the potentially inflated association, the influence of respondent effects may have been reduced, but we cannot rule out that it was not completely accounted for. Ideally, observational measures should have been applied to capture emotional feeding, given that research suggests this method to be complementary to parent-report in capturing parents' use of food to soothe their children, at least in infant and toddlers (Stifter & Moding, 2015). Repeated observations of family meals and between meal snacking would perhaps be even more reliable in order to capture consistent and representative feeding practices, but is too time consuming and costly to apply in large scale studies such as the present one, which also accords for laboratory measures of eating behavior. Notably though, questionnaire measured emotional feeding is found to predict laboratory measured emotional eating in preschoolers (Blissett et al., 2010). Using multiple informants (e.g. a teacher or at least both parents) would also be an advantage given the lack of observational data. However, teachers rarely observe children's ad libitum eating and would therefore find it difficult to report accurately on such behavior. Because the present study is part of a larger, ongoing longitudinal study (The Trondheim Early Secure Study), the data collection is comprehensive and time-consuming (e.g. at age 6 the child and his/her parent spent a whole day doing assessments), and although we urged both parents to participate, we could not place such a demand on the families. Finally, it should be acknowledged that the present study was conducted in Norway, which has a relatively homogenous well educated population. Findings may therefore not generalize to more diverse populations or cultures with other feeding and eating practices.

## **Conclusion**

Our study revealed a reciprocal relation between emotional feeding and emotional eating in middle childhood, and showed that comparatively higher levels of negative affectivity put children at increased risk for the cascading relation between emotional feeding

and emotional eating. Although not examined in the present study, reinforcing processes both within the child and the parent (both at a physiological and psychological level), as well as between them, might constitute the mechanisms underlying the reciprocal relation between emotional feeding and emotional eating detected. Future studies should aim to identify these mechanisms. The bidirectional relation found in our study also needs to be tested in laboratory studies and in samples of children with overweight where emotional eating is more prevalent (Croker et al., 2011).

Figure 1

*Sample recruitment and follow-up. First assessment (T1)=age 4; Second assessment (T2)=age 6; Third assessment (T3)=age 8; Fourth assessment (T4)=age 10.*

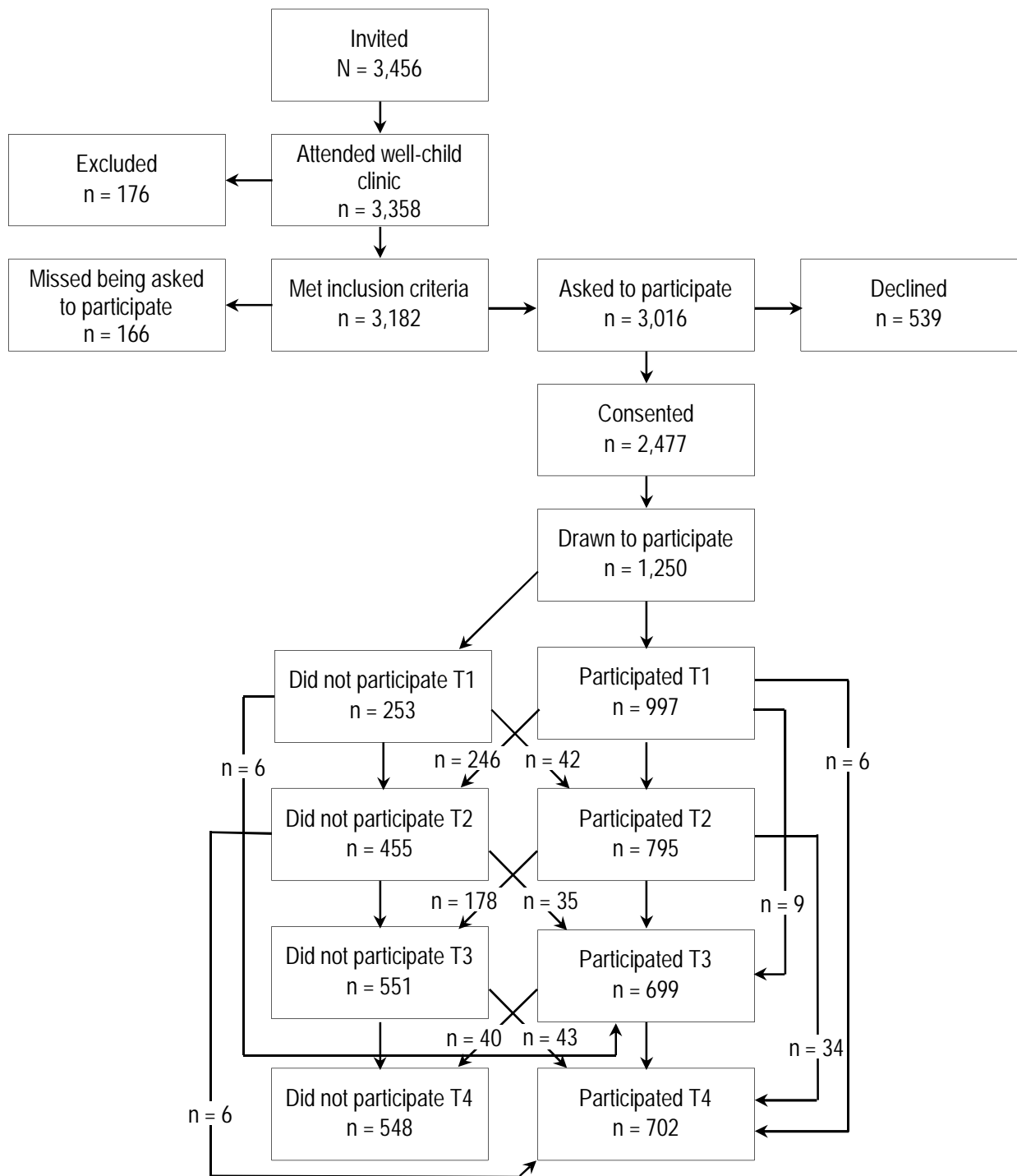


Table 1  
*Means and standard deviations (SD) of all study variables*

Study variables (possible range)	Means	SD
<b>Emotional feeding (1-5)</b>		
Age 6 (n=750)	1.38	0.42
Age 8 (n=658)	1.33	0.42
Age 10 (n=691)	1.32	0.40
<b>Emotional eating (1-5)</b>		
Age 6 (n=752)	1.45	0.45
Age 8 (n=655)	1.46	0.48
Age 10 (n=691)	1.49	0.49
<b>Children's BMI</b>		
Age 4 (n=1218)	15.93	1.23
Age 6 (n=650)	15.58	1.48
Age 8 (n=675)	16.62	1.99
Age 10 (n=692)	17.55	2.52
Negative affectivity age 4 (1-7) (n=900)	3.70	0.47

Table 2

*Bivariate correlations between emotional feeding and emotional eating*

	Emotional feeding age 8	Emotional feeding age 10	Emotional eating age 6	Emotional eating age 8	Emotional eating age 10
Emotional feeding age 6	.58*** (n=788)	.56*** (n=798)	.51*** (n=753)	.40*** (n=787)	.34*** (n=798)
Emotional feeding age 8		.61*** (n=721)	.36*** (n=788)	.48*** (n=658)	.38*** (n=721)
Emotional feeding age 10			.39*** (n=798)	.40*** (n=721)	.49*** (n=671)
Emotional eating age 6				.53*** (n=787)	.52*** (n=798)
Emotional eating age 8					.60*** (n=721)

Note: \*p < .05; \*\*p < .01.; \*\*\*p < .001.

Table 3

All indirect effects estimated in the main autoregressive cross lagged model (N=801)

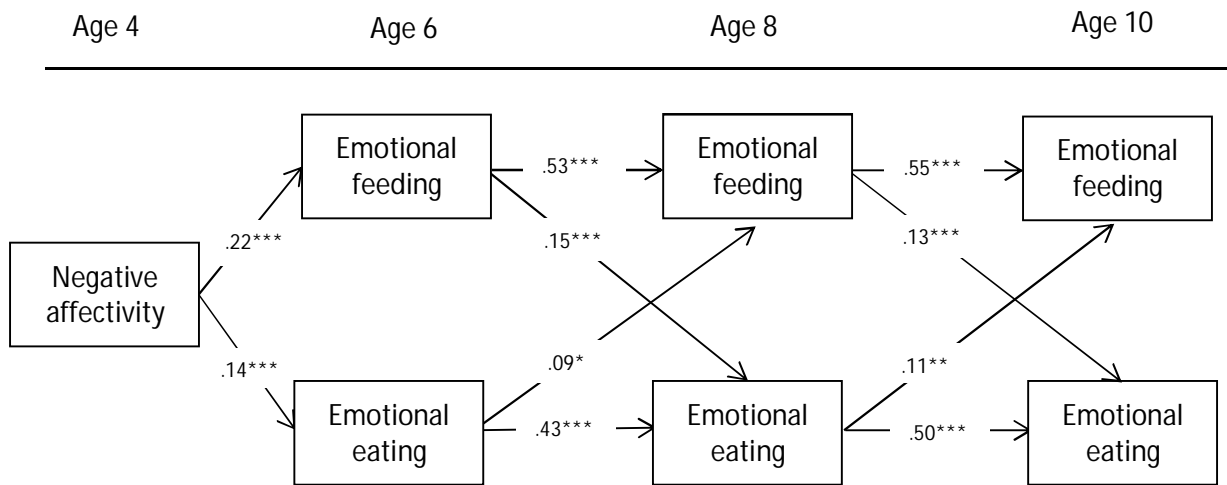
Parameter estimates – specific indirect effects	Unstandardized	95% CI	Standardized
<b>Emotional feeding age 6 → Emotional eating age 10</b>			
EF age 6 → EE age 8 → EE age 10	.08***	(.03, .13)	.08
EF age 6 → EF age 8 → EE age 10	.08**	(.03, .13)	.07
<b>Emotional eating age 6 → Emotional feeding age 10</b>			
EE age 6 → EF age 8 → EF age 10	.04*	(.00, .09)	.05
EE age 6 → EE age 8 → EF age 10	.05*	(.01, .08)	.05
<b>Emotional feeding age 6 → Emotional feeding age 10</b>			
EF age 6 → EE age 8 → EF age 10	.02	(-.00, .03)	.02
<b>Emotional eating age 6 → Emotional eating age 10</b>			
EE age 6 → EF age 8 → EE age 10	.01	(-.00, .03)	.01
<b>Negative affectivity age 4 → Emotional eating age 10</b>			
NA age 4 → EF age 6 → EE age 8 → EE age 10	.02**	(.01, .03)	.02
NA age 4 → EF age 6 → EF age 8 → EE age 10	.02**	(.00, .03)	.02
NA age 4 → EE age 6 → EF age 8 → EE age 10	.00	(-.00, .00)	.00
NA age 4 → EE age 6 → EE age 8 → EE age 10	.03***	(.01, .05)	.03
NA age 4 → EF age 8 → EE age 10	.01	(-.00, .02)	.01
NA age 4 → EE age 8 → EE age 10	.06**	(.02, .09)	.06
<b>Negative affectivity age 4 → Emotional feeding age 10</b>			
NA age 4 → EE age 6 → EF age 8 → EF age 10	.01	(-.00, .01)	.01
NA age 4 → EE age 6 → EE age 8 → EF age 10	.01*	(.00, .01)	.01
NA age 4 → EF age 6 → EE age 8 → EF age 10	.00	(.00, .08)	.00
NA age 4 → EF age 6 → EF age 8 → EF age 10	.05***	(.03, .08)	.06
NA age 4 → EE age 8 → EF age 10	.01	(.00, .02)	.01
NA age 4 → EF age 8 → EF age 10	.02	(-.01, .05)	.02
<b>Negative affectivity age 4 → Emotional eating age 8</b>			
NA age 4 → EF age 6 → EE age 8	.03**	(.01, .05)	.03
NA age 4 → EE age 6 → EE age 8	.06***	(.03, .09)	.06
<b>Negative affectivity age 4 → Emotional feeding age 8</b>			
NA age 4 → EE age 6 → EF age 8	.01	(-.00, .02)	.01
NA age 4 → EF age 6 → EF age 8	.10***	(.06, .14)	.18

Note: \*p < .05; \*\*p < .01.; \*\*\*p < .001.



Figure 2.

Estimated paths ( $\beta$ ) of the main autoregressive cross lagged model ( $N=801$ ), adjusted for BMI at ages 4, 6, 8 and 10. Within time correlations were estimated, but are not displayed in the figure (Supplementary Table 1). All coefficients displayed are standardized. Asterisks indicate the level of significance ( $*=p < 05$ ;  $**=p \leq .01$ ;  $***=p \leq 001$ ).



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