



Short communication

Associations between parental stress, parent feeding practices, and child eating behaviors within the context of food insecurity

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ABSTRACT

Food insecurity is becoming increasingly prevalent, especially for children from diverse households. Food insecurity presents a potentially different context in which parents engage in food-related parenting practices and children engage in eating behaviors. Parents may also experience higher levels of stress and depressed mood in the context of food insecurity. This study aims to examine associations between momentary parental stress and depressed mood, food-related parenting practices, and child eating behaviors within food secure and insecure households. Children ages 5–7 and their families ($n = 150$) from six racial/ethnic groups ($n = 25$ each African American, Hispanic, Hmong, Native American, Somali, White) were recruited for this mixed-methods study through primary care clinics in Minneapolis/St. Paul, MN in 2015–2016. High levels of parental stress and depressed mood experienced earlier in the day within food insecure households was associated with using restrictive feeding practices and serving more pre-prepared foods at the evening meal the same night. Parents from food secure households who experienced high levels of stress earlier in the day were more likely to engage in pressure-to-eat feeding practices, serve more fast food, and to have children who engaged in picky eating behaviors at the evening meal the same night. Health care clinicians may want to consider, or continue to, screen parents for food insecurity, stress, and depressed mood during well child visits and discuss the influence these factors may have on every day food-related parenting practices. Additionally, future research should consider using real-time interventions to reduce parental stress to promote healthy food-related parenting practices within food insecure and secure households.

1. Introduction

Food insecurity is the lack of reliable access to sufficient quantities of affordable, nutritious, and culturally appropriate food for all people at all times (Pan et al., 2012; Martin and Ferris, 2007; Berge et al., 2020; Taillie and Poti, 2017). Approximately one in eight American households experience periodic food insecurity annually (Pan et al., 2012; Martin and Ferris, 2007; Gundersen, 2013; Gundersen et al., 2008; Trofholz et al., 2020). Research indicates that food insecurity in children is associated with serious health, behavioral, and cognitive problems into adulthood (Taillie and Poti, 2017; Gundersen et al., 2008; Trofholz et al., 2020; Tiwari et al., 2017; Kohn et al., 2014). Recent research also indicates that food insecure children have lower

quality diets and some food insecure children may have a higher risk for obesity (Berge et al., 2020; Tiwari et al., 2017; Kohn et al., 2014; Mills et al., 2017).

Food insecurity presents a context in which parents must engage in food-related parenting practices when food is scarce (Gundersen et al., 2008; Wolfson and Bleich, 2015), which may alter their typical behaviors. For example, knowing there is not enough food to last the entire month may result in more restrictive feeding practices (e.g., withholding food from people) to spread food resources out across the month in order to ensure that family members do not go hungry (Berge et al., 2020; Wolfson and Bleich, 2015; Mills et al., 2017). Or, having to choose between feeding your child(ren) or yourself may introduce additional stressors that may alter the way in which parents approach

Abbreviations: EMA, ecological momentary assessment; EMI, ecological momentary intervention

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food-related parenting practices such as using pressure-to-eat feeding practices (e.g., pushing people to eat food) to not waste food, or serving more pre-prepared/pre-packaged foods because they are less expensive and more shelf stable (Wolfson and Bleich, 2015). One prior study found that mothers were more likely to use restrictive feeding practices when the household was food insecure (Bauer et al., 2015). Although this study was conducted with adolescents, it provides initial support for the hypothesis that parents use more controlling feeding practices within the context of food insecurity. In addition, child eating behaviors (e.g., picky eating) may be altered in the context of food insecurity (Taylor et al., 2005; Tester et al., 2016). For example, a child may become more or less picky because of the lack of food, due to fewer food choices available in a food insecure environment, or because parents are less responsive to their requests.

Other parent-related factors such as stress or depressed mood may also be more prevalent in the context of food insecurity and also influence parents' food-related parenting practices (Berge et al., 2020; Taillie and Poti, 2017; Gundersen et al., 2008; Leung et al., 2015). Prior studies have shown that maternal stress and depressed mood were associated with increased risk of engaging in pressure-to-eat feeding practices (Goulding et al., 2014) and that stress was associated with parents engaging in more controlling feeding practices with children regardless of food secure status (El-Behadli et al., 2015). In our prior research, momentary parental stress (e.g., a lot to get done, interpersonal problems, child misbehavior) and depressed mood earlier in the day were associated with serving less homemade foods and more pre-prepared foods the same night at the evening meal (Berge et al., 2017a; Berge et al., 2018). Momentary stress was measured using ecological momentary assessment (EMA), which allows for assessing fluctuations in behavior across time and context. Using EMA measures within the context of food insecurity is important because fluctuating behaviors such as parental stress and depressed mood may be influenced by cycles of food insecurity (Bauer et al., 2015). As a natural extension of our prior work, the current study was conducted to examine associations between momentary parental stress and depressed mood and food-related parenting practices in households with and without food insecurity to better understand how the combination of stress and food insecurity impact food-related parenting practices.

With regard to child eating behaviors, prior studies have shown that child eating behaviors (e.g., eating more food, eating less food, picky eating) are influenced by parent feeding practices such as restriction and pressure-to-eat (Berge et al., 2020; Birch and Fisher, 2000; Birch et al., 2003; Fisher and Neumark-Sztainer, 2003; Loth et al., 2013; Loth et al., 2013; Loth et al., 2014), however we are unaware of any prior research examining parental stress and child eating behaviors. Thus, research examining the association between parental stress and child eating behaviors would greatly advance the field, in addition to examining this relationship within the context of food security.

Given the potential harmful outcomes associated with controlling parent feeding practices, unhealthy food served at family meals, and child picky eating it is important to identify whether these types of food-related parenting practices and child eating behaviors are increased in the presence of food insecurity, which may help explain the negative health outcomes associated with food insecurity found in prior studies (Berge et al., 2020; Taillie and Poti, 2017; Gundersen et al., 2008; Trofholz et al., 2020; Tiwari et al., 2017; Kohn et al., 2014; Mills et al., 2017). The three-part research question guiding this study is: what is the association between parental stress and depressed mood earlier in the day and (1) parent feeding practices, (2) healthfulness of foods served, and (3) child eating behaviors at evening meals the same night in households with and without food insecurity?

2. Material and methods

Data for the current study are from Phase I of *Family Matters*, a National Institutes of Health funded study (Berge et al., 2017b). *Family*

Matters is a 5-year incremental (Phase I = 2014–2016.; Phase II = 2017–2019), mixed-methods (e.g., video-recorded tasks, EMA, interviews, surveys) longitudinal study designed to identify risk and protective factors for childhood obesity in the home environments of racially/ethnically diverse and primarily low-income children.

In Phase I, a mixed-methods (i.e., EMA, dietary recalls, home food inventory, accelerometry, built environment audit, observational family task, qualitative interviews) (Berge et al., 2017a, b, 2018) 10-day in-home examination of the home environments of children ages 5–7 years old ($n = 150$) from six racial/ethnic groups (i.e., African American, Hispanic/Latino, Hmong, Native American, Somali, and White) in Minneapolis/St. Paul, MN in 2015 was conducted to identify individual, dyadic, and familial risk and protective factors for childhood obesity. The University of Minnesota's Institutional Review Board Human Subjects Committee approved all protocols used in the study. In-depth details about the study design, recruitment and eligibility criteria, sample, and measures are published elsewhere (Berge et al., 2017b).

2.1. Sample demographics

The full sample included 150 diverse families who were equally distributed across the six racial/ethnic groups recruited in the study. One family was omitted from this analysis because of missing data on food security status. Each family's primary caregiver reported on one study child between the age of 5 and 7 (mean = 6.4, SD = 0.8). The majority of primary caregivers were mothers (91%) who were approximately 35 years old (mean = 34.5; sd = 7.1). The families were from low-income households, with 70% of families earning less than \$35,000 per year. A quarter of families ($n = 39$) were determined to be food insecure based on their responses to a series of six questions (see Table 1).

2.2. Measures

All measures in the current study are described in Table 1.

2.3. Statistical analysis

Inferential statistics were used to examine how morning stress and depressed mood related to evening feeding practices (i.e., pressure-to-eat, food restriction), the composition of food types (i.e., homemade, pre-prepared, fast food) served at evening meals (including snacking meal occasions) (Loth et al., 2020), and child food fussiness (i.e., child refuses to eat) by food security status. The two predictor variables (i.e., stress and depressed mood before noon) were analyzed as continuous random variables. The outcome variables were evaluated with generalized estimating equations with a binomial variance family and logistic link to account for multiple daily observations of each family/child. Robust standard errors were used and the covariance structure was set to independent. These analyses were performed separately for food secure and food insecure families to evaluate differences in sub-population response to level of stress or depressed mood.¹ All models were adjusted for whether the observation day occurred on a weekday or weekend, the number of evening meals on that observation day, number of children in the household, the primary caregiver's age, race/ethnicity, weight status, and anxiety scores, and child's age, sex, and weight status given concern that these variables may be associated with the dependent variable. All analyses were performed in Stata 16.1SE

¹ Chow tests indicated that for most outcomes, the coefficients of the covariates estimated for the food secure group were jointly statistically significantly different from the coefficients estimated for the food insecure group at $p < 0.05$. Based on the results of these tests, separate models for each group were estimated instead of interaction models on the pooled groups.

Table 1
Food Insecurity Stratification, EMA Procedures, and Exposure and Outcomes Variables Used in the Analysis*

| | |
|--|---|
| A priori Stratification Variable Food insecurity | Household food insecurity was assessed via the short form of the Household Food Security Scale (Blumberg et al., 1999) asked in an online survey completed by the parent at the second home visit. The scale is a sum of the affirmative responses to the following six questions about whether in the last 12 months: (1) the primary caregiver (or other adults in the household) ever cut the size of meals or skip meals because there wasn't enough money for food; (2) that this happened more than 1 or 2 months; (3) the primary caregiver was hungry but didn't eat because they couldn't afford enough food; (4) the food they bought didn't last and they didn't have enough money to get more; (5) they couldn't afford balanced meals; and (6) they couldn't afford to eat balanced meals. A household was categorized as food secure if they had no affirmative responses to these 6 questions and households were classified as food insecure if they answered yes to one or more questions. |
| Ecological Momentary Assessment Procedures EMA Signal- and Event-contingent Surveys | Multiple daily measures of EMA over eight days were collected on parents. Standardized EMA data collection protocols from prior studies (Shiffman et al., 2008) were used in the study including: (1) signal contingent and (2) event contingent EMA messaging (Shiffman et al., 2008). iPad minis were provided to parents to enter responses to the EMA surveys. <ul style="list-style-type: none"> • Signal contingent recordings were researcher-initiated and were used in a stratified random manner so that each parent was prompted via a text message to fill out a survey five times a day, within a three-hour time block (e.g., 7-10am, 10-1 pm, 1-4 pm, 4-7 pm, 7-10 pm). The timing of EMA prompts was adjusted for parent shift work and wake times to accommodate parent's differing life situations. The signal contingent recordings allowed for examining different contexts that occurred day-to-day, moment-by-moment, in families' lives. Questions asked on the signal contingent surveys included parent modeling of eating, physical activity and sedentary behavior, parent stress levels and depressed mood, and parent feeding practices. • Event contingent recordings were self-initiated by parents whenever an eating occasion (i.e., child and at least one other person were eating) occurred. In addition, the parent had to be present for the meal and indicate who was eating the meal together (e.g., child, parent, sibling). Parents were asked to fill out information about the type of food served at the meal occasion, what the child actually ate, parent feeding practices, child eating behaviors, child food fussiness/pickiness, meal atmosphere, food preparation and planning, and other meal logistics (e.g., how long the meal lasted, where it occurred). |
| Exposure Variables Parent stress | Parental stress was measured via signal contingent EMA surveys using items adapted from the Daily Health Diary (Berge et al., 2017b; Dunton et al., 2015). Parents were asked about their current level of stress (i.e., How stressed are you feeling right now?), the main source of stress (i.e., What is the main source of your stress?; response options e.g., a lot of work to get done at job or school, conflicts or arguments with my spouse or romantic partner), and their perceived ability to cope with stress (Dunton et al., 2015) (i.e., Right now, how certain do you feel that you can handle all the things that you have to do today?) since they woke up or since the last survey. EMA-reported stress before noon (i.e., morning stress) was analyzed as a continuous random variable with likert scale values ranging from 0 to 4 (0 – “Not at All”, 1 – “A little”, 2 – “Moderately”, 3 – “Quite a bit”, 4 – “Extremely”). Multiple morning stress observations on signal contingent EMA surveys were averaged by participant and by observation day if the stress measure occurred before noon to ensure temporal ordering of the predictor variable. |
| Parent depressed mood | Parent depressed mood was measured during signal contingent EMA surveys using an item adapted from Kessler-6 measure of depressive symptoms. (Viswanathan et al., 2009) Parents were asked about their current level of depressed mood (i.e., How sad or depressed are you feeling right now?). EMA-reported depressed mood before noon (i.e., morning stress) was also analyzed as a continuous random variable with likert scale values ranging from 0 to 4 (0 – “Not at All”, 1 – “A little”, 2 – “Moderately”, 3 – “Quite a bit”, 4 – “Extremely”). Temporal ordering was handled for morning depressive symptoms in the same way as the morning stress measure. |
| Outcome Variables Parent feeding practices | Parent restriction and pressure-to-eat parent feeding practices were measured during event contingent (i.e., meal occasions) EMA surveys using two items adapted from Dr. Birch's Child Feeding Questionnaire. (CFQ) (Birch et al., 2001) Parent restriction (i.e., Did you have to make sure [child's name] didn't eat too much food at this meal?) and pressure-to-eat (i.e., Did you have to encourage [child's name] to eat more food at this meal?) feeding practices at meal occasions were measured as a dichotomous variable (0 – “No”, 1 – “Yes”). Dinner and snacking event contingent meal occasions occurring at 4 pm or later were included for analysis (i.e., breakfast and lunch meal occasions were excluded to avoid reverse causation). Evening feeding practices were averaged at the participant and observation day level and treated as a binomial outcome variable ranging between 0 and 1 in all quantitative analyses. If a participant reported pressuring feeding practices at two of three meal occasions, the binomial outcome variable at the day level would be equal to 0.667 (i.e., 2 meal occasions in which the feeding practice was observed divided by the 3 total meals occurring that day after 4 pm at dinner or snacking occasions). |
| Type of foods served at meals | The type of foods served at meal occasions were assessed during event contingent EMA surveys. These questions were based on prior research showing serving homemade foods is associated with higher diet quality and that pre-prepared foods are more likely to contain less nutritious ingredients (Taillie and Poti, 2017; Tiwari et al., 2017; Fertig et al., 2019; Mills et al., 2017; Wolfson and Bleich, 2015; Mills et al., 2017). Parents were asked what types of foods were served at the meal (i.e., Which best describes the type of food served?), adapted from prior survey research questions (Boutelle et al., 2007). The response options for types of food served included: a) Fast food/take-out (eaten at home or at a restaurant); b) Pre-prepared foods (e.g., macaroni and cheese, frozen meals) or purchased snacks (e.g., fruit snacks, chips, granola bars, cereal); c) Homemade/freshly prepared (include fresh fruits or vegetables). Parents could report multiple types of foods served at any one meal occasion. Breakfast and lunch meals were excluded to ensure temporal ordering of early parental stress and later-day parent feeding practices and type of foods served at meals. However, snacks occurring in the evening were included in the analyses, given prior research showing that snacks are a strong contributor to overall child diet quality (Loth et al., 2020). The proportion of evening meal occasions (at the participant, observation day level) in which the food type was present was operationalized as a binomial outcome variable in the same way as the parent feeding practices variable (i.e., range 0-1). Like the example provided above, if the daily proportion of fast food at an evening meal occasions was equal to 0.667, then two-thirds of one day's evening meal occasions had fast food item present. |
| Child food fussiness/picky eating | Child food fussiness (picky eating) was measured during event contingents (i.e., meal occasions) EMA surveys using the question “Did the child refuse to eat any of the food you offered him/her?” The possible responses were 0 – “No” and 1 – “Yes”. As with the other outcomes measures above, dinner and snacking event contingent meal occasions occurring at 4 pm or later were included for analysis (i.e., breakfast and lunch meal occasions were excluded to avoid reverse causation). Evening child eating behavior was averaged at the participant and observation day level and treated as a binomial outcome variable ranging between 0 and 1 in all quantitative analyses. As in the example above, if a participant reported that the child refused food at two of the three meal occasions, the binomial outcome variable at the day level would be equal to 0.667. |

* Participants were from Minneapolis/St. Paul, MN in 2015.

Table 2
Characteristics of Sample by Food Security Status.

| | Food Secure (110 families over 746 days) % or Mean | Food Insecure (39 families over 248 days) % or Mean | Statistical difference between food secure groups p-value |
|---|---|--|--|
| Parent Age (range 21–58) | 35.0 | 33.1 | 0.167 |
| Parent classified as overweight ($25 \leq \text{BMI} < 30$) | 22% | 36% | 0.112 |
| Parent classified as having obesity ($\text{BMI} \geq 30$) | 52% | 49% | 0.743 |
| Parent anxiety score (range 0–6) | 0.85 | 1.74 | 0.006** |
| Child Age (range 5–7) | 6.4 | 6.5 | 0.128 |
| Child Female | 52.7% | 30.8% | 0.016* |
| Child classified as overweight ($85 \geq \text{pBMI} > 95$) | 18.2% | 20.5% | 0.758 |
| Child classified as having obesity ($\text{pBMI} \geq 95$) | 27.3% | 35.9% | 0.335 |
| Parent Race | | | |
| African-American | 15% | 21% | 0.421 |
| White | 18% | 13% | 0.417 |
| Hmong | 13% | 28% | 0.057 |
| Hispanic | 19% | 10% | 0.158 |
| Native American | 15% | 23% | 0.268 |
| Somali | 21% | 5% | 0.003** |
| Average Morning Stress (range 0–4) | 0.58 | 0.90 | < 0.001** |
| Average Morning Depressed Mood (range 0–4) | 0.34 | 0.71 | < 0.001** |
| % evening meals where: | | | |
| Parent pressures child to eat | 13% | 17% | 0.098 |
| Parent restricts child food | 11% | 12% | 0.688 |
| Parent serves Fast food | 15% | 15% | 0.129 |
| Parent serves Pre-prepared foods | 31% | 33% | 0.811 |
| Parent serves Homemade foods | 62% | 59% | 0.547 |
| Child refuses food | 8% | 11% | 0.285 |

Significance tests for continuous variables are unpaired two-sample t-tests assuming unequal variances; for binary or categorical, chi-squares tests were performed. *p < 0.05, **p < 0.01. pBMI, percentile body mass index; BMI, body mass index. Example interpretations: In 52.7% of food secure families, the target child was female, where the target child was female in only 30.8% of food insecure families. This difference in proportion by food security status (52.7% vs. 30.8%) is statistically significant at p = 0.016. The average morning stress rating among parents in food secure families is 0.58 where the average rating among parents in food insecure families is 0.90. This difference in means by food security status (0.58 vs. 0.90) is statistically significant at p < 0.001.

(College Station, TX).

3. Results

3.1. Descriptive results

Descriptive statistics of the families and of the predictor and outcome variables by food security status are presented in Table 2. Parents in food insecure households were significantly more likely to experience momentary stress and depressed mood in the morning compared to parents from food secure households (p < 0.001). However, the average parenting practices, types of food served, and child food fussiness rates were not significantly different by food security status.

3.2. Associations between momentary stress and depressed mood and parent feeding practices within the context of food insecurity

Regression results showed that in households where families were food secure, a one-unit increase in parental stress earlier in the day was associated with a 53% greater odds of parents engaging in pressure-to-eat feeding practices at the evening meal (p = 0.018; Table 3). Whereas, in households where families were experiencing food insecurity, a one-unit increase in parental stress earlier in the day was associated with an 81% greater odds of parents engaging in restrictive feeding practices at evening meals the same night (p = 0.010). A one-unit increase in morning depressed mood was associated with a 66% greater odds of restrictive feeding practices at evening meals the same night (p = 0.037). There were no significant associations found between parental depressed mood and parent feeding practices among food secure families. Note that the differences in parent feeding practices when the parents were not experiencing stress or depressed mood appear to differ by food security status however, the differences were not statistically significant.

3.3. Associations between momentary stress and depressed mood and types of food served for meals within the context of food insecurity

Results showed that in households experiencing food security, a one-unit increase in parental stress earlier in the day was associated with a 29% greater odds that fast food was served at the evening meals (p = 0.044; Table 3). However, in households where families were food insecure, a one-unit increase in parental stress earlier in the day was associated a 58% greater odds that pre-prepared foods were served at the evening meal (p = 0.004). In addition, a one-unit increase in depressed mood earlier in the day was associated with a 55% greater odds that pre-prepared foods were served (p = 0.008) and a 25% lower odds that homemade foods were served at the evening meal the same night (p = 0.022). There were no significant associations found between parental depressed mood and types of foods served among food secure families. As above, the differences in the types of foods served when parents are not experiencing stress or depressed mood appear to differ by food security status, by the differences are not statistically significant.

3.4. Child food fussiness/pickiness within the context of food insecurity

Results indicated that in households where families were food secure, a one-unit increase in parental stress earlier in the day was associated with a 62% greater odds of child food fussiness/pickiness at the evening meal (p = 0.029; Table 3). In addition, in households where families were food secure, a one-unit increase in depressed mood was associated with a 103% greater odds of child food fussiness/pickiness at the evening meal the same night (p = 0.005). However, children in households experiencing food insecurity were not at greater odds of refusing food when their parents reported higher stress levels or depressed mood earlier in the day. The rates of children refusing food when parents are not experiencing stress or depressed mood is significantly higher in food insecure families compared to food secure

Table 3
Adjusted Associations Between Morning Stress/Mood Levels with Evening Meals' Behaviors/Foods by Food Security Status.

| Outcome: | Parent Feeding Practices | | Types of Food Served | | | Fussiness/Pickiness | |
|---|--------------------------|------------------|----------------------|----------------|----------------|---------------------|-------------|
| | Pressure to Eat | Food Restriction | Fast food | Prepared Foods | Homemade foods | Child Refuses food | |
| Food Secure Families (N = 110 families; N = 746 days) | | | | | | | |
| Morning Stress | OR | 1.53 | 1.30 | 1.29 | 1.00 | 0.90 | 1.62 |
| 95% CI | | (1.07–2.17) | (0.81–2.07) | (1.01–1.64) | (0.83–1.21) | (0.74–1.10) | (1.05–2.50) |
| p-value | | 0.018* | 0.275 | 0.044* | 0.989 | 0.312 | 0.029* |
| Mean Outcome if Stress = 0 | | 10.7% | 11.1% | 13.1% | 32.3% | 62.7% | 5.6% |
| Morning Depressed Mood | OR | 1.54 | 1.31 | 1.05 | 1.11 | 0.88 | 2.03 |
| 95% CI | | (0.92–2.56) | (0.84–2.03) | (0.74–1.48) | (0.90–1.38) | (0.70–1.11) | (1.24–3.34) |
| p-value | | 0.098 | 0.234 | 0.788 | 0.335 | 0.281 | 0.005** |
| Mean Outcome if Stress = 0 | | 11.5% | 10.7% | 13.9% | 30.9% | 63.5% | 5.7% |
| Food Insecure Families (N = 39 families; N = 248 days) | | | | | | | |
| Morning Stress | OR | 1.26 | 1.81 | 0.78 | 1.58 | 0.82 | 1.23 |
| 95% CI | | (0.81–1.98) | (1.15–2.85) | (0.55–1.10) | (1.16–2.17) | (0.65–1.03) | (0.80–1.87) |
| p-value | | 0.307 | 0.010** | 0.159 | 0.004** | 0.083 | 0.344 |
| Mean Outcome if Depressed Mood = 0 | | 16.4% | 7.1% | 14.5% | 28.8% | 63.7% | 11.4% |
| Morning Depressed Mood | OR | 1.34 | 1.66 | 0.87 | 1.55 | 0.75 | 1.31 |
| 95% CI | | (0.83–2.18) | (1.03–2.67) | (0.60–1.27) | (1.12–2.14) | (0.59–0.96) | (0.81–2.11) |
| p-value | | 0.232 | 0.037* | 0.471 | 0.008** | 0.022* | 0.273 |
| Mean Outcome if Depressed Mood = 0 | | 16.1% | 7.9% | 13.8% | 29.1% | 64.9% | 11.3% |

*p < 0.05, **p < 0.01. Adjusted models include covariates: primary caregiver age, weight status, anxiety, and race/ethnicity; child age, sex, and weight status; weekend observation; number of evening meals averaged; number of children in the household. Interpretation example: a 1-unit increase in morning stress was associated with 53% greater odds of pressure to eat feeding practices (OR: 1.53, 95% CI: 1.07 to 2.17, p = 0.018) the same evening at the dinner or snacking meal occasions served after 4 pm for food secure families, after controlling for all other covariates. OR, odds ratio; CI, confidence interval.

families (p = 0.013 among parents with no morning stress, p = 0.006 among parents with no morning depressed mood).

4. Discussion

Findings indicated that when parents within food insecure households felt stressed or depressed earlier in the day, they were more likely to use restrictive feeding practices, serve less homemade food and more pre-prepared foods at the evening meal the same night. In addition, children in food insecure households did not change their food fussiness/pickiness in response to parent's stress or depressed mood, but children in food secure families were more likely to refuse food when parents were stressed or depressed. These results suggest that when parents are stressed/worried about having enough food in their household they may be more likely to restrict foods from their children to ensure food resources are allocated across the month. It is also important to put these findings into context. For example, one systematic review of the literature examining parental sensitivity in racial/ethnic minority groups showed that parental sensitivity is lower in families from low income households, mainly due to family stress caused by financial strain (Mesman et al., 2012). Thus, families experiencing food insecurity are likely to also be experiencing many other stressors that may increase their likelihood to engage in less healthy parent food-related parenting practices. Regarding the child food fussiness/picky eating finding, because the rates of food fussiness is relatively high in food insecure households compared to food secure families, it may be that parents in food insecure households perceive their children to be fussy or picky regardless of stress levels or depressed mood.

Results also indicated that when parents from food secure households experienced stress, they were more likely to engage in pressure-to-eat feeding practices, serve fast foods at the evening meal, and have children who engage in picky eating behaviors at the evening meal the same night. These findings support prior studies showing that parental stress and depressed mood are associated with higher levels of parent pressure-to-eat feeding practices (Berge et al., 2017a) and extend past studies by showing that when parents in households with food security or abundance experience stress, they are more likely to respond by engaging in pressure-to-eat feeding practices versus restrictive feeding practices.

Results from the current study have implications for health care

professionals who work with children and families. For example, physicians may want to consider screening parents for food insecurity and stressed/depressed mood during well-child visits, if they are not already doing this, in order to provide potential resources (e.g., food shelves/pantries) and anticipatory guidance to parents regarding the increased likelihood of engaging in restrictive feeding practices and serving less healthful foods when experiencing stress or depressed mood (Cook et al., 2008). It may also be helpful for physicians to offer resources to parents regarding stress reduction (e.g., apps, referrals to mental health providers, online resources). Among food secure households, it may be beneficial to discuss the increased potential for engaging in more pressure-to-eat feeding practices and tips for addressing child food fussiness/pickiness. However, it is important for physicians to deliver these messages about parent feeding practices in a manner that will be well received by the parent, given adding another stressor (e.g., need to change feeding practices) may have unintended consequences.

Additionally, there are implications for future research. For example, researchers may want to consider developing future interventions that utilize momentary intervention techniques such as ecological momentary intervention (EMI) methods to intervene in real-time with parents to help them engage in healthful food-related parenting practices when experiencing high levels of stress or depressed mood within the context of food insecurity.

There were limitations of the current study, including: (1) use of survey items that have not been used with EMA or immigrant populations and that are individual items rather than scales; (2) overall small sample size, however because EMA was conducted over an 8-day period (4x's/day), there are over one thousand data points, increasing the precision of our analyses; (3) the population was drawn from one geographic location; thus, generalizing findings to other populations should be done cautiously; (4) this study only examined the relationships between parental stress and parent feeding practices and child eating behaviors, it is also possible that child eating behaviors may promote parental stress. This bidirectional relationship should be examined in future research; and (5) our measure of food types has limitations in that we do not know the exact foods participants classified as homemade or pre-prepared; not all homemade foods are necessarily healthy, nor are all pre-prepared foods unhealthy.

5. Conclusion

Results indicated that high levels of stress and depressed mood experienced earlier in the day by parents within food insecure households was associated with the use of restrictive feeding practices, serving less homemade food and more pre-prepared foods, whereas parents experiencing high levels of stress earlier in the day within food secure households were more likely to engage in pressure-to-eat feeding practices, to serve fast foods, and to have children who engaged in picky eating behaviors at the evening meal the same night. Study implications include: (1) future research developing interventions using ecological momentary intervention (EMI) to target momentary factors in real-time that influence food-related feeding practices (e.g., stress, mood) in the context of food insecurity, and (2) health care providers using study findings to guide anticipatory guidance with parents during well-child visits regarding the influence that stress and depressed mood can have on every day food-related parenting practices and considering screening for food insecurity, stress, and depressive symptoms, if not already screening.

Author contribution

Jerica M. Berge: Dr. Berge is the principal investigator on the grant and conceptualized the paper, assisted with data analysis and interpretation, wrote all drafts of the paper, and agrees to be accountable for all aspects of the work regarding the accuracy or integrity of any part of the work.

Angela R. Fertig: Dr. Fertig conducted the data analysis. She also assisted with the conceptualization of the paper, critically reviewed the paper, gave final approval of this version to be published and agrees to be accountable for all aspects of the work regarding the accuracy or integrity of any part of the work.

Amanda Trofholz: Ms. Trofholz assisted with data acquisition and interpretation of the data. She also critically reviewed the paper, gave final approval of this version to be published and agrees to be accountable for all aspects of the work regarding the accuracy or integrity of any part of the work.

Dianne Neumark-Sztainer: Dr. Neumark-Sztainer assisted in conceptualizing the paper and contributed to the design of the study. She also critically reviewed the paper, gave final approval of this version to be published and agrees to be accountable for all aspects of the work regarding the accuracy or integrity of any part of the work.

Beth Rogers: Dr. Rogers assisted with the interpretation of the data. She also critically reviewed the paper, gave final approval of this version to be published and agrees to be accountable for all aspects of the work regarding the accuracy or integrity of any part of the work.

Katie Loth: Dr. Loth assisted with the conceptualization of the paper. She also critically reviewed the paper, gave final approval of this version to be published and agrees to be accountable for all aspects of the work regarding the accuracy or integrity of any part of the work.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.pmedr.2020.101146>.

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