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# COVID-19 pandemic shifts in food-related parenting practices within an ethnically/racially and socioeconomically diverse sample of families of preschool-aged children

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ABSTRACT

This study aimed to evaluate the influence of the COVID-19 pandemic on food parenting practices used by parents of young children. Ecological Momentary Assessment (EMA) was used to evaluate parents' use of coercive, indulgent, structured, and autonomy supportive food parenting practices before and during the COVID-19 pandemic among a diverse racial/ethnic sample (n = 72) of parents of preschool-aged children. The impact of parent and child mood/behavior on use of specific food parenting practices was also evaluated during both time periods. Results revealed that most parents of preschoolers use a variety of food parenting practices, including coercive control, indulgence, structure, and autonomy support practices. The use of structured and autonomy supportive practices, however, decreased during the COVID-19 pandemic. Further, the types of practices used by parents were contextually associated with the mood of the parent as well as child mood. Parent negative mood during COVID-19 was associated with higher levels of coercive control and indulgence and lower levels of structure, whereas child positive child mood was associated with greater use of autonomy supportive practices. These findings suggest that effects of the COVID-19 pandemic on family dynamics around feeding young children include shifts away from theoretically supportive approaches to parenting and highlight the roles of parent and child mood/behavior as potentially important momentary influences on food parenting during this time. Public health practitioners and clinicians working with parents of young children during COVID-19, and in years to come, should consider the potential impact of parental mood and stress, as well as child mood and behaviors. Additional research is needed to better understand how to best help parents maintain supportive feeding practices in the face of challenging situations.

## 1. Introduction

Efforts to contain the spread of the novel coronavirus disease-2019 (COVID-19) following its emergence in December 2019 dramatically changed the day-to-day lives of families in the US and throughout the world. In an effort to mitigate exponential growth of COVID-19 cases, national, state, and local governments put into place various mandates, including shelter-in-place laws which included required closure of various non-essential businesses, schools and child-care facilities, and the cancellation of large group gatherings, and social activities. While mandates have varied widely by state and country, and have evolved over time, the pandemic led to significant changes in family life, which are likely to have longer term implications that are important to understand and address going forward.

Families have experienced reduced access to education and childcare (e.g., daycare, school, public libraries), recreational activities (e.g., parks, playmates), and social support (e.g., teachers, family, other caregivers). At the same time, parents have been forced to adapt to significant changes in work, school, and childcare schedules. Qualitative findings from a community-based study of Canadian parents suggests that balancing work responsibilities with childcare and/or support of children's remote schooling while working from home has been a considerable source of stress for many parents (Carroll et al., 2020). Similarly, a Pew Research Center poll conducted in October 2020

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indicated that just over half (52%) of parents with children aged 12 and under found it somewhat or very difficult to handle childcare related responsibilities (Parker et al., 2020). Additionally, for many families, the economic fall-out of the pandemic has resulted in job loss, furlough, difficulty paying bills, and decreases in household food security (Parker et al., 2020). A September 2020 Pew Research Center poll found that, since the start of the pandemic, 25% of US adults say that they or someone in their family has lost a job since the start of the pandemic, 25% of families say they have had trouble paying their bills, and 17% say they have gotten food from a food bank/organization since the start of the pandemic (Parker et al., 2020). While these data point to a profound impact of the COVID-19 pandemic on family life and have raised concerns about population level impacts on maternal and child nutrition (Akseer et al., 2020), influences on family dynamics around feeding young children and the home food environment are not well characterized.

A broad and growing body of research has documented that the family and home food environment has considerable influence on the development of eating behaviors, dietary intake, and weight status in early childhood (Loth et al., 2018; Shloim et al., 2015; Vaughn et al., 2016; Yee et al., 2017). Specifically, parents influence their children's eating by providing the foods that create the home food environment, modeling of eating behaviors which children learn to emulate, and through their use of food-related parenting practices (Birch, 1998; Loth et al., 2014; Vaughn et al., 2016; Yee et al., 2017) (i.e., goal-directed behaviors to influence children's eating behaviors or dietary intake) (Birch, 1998). Current theoretical frameworks describe three higher-order domains of food-parenting practices: structure, including home food availability and limit setting; autonomy support, including praise and reasoning; and coercive control, including pressure-to-eat and overt food restriction (O'Connor et al., 2017; Vaughn et al., 2016). Indulgence has been discussed as both a sub-domain of structure (Vaughn et al., 2016), as well as a fourth unique high-level domain of potential importance (Loth et al., 2018); indulgent behaviors include being overly permissive by allowing a child complete freedom over what, when, and how much to eat, or engaging in anticipatory catering by only purchasing foods they know the child will enjoy eating to avoid power struggles over food. Laboratory, cross-sectional, and longitudinal research studies to date have generally found that structure and autonomy support are associated with children's healthful dietary intake and eating behaviors, whereas coercive and indulgent practices have been associated with healthful dietary intake, a higher body mass index, and the development of maladaptive eating behaviors over time (Beckers et al., 2020; Faith et al., 2004; Larsen et al., 2020; Shloim et al., 2015; Yee et al., 2017). The conceptual framework put forward by Vaughn and colleagues to guide future research in this area (Vaughn et al., 2016) describes feeding practices within the structure and autonomy support domain as "supportive" and those practices within the coercive control and indulgent domains as "unsupportive". Nevertheless, the strength of the evidence linking specific food-related parenting practices to child outcomes is mixed; the strongest associations of food parenting with child outcomes have been observed between the home food availability of healthful foods and parenting modeling of healthful dietary intake and positive weight-related outcomes in children (Faith et al., 2004; Shloim et al., 2015; Vaughn et al., 2016; Yee et al., 2017).

Research conducted prior to the COVID-19 pandemic demonstrated that parental stress and family-level food insecurity have the potential to impact children's eating behaviors through changes to food-related parenting practices (Adams et al., 2020; Arlinghaus & Laska, 2021; Bauer et al., 2015; Berge et al., 2017, 2020; Bruening et al., 2012, pp. 1–7). Specifically, previous research conducted with diverse families with school-aged children found that high levels of momentary parental stress or depressive symptoms experienced earlier in the day were associated with more controlling parent feeding practices at dinner the same evening (Berge et al., 2017, 2018, 2020). Additionally, parents experiencing food insecurity are more likely to report engagement in coercive or controlling, as well as indulgent, food-related parenting practices as compared to families without food insecurity (Adams et al., 2020; Arlinghaus & Laska, 2021; Berge et al., 2020). In alignment with these findings, a recent qualitative study by Loth and colleagues conducted within a racially/ethnically and socioeconomically diverse sample of parents of young children, found that parents described adapting or shifting their approach to feeding both within and across meals, with the goal of avoiding power struggles with their children around food and mealtimes (Loth et al., 2018). Specifically, parents in this sample described shifting their approach from more supportive to less supportive food-related parenting practices in response to momentary or situational factors that were stressful or disruptive, ranging from schedule changes to child mood and behavior.

Given the numerous disruptions to family life brought on by the COVID-19 pandemic and public health attempts to mitigate spread (e.g., virtual school, work closures), it is of interest to understand how parents' approach to feeding might have changed during the pandemic. A cross-sectional study conducted during the COVID-19 pandemic revealed that parents who experienced higher COVID-19-specific stress were more likely to engage in coercive and indulgent feeding practices; interestingly, these parents also reported more structure and positive interactions, including more shared mealtimes and engagement with their children during mealtimes (Jansen et al., 2021). To our knowledge, no studies have been conducted to date that have been able to directly compare data collected from families on the use of food-related parenting practices before the start of COVID-19 to data collected from the same families during the COVID-19 pandemic. The current research aimed to address this gap by evaluating parents' day-to-day use of a broad range of coercive, indulgent, structured, and autonomy supportive food parenting practices before and during COVID-19 among a diverse racial/ethnic sample of parents of children aged 2–5. A secondary aim was to evaluate potential contributions of parent and child mood/behavior to use of specific food-related parenting practices during both periods. Following observations of recent work (Yee et al., 2017), we hypothesized that parents' use of supportive feeding practices, defined as those practices within the structure and autonomy support domains, would be lower during the COVID-19 pandemic, and parents' use of unsupportive feeding practices, defined as those within the coercive control and indulgent domains, would be higher during the COVID-19 pandemic, as compared to during the time period before the COVID-19 pandemic. Further, we hypothesized that parent and child negative mood, parent stress and child negative behavior would contribute to larger decreases in the use of supportive feeding practices and larger increases in the use of unsupportive feeding practices from prior to the COVID-19 pandemic to during the COVID-19 pandemic.

The current study employed the *Real-Time Parent Feeding Practices* tool, a novel tool developed for use within Ecological Momentary Assessment (EMA) protocol, to assess parents momentary use of a broad range of food-related parenting practices over the course of multiple days (both pre- and during COVID-19). The use of EMA provides unique insights into real-time use of food parenting practices across time and contexts as well as the opportunity to evaluate relationships with dynamic variables, such as mood, stress, and context. The use of EMA in the current research provided the opportunity to understand how exposure to stressors in family life brought on by COVID-19 has impacted parents' use of specific food parenting practices. Understanding the impact of the COVID-19 pandemic on food parenting practices will inform the design of public health efforts to support families during the current pandemic and in the event of future public health crises.

## 2. Methods

### 2.1. Study design and population

This research involved a longitudinal observational design using

data from Kids EAT!, a cohort study of food parenting practices among preschool aged children (Loth, 2021Loth). Kids EAT! is an ancillary study to EAT 2010–2018 (Eating and Activity over Time), a large, population-based cohort study on eating, activity, and weight-related health (Larson et al., 2020). Kids EAT! study participants (n = 119) completed a baseline survey and ten-day Ecological Momentary Assessment (EMA) protocol during the fall of 2019; a subset of these participants (n = 72) engaged in a COVID-19 specific follow-up survey and a second ten-day EMA protocol during April 2020. The University of Minnesota's Institutional Review Board Human Subjects Committee approved the protocols used for all components of the Kids EAT! and EAT 2010–2018 studies.

### 2.2. Participants

Participants were parents and their preschool aged children from Kids EAT! who, were in turn, recruited from the EAT 2018 study of 1491 young adults (Mean age in 2018: 22.2 years) (Larson et al., 2020). Only those individuals who participated in the initial Kids EAT! study (n = 119) were invited to participate in the follow-up COVID-19 specific data collection based on the following inclusion criteria: young adults who indicated on the EAT 2018 survey that they had at least one child aged 2–5 years who lived with them at least 50% of the time were invited by email to participate in the Kids EAT! study. For families with more than one child aged 2–5, one child in this age range was randomly chosen to be the primary study participant and parents were asked to focus their survey and EMA responses on this child specifically.

Recruitment emails were sent in batches of 10–15, starting in October 2019. Kids EAT! recruitment e-mails indicated that the study goal was to learn more about parents' experiences feeding their preschool aged child and provided information about study data collection. Interested participants were instructed to click on an individualized link included in the e-mail, which directed them first to an eligibility screener survey. Once eligibility was confirmed, participants were given the opportunity to review an IRB approved Study Information Sheet which described in full the various data collection components, as well as the risks and benefits related to their participation. Participants could then choose to opt out of participation or to continue on by starting the Kids EAT! online survey. Per IRB recommendations, consent was assumed for those eligible participants who chose to continue on to complete the survey.

Recruitment for the Kids EAT! follow-up study began at the end of March 2020 and was conducted using the same protocol described above. The recruitment e-mail for the follow-up study clarified that the purpose of the follow-up was to deepen our understanding of how families with young children had been impacted by the COVID-19 pandemic. Families were offered an incentive of a $150 gift card for participation in each of the two waves of data collection (total incentive $300).

Table 2 provides demographic information on the sample, as reported by participants on the baseline survey conducted in the fall of 2019. Of 72 participating parents, self-identified race/ethnicity was diverse (30.6% Black, 28.4% Hispanic, 16.7% Asian, and 15.3% White). Parents were well-educated, with close to a majority (60.5%) reporting education beyond high school. Approximately 20% of the sample reported household incomes below the 2020 federal poverty line for household sizes of two or more individuals ($17,240). Child gender was roughly evenly split between male and female children. The bulk of participants lived in the Minneapolis/Saint Paul Metropolitan area (n = 66), with a few residing in out-state Minnesota (n = 2), and a few others living out of state (n = 4).

### 2.3. Procedures and data collection

Participants completed an online survey, followed by a 10-day EMA at both time points: pre-COVID (October 2019–January 2020) and

**Table 1**
EMA food parenting practice items by higher-order domain.

| Food Parenting Practices | | Study Measure | Tool from which Measure was Adapted |
|---|---|---|---|
| **Higher Level Domain** (Faith et al., 2004; Shloim et al., 2015) | Sub-Constructs | Yes/No Items ("At this meal/ snack did you …") | |
| **Coercive Control** (Shloim et al., 2015) **(5 items)** | Food restriction | Have to make sure that [child] did not eat too much food? | Child Feeding Questionnaire (Birch et al., 2001); Food Parenting Inventory (Power et al., 2019) |
| | Threats and Bribes | Trick or bribe [child] into eating more than they wanted to? | Parental Feeding Style Questionnaire (Wardle et al., 2002) |
| | Threats and Bribes | Offer [child] a treat or reward for trying a new food? | Parental Feeding Style Questionnaire (Wardle et al., 2002) |
| | Pressure-to-Eat | Have to encourage [child] to eat more food than they wanted to? | Child Feeding Questionnaire (Birch et al., 2001); Food Parenting Inventory (Power et al., 2019) |
| | Threats and Bribes | Offer [child] a treat or reward for eating more? | Parental Feeding Style Questionnaire (Wardle et al., 2002) |
| **Indulgent** (Yee et al., 2017) **(3 items)** | Using food to control negative emotions. | Give [child] food in order to calm her down or help manage her behavior? | Food Parenting Inventory (Power et al., 2019) |
| | Anticipatory Catering | Prepare a separate food/ meal that you know [child] would enjoy eating? | Developed based on qualitative work by Loth et al. (Loth et al., 2018) |
| | Unstructured Practices | Allow your child to choose a separate food/ meal because they did not want to eat what was offered? | Comprehensive Feeding Practices Questionnaire (Musher-Eizenman & Holub, 2007) |
| **Structure** (Shloim et al., 2015) **(5 items)** | Guided Choices | Allow your child to choose what to eat, from several options you already picked out (guided choices)? | Parental Child Feeding Strategies Questionnaire (Zeinstra et al., 2010) |
| | Food availability | Choose what foods [child] got to eat? | Family Food Rules and Questionnaire (van Assema et al., 2007) |
| | Meal and snack routines | Choose where [child] ate the meal/snack? | Food Parenting Inventory (Power et al., 2019), Family Food Rules and Questionnaire (van Assema et al., 2007) |
| | Monitoring | Closely monitor the type and amount of food being eaten by [child]? | Child Feeding Questionnaire (Birch et al., 2001); Food Parenting Inventory (Power et al., 2019) |
| | Modeling | Did you sit and eat with [child]? | Family Meal Practices Survey (Lytle et al., 2011) |
| **Autonomy Support** ( | Child involvement | Involve your child in deciding | Comprehensive Feeding Practices |

(*continued on next page*)

**Table 1** (*continued*)

| Food Parenting Practices | | Study Measure | Tool from which Measure was Adapted |
|---|---|---|---|
| Shloim et al., 2015) **(9 items)** | | about what foods they would eat? | Questionnaire (Musher-Eizenman & Holub, 2007) |
| | Encouragement | Encourage your child to at least try a small amount (e.g., one bite) of all foods offered? | Food Parenting Inventory (Power et al., 2019) |
| | Negotiation | Negotiate with your child about what foods they needed to eat? | Food Parenting Practices Questionnaire (Vereecken et al., 2004) |
| | Negotiation | Negotiate with your child about how much food they needed to eat? | Food Parenting Practices Questionnaire (Vereecken et al., 2004) |
| | Reasoning | Tell your child why you wanted them to eat more of certain foods? | Parent Mealtime Action Scale (Hendy et al., 2009) |
| | Reasoning | Tell your child why you wanted them to eat less of certain foods? | Parent Mealtime Action Scale (Hendy et al., 2009) |
| | Nutrition education | Teach your child about why you wanted them to eat more of certain foods? | Comprehensive Feeding Practices Questionnaire (Musher-Eizenman & Holub, 2007) |
| | Nutrition education | Teach your child about why you wanted them to eat less of certain foods? | Comprehensive Feeding Practices Questionnaire (Musher-Eizenman & Holub, 2007) |
| | Child involvement | Allow your child to take seconds if they asked for them? | Family Food Rules and Questionnaire (van Assema et al., 2007) |

during COVID (March–April 2020). At each time point, EMA prompts began the day following survey completion. All assessments were completed in English; participants' English language fluency was known given their initial enrollment in the EAT 2010–2018 study.

### 2.4. Measures

#### 2.4.1. EMA

Food parenting practices as well as parent and child mood/behavior were measured via EMA. Multiple daily measures were collected from parents using EMA over a period of ten days prior to COVID-19 and during COVID-19. Standardized EMA data collection protocols from prior studies (Shiffman et al., 2008) were used, including: (1) signal contingent, (2) event contingent, and (3) end-of-day EMA mobile surveys. Parents completed these EMA surveys using their own electronic device.

Data from both the signal (e.g., parent affect, stress and child affect, behavior) and event contingent (e.g., food-related parenting practices) recordings were used for the current analysis; data from end-of-day recordings was not used for this manuscript.

Signal contingent recordings were researcher initiated. Specifically, participants received prompts via a text message which included a link directing participants to complete a short survey using their cell phone. These prompts were sent four times daily; timing of signal contingent prompts was random, situated within four predetermined 3-h time blocks of time (e.g., 7–10 a.m., 11-2 pm, 3–6 pm, 7–10 p.m.). The surveys expired after 1 h. The schedule for signal contingent prompts was

**Table 2**
Demographic characteristics (n = 72).

| | | Mean |
|---|---|---|
| Parent age | | 26.67 |
| Child age | | 3.71 |
| | | n (%) |
| Parent Race/Ethnicity | Black | 22 (30.6) |
| | Hispanic | 19 (26.4) |
| | Asian | 12 (16.7) |
| | White | 11 (15.3) |
| | More than One Race/Other | 6 (8.3) |
| | Native American | 2 (2.8) |
| Parent Education | Partial high school or less | 7 (9.7) |
| | High school graduate or GED | 21 (29.2) |
| | Partial college or specialized training | 25 (34.7) |
| | College graduate | 16 (22.2) |
| | Graduate degree | 3 (4.2) |
| Spouse Education | Partial high school or less | 7 (9.7) |
| | High school graduate or GED | 17 (23.6) |
| | Partial college or specialized training | 17 (23.6) |
| | College graduate | 7 (9.7) |
| | Graduate degree | 4 (5.6) |
| | No spouse/not applicable | 20 (27.8) |
| Household Income | $0-$4,999 | 6 (8.3) |
| | $5,000-$9,999 | 3 (4.2) |
| | $10,000-$14,999 | 6 (8.3) |
| | $15,000-$24,999 | 11 (15.3) |
| | $25,000-$34,999 | 14 (19.4) |
| | $35,000-$49,999 | 11 (15.3) |
| | $50,000-$74,999 | 16 (22.2) |
| | $75,000-$99,999 | 4 (5.6) |
| | $100,000 and above | 1 (1.4) |
| Current Relationship Status | Single | 26 (36.1) |
| | Committed Relationship | 26 (36.1) |
| | Married | 20 (27.8) |
| Geographic Location* | Minneapolis/Saint Paul Metropolitan Area | 66 (91.7%) |
| | Greater Minnesota | 2 (2.8%) |
| | Outside of Minnesota | 4 (5.6%) |

Notes: The bulk of participant demographic characteristics were self-reported by participants on the baseline survey conducted in the fall of 2019; Most recent geographic location where participant was living was determined using data collected through ongoing participant tracking associated with the Project EAT cohort study.

adjusted for parent shift work and wake times to accommodate parents' differing life situations, using information obtained from the EMA registration form. The percent compliance for signal contingent prompts was 76% both pre- and during COVID-19; this means that out of the four signal contingent surveys sent daily, participants responded to an average of about three prompts daily.

Event contingent recordings were self-initiated by parents whenever the child ate in the presence of the parent; they used their phone to click a study provided link that directed them to the correct survey. On average parents completed 2.67 event contingent surveys per day in the initial Kids EAT! Study and 3.07 in the COVID-19 follow-up study. The average EMA survey took participants 2–3 min to complete.

Participants were asked to respond to at least two signal, two event, and one end-of-day prompts for the day to be considered "complete". At both time points, the study incentive (i.e., $150 Visa Giftcard) was provided to parents once they completed the survey and finished ten complete days of EMA. If a parent missed a day or failed to engage with the necessary prompts for a day to be considered complete, another day was added to their data collection time period until ten full days were completed. All families that completed data collection received the full incentive (total incentive for both time points = $300). On average, it took participants 15.9 days to achieve ten complete days.

**Food parenting practices.** Parents' use of a broad range of food-

related parenting practices was assessed using the *Real-Time Parent Feeding Practices* Measurement Tool, a novel tool developed for the current study to measure a broad range of food-related parenting practices within an EMA protocol. This measurement tool includes 22 questions on food-related parenting practices situated within four higher level theoretical domains, including Coercive Control (5 items), Indulgent (3 items), Structure (5 items), Autonomy Support (9 items); the language for each individual measure is included in Table 1. Individual questions were designed to measure specific sub-constructs as outlined in Vaughn's content map of fundamental constructs in food parenting practices (Vaughn et al., 2016). Individual items were taken from existing questionnaires where possible, such as the Child Feeding Questionnaire (Birch et al., 2001) and the Food Parenting Inventory (Power et al., 2019), and adapted for use in an EMA protocol. For example, an item on the Child Feeding Questionnaire designed to measure parental pressure to eat reads, "I have to be especially careful to make sure my child eats enough". This question was adapted for EMA to focus on a parent's specific behavior at the most recent meal or snack consumed by their child to read, "Thinking of this meal or snack, did you have to encourage your child to eat more food than they wanted to?".

Parents responded yes/no for each item. A total score in each domain was calculated as the sum of yes/no item responses; daily scores were calculated as the mean across all reported eating occasions of the day.

**Parent stress and mood.** Stress was assessed by 11 items developed based on previous qualitative findings of momentary impacts on food parenting practices (Yee et al., 2017) and rated on a 5-point Likert scale (1-very slightly or not at all to 5-extremely): Felt like I didn't have enough time to get everything done that I needed to; Busy with a number of work or household activities; Busy with family or friend activities; Occupied by a special event; Down, sad or depressed; Stressed out; Worn out, tired or exhausted; Sick or under the weather; Constantly on-the-go; Disrupted by unexpected changes to my plan or routine; Overwhelmed or at my wits end. A total score was calculated as the sum of item scores; possible scores ranged from 11 to 55.

Parent Negative and Positive Affect were each assessed by 20 items adapted from the short form of the Positive and Negative Affect Scale (PANAS) (Watson et al., 1988)for EMA (Smyth et al., 2009) and rated on a 5-point Likert scale (1-very slightly or not at all to 5-extremely). Negative Affect (10 items) included: Distressed, Upset, Guilty, Scared, Hostile, Irritable, Ashamed, Nervous, Jittery, Afraid. Positive Affect (10 items) included: Interested, Excited, Strong, Enthusiastic, Proud, Alert, Inspired, Determined, Attentive, Active. A total score for each scale was calculated as the sum of item scores; possible scores ranged from 10 to 50.

**Child behavior and mood.** Given the young age of the child participants (2–5), all questions pertaining to child behavior and mood were responded to by the parent participants, reporting on behalf of their child. Positive Behaviors and Negative Behaviors were assessed by asking parents to report on their child's behavior using 8 items developed based on previous qualitative findings of momentary impacts on food parenting practices (Yee et al., 2017) and rated on a 5-point Likert scale (1-very slightly or not at all to 5-extremely). Positive Behaviors (2 items) were Well-behaved and Agreeable/Easy Going. Negative Behaviors (6 items) were Getting into trouble/Acting Out; Crabby; Fussy/-Whiny; Out-of-control; Having a hard time sitting still; Hyper/Overly-energetic. A total score for each scale was calculated as the sum of item scores; possible scores for Positive Behaviors ranged from 2 to 10 and possible scores for Negative Behaviors ranged from 6 to 30.

Child Positive Affect and Negative Affect were assessed by asking parents to report on their child's mood using a total of 8 items adapted from the PANAS-C (Sanmartín et al., 2018) for EMA and rated on a 5-point Likert scale (1-very slightly or not at all to 5-extremely). Positive Affect (4 items) were Happy, Joyful, Excited, and Energetic. Negative Affect (8 items) included Sad, Angry, Nervous, and Upset. A total score for each scale was calculated as the sum of item responses; possible scores ranged from 4 to 20.

#### 2.4.2. Demographics

Child- (e.g., age, sex), parent- (e.g., age, sex, educational attainment), and family-level (e.g., income, family structure) demographic characteristics were assessed via questions on the Kids EAT! baseline survey (Loth, 2021Loth).

#### 2.4.3. Data analysis

For each food-related parenting domain (i.e., coercive control, indulgent, structure, autonomy support), a mean value was generated for each participant by calculating the average use of specific food-related parenting practices belonging to the corresponding domain across all reported meals; practices reported pre-COVID and during-COVID are treated separately. A pairwise *t*-test was then applied to compare the individualized mean values of domain in pre-COVID survey and during-COVID survey, obtaining the mean estimation of difference, standard errors, t-statistics, and p-values. The results are interpreted as part of Fig. 2.

Similarly, the within-person cumulated proportion of each domain was expressed as the individualized proportion of the participant's total food-related parenting practices belonging to the domain. To show the relationship among domains, we calculated the pairwise correlations of the with-in person domain proportions for pre-COVID survey. The results are demonstrated in Table 3.

In the final model, we analyzed the effects of parent stress, parent and child mood, and child behavior on each of the food-related parenting practice domains, both prior to and during COVID. For each combination of parent or child mood/behavior variable and parenting practice domain, we fit a linear mixed-effect regression model for the outcome of number of items endorsed within each domain; in total, 28 regressions models were run (4 domains $\times$ 7 child and parent mood/behavior factors). Each model included a participant-specific random intercept to account for correlation of outcomes within participants, main effects of the mood/behavior variable and period (pre-COVID or during COVID), and an interaction term to enable estimation of pre- and during-COVID effects of the mood/behavior variable in a single model. The results are shown in Table 4. Since each mood/behavior variable was analyzed in a separate model, collinearity between these predictor variables was not a concern. Supplemental Table 5 shows the results of the same analyses repeated for the outcome of proportion of items endorsed within each domain (see Table 5).

All data management and statistical analysis were performed in R (version 4.0.2). P values of $<0.05$ were used to infer statistical significance, and were not adjusted for multiple testing.

## 3. Results

### 3.1. Descriptive statistics on food parenting practices

As illustrated in Fig. 1, the relative frequency with which participants used practices within each food parenting domain was similar prior to, and during, COVID-19. At both time points, structure (e.g., mealtime rules and routines) and autonomy support (e.g., guided choices, nutrition education) represented the greatest proportion of all practices used. The following proportion percentages are described in ranges as separate proportions were calculated for each family. Structured practices represented 22.1%–83.5% of all practices used pre COVID-19, and 22.1%–94.7% during COVID-19. Autonomy supportive practices represented 12.9%–55.0% of all practices used pre-COVID-19, and 5.3%–50.2% during COVID-19. Indulgent and coercive practices were used less frequently at both time points. Coercive practices represented 0.0%–29.0% of all practices used pre-COVID-19, and 0.0%–29.7% during COVID-19. Similarly, indulgent practices represented 0.0%–26.8% pre-COVID-19, and 0.0%–28.5% during COVID-19.

Use of coercive and indulgent practices were positively correlated

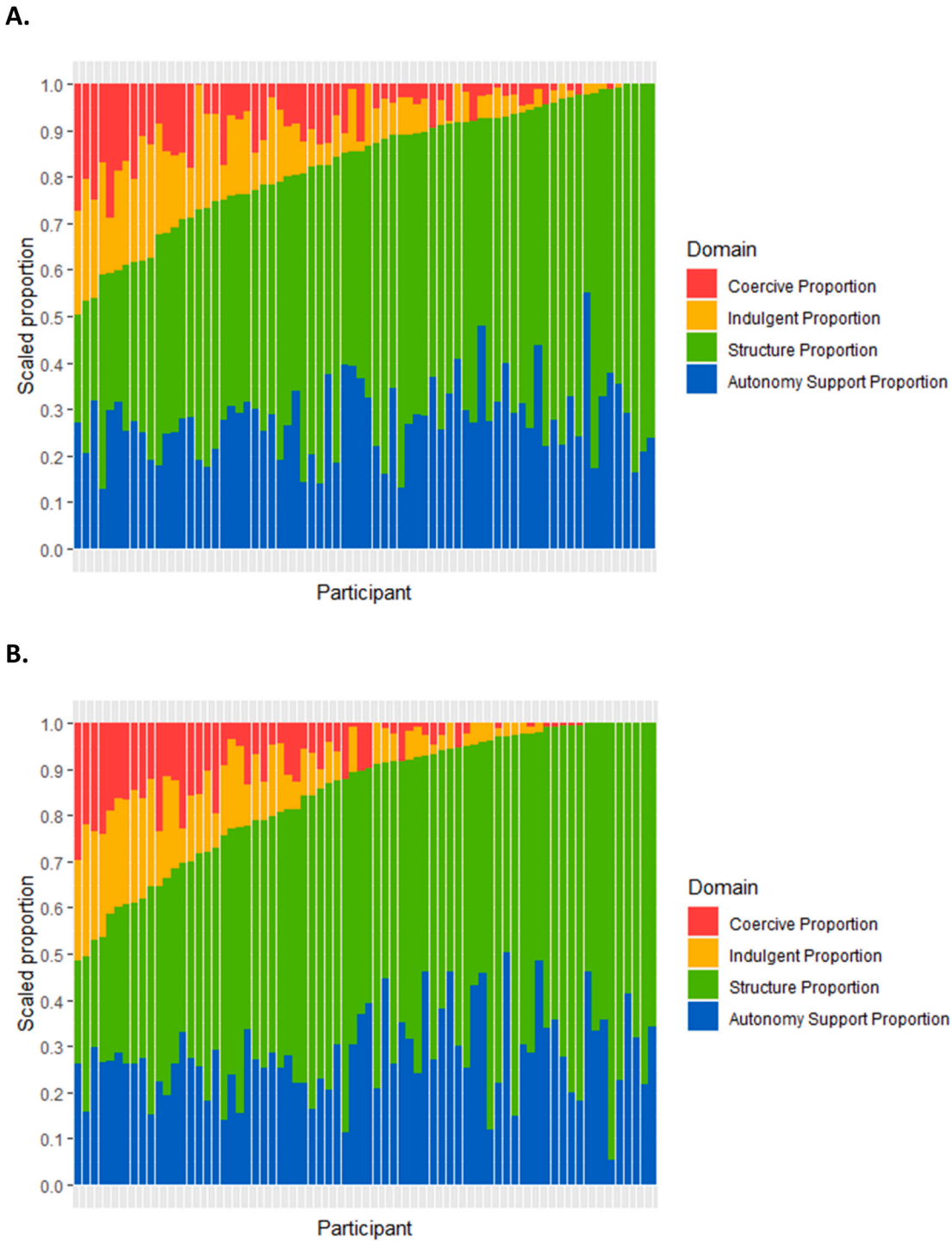


**Fig. 1.** Relative use of food parenting practices by domain for each study parent/child dyad pre (A) and during (B) COVID-19. Legend. Each column in the figures corresponds to one study participant and shows the relative frequency with which they used parenting practices in each domain. Relative frequency was computed by averaging the proportion of endorsed items in each domain across all a participant's meal surveys. For example, if the average proportion of endorsed items was 45%, 35%, 50%, and 20% for the four parenting practice domains, the relative frequency would be calculated as (45/150, 35/150, 50/150, 20/150) = (0.3, 0.23, 0.33, 0.13). The columns are arranged in order of increasing proportion of use of structure and autonomy support practices, ranging from approximately 50%–100% across participants.

with one another ($r = 0.56$, $p < 0.05$) and negatively correlated with the use of structured practices ($r = -0.63$, $p < 0.05$ and $r = -0.47$, $p < 0.05$, respectively), but unassociated with autonomy supportive practices (Table 3). Structured practices were also negatively correlated with the use of autonomy supportive practices ($r = -0.64$, $p < 0.05$).

### 3.2. *Changes in food parenting practices by domain, pre-COVID-19 to during COVID-19*

Fig. 2 illustrates the median, lower and upper quartiles, and minimum maximum values for food parenting practices by domain, pre- and during COVID-19. Mean levels of structure (mean (SD) = 2.61 (0.89) vs. 2.39 (0.88)) and autonomy support practices (mean (SD) = 2.58 (1.73)

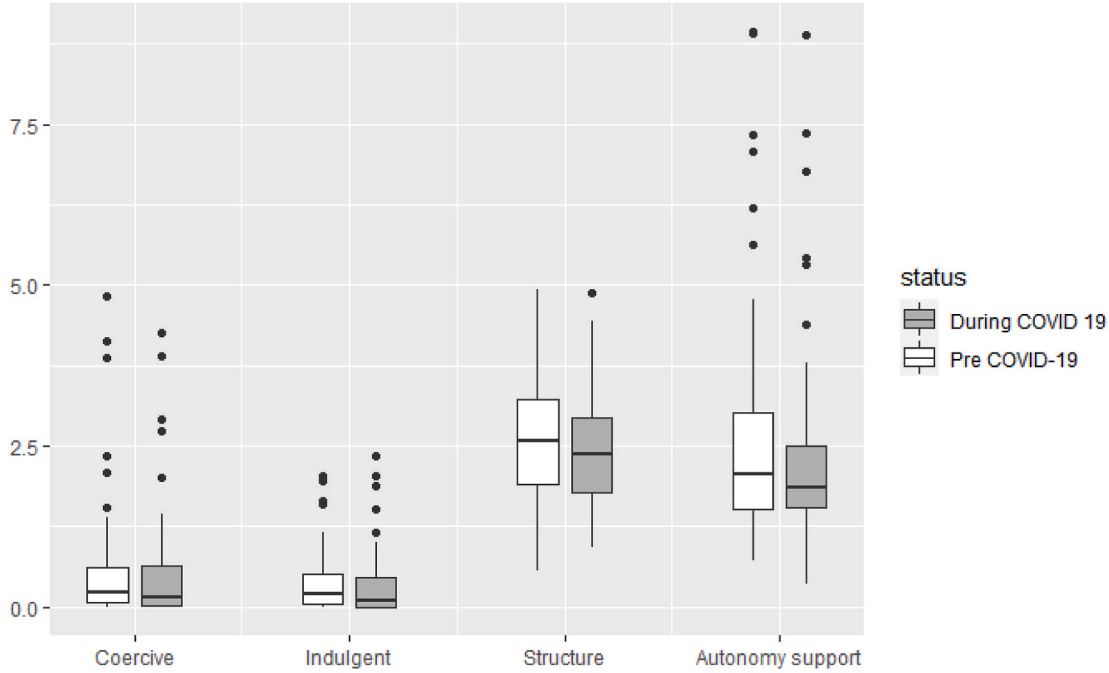


**Fig. 2.** Distribution and variability of food parenting practices by domain pre COVID-19 and during COVID-19. Legend. Box (median, 25th/75th) and whisker (5th/95th) plot showing the distribution and variability of the frequencies of food parenting practices per reported meal pre- and during COVID-19. Possible scores in each domain ranged from 0 to the number of questions in the domain. Lower levels of all domains (coercive mean (SD) = 0.56 (0.93) vs. 0.50 (0.85); indulgent mean (SD) = 0.40 (0.49) vs. 0.33 (0.49); structure mean (SD) = 2.61 (0.89) vs. 2.39 (0.88); autonomy support mean (SD) = 2.58 (1.73) vs. 2.28 (1.50)) were observed during vs. pre-COVID-19. The with-in family difference of structure and autonomy support are detected as significant. Autonomy support also showed less variability (mean variance = 1.78 vs. 1.35; mean difference (SE) = −0.44 (0.22), $p < 0.05$) during vs. pre-COVID-19.

**Table 3**
Correlations between food parenting domain scores pre COVID-19.

| | Coercive | Indulgent | Structure | Autonomy Support |
|---|---|---|---|---|
| Coercive | – | 0.56* | −0.63* | −0.12 |
| Indulgent | | – | −0.47* | −0.23 |
| Structure | | | – | −0.64* |
| Autonomy Support | | | | – |

*p-value<0.05.

vs. 2.28 (1.50)) was lower during COVID-19 as compared to mean use of these practices reported pre COVID-19, pairwise *t*-test shows the within family difference is significant with $p < 0.01$ for both structure and autonomy support. Mean levels of coercive and indulgent practices within family were not significantly different during COVID-19 as compared to pre-COVID-19, but the general mean levels both decrease (coercive mean (SD) = 0.56 (0.93) vs. 0.50 (0.85) and indulgent mean (SD) = 0.40 (0.49) vs. 0.33 (0.49)). Pairwise t-tests of the mean variance of each food parenting domain during each timepoint (pre- and during COVID-19), revealed that there was less within-family variability in use of autonomy support practices (mean variance = 1.78 vs. 1.35; mean difference (SE) = -0.44 (0.22), $p < 0.05$) during COVID-19 as compared to pre-COVID-19. Mean variances of other food parenting domains were not different during COVID-19 than pre-COVID-19, suggesting that the within family variability in use of structure, coercive, and indulgent food parenting practices was similar during both time periods.

### *3.3. Association of parent and child mood/behavior on food parenting practices pre- and during COVID-19*

***Parent mood.*** As shown in Table 4, parent negative mood was positively associated with the use of indulgent practices pre-COVID (0.0069; $p < 0.05$) and negatively associated with the use of structured practices (−0.0152 and −0.0251, pre and during COVID-19, respectively; both $p < 0.05$) at both time points. Interestingly, parent stress was positively associated with the use of practices in all domains during COVID-19 (0.0072, 0.0096, 0.0092, and 0.0161, for coercive, indulgent, structure, and autonomy support, respectively; all $p < 0.05$), but less consistently pre-COVID-19. Positive mood was positively associated with parents' use of coercive and structured practices pre-COVID-19 (0.0064 and 0.0130, coercive and structure, respectively; both $p < 0.05$), but unassociated with parents' use of food parenting practices across all domains during COVID-19.

***Child mood/behavior.*** Child negative behavior was positively associated with parents' use of indulgent (0.0246 and 0.0194, pre- and during COVID-19, respectively; both $p < 0.05$) practices both pre- and during COVID-19 (Table 4). Similarly, child negative mood was positively associated with indulgent practices at both time points (0.0246 and 0.0194, pre- and during COVID-19 respectively, both $p < 0.05$). Alternatively, child positive mood was positively associated with parents' use of structure pre-COVID-19, but less so during COVID-19. For instance, positive child mood was positively associated with parents' use of structured practices (0.0322; $p < 0.05$) pre-COVID-19, and unassociated (0.0060; p = ns) with parents' use of structure during COVID-19.

Using the proportion, rather than number, of items endorsed in each domain yielded the same pattern of statistical significance with different magnitudes of association that allow effects to be more readily compared across domains (see Supplemental Table 5). For example, child negative behavior had a similar impact on the proportion of coercive (0.0054 pre-COVID and 0.0056 during COVID, both $p < 0.001$) and indulgent feeding practices (0.0048 pre-COVID and 0.0040 during COVID, both $p < 0.05$), whereas effects on the number of coercive and indulgent practices endorsed were quite different (0.0269 and 0.0281 vs. 0.0145 and 0.0121).

**Table 4**
Child and parent mood/behavior influences on food parenting pre and during COVID-19 (N=72)[a].

| | Coercive | | Indulgent | | Structure | | Autonomy Support | |
|---|---|---|---|---|---|---|---|---|
| | Pre COVID-19 | During COVID-19 | Pre COVID-19 | During COVID-19 | Pre COVID-19 | During COVID-19 | Pre COVID-19 | During COVID-19 |
| **Parent** | | | | | | | | |
| Positive mood | 0.0064* (p = 0.002) | 0.0009 (p = 0.651) | 0.0012 (p = 0.473) | −0.0007 (p = 0.632) | 0.0130* (p < 0.001) | 0.0043 (p = 0.143) | 0.0069 (p = 0.080) | 0.0072 (p = 0.055) |
| Negative mood | −0.0073 (p = 0.091) | 0.0099* (p < 0.001) | 0.0069* (p = 0.040) | 0.0061 (p = 0.100) | −0.0152* (p = 0.018) | −0.0251* (p < 0.001) | 0.0080 (p = 0.323) | 0.0070 (p = 0.433) |
| Stress | 0.0051 (p = 0.050) | 0.0072* (p = 0.012) | 0.0095* (p < 0.001) | 0.0096* (p < 0.001) | 0.0033 (p = 0.396) | 0.0092* (p = 0.035) | 0.0164* (p = 0.001) | 0.0161* (p = 0.003) |
| **Child** | | | | | | | | |
| Positive mood | 0.0084 (p = 0.070) | −0.0071 (p = 0.138) | 0.0014 (p = 0.692) | 0.0059 (p = 0.116) | 0.0322* (p < 0.001) | 0.0060 (p = 0.404) | 0.0209* (p = 0.017) | 0.0187* (p = 0.040) |
| Negative mood | 0.0051 (p = 0.614) | 0.0161 (p = 0.147) | 0.0246* (p = 0.002) | 0.0194* (p = 0.025) | −0.0351* (p = 0.020) | −0.0112 (p = 0.499) | 0.0325 (p = 0.086) | 0.0069 (p = 0.743) |
| Positive behavior | 0.0047 (p = 0.588) | −0.0374* (p < 0.001) | −0.0060 (p = 0.371) | 0.0002 (p = 0.972) | 0.0361* (p = 0.005) | −0.0083 (p = 0.534) | −0.0105 (p = 0.522) | 0.0014 (p = 0.932) |
| Negative behavior | 0.0269* (p < 0.001) | 0.0281* (p < 0.001) | 0.0145* (p = 0.009) | 0.0121* (p = 0.039) | −0.0096 (p = 0.364) | 0.0099 (p = 0.377) | 0.0308* (p = 0.021) | 0.0251 (p = 0.075) |

Note that the parent or child mood/behavior factors are the daily mean values of the observations. Most factors have different scales, so the magnitude of coefficients cannot be directly compared across factors. The during COVID-19 effects are calculated by using the fixed effect estimations and the corresponding interaction terms.
* implies association of parent or child mood/behavior with food parenting domain by meal time has p-value < 0.05, the p-value is in parenthesis. Underline indicates change in coefficient from pre to during COVID-19 has p-value < 0.05.
Interpretation example: During the pre COVID-19 time period, with a one unit increase in daily mean for parent positive mood (range 10–50), an average individual in our population would engage in 0.0064 more coercive parenting behaviors at each observed meal time after adjusting for the race and income; the fixed effect is significant with p < 0.05. During COVID-19, this same one unit increase in daily mean for parent positive mood is associated with an increase in coercive parenting behaviors by 0.0008, an amount not significantly different from 0. The change between the pre COVID-19 and during COVID-19 parent positive mood effect on coercive feeding practices is statistically significant.
[a] Mixed-effects regressions with the meal-level frequency of the food parenting activities of domains as outcomes. The predictors include: race, income, **one of the** parent and child mood/behavior factors, a dummy variable indicating pre- or during COVID-19, an interaction term between the dummy variable and the included mood/behavior factor, and an individual random effect term. There are 4 domains × 7 the child and parent mood/behavior factors = 28 regressions in total.

**Table 5**
Child and parent mood/behavior influences on food parenting pre and during COVID-19, scaled by number of behaviors per domain (N=72)[a].

| | Coercive | | Indulgent | | Structure | | Autonomy Support | |
|---|---|---|---|---|---|---|---|---|
| | Pre COVID-19 | During COVID-19 | Pre COVID-19 | During COVID-19 | Pre COVID-19 | During COVID-19 | Pre COVID-19 | During COVID-19 |
| **Parent** | | | | | | | | |
| Positive mood | 0.0013* (p = 0.002) | 0.0002 (p = 0.651) | 0.0004 (p = 0.473) | −0.0002 (p = 0.632) | 0.0026* (p < 0.001) | 0.0009 (p = 0.143) | 0.0008 (p = 0.080) | 0.0008 (p = 0.055) |
| Negative mood | −0.0015 (p = 0.091) | 0.0020* (p < 0.001) | 0.0023* (p = 0.040) | 0.0020 (p = 0.100) | −0.0031* (p = 0.018) | −0.0050* (p < 0.001) | 0.0009 (p = 0.323) | 0.0008 (p = 0.433) |
| Stress | 0.0010 (p = 0.050) | 0.0014* (p = 0.012) | 0.0032* (p < 0.001) | 0.0032* (p < 0.001) | 0.0007 (p = 0.396) | 0.0018* (p = 0.035) | 0.0018* (p = 0.001) | 0.0018* (p = 0.003) |
| **Child** | | | | | | | | |
| Positive mood | 0.0017 (p = 0.070) | −0.0014 (p = 0.138) | 0.0005 (p = 0.692) | 0.0020 (p = 0.116) | 0.0064* (p < 0.001) | 0.0012 (p = 0.404) | 0.0023* (p = 0.017) | 0.0021* (p = 0.040) |
| Negative mood | 0.0010 (p = 0.614) | 0.0032 (p = 0.147) | 0.0082* (p = 0.002) | 0.0065* (p = 0.025) | −0.0070* (p = 0.020) | −0.0022 (p = 0.499) | 0.0036 (p = 0.086) | 0.0008 (p = 0.743) |
| Positive behavior | 0.0009 (p = 0.588) | −0.0075* (p < 0.001) | −0.0020 (p = 0.371) | 0.0001 (p = 0.972) | 0.0072* (p = 0.005) | −0.0017 (p = 0.534) | −0.0012* (p = 0.522) | 0.0002 (p = 0.932) |
| Negative behavior | 0.0054* (p < 0.001) | 0.0056* (p < 0.001) | 0.0048* (p = 0.009) | 0.0040* (p = 0.039) | −0.0019 (p = 0.364) | 0.0020 (p = 0.377) | 0.0034* (p = 0.021) | 0.0028 (p = 0.075) |

Note that the parent or child mood/behavior factor are the daily mean value of the observations. Most factors have different scales, so the magnitude of coefficients cannot be directly compared across factors. The during COVID-19 effects are calculated by using the fixed main effects and corresponding interaction terms.
* implies association of parent or child mood/behavior with food parenting domain by meal time has p-value < 0.05, the p-value is in parenthesis. Underline indicates change in coefficient from pre to during COVID-19 has p-value < 0.05.
[a] Mixed-effects regressions with the meal-level frequency of the food parenting activities of domains as outcomes, scaled by number behaviors per domain. The predictors include: race, income, **one of the** child or parent mood/behavior factors, a dummy variable indicating pre- or during COVID-19, an interaction term between the dummy variable and the included mood/behavior factor, and an individual random effect term. There are 4 domains × 7 the child and parent mood/behavior factors = 28 regressions in total.

## 4. Discussion

To our knowledge, this is the first prospective study to evaluate food parenting before and during the COVID-19 pandemic using the rich methodological strengths of EMA. Whereas traditional surveys assessing food-related parenting practices ask parents to retrospectively report on their usual use of specific practices (O'Connor et al., 2017), EMA relies on repeated assessment in real-time of the diversity of practices parents use across meals and days (Shiffman et al., 2008). Results revealed that most parents of preschoolers use a variety of food parenting practices in the day-to-day that span four higher-order domains of coercive control (e.g., restriction, pressure-to-eat), indulgence (e.g., anticipatory

catering, child choosing meals), structure (e.g., mealtime rules and routines), and autonomy support (e.g., guided choices, nutrition education). However, in alignment with study hypotheses, the use of food-related parenting practices known to be associated with more healthful dietary intake and eating patterns in children (i.e., structure and autonomy support behaviors) decreased during the COVID-19 pandemic. Further, as hypothesized, the types of practices used by parents were situationally associated with the mood of the parent as well as child mood. Parent negative mood during COVID-19 was associated with higher levels of coercive control and lower levels of structure, whereas positive child mood was associated with greater use of autonomy supportive practices. These findings suggest that effects of the COVID-19 pandemic on family dynamics around feeding young children include shifts away from theoretically (Vaughn et al., 2016) and empirically (Shloim et al., 2015; Yee et al., 2017) supportive approaches to food parenting and highlight the roles of parent and child mood/-behavior as potentially important momentary influences on food parenting during this time. Additionally, observed associations between parent stress and mood, child behavior, and use of specific food-related parenting practices highlight the interconnected and likely bidirectional nature of these biopsychosocial relationships (Russell & Russell, 2019). For example, the child's mood and behavior may shape the parent's approach to feeding (and vis a versa) which in turn influences the child's dietary intake. Similarly, it is possible that a parents' negative affect or stress may increase as they attempt to use a variety of feeding approaches that may or may not be successful at achieving their feeding goals. Future research should pursue a deepened understanding of the interconnected relationship between parent and child with respect to parental use of food-related parenting practices leading to differences in child eating patterns and dietary intake, with the goal of understanding how to best intervene on the development of food-related parenting practices that are less helpful to children over time.

In the present study, mean levels of coercive control or indulgent feeding practices during COVID-19 did not differ from those pre-COVID-19. This finding contrasts to our study hypotheses, as well as the recently published cross-sectional work of Jansen and colleagues (Jansen et al., 2021), which found that higher COVID-19-specific stress was associated with more coercive and indulgent feeding practices. Further, in the present study, parents were found to be less reliant on structure and autonomy support during COVID-19. It might be that increases in stress and demands on their time or financial resources have made it harder for parents to maintain a similar level of structure around their meals and/or snack times or to devote time to autonomy support activities, such as including their child in choices about food or meal preparation. Shifts in food parenting practices may also reflect broader changes to eating behavior within families during COVID-19. In an online survey of 254 Canadian families, for instance, more than half reported that eating and meal routines had changed during COVID-19, with the most commonly reported changes involving eating more food, eating more snacks, and eating less take-out food (Carroll et al., 2020). Similarly, a recent retrospective online survey of 584 US parents of children between 5 and 18 years of age revealed increases in high-calorie snack foods and desserts and sweets in the home during vs. before the COVID-19 pandemic as well as parents' use of coercive feeding practices (i.e., restriction and pressure-to-eat) (Adams et al., 2020).

In this study, parent negative mood during COVID-19 was associated with higher levels of coercive control and indulgence and lower levels of structure. Associations of negative mood with higher indulgence and lower structure were also seen pre-COVID. These findings align with study hypotheses, as well as the qualitative work of Loth and colleagues (Yee et al., 2017) in which parents described shifting from aspirational feeding practices (e.g., structure and autonomy support) to responsive practices (e.g. coercive control and indulgent) when faced with situational challenges, such as periods of high stress or low mood. One might hypothesize that when parents are struggling with low mood, they rely on feeding practices that either help them to "get the job done" (e.g., coercive control) or "eliminate the need for power struggles" (e.g., indulgent practices). Interestingly, in the current study, parental stress was found to be associated with increased use of feeding practices from all domains, although this association was less consistent during the pre-COVID time period. Previous research has found that parental stress is positively associated with use of controlling feeding practices, such as pressure to eat and restriction. Taken together, these observations suggest that when faced with higher levels of stress, parents may increase the variety of feeding techniques to manage the demands of the feeding situation. Previous qualitative research highlights the wide range of situational factors cited by parents as influencing the approach to feeding, including changes to family schedules (e.g., parent work), child activities, parent mood, time constraints, type of eating occasion (e.g., snack versus dinner), and child mood/behavior (Yee et al., 2017). While disruptions to family eating brought on by COVID-19 represent a deviation from the norm for families, it will be important for researchers to continue to consider the role of parental negative affect and stress when examining the use of specific food-related parenting practices, as many parents experience these feelings outside of the context of a pandemic.

There are both strengths and limitations to this study. This study adds significantly to the emerging literature aimed at broadening our conceptualization of food parenting practices, by being the first, to our knowledge, study to use EMA to objectively measure the dimensions proposed in the content map developed by Vaughn and other leading experts in the field. Further, this study adds to the evolving conversation about food parenting practices as dynamic and context specific constructs by exploring situational or momentary influences of parental and child mood/behavior on food parenting practices. Finally, the longitudinal design of the current study adds to our understanding of how the COVID-19 pandemic has impacted parents' use of food-related parenting practices. This understanding will be useful in the development of public health programs designed to support families during the pandemic and as we emerge from the pandemic, as patterns may continue. While the sample was drawn from a large, population-based study and was racially/ethnically and socioeconomically diverse, the demographic characteristics of the participants in this sample are not reflective of the demographics of parents within the US. Specifically, parents within this sample included a larger percentage of families from low-income and racial minority groups (e.g., Black, Hispanic, Asian American) than would be included in a nationally representative sample; parental educational attainment in the current sample aligned closely with the general population (Bureau, 2020Bureau). The higher level of diversity within the sample represents a study strength, given the need to learn more about families disproportionally affected by the COVID-19 pandemic. However, extrapolations to the broader US parent population should be made cautiously; it is possible that our findings indicate a larger shift in food-related parenting practices than would be seen in a population-based sample of parents of preschoolers. Additionally, our EMA protocol allowed parents to add additional observations days as needed to achieve 10 study days with complete data and on average it took participants 15.9 days to achieve 10 complete days of data collection. It is possible that families were less capable of compliance with EMA protocols on days when stress levels were higher, moods were lower, and/or child behaviors were more difficult to manage; no data was collected on reasons for noncompliance, challenging our ability to explore this further which is a limitation in our study design. With regard to our COVID-19 specific findings, it is important to recognize that parents completed EMA for a 10-day period; these data do not capture variation in family dynamics around feeding occurring across time during the COVID-19 pandemic. Further, the COVID-19 specific data were collected during the early months of the COVID-19 pandemic (March–April 2020) and this timing may have an impact on observed differences. For example, it might be that some families experienced a shift in their use of specific food-related parenting practices during these very early months, yet were able to return to their baseline use of feeding practices somewhat quickly. Alternatively, it

might be that some families experienced a small shift in their use of specific food-related parenting practices in the early months of the pandemic, and as the pandemic and its impacts persisted over time, these small shifts grew to represent larger and more ingrained changes in behavior. Understanding of the longevity of such shifts to food parenting practices with stresses to family life is an important question for future research. Finally, whether and how shifts in food parenting during COVID-19 have shaped dietary quality and risks of undernutrition/obesity among children are important questions that were not addressed in this research.

## 5. Conclusions

The COVID-19 pandemic has had a profound impact on the day-to-day lives of families with young children. Findings from the current study indicate that food parenting practices used by parents of preschool-aged children during COVID-19 have involved lower levels of structure and autonomy support and are situationally responsive to parent and child mood. These findings contribute to the understanding of the COVID-19 pandemic on family dynamics around eating and suggest that the pandemic has shifted feeding practices away from those theorized to be most supportive to child dietary and weight outcomes. The significance of the findings for child nutrition and growth is underscored by the fact that young children have spent much less time in the care of others and at school during the pandemic. Despite these shifts, structure and autonomy support practices represented the vast majority of practices used by parents at both time points. This observation is interesting in light of the fact that much of research on feeding young children has historically focused on "control" in feeding (O'Connor et al., 2017; Vaughn et al., 2016). While newer studies have found associations of practices reflecting structure (e.g., food availability) and autonomy support (e.g., praise) with children's intake of healthful foods (Shloim et al., 2015; Yee et al., 2017), research on these higher domains of food parenting remains limited and is clearly a priority. Finally, the findings highlight the important role of parental stress and mood in the day-to-day experience of feeding young children. Public health practitioners and clinicians working with parents of young children during COVID-19 should consider the potential impact of parental mood and stress, as well as child mood and behaviors. Additional research is needed to better understand the role of the emotional climate of feeding on food parenting as well as to tailor intervention strategies to help parents maintain supportive feeding practices in the face of challenging situations.

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## Data and code availability

Data and code will be made available upon request and the lead author has full access to the data reported on in the manuscript.

## Author contributions

Katie A. Loth: Dr. Loth is the Principal Investigator for the Kids EAT! study and conceptualized the paper, assisted with data interpretation, worked collaboratively to write the paper, and agrees to be accountable for all aspects of the work regarding the accuracy or integrity of any part of the work.

Ziyu Ji: Ms. Ji conducted the data analysis. She also assisted with the conceptualization of the paper, wrote drafts of the data analysis section of the paper, prepared figures and tables, critically reviewed the full 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.

Julian Wolfson: Dr. Wolfson oversaw the data analysis conducted by Ms. Ji. He also assisted with the conceptualization of the paper, critically reviewed the full 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.

Jerica Berge: Dr. Berge provided mentorship throughout the conceptualization of the Kids EAT! research study. She also assisted with the conceptualization of the paper, critically reviewed the full 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 provided mentorship throughout the conceptualization of the Kids EAT! research study and is the Principal Investigator for the EAT 2010–2018 parent study. She assisted with the conceptualization of the paper, critically reviewed the full 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.

Jennifer Fisher: Dr. Fisher provided mentorship throughout the conceptualization of the Kids EAT! research study. She also assisted with the conceptualization of the paper, critically reviewed the full 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.

## Ethical statement

All protocols used in the Kids EAT! and EAT 2010–2018 studies were approved by the University of Minnesota's Institutional Review Board Human Subjects Committee and are published elsewhere. Adult participants gave informed consent and children gave verbal assent before taking part any parts of the study protocol.

## Declaration of competing interest

We have no known conflicts of interest to disclose.

## Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.appet.2021.105714.

## References

Adams, E. L., Caccavale, L. J., Smith, D., & Bean, M. K. (2020). Food insecurity, the home food environment, and parent feeding practices in the era of COVID-19. *Obesity, 28* (11), 2056–2063. https://doi.org/10.1002/oby.22996

Akseer, N., Kandru, G., Keats, E. C., & Bhutta, Z. A. (2020). COVID-19 pandemic and mitigation strategies: Implications for maternal and child health and nutrition. *American Journal of Clinical Nutrition, 112*(2), 251–256.

Arlinghaus, K. R., & Laska, M. N. (2021). Parent feeding practices in the context of food insecurity. *International Journal of Environmental Research and Public Health, 18*(2), 366. https://doi.org/10.3390/ijerph18020366

van Assema, P., Glanz, K., Martens, M., & Brug, J. (2007). Differences between parents' and adolescents' perceptions of family food rules and availability. *Journal of*

*Nutrition Education and Behavior, 39*(2), 84–89. https://doi.org/10.1016/j.jneb.2006.08.031

Bauer, K. W., MacLehose, R., Loth, K. A., Fisher, J. O., Larson, N. I., & Neumark-Sztainer, D. (2015). Eating- and weight-related parenting of adolescents in the context of food insecurity. *Journal of the Academy of Nutrition and Dietetics, 115*(9), 1408–1416. https://doi.org/10.1016/j.jand.2015.01.011

Beckers, D., Karssen, L. T., Vink, J. M., Burk, W. J., & Larsen, J. K. (2020). Food parenting practices and children's weight outcomes: A systematic review of prospective studies. *Appetite*, 105010. Published online.

Berge, J. M., Fertig, A. R., Trofholz, A., Neumark-Sztainer, D., Rogers, E., & Loth, K. (2020). Associations between parental stress, parent feeding practices, and child eating behaviors within the context of food insecurity. *Preventive Medicine Reports, 19*, 101146.

Berge, J. M., Tate, A., Trofholz, A., et al. (2017). Momentary parental stress and food-related parenting practices. *Pediatrics, 140*(6), Article e20172295.

Berge, J. M., Tate, A., Trofholz, A., et al. (2018). Examining variability in parent feeding practices within a low-income, racially/ethnically diverse, and immigrant population using ecological momentary assessment. *Appetite, 127*, 110–118.

Birch, L. L. (1998). Psychological influences on the childhood diet. *Journal of Nutrition, 128*(2), 407S–410S.

Birch, L. L., Fisher, J. O., Grimm-Thomas, K., Markey, C. N., Sawyer, R., & Johnson, S. L. (2001). Confirmatory factor analysis of the child feeding questionnaire: A measure of parental attitudes, beliefs and practices about child feeding and obesity proneness. *Appetite, 36*(3), 201–210.

Bruening, M., MacLehose, R., Loth, K., Story, M., & Neumark-Sztainer, D. (2012). Feeding a family in a recession: Food insecurity among Minnesota parents. Published online. *Am J public health*.

Bureau, U. C.. America's families and living arrangements: 2020. The United States census Bureau. https://www.census.gov/data/tables/2020/demo/families/cps-2020.html. (Accessed 23 June 2021) Accessed.

Carroll, N., Sadowski, A., Laila, A., et al. (2020). The impact of COVID-19 on health behavior, stress, financial and food security among middle to high income Canadian families with young children. *Nutrients, 12*(8), 2352.

Faith, M. S., Scanlon, K. S., Birch, L. L., Francis, L. A., & Sherry, B. (2004). Parent-child feeding strategies and their relationships to child eating and weight status. *Obesity, 12*(11), 1711–1722.

Hendy, H. M., Williams, K. E., Camise, T. S., Eckman, N., & Hedemann, A. (2009). The Parent Mealtime Action Scale (PMAS). Development and association with children's diet and weight. *Appetite, 52*(2), 328–339.

Jansen, E., Thapaliya, G., Aghababian, A., Sadler, J., Smith, K., & Carnell, S. (2021). Parental stress, food parenting practices and child snack intake during the COVID-19 pandemic. *Appetite, 161*, 105119. https://doi.org/10.1016/j.appet.2021.105119

Larsen, J. K., Beckers, D., Karssen, L. T., & Fisher, J. O. (2020). Food parenting and children's diet and weight outcome. In *Food science, technology and nutrition for babies and children* (pp. 211–233). Springer.

Larson, N., Laska, M. N., & Neumark-Sztainer, D. (2020). Food insecurity, diet quality, home food availability, and health risk behaviors among emerging adults: Findings from the EAT 2010-2018 study. *American Journal of Public Health, 110*(9), 1422–1428. https://doi.org/10.2105/AJPH.2020.305783

Loth, K.. An exploration of the momentary mechanisms of controlling food-related parenting practices among mothers and fathers of preschool children. https://grantome.com/grant/NIH/K23-HD090324-02. (Accessed 23 February 2021) Accessed.

Loth, K., Fulkerson, J. A., & Neumark-Sztainer, D. (2014). Food-related parenting practices and child and adolescent weight and weight-related behaviors. *Clinical Practices London England, 11*(2), 207–220. https://doi.org/10.2217/cpr.14.5

Loth, K. A., Uy, M., Neumark-Sztainer, D., Fisher, J. O., & Berge, J. M. (2018). A qualitative exploration into momentary impacts on food parenting practices among parents of pre-school aged children. *Appetite, 130*, 35–44. https://doi.org/10.1016/j.appet.2018.07.027

Lytle, L. A., Hearst, M. O., Fulkerson, J., et al. (2011). Examining the relationships between family meal practices, family stressors, and the weight of youth in the family. *Annals of Behavioral Medicine, 41*(3), 353–362. https://doi.org/10.1007/s12160-010-9243-z

Musher-Eizenman, D., & Holub, S. (2007). Comprehensive feeding practices questionnaire: Validation of a new measure of parental feeding practices. *Journal of Pediatric Psychology, 32*(8), 960–972.

O'Connor, T. M., Mâsse, L. C., Tu, A. W., et al. (2017). Food parenting practices for 5 to 12 year old children: A concept map analysis of parenting and nutrition experts input. *International Journal of Behavioral Nutrition and Physical Activity, 14*(1), 122. https://doi.org/10.1186/s12966-017-0572-1

Parker, K., Minkin, R., & Bennett, J. (2020). *Economic fallout from COVID-19 continues to hit lower-income Americans the hardest* (p. 21). Pew Research Center. Published online.

Power, T. G., Johnson, S. L., Beck, A. D., Martinez, A. D., & Hughes, S. O. (2019). The Food Parenting Inventory: Factor structure, reliability, and validity in a low-income, Latina sample. *Appetite, 134*, 111–119. https://doi.org/10.1016/j.appet.2018.11.033

Russell, C. G., & Russell, A. (2019). A biopsychosocial approach to processes and pathways in the development of overweight and obesity in childhood: Insights from developmental theory and research. *Obesity Reviews: Official Jouranl of International Association Study of Obesity, 20*(5), 725–749. https://doi.org/10.1111/obr.12838

Sanmartín, R., Vicent, M., Gonzálvez, C., et al. (2018). Positive and negative affect schedule-short form: Factorial invariance and optimistic and pessimistic affective profiles in Spanish children. *Frontiers in Psychology, 9*. https://doi.org/10.3389/fpsyg.2018.00392

Shiffman, S., Stone, A. A., & Hufford, M. R. (2008). Ecological momentary assessment. *Annual Review of Clinical Psychology, 4*, 1–32.

Shloim, N., Edelson, L. R., Martin, N., & Hetherington, M. M. (2015). Parenting styles, feeding styles, feeding practices, and weight status in 4-12 Year-old children: A systematic review of the literature. *Frontiers in Psychology, 6*, 1849. https://doi.org/10.3389/fpsyg.2015.01849

Smyth, J. M., Wonderlich, S. A., Sliwinski, M. J., et al. (2009). Ecological momentary assessment of affect, stress, and binge-purge behaviors: Day of week and time of day effects in the natural environment. *International Journal of Eating Disorders, 42*(5), 429–436. https://doi.org/10.1002/eat.20623

Vaughn, A. E., Ward, D. S., Fisher, J. O., et al. (2016). Fundamental constructs in food parenting practices: A content map to guide future research. *Nutrition Reviews, 74*(2), 98–117. https://doi.org/10.1093/nutrit/nuv061

Vereecken, C. A., Keukelier, E., & Maes, L. (2004). Influence of mother's educational level on food parenting practices and food habits of young children. *Appetite, 43*(1), 93–103. https://doi.org/10.1016/j.appet.2004.04.002

Wardle, J., Sanderson, S., Guthrie, C. A., Rapoport, L., & Plomin, R. (2002). Parental feeding style and the inter-generational transmission of obesity risk. *Obesity, 10*(6), 453–462.

Watson, D., Clark, L. A., & Tellegen, A. (1988). Development and validation of brief measures of positive and negative affect: The PANAS scales. *Journal of Personality and Social Psychology, 54*(6), 1063.

Yee, A. Z. H., Lwin, M. O., & Ho, S. S. (2017). The influence of parental practices on child promotive and preventive food consumption behaviors: A systematic review and meta-analysis. *International Journal of Behavioral Nutrition and Physical Activity, 14*, 47. https://doi.org/10.1186/s12966-017-0501-3

Zeinstra, G. G., Koelen, M. A., Kok, F. J., van der Laan, N., & de Graaf, C. (2010). Parental child-feeding strategies in relation to Dutch children's fruit and vegetable intake. *Public Health Nutrition, 13*, 787–796, 06.