Children’s Healthy and Unhealthy Food Intake Related to Parental Fear of the Covid-19, Family Communication Patterns, and Parental Controlling Feeding Practices

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Abstract

Background: The COVID-19 pandemic has caused abrupt changes in the daily lives of most families, including their food environments. Fear of COVID-19 and family communication patterns are hypothesized to influence parental feeding practices and ultimately children's intake of healthy as well as unhealthy foods. Based on a conceptual model of direct and indirect effects among these variables, we test these hypotheses in an observational cross-sectional design.

Methods: 306 parents (51% fathers) with children in the age range 5 - 12 were recruited via a Facebook snowball sampling method. They completed questionnaires online to measure fear of COVID-19, conversation- and conformity-oriented family communication patterns, and parental controlling feeding practices. In addition, they reported on the child's intake of food categories marking healthy (fruits and vegetables) and unhealthy (juice, soda, sweets, fast foods) diets. The conceptual model was analyzed with structural equations modeling, including a multi-group analysis to discern differences between mothers and fathers.

Results: There were significantly positive associations between parental fear of COVID-19 and both conversation and conformity family communication patterns, both of which in turn were positively associated with parental controlling feeding practices. Conversation communication pattern was associated with reduced unhealthy food intake in children. For the most part, these associations occurred for both mothers and fathers. However, whereas fathers’ communication patterns were not related to children’s food intake, mothers’ conversation pattern was negatively, and conformity pattern was positively, associated with children's unhealthy food intake.

Conclusion: COVID-19 has had a profound impact on families, including children's dietary intake. These results underscore that general family patterns play an important role for children's dietary intake. Therefore, it may be useful to help parents adopt general positive parenting approaches to influence their children's healthy development, including dietary intake.

Introduction

A well-balanced healthy diet with adequate nutrients is pivotal for children's mental and physical development [1]. Unhealthy food intake among young children therefore should be a critical public health concern, given that this not only inhibits overall healthy development but also becomes predictive of chronic diseases later into adulthood such as cardiovascular disease, obesity, and diabetes [2]. However, children's typical dietary intake is poorly aligned with national dietary guidelines in that their diets are often low in fruits and vegetables and high in discretionary food, which is often less healthy or unhealthy [3]. It is well known that parents and other aspects of the home environment are key influences on children's food consumption [4]. Meanwhile, a striking shift has occurred recently that likely changed the home food environment for most families.

Since the early 2020, the world has been swept by the rapid spread of a novel coronavirus (COVID-19). Consequently, the COVID-19 pandemic has caused abrupt changes in the daily lives of most people due to the drastic measures that imposed such as closure of school and work, lock down of communities, and social distancing policies. Parents were put under sudden pressure with conflicting duties of working from home while caring for children throughout the day, which left them with an elevated psychological burden [5]. One of the crude emotions that frequently arise under a pandemic is fear. People fear getting exposed to the virus and losing loved ones as well as around the uncertainties about how this pandemic would unfold and end [6]. Fear could be a root cause of other mental health issues during the pandemic as people reporting more COVID-19 fear also report more anxiety and depression symptoms [7]. In addition, parents are a vulnerable group to COVID-19 fear as they tended to report more fear of COVID-19 than their counterparts without children [8].

Coupled with the upheaval of daily lives and associated psychological consequences from the COVID-19 pandemic, it was unavoidable that changes would follow in the home food environment. For instance, parental motivations
for buying foods for children, feeding practices, and meal preparing tactics changed during the pandemic [9]. Parents became even more influential on their children's food intake given that many spent all days with their children confined at home, serving all meals and snacks during at least the first phase of the pandemic. Nonetheless, it is still unclear how psychological consequences due to the pandemic are related to children's food intake. There have been mixed reports on children's healthy and unhealthy food intake during the pandemic. Some have reported increases in intake of both processed foods and fresh foods in the home [10] and others have reported only an increase in junk food [11]. As such, more information is warranted on how parental and family factors that impact children's dietary intake have been affected during the pandemic.

The proximal parental influence on children's food intake is their goal-oriented tactics with specific content that may reinforce children's food consumption [12]. One commonly examined feeding practice is parents’ controlling feeding, including restriction, pressure to eat, and monitoring. Controlling feeding is known to increase during stress [13], such as during the COVID-19 pandemic [11]. It appears that distress from the external factor wares on parents, and they become less responsive to their children's hunger and satiety cues [14, 15], which should otherwise be the prime stimulus for feeding. Thus, it is likely that controlling feeding practices may have increased during the early phase of the COVID-19 pandemic.

There is also a growing literature that broader parental factors are as or more important than specific feeding practices in influencing children's food intake [16]. For instance, general parenting styles that focus on warmth and provide control seemed to promote healthy eating among children [17], whereas permissive parenting was associated with children's eating fewer fruit and vegetable [18]. Furthermore, previous research suggested that the proximal feeding practices are reflective of broader parental styles such as that permissive general parenting is related to increased use of restriction of certain food [19].

Among various broader parental factors affecting children's diets, we specifically expect family communication patterns to serve as a vehicle for effective parental feeding practices, because feeding practices are based on parent-child communication. Parents express their feeding practices both verbally and non-verbally to children [20]. Conversely, children also express their opinions regarding parents’ food choices and feeding practices by making demands, negotiating, and refusing to eat [21]. Similarly, multiple studies showed that when more food choices were provided to children, they tended to make unhealthy food choices [22]. But parents use controlling feeding practices purposely to increase children's healthy food consumption. In this sense, feeding practices can be viewed as constant juggle between parents and children through communication. Therefore, effective parental communication should lead to more desirable parental feeding practices, which may in turn lead to better quality of food intake in children.

Specifically, according to the theory of family communication patterns, which is one of the most frequently applied theories in the field [23], family values and beliefs are reflected verbally through conversation-oriented (CONV) and conformity-oriented (CONF) communication. The CONV communication pattern is characterized by unstrained interaction among family members and freedom to voice differing viewpoints, whereas the CONF pattern is marked by prioritization of family interest above those of individuals and emphasis on children's obedience to authority figures, including parents. Family communication patterns thus would serve as an overarching basis for parental feeding practices. Accordingly, CONF communication is proposed to lead to elevated controlling feeding practices because parents’ restriction, monitor, and pressure to eat are based upon the notion that children should follow parents’ food choices. Likewise, CONV pattern is expected to work in an opposite direction because it emphasizes individuals' onions.

Although it is evident that the COVID-19 pandemic changed the food consumption of the families, it is currently unknown through which mechanisms it altered family food environment. We propose that the fear of COVID-19 pandemic has influenced how families communicate and interact with each other and this ultimately has indirect effects on children's food intake, if not direct and obvious. Thus, the current study sought to investigate how broader factors such as parental fear of COVID-19, family communication patterns, and more proximal parental controlling feeding practices are related to children's healthy and unhealthy food consumption when family life changed drastically during the first few months of the...
pandemic, at a time when many parents experienced heightened emotions including fear. Given the expectations that fathers on average became more engaged in parenting during this unique period due to spending more time at home, we will also examine if there were distinctive differences between mothers and fathers in shaping the feeding practices and dietary intake of their children.

Reflecting the discussion above, the conceptual model shown in Figure 1 identifies hypothesized relationships among parental fear of COVID-19, family communication patterns, parental controlling feeding practices, and child’s dietary intake, which leads to three hypotheses we specifically test here:

H1. CONV communication is inversely and CONF communication is positively related to parental controlling feeding practices.

H2. Broader family factors such as parental fear of COVID-19 and family communication patterns are related more strongly to children’s healthy and unhealthy food intake than the parental controlling feeding practices.

H3. Family communication and parental controlling feeding practices carry indirect effects between parental fear of COVID-19 and children’s food intake.

Methods

Institutional Review Board from the University of California, Merced approved the study, which was conducted in compliance with ethical standards in the treatment of the participants between August 13, 2020 and August 21, 2020.

Participants

The study included 306 parents (51% fathers), satisfying common recommendations for sample size requirements [24], given 31 parameters and 8 variables in the structural equations modeling (SEM) of the proposed model. Eligibility requirements were participants being above 18 years of age and proficient in English, residing in the US, and having at least one child between 5 and 12 years of age (Mean child age = 8.71, SD = 1.97). When a participant had more than one child, he or she was asked to select one child in the age range to complete the questionnaire. Demographic information is presented in Table 1.

Table 1. Sample demographic information
| Variable                                      | %   |
|----------------------------------------------|-----|
| Child's gender                               |     |
| Boy                                          | 67.40 |
| Girl                                         | 32.60 |
| Child's race                                 |     |
| Asian                                        | 7.10 |
| Black                                        | 16.45 |
| Latinx                                       | 6.13 |
| White                                        | 66.77 |
| Other                                        | 3.55 |
| Respondent's relationship to the child       |     |
| Biological father                            | 50.32 |
| Biological mother                            | 48.06 |
| Adoptive father                              | 0.97 |
| Adoptive mother                              | 0.65 |
| Father's educational level                   |     |
| 8th grade or less                            | 0.63 |
| High school graduate and GED                 | 7.55 |
| Some college, or 2-year degree               | 35.85 |
| 4-year college graduate                      | 49.69 |
| More than a 4-year college degree            | 6.29 |
| Mother's educational level                   |     |
| 8th grade or less                            | 0.66 |
| High school graduate and GED                 | 4.64 |
| Some college, or 2-year degree               | 32.19 |
| 4-year college graduate                      | 48.58 |
| More than a 4-year college degree            | 13.93 |
| Father's feeding involvement <sup>a</sup>    |     |
| Never                                       | 5.70 |
| Seldom                                       | 25.30 |
| About half the time                          | 41.80 |
| Most of the time                             | 24.70 |
| Always                                       | 2.50 |
| Mother's feeding involvement <sup>a</sup>    |     |
| Frequency          | Percentage |
|-------------------|------------|
| Never             | 3.30       |
| Seldom            | 30.70      |
| About half the time | 29.30     |
| Most of the time  | 26.00      |
| Always            | 10.70      |

a Response to the question “when your child is at home, how often are you responsible for feeding him or her?”

**Procedures**

Participants were recruited using a Facebook snowball sampling method, which was selected because it provided easy access to the target population at a lower cost than alternatives [25]. Moreover, the number of cases detected by Facebook has found to be higher than the traditional snowball sampling method [26]. Participants saw threads on Facebook and clicked the link for the study, which led to the Google Survey form through which the study was administered. To start, participants were presented with a description of the study and the informed consent. After indicating written consent, they answered questions online, using their smartphone or computer for approximately 20 – 30 minutes. The first 100 participants were compensated with a $10 Amazon e-gift card, and their remainder with a $5 card.

**Measures**

**Fear of COVID-19**

Participants were asked to indicate their level of agreement with seven items addressing fear of COVID-19, such as “I am most afraid of COVID-19” and “It makes me uncomfortable to think about COVID-19,” used in previous research [27]. Responses were recorded on a five-point Likert scale (1 = “strongly disagree” to 5 = “strongly agree”). A total sum across items was calculated, with higher scores indicating higher levels of fear of COVID-19. Internal consistency for this sample was $\alpha = .80$.

**Parent-child communication**

Parent-child communication was evaluated with the Revised Family Communication Pattern Instrument – Parent Version (RFCP) [28], which has been developed to measure family communication according to the Family Communication Patterns Theory [29]. The RFCP consists of 26 items measuring two underlying dimensions of family communication pattern, using a Likert-scale (1 = “strongly disagree” to 5 = “strongly agree”): (1) conversation-oriented (CONV) family communication (15 items) such as “I often ask my child’s opinion when the family is talking about something” and “My child and I often have long, relaxed conversations about nothing in particular;” and (2) conformity-oriented (CONF) family communication (11 items) such as “When my child is at home, it is expected to obey the parents’ rules” and “In our home, the parents usually have the last word.” Scores were calculated as the mean item score separately for each communication dimension, with a higher score indicating stronger presence of that dimension. Internal consistency for this sample was $\alpha = .91$ for CONV and .80 for CONF communication.

**Parent’s controlling feeding practices**

The parental controlling feeding practices with the child were assessed, using the Child Feeding Questionnaire [30], which is designed to assess seven dimensions. From these, three dimensions addressing controlling feeding practices were selected, including (1) monitor (3 items, e.g., “How much do you keep track of the sweets that your child eats?”), (2) restriction (5 items, e.g., “I have to be sure that my child does not eat too much of his or her favorite foods”), and (3) pressure to eat (5 items, e.g., “My child should always eat all of the food on his or her plate”). Responses were made on 5-point scales, with anchors from “never” to “always” for the monitoring items and from “disagree” to “agree” for the
restion and the pressure to eat items. Items were subjected to a confirmatory factor analysis (CFA) (see Results) to confirm the item structure of these three dimensions and that they could indicate a latent variable of controlling feeding practices. Internal consistency was $\alpha = .81$.

**Child's dietary intake**

Using items from the California Health Interview Survey Diet Screener [31], parents were asked about the child's dietary intake of two food categories commonly used to mark healthy intake (fruits and vegetables) and four used to mark unhealthy intake (juice, soda, sweets, and fast-food consumption). These are food categories commonly used in survey research to mark healthy and unhealthy diet intake [32, 33, 34]. Questions ask about the number of servings the child consumed yesterday for each food category, with responses ranging from "0" to "more than 8 servings." The exception was for fast-food consumption, for which the period was last week. Servings were self-defined by parent and considered to be child's regular portion of the food. Items were subjected to CFA to confirm using them to measure the latent variables of healthy intake and unhealthy intake, respectively. Internal consistency for healthy food was $\alpha = .60$ and unhealthy food $\alpha = .80$.

**Race/ethnicity**

Participants indicated which one or more of eight racial/ethnic categories described the child from the following: American Indian or Alaska Native, Asian, Black/African American, Caucasian/White, Hispanic/Latino, Middle Eastern, Mixed and Multi-racial, or other race and ethnicity. Using the Census classification approach, the child was classified as Asian or Latino if so indicted, regardless of other racial/ethnic indication.

**Statistical Analysis**

IBM SPSS Statistics 20 was used for descriptive statistics and Mplus for SEM analysis. To assess the construct validity of the measurement models of the controlling feeding practices and child's healthy and unhealthy dietary intake categories, a series of CFA were conducted to establish them as latent variables. After ensuring the adequate fit of the measurement models, three items from restriction, one item from pressure to eat, and two items from monitoring were included in the final model to measure the latent variable of controlling feeding practices.

A SEM path analysis was conducted first for the total sample. Subsequently, a multi-group SEM analysis was used with the father and mother subsamples. Child's gender was entered as a control variable in the path analysis. Additionally, the structural models of indirect effects of family communication and parental controlling feeding practices between parental COVID-19 fear and children's healthy and unhealthy food intake were tested using maximum likelihood estimation and a bias corrected bootstrapping procedure with 1000 iterations. The bootstrapping method can correct bias and thus give more accurate estimations [35]. The indirect effect is considered statistically significant if zero is not contained in the 95% confidence interval. Multi-group path analysis was completed also to test for fathers and mothers group differences in structural parameters of the indirect effect model.

To examine goodness of fit of the model, the comparative fit index (CFI), Tucker-Lewis index (TLI), and root mean square error of approximation (RMSEA) were assessed. Adequate fit for parsimonious SEM has been identified as CFI $\geq 0.90$, TLI $\geq 0.90$, and RMSEA $\leq 0.10$ [36]. A value of $\alpha = 0.05$ was set for statistical significance. Missing data was implemented under maximum likelihood estimation [37].

**Results**

Descriptive information about the participants is presented in Table 1 and for the study variables in Table 2. About the same proportion of fathers (69%) and mothers (66%) reported that they are responsible for feeding their child "about half the time" or more (Table 1). Independent samples t-tests indicated there was no significant differences between fathers and mothers
reporting use of the family communication or controlling feeding practices patterns (Table 2). Children were reported to consume approximately three servings a day for both fruits and vegetables. They were also reported to consume between two and three servings each of sweets, juice, and soda per day and three servings of fast-food per week. Correlations among variables as well as factor loadings for latent variable are presented in Table 3. All observed variables loaded significantly onto their respective latent factors of parental controlling feeding, child's healthy intake, and child's unhealthy intake based on the CFA (Table 3) and the resulting measurement models showed a close fit.

Table 2. Descriptive statistics for study variables for total sample and father and mother subsamples
|                                | Mean (SD) | t-test |
|--------------------------------|-----------|--------|
|                                | Scale     | Total  | Fathers | Mothers |
| **Parental fear of COVID-19**a | 5-35      | 22.08  | 22.20   | 21.96   |
|                                | (5.00)    | (5.06) | (4.95)  |         |
|                               | t (293) = -.42, p = .67 |
| **Family Communication Patterns**b |          |        |         |         |
| Conversation-oriented communication | 1-5   | 3.21   | 3.15    | 3.28    |
|                                | (0.69)    | (0.68) | (0.70)  |         |
|                               | t (308) = 1.69, p = .92 |
| Conformity-oriented communication | 1-5   | 2.96   | 3.02    | 2.89    |
|                                | (0.62)    | (0.64) | (0.59)  |         |
|                               | t (308) = -1.81, p = .07 |
| **Parental feeding practice - Restriction**c |          |        |         |         |
| Child's sweets intake | 1-5 | 3.10   | 3.07    | 3.13    |
|                                | (1.16)    | (1.16) | (1.17)  |         |
|                               | t (306) = .43, p = .67 |
| Child's high fat food intake | 1-5 | 3.05   | 2.95    | 3.15    |
|                                | (1.19)    | (1.21) | (1.15)  |         |
|                               | t (305) = 1.47, p = .14 |
| Child's favorite food intake | 1-5 | 3.08   | 3.14    | 3.02    |
|                                | (1.07)    | (1.08) | (1.07)  |         |
|                               | t (307) = -.97, p = .33 |
| **Parental feeding practice - Pressure to eat**c |          |        |         |         |
| To eat enough | 1-5 | 3.06   | 3.09    | 3.02    |
|                                | (1.11)    | (1.10) | (1.21)  |         |
|                               | t (306) = -.54, p = .59 |
| **Parental feeding practice - Monitoring**d |          |        |         |         |
| Child's snack intake | 1-5 | 2.99   | 3.02    | 2.96    |
|                                | (0.97)    | (0.97) | (0.97)  |         |
|                               | t (304) = -.54, p = .59 |
| Child's sweets intake | 1-5 | 2.97   | 2.95    | 3.00    |
|                                | (0.96)    | (0.92) | (1.00)  |         |
|                               | t (308) = 1.16, p = .25 |
| **Child's Healthy food Intake** |          |        |         |         |
| Child's fruit intaked | 0-8+ | 3.24   | 3.02    |        |
|                                | (1.37)    | (1.10) |         |         |
| Child's vegetable (green salad, green beans, or potatoes) intaked | 0-8+ | 2.96   | 2.95    |        |
|                                | (1.32)    | (0.92) |         |         |
| **Child's Unhealthy food Intake** |          |        |         |         |
| Child's candies intaked | 0-8+ | 2.36   | 2.83    |        |
|                                | (1.60)    | (1.97) |         |         |
| Child's fast-food intaked | 0-8+ | 2.83   | 2.37    |        |
|                                | (1.97)    | (1.67) |         |         |
| Child's juice intakee | 0-8+ | 2.37   | 2.39    |        |
|                                | (1.67)    | (1.88) |         |         |
| Child's soda intakef | 0-8+ | 2.39   | 2.36    |        |
|                                | (1.88)    | (1.60) |         |         |

aComposite score of 7 items each ranged from "strongly disagree (1)" to "strongly agree (5)"; bScores ranged from "strongly disagree (1)" to "strongly agree (5)"; cScores ranged from “disagree (1)” to “agree (5)”; dScores ranged from “never (1)” to
always (5); *Scores ranged from “0/yesterday (0)” to “more than 8 servings/yesterday (8)”; fScores ranged from “0/last week (0)” to “more than 8 servings/last week (8)”; *p < .05.

Table 3. Correlations and Factor Loadings Among Variables in Total Sample

|     | 1     | 2     | 3     | 4     | 5     | 6     | 7     | 8     | 9     | 10    | 11    | 12    | 13    | 14    | 15    |
|-----|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 1   | 1     |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
| 2   | 0.66  | 1     |       |       |       |       |       |       |       |       |       |       |       |       |       |
| 3   | 0.60  | 0.53  | 1     |       |       |       |       |       |       |       |       |       |       |       |       |
| 4   | 0.35  | 0.54  | 0.41  | 1     |       |       |       |       |       |       |       |       |       |       |       |
| 5   | 0.44  | 0.61  | 0.41  | 0.60  | 1     |       |       |       |       |       |       |       |       |       |       |
| 6   | 0.37  | 0.47  | 0.46  | 0.49  | 0.47  | 1     |       |       |       |       |       |       |       |       |       |
| 7   | 0.49  | 0.50  | 0.39  | 0.30  | 0.35  | 0.32  | 1     |       |       |       |       |       |       |       |       |
| 8   | 0.35  | 0.45  | 0.46  | 0.29  | 0.31  | 0.36  | 0.36  | 1     |       |       |       |       |       |       |       |
| 9   | 0.33  | 0.45  | 0.39  | 0.29  | 0.27  | 0.34  | 0.30  | 0.41  | 1     |       |       |       |       |       |       |
| 10  | 0.05  | 0.04  | 0.08  | 0.05  | 0.04  | 0.02  | 0.10  | 0.05  | 0.01  | 1.    |       |       |       |       |       |
| 11  | 0.07  | 0.10  | 0.07  | 0.06  | 0.04  | 0.00  | 0.08  | 0.00  | 0.05  | 0.39  | 1.    |       |       |       |       |
| 12  | 0.01  | 0.08  | 0.19  | 0.05  | 0.01  | 0.02  | 0.10  | 0.06  | 0.01  | 0.32  | 0.35  | 1.    |       |       |       |
| 13  | 0.07  | 0.02  | 0.25  | 0.00  | 0.01  | 0.05  | 0.21  | 0.09  | 0.10  | 0.35  | 0.43  | 0.47  | 1.    |       |       |
| 14  | 0.00  | 0.16  | 0.22  | 0.04  | 0.05  | 0.02  | 0.01  | 0.00  | 0.02  | 0.38  | 0.45  | 0.44  | 0.48  | 1.    |       |
| 15  | -0.10 | -0.19 | 0.19  | -0.08 | -0.08 | 0.05  | 0.03  | 0.02  | 0.01  | 0.34  | 0.33  | 0.46  | 0.45  | 0.42  | 1.    |

Factor Loadings

A

B

C

Note. All correlations in bold and factor loadings $p < .05$; controlled for child’s gender.

Variables: 1. Parental fear of COVID-19, 2. Conversation-oriented communication style, 3. Conformity-oriented communication style, 4. Parental restriction on child's sweets intake, 5. Parental restriction on child's high fat food intake, 6. Parental restriction on child's favorite food intake, 7. Parental pressure on child to eat enough, 8. Parental monitor on child's sweets intake, 9. Parental monitor on child's snack intake, 10. Child's fruit intake, 11. Child's vegetable intake (green salad, green beans, or potatoes), 12. Child's sweets intake, 13. Child's juice intake, 14. Child's soda intake, 15. Child's fast-food intake. A. Parental controlling feeding practices, B. Child's healthy food intake, C. Child's unhealthy food intake

Structural Model for the Total Sample

Results from the path analysis tested with SEM on the total sample are shown in Figure 2. This resulted in a satisfactory fit with the data (CFI = 0.92, TLI = 0.90, RMSEA = 0.07). Parental fear of COVID-19 was positively associated with both CONV and CONF family communication patterns but did not show association with either children's healthy or
unhealthy food intake. Both CONV and CONF family communications were positively related to parental controlling feeding practices. While CONV communication was inversely related to children's unhealthy food consumption, CONF was positively associated with children's unhealthy dietary intake. Parental controlling feeding practices did not have associations with children's dietary intake.

As shown in Table 4, both CONV and CONF family communications had significant indirect effects on children's unhealthy dietary intake. Specifically, CONV family communication mediated between parental COVID-19 fear and children's unhealthy food intake in the negative direction whereas CONF family communication did in the positive direction.

Table 4. Standardized Estimates of Indirect Effects, Standard Errors, and 95% Bias-Corrected Bootstrap Confidence Intervals.

| Indirect Effect | Estimate (β) | SE | Bootstrap 95% CI |
|----------------|--------------|----|-----------------|
| **Total Parents** |              |    |                 |
| • Parental COVID-19 fear → CONV family communication → Children's unhealthy food intake | -.31 | .10 | -.53, -.13 |
| • Parental COVID-19 fear → CONF family communication → Children's unhealthy food intake | .31 | .07 | .19, .45 |
| **Mothers** |              |    |                 |
| • Parental COVID-19 fear → CONV family communication → Children's unhealthy food intake | -.36 | .09 | -.56, -.19 |
| • Parental COVID-19 fear → CONF family communication → Children's unhealthy food intake | .19 | .07 | .07, .35 |

Note. CI = Confidence Interval.

**Structural Model for Fathers and Mothers**

The multi-group testing resulted in slightly reduced fit (CFI = 0.89, TLI = 0.87, RMSEA = 0.08), which is typically due to the smaller sample size when sub-samples are tested. However, based on the satisfactory fit from the total sample and RMSEA at 0.08, the multi-group model fits the data sufficiently well that it should be informative to examine differences between fathers and mothers.

In the first iteration of implementing the multi-group model, analysis of the mothers produced a non-significant negative residual variance for one observed variable (child's salad intake). This situation is common in SEM when there is little-to-no variation across individuals, and a solution is to fix this variation to zero and remove the negative variance from the model [38]. With this adjustment, the model properly estimated all parameters. This multi-group analysis examined
whether parameters differed significantly from zero and enabled us to explore differences in significant patterns between fathers and mothers.

As shown in Figure 2, both fathers and mother had the similar associations that their fear of COVID-19 is positively related to communication patterns, and communication patterns are also positively related to their controlling feeding practices. The notable difference was witnessed that only mothers’ CONV communication pattern was negatively and mothers’ CONF communication was positively linked to children's unhealthy eating. Also, as shown in Table 4, only mothers’ CONV and CONF communication carried an indirect effect between COVID-19 fear and children's unhealthy food intake.

Discussion

The current study aimed to understand how parental fear of COVID-19, family communication patterns, parental controlling feeding practices, and children's dietary intake are associated according to a conceptual model among American families with young school-age children during the first few months of the COVID-19 pandemic. We found significantly positive associations between parental fear of COVID-19 and both CONV and CONF family communication patterns. Both communication patterns in turn were positively associated with parental controlling feeding practices. Finally, CONV communication pattern was associated with reduced unhealthy food intake in children, while CONF communication was related to increased unhealthy food consumption. For the most part, these associations occurred for both mothers and fathers. But they differed in that fathers’ communication patterns were not related to children’s food intake, whereas mothers’ CONV pattern was negatively and CONF pattern was positively associated with children's unhealthy food intake. Moreover, we found that COVID-19 fear among mothers was indirectly associated with children's unhealthy diet through a link with CONV and CONF communications, where specifically more CONV communication and less CONF communication were associated with reduced food intake in children.

The consistently positive association between parental fear of COVID-19 and both types of family communication patterns revealed that when parents fear COVID-19 more, they are more likely to actively engage in communicating with their children in various ways. Past research identified families that are high in both CONV and CONF orientation as “consensual,” which is characterized by a focus on each other's needs and wants [39]. In these families, while open discussion of a wide variety of topics is highly encouraged, each family member's feelings about those topics are ultimately aligned to be congruent with family beliefs and values [40]. Under the pandemic situations, we could argue that parents are very interested in their children's feelings and thoughts to ensure children adapt to the changing conditions. At the same time, parents have the final say on the decisions and expect their children to follow their direction as a team to stay healthy and safe.

The finding that both CONV and CONF family communications were related to increased parental use of controlling feeding tactics was contrary to our Hypothesis 1, as we expected that CONV would inversely relate to parental controlling feeding. Although the COVID-19 has added a toll on families, it also had silver linings in that families spent more time together at home, providing opportunities to increase family bonds [41]. Some parents sought to provide structure in the meal environment as they shared meals more frequently with children [42]. It could be that parental controlling feeding practices of monitoring and restricting the discretionary food items and pressuring child to eat enough were of high value during the first phase of the pandemic, at a time when parents may have felt the need to ensure their children's healthy development under abnormal, even threatening, circumstances.

Parents’ controlling feeding practices are considered to hinder children developing their own food preferences and self-control, resulting in children's worse diet quality [43, 44, 45]. Also, a recent meta-analysis concluded that pressure to eat overall had a significantly negative association with children's healthy intake while restriction had a negative association with unhealthy food intake [46]. However, our study did not find significant direct or indirect effects involving parental controlling feeding practices on children's neither healthy nor unhealthy dietary intake. One potential explanation is that there are many other important factors influencing child eating, depending on types of meals and snacks, family
demographics such as number of siblings, cultural differences, and child food preferences that cannot be influenced by specific food-related practices.

While we did not find significant effects involving parental controlling feeding practices, we found associations indicating two indirect effects through CONV and CONF communication. Specifically, CONV communication negatively mediated whereas CONF communication positively mediated the relationship between parental COVID-19 fear and children's unhealthy food intake. The positive indirect effect through CONF communication to children's unhealthy food intake suggests that this type of rigid communication of expecting children to follow parents' direction may interfere with children's diet quality. Similarly, increased CONV communication, which emphasizes open and honest communication among family members, significantly correlated with children's decreased unhealthy food intake, suggesting that bi-directional communication and a positive interaction climate in the family and similar parenting behaviors may affect children's food intake [16]. Thus, this study suggests that broader family factors exert more influence on children's diets than specific food-focused feeding practices, which was consistent with our Hypothesis 2.

Furthermore, we found no associations with children's healthy food intake, which could suggest that the influences of parental and family factors are more salient on health-risk behaviors, such as unhealthy eating than on health-promoting behaviors, such as healthy eating [16]. Alternatively, families adopted more distinctive eating patterns around unhealthy food in general during the pandemic. Indeed, studies have reported that families were more likely to reach for snacks or comfort foods due to the increased availability when spending more time at home or in response to stress or boredom during this time [47, 48]. The COVID-19 has opened the opportunity for fathers to become more involved in caretaking, and the majority of the current sample of fathers indicated that they were involved in the feeding of their child. Nonetheless, the multi-group analysis revealed that mother's communication patterns were more prominent correlates of children's unhealthy food intake. The father's COVID-19 fear was linked to CONV and CONF communication, which were also related to their controlling feeding practices, but neither was connected with children's eating behaviors. This pattern of findings suggest that fathers contribute to the family emotional climate, but mothers are more likely to influence children's diets through their communication pattern, as primarily mothers make decisions of grocery shopping, food preparation, or meal plan [49].

**Limitations**

Among limitations of this study is that the sample volunteered to participate in response to a Facebook thread. Given the focus of the study, many parents presumably volunteered because of interest in what the study addressed, possibly creating a biased sample that may not represent all parents. Our sample furthermore was over-represented with educated parents who had access to the internet, likely also limiting generalization. Moreover, the experience of the COVID-19 pandemic may differ depending on the infection rate and the government response in the location of the participants, which have varied considerably even within the United States. We were unable to examine such regional variations here. Finally, the causal relationships among the variables cannot be determined due to the observational study design. Notwithstanding these limitations, this is the first study we are aware of that illuminates the potential mechanism how family dynamics may influence children's dietary intake during the first few months of the COVID-19 pandemic.

**Conclusions**

The COVID-19 pandemic has changed our lives deeply, and it will certainly linger in children's and parents' lives. Parents both knowingly and unknowingly share the family context in the household during stressful time. Therefore, we need to recognize that the burden of COVID-19 has on the multiple family dynamics including dietary intake. This argues for providing practical help to strengthen family coherence and resilience and promoting family well-being, which should create numerous positive cascades in family lives, including the food environment. Broad approaches to support parents to
practice advanced parenting skills should be identified. More research, especially longitudinal studies, will help us better understand what constitutes optimal family food environments for children's health and well-being.

**Declarations**

**Ethics approval and consent to participate:** Institutional Review Board from the University of California, Merced approved the study, which was conducted in compliance with ethical standards in the treatment of the participants. Informed consent was obtained from all individual participants included in the study.

**Consent for publication:** The participants consented to the submission of the case report for submission to the journal.

**Availability of data and material:** The datasets generated and analyzed during the current study are available in the Mendeley Data, https://data.mendeley.com/datasets/yyjhg2czrt/1

**Competing interests:** The authors declared no conflict of interest.

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**Authors’ contributions:** KK conceived and designed the study, completed data collection, statistical analysis, and literature search and drafted the initial version of the manuscript. JW supervised the study, contributed to the design, and edited the manuscript. All authors critically reviewed the manuscript and approved the final version as submitted.

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Figures

Figure 1
Hypothesized Model

Figure 2
Final model with significant standardized path coefficients marked with solid lines (*$p < .05$). Child’s gender was entered as a control variable. Ellipses and rectangles represent unobserved latent and observed variables, respectively. Dashed line indicates a non-significant path.

T: Total sample, F: Fathers, M: Mothers.