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Parenting styles, food-related parenting practices, and children's healthy eating: A mediation analysis to examine relationships between parenting and child diet

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Abstract

Parents exert a strong influence on their children's diet. While authoritative parenting style is linked to healthier weight and dietary outcomes in children, and authoritarian and permissive parenting styles with unhealthy eating, little is known about the mechanisms that mediate these relationships. Feeding styles are often examined in relation to child diet, but they do not consider the social and physical environmental contexts in which dietary behaviors occur. Therefore, this study examined whether parenting styles (authoritative, authoritarian, and permissive) were associated with three specific food-related parenting practices - mealtime structural practices (e.g., eating meals as a family), parent modeling of healthy food, and household food rules and whether these parenting practices mediated the association between parenting styles and children's diet. Participants were 174 mother-child dyads. Mothers (68% married, 58% college graduates, $M_{\text{age}}=41$ years [$SD=6.2$]) reported on their parenting practices using validated scales and parenting style using the Parenting Styles and Dimensions Questionnaire. Children (52% female, $M_{\text{age}}=10$ years [$SD=0.9$]) completed two telephone-based 24-hour dietary recalls. Dietary outcomes included the Healthy Eating Index (HEI)-2010 score, and fruit and vegetables and added sugar intake. Using PROCESS, multiple mediation cross-sectional analyses with parallel

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Appendix A. Supplementary data

Supplementary data related to this article can be found at <http://dx.doi.org/10.1016/j.appet.2018.06.021>.

Conflicts of interest

No potential conflicts of interest on part of any of the authors exist with regards to the research reported in this article.

mediators using 10,000 bootstraps were performed. Significant indirect effects were observed with mealtime structure and the relationships between authoritative parenting and HEI-2010 score ($b=0.045$, $p < .05$, $CI=[0.006, 0.126]$), authoritarian parenting and HEI-2010 score ($b=-0.055$, $p < .05$, $CI=[-0.167, -0.001]$), and permissive parenting and HEI-2010 score ($b=-0.093$, $p < .05$, $CI=[-0.265, -0.008]$). Child diet quality is affected by mealtime structural practices. Further examination of the features by which mealtime structural practices serve as a mechanism for parents to support healthy eating among their children may improve children's diet quality.

Keywords

Parenting style; Food-related parenting practices; Child diet

1. Introduction

The prevalence of child obesity has increased over the past three decades, with one in three children classified as overweight or obese (Ogden, Carroll, Fryar, & Flegal, 2015). Mid-childhood (ages 7–11 years), a period of rapid growth, has been identified as a time of increased risk for childhood obesity, partially due to changing eating patterns such as increased consumption of energy-dense, nutrient-poor foods (Emmett & Jones, 2015). Parents and their parenting styles have a primary influence on their children's eating behaviors and overall diet (Larson, Wall, Story, & Neumark-Sztainer, 2013; Vereecken, Legiest, De Bourdeaudhuij, & Maes, 2009). Therefore, evaluating parenting styles and food-related parenting practices is important in understanding children's dietary intake and subsequent obesity risk.

Parenting style incorporates parents' attitudes, beliefs, and behaviors and is considered a global measure of parental warmth and control regarding children's behaviors (Baumrind, 1971). These styles encompass a wide range of parenting domains including feeding, physical activity, bedtime, playtime, bath time, and education. Research by Baumrind and colleagues identified authoritative, authoritarian, and permissive parenting styles (Baumrind, 1971). The authoritative parenting style is characterized by structured guidance that incorporates the child's individual desires. The authoritarian parenting style is characterized as strict enforcement of parental rules with little promotion of child autonomy. The permissive parenting style is characterized by indulgence with little structural guidance provided to the child (Baumrind, 1971). Consistent findings on the relationship between parenting style and child dietary outcomes is limited due to the various methods used in their evaluation. For example, studies that evaluate children's diets often use either parent-reported or child-reported food frequency questionnaires (FFQs) which are limited by recall bias, incomplete reports, and social desirability bias. Few studies use 24-hr dietary recall data as a measure of children's diet even though it provides a more comprehensive, reliable, and valid assessment (Langer, Seburg, JaKa, Sherwood, & Levy, 2017). Extant literature has more frequently examined the relationship among parenting styles and fruit and vegetable intake as compared to other dietary outcomes. While some studies indicate there are no differences in fruit and vegetable intake among children across parenting style (De Bourdeaudhuij et al., 2009; Vereecken et al., 2009), others suggest fruit and vegetable intake

is higher among children with authoritative mothers (Lytle et al., 2003), and non-authoritative (Lytle et al., 2003) or permissive fathers (Berge, Wall, Loth, & Neumark Sztainer, 2010). Compared to the other parenting styles, authoritative parenting style is associated with less risk of child overweight (Shloim, Edelson, Martin, & Hetherington, 2015a, 2015b) and healthier dietary behaviors (Zahra, Ford, & Jodrell, 2014).

Feeding styles, a separate construct adapted from parenting styles, are generally characterized in terms of the following six feeding practices: responsibility, monitoring, modeling, encouraging, restriction, and pressure to eat (Hubbs-Tait, Kennedy, Page, Topham, & Harrist, 2008). Similar to results from studies examining authoritative parenting style and child dietary outcomes, the authoritative feeding style is associated with children's greater consumption of vegetables (Patrick, Nicklas, Hughes, & Morales, 2005). However, research indicates that feeding styles and parenting styles do not always match (Hennessy, Hughes, Goldberg, Hyatt, & Economos, 2010). While feeding styles are domain-specific to children's eating, they do not consider the extent of the social and physical environmental context in which children's dietary behaviors occur. Therefore, examining the influence of the global measure of parenting style on children's dietary behaviors provides the opportunity to evaluate the overarching environment in which parenting practices occur.

Food-related parenting practices are goal-oriented behavioral strategies that parents employ during meal and snack times. Three food-related parenting practices within the home environment that may affect children's dietary behaviors include establishing structure around mealtimes (e.g., a routine time for the evening meal, meals not eaten in front of the television), modeling of healthy eating, and the presence and enforcement of household food rules. Extant research regarding the effects of mealtime structure on the dietary intake of children is limited. However, one observational study examined the interpersonal characteristics of family communication and behavior management during mealtimes. These characteristics were positively associated with adolescents' vegetable consumption (Berge, Jin, Hannan, & Neumark-Sztainer, 2013). Research regarding parent modeling of healthy eating and household food rules is more extensive. A systematic review concluded that parent modeling of healthy eating was positively associated with children's fruit and fruit/vegetable juice consumption (Pearson, Biddle, & Gorely, 2009). A separate study showed that household food rules were positively associated with children's diet quality as measured by the Dietary Approaches to Stop Hypertension (DASH) score (Couch, Glanz, Zhou, Sallis, & Saelens, 2014). While research has investigated the relationships among food-related parenting practices and children's diet, few studies have incorporated socioeconomic and culturally diverse samples. Ensuring diversity of socioeconomic and race/ethnic factors is important for generalizability of findings because different racial and ethnic groups hold different goals for children's dietary behaviors and value different parenting practices (Chao, 2000). Understanding how food-related parenting practices and parenting style impact children's diet quality is important for future parent-based interventions intended to prevent childhood obesity.

To address the limitations of existing research, this study examined whether parenting styles (authoritative, authoritarian, and permissive) were associated with three specific food-related parenting practices (mealtime structural practices, parent modeling of healthy eating, and

household food rules), and whether these food-related parenting practices mediated the association between individual parenting styles and children's dietary outcomes (measured by 24-hour dietary recall) in a sample of 174 mother-child dyads participating in the Mothers and Their Children's Health (MATCH) study. The assessed dietary outcomes included HEI-2010 score, calorie-adjusted daily servings of combined fruit and vegetables, and calorie-adjusted mean daily added sugars (by total sugars). Although the HEI-2010 score is a composite score representing overall diet quality, we chose to include the fruit and vegetable and added sugar outcome variables as these are most amenable to intervention researchers due to the current dietary guidelines (US Department of Health and Human Services, 2015). We hypothesized that all three food-related parenting practices (mealtime structural practices, parent modeling of healthy eating, and household food rules) would mediate the relationship between authoritative parenting style and children's HEI-2010 score and calorie-adjusted daily servings of combined fruit and vegetables, and have a negative indirect effect on the relationship between authoritative parenting style and calorie-adjusted mean daily added sugars (by total sugars) (Fig. 1). Results from the analyses examining the mediational relationships between authoritarian and permissive parenting style and children's dietary outcomes were exploratory, with no prior hypotheses noted.

2. Methods

2.1. Overview

The current study used an analytical sample of 174 parent-child dyads who participated in baseline measures of the Mothers and Their Children's Health (MATCH) study, a longitudinal study designed to examine the role of mother's stress on their children's obesity risk. A detailed description of study methodology is described elsewhere (Dunton et al., 2015). Briefly, 8 to 12-year-old children and their mothers were recruited from Los Angeles-area elementary schools and community centers to participate in six semi-annual assessment waves across three years. During the baseline assessment, participants' anthropometrics were assessed, and paper questionnaires which included measures of household rules about children's eating and activity (Forman et al., 2008), parenting style (Dornbusch, Ritter, Leiderman, Roberts, & Fraleigh, 1987), family meal patterns (Lytle et al., 2011), and demographic information were completed. Additionally, children completed two telephone-based 24-hour dietary recalls within one week of their data collection appointment.

2.2. Participants

Mothers and their children were recruited through informational flyers and in-person visits by research staff to Boys and Girls Clubs throughout the greater Los Angeles area, and schools within the Pasadena Unified School District and Burbank Unified School District. Eligibility for the MATCH study was determined based upon the following inclusion criteria for mothers and their children: (1) child is 8–12 years old, (2) mother has at least 50% child custody, and (3) both mother and child are able to read English or Spanish. Ineligibility for the MATCH study was based upon the following exclusion criteria for mothers or children: (1) currently taking medications for a psychological condition, (2) health issues that limit physical activity, (3) child enrolled in special education programs, (4) currently using oral or

inhalant corticosteroids, (5) mother is currently pregnant, and (6) mother works more than 2 weekday evenings (e.g. between 5 and 9pm) per week, or 8 h or more on any weekend day.

2.3. Procedures

Participants attended a 90-minute data collection session at either a local school or recreation center. During these sessions, they completed the anthropometric measures and paper questionnaires. Mothers provided written informed consent and parental permission for their children. Children provided written and verbal assent. All procedures were approved by Institutional Review Boards at Northeastern University and the University of Southern California.

2.4. Mother-reported measures

Demographics.—Mothers reported their age, race/ethnicity, education level, household income, work status, and household structure, as well as their child's age and race/ethnicity. For the purposes of these analyses, mother's ethnicity (Hispanic/Latina vs. not Hispanic/Latina), full-time work status (working full-time vs. not working full time), education (college-educated or higher vs. not college-educated), and household structure (single-parent household vs. dual-parent/multigenerational household) were dichotomized.

Parenting Style.—The Parenting Style and Dimensions Questionnaire (PSDQ) (Robinson, Mandleco, Olsen, & Hart, 2001) was used to assess mothers' authoritative, authoritarian, and permissive parenting styles. Questions for each style were scored separately to create individual authoritative, authoritarian, and permissive scores. For all sub-scales, each item was scored from 1 (never) to 5 (always). *Authoritative parenting style* was comprised of the sum of scores from four separate sub-scales including parental warmth/involvement (11 items), use of reasoning/induction (7 items), democratic participation (5 items), and being good-natured/easygoing (4 items). Possible authoritative scores ranged from 27 to 135 (Cronbach's $\alpha=0.89$). *Authoritarian parenting style* was comprised of the sum of scores from four separate sub-scales including verbal hostility (4 items), use of corporal punishment (6 items), use of non-reasoning, punitive strategies (6 items), and directiveness (4 items). Possible authoritarian parenting style scores ranged from 20 to 100 (Cronbach's $\alpha=0.82$). *Permissive parenting style* was comprised of the sum of scores from three separate sub-scales including lack of follow-through (6 items), ignoring misbehavior (4 items), and parenting self-confidence (5 items). Possible permissive scores ranged from 15 to 75 (Cronbach's $\alpha=0.78$).

Food-Related Parenting Practices.—The 10-item *Structure of Family Meals* (Anderson, Must, Curtin, & Bandini, 2012) was used to measure families' mealtime structural practices. Sample items included, "Our family eats an evening meal at a regular time" and "My child eats the same food as everyone else." Response options ranged from 0 (never) to 4 (always or almost always). Negatively worded items were recoded. Mean scores were computed (Cronbach's $\alpha=0.65$).

Parent Modeling of Healthy Eating (Gattshall, Shoup, Marshall, Crane, & Estabrooks, 2008), a 12-item scale, was used to determine the mother's assessment of her child's

observation of her eating behaviors. Sample items included, “Does your child see you eat when you are bored?” and “Does your child see you eat healthy snacks?” Five response options were provided from 0 (never) to 4 (always or almost always). Participants needed to respond to at least 75% of the questions in order to create a final score. Mean scores were computed (Cronbach’s $\alpha=0.70$).

Household Food Rules were assessed with a 12-item scale previously used in the “Active Where?” study (Forman et al., 2008). Sample items included, “No meals while watching TV/DVDs,” and “Must eat dinner with family.” Response options were 1 (Yes), 0.5 (Sometimes), and 0 (No). Summed index scores were computed, with possible scores ranging from 0 to 12 (Cronbach’s $\alpha=0.73$). For all parenting practices scales, higher scores indicated greater use of that parenting practice.

2.5. Child-reported measures

Dietary Assessment.—Children’s diet was assessed by two 24-hour dietary recalls collected during one week. Research staff at the Northeastern University Dietary Assessment Center (DAC) (<http://www.northeastern.edu/dac/>) interviewed children over the telephone on one weekday and one weekend day. Previous research supports reliable completion of dietary assessment exclusively by children as young as seven years old (Burrows, Martin, & Collins, 2010). Children were asked to recall all food and beverages consumed on the previous day, from midnight to midnight. Mothers were requested to be available during the 24-hour dietary recall should the interviewer or child request their assistance in reporting on child diet. Participants were provided with a portion size estimation booklet to use during the 24-hour dietary recalls, and were asked to refer to it during the recall. Dietary data were entered directly into the Nutrition Data System for Research (NDSR) (Harnack, 2013) using a multiple-pass technique. This approach allows the participant to add or modify food and drink choices at multiple points during the recall session and asks detailed questions about food preparation, portion size, and added foods (e.g., condiments). Nutrition data were analyzed to quantify macronutrients and micronutrients for participants. Any 24-hr dietary recalls that had implausible intakes (< 500 kcal or > 4000 kcal) were excluded from the analytical dataset (Willett, 1998). We attempted to obtain two 24-hour dietary recalls from all participants; however, n=28 provided only one 24-hour dietary recall. Because there were no statistical differences in intakes (e.g., kcals, calorie-adjusted mean daily servings of combined fruit and vegetables, calorie-adjusted mean daily added sugars (by total sugars), or HEI-2010 total scores between those with one vs. two recalls, we included all participants with one or two recalls for a final analytical sample of N=174. Of these, 23 (13.2%) had one day of 24-hour dietary recall data, 11 (7.3%) had two weekend days of 24-hr dietary recall data, and 25 (16.6%) had two weekdays of 24-hour dietary recall data. In all cases with two completed calls, nutrition data collected by the 24-hr dietary recalls were averaged and analyzed as a measure of a child’s usual diet.

HEI-2010 Dietary Outcome.—The quality of the children’s usual diet as measured by the 24-hr dietary recalls was quantified using the Healthy Eating Index-2010 (HEI-2010) (Guenther et al., 2013). The HEI-2010 evaluates the extent to which one’s diet meets the

Dietary Guidelines for Americans (DGAs). Data to generate the HEI-2010 density, component and total scores were computed using the HEI scoring macro in SAS 9.4 (<https://epi.grants.cancer.gov/hei/sas-code.html>). The total score ranges from 0–100 with higher scores reflecting greater consistency with DGAs. A score of 100 reflects a diet that meets all of the dietary guidelines.

Fruit and Vegetable Intake.—Usual fruit and vegetables intake was assessed using the 24-hr dietary recall data analyzed by NDSR as mean daily servings of combined fruits and vegetables. This variable was standardized by calorie-adjustment (servings/1000 kcals of total energy intake) to account for underreporting and to ensure that intakes were independent of total energy intake. Because this variable was not normally distributed, a square root transformation was used for analyses in order to approach normality. Higher values represent greater mean consumption of fruit and vegetables.

Added Sugars Intake.—Usual added sugar intake was assessed using the 24-hr dietary recall data analyzed by NDSR as mean daily grams of added sugars as a proportion of total sugars consumed and was calorie-adjusted (grams/1000 kcals of total energy intake). Greater values represent higher consumption of added sugars.

2.6. Statistical analyses

Descriptive analyses, correlations, and mediation analyses conducted on survey data were completed using SPSS 24 (IBM SPSS, 2012). Frequencies, means, and standard deviations were calculated to summarize demographic, parenting variables, and children’s dietary data. Correlations tested initial associations between the variables of interest. To test for indirect effects of parenting style on children’s diet through food-related parenting practices, PROCESS v2.16.3 (Hayes, 2013) was performed using 10,000 bootstraps.

PROCESS used a regression-based approach and allowed for comparison of indirect effects, effect size, and examined the total effect model and results from Sobel testing. PROCESS estimated the indirect effect coefficient for each indirect pathway between the independent variable (authoritative, authoritarian, and permissive parenting style) and the dependent variable (children’s HEI-2010 score, fruit and vegetable intake, and added sugar intake), accounting for respective indirect effects (mealtime structural practices, parent modeling of healthy eating, and household food rules) and covariates (mother’s age, Hispanic ethnicity, marital status, income, education, full-time work status, and child’s gender). The parallel multiple indirect effect model allowed for potential mediator variables to be correlated but not causally influence the other. A parallel multiple indirect effect was used due to the grouping of parenting practices as tools that are used in combination rather than related sequentially. The indirect effects data from using PROCESS are generated with 95% Confidence Intervals, representing p -values $<.05$ rather than generating exact p -values.

3. Results

Demographic data are included in Table 1 ($n=174$). Children had a mean age of 9.6 years ($SD=0.89$), and just over half (52%) were girls. A total of 41.4% of children reported that they received free lunch at school. The majority of mothers were college-educated (60%)

and married (68%). Children's dietary data indicated a mean caloric intake of 1729 kcal per day (SD=461), which is slightly lower than national data for children ages 9–13 (Usual Dietary Intakes, 2007). Macronutrient composition of the children's usual diets fell within recommended macronutrient proportions by age at 33% (SD=6.5) of kilocalories from fat, 52% (SD=8.3) of kilocalories from carbohydrate, and 16% (SD=4.7) of kilocalories from protein (Institute of Medicine, 2002). The mean HEI-2010 score was 49.3 (SD=12.1), which is lower than the HEI-2010 score of 55.1 derived from NHANES 2011–2012 data (Healthy Eating Index (HEI), 2018). Mean daily servings of combined fruit and vegetables was 2.0 (SD=1.3) servings/1000 kcals, which is consistent with recommendations for fruit and vegetable intake (4 cups of fruit and vegetables daily per 1800 kcals) (Baron & Kenny, 1986). Mean daily added sugar intake was 29.8 g (SD=15.1), which is lower than the nationally reported mean daily intake of 21.5 tsp for boys and 17.8 tsp for girls (4 g sugar is the equivalent of one teaspoon). (Usual Dietary Intakes, 2007).

Bivariate correlations are presented in Table 2. Partial correlations were evaluated, and were adjusted for mother's age, child's gender, mother completing college versus not, mother being Hispanic/Latino versus not, mother being a single parent versus not, and mother working full-time versus not (data not shown). Exploratory analyses with study data indicated these covariates should be included in subsequent statistical models testing our hypotheses. Bivariate correlations were used to assess parenting style and food-related parenting practices. Authoritative parenting style was positively associated with mealtime structural practices ($r=0.220$, $p=.008$) and parent modeling of healthy foods ($r=0.190$, $p=.022$). The strength of these associations increased after controlling for all the sociodemographic covariates. Authoritarian parenting style and permissive parenting style were negatively associated with mealtime structural practices ($r=-0.156$, $p=.049$; $r=-0.281$, $p=.001$) and parent modeling of healthy foods ($r=-0.265$, $p=.001$; $r=-0.246$, $p=.002$). These associations persisted after controlling for sociodemographic covariates. Permissive parenting style was also negatively associated with household food rules ($r=-0.160$, $p=.042$). This association persisted after controlling for sociodemographic covariates. There were no significant direct effects observed among the three parenting styles and children's dietary outcomes.

Bivariate correlations were used to assess food-related parenting practices and dietary outcomes (Table 2). Mealtime structural practices and household food rules were positively associated with HEI-2010 score ($r=0.220$, $p=.004$; $r=0.255$, $p=.001$). These relationships remained significant after adjusting for covariates. Mealtime structural practices, parent modeling of healthy food, and household food rules were positively associated with calorie-adjusted daily servings of combined fruit and vegetables ($r=0.190$, $p=.012$; $r=0.158$, $p=.038$; $r=0.297$, $p=.001$). Only the associations between structure of family meals and household food rules persisted. Household food rules were negatively associated with added sugars ($r=-0.266$, $p=.001$), and the association persisted after controlling for covariates.

Results from the mediation analyses are presented in Figs. 2–4. Due to missing values for at least one of the variables, mediational analyses had varied sample sizes ranging from $n=142$ –156.

Authoritative parenting style had a negative, although insignificant, total effect on HEI-2010 score (*path c*, $b=-0.088$, $SE=0.085$, $p=.31$, $CI=-0.256,0.081$, $R^2=0.01$) (see Fig. 2). Authoritative parenting style predicted greater use of mealtime structural practices (*path a*, $b=0.007$, $SE=0.003$, $p=.02$, $CI=0.001,0.013$, $R^2=0.13$), and parent modeling of healthy eating (*path a*, $b=0.008$, $SE=0.003$, $p=.006$, $CI=0.002,0.013$, $R^2=0.13$). Greater use of mealtime structural practices (*path b*, $b=6.398$, $SE=2.528$, $p=.01$, $CI=1.396, 11.399$) and household food rules (*path b*, $b=1.209$, $SE=0.547$, $p=.03$, $CI=0.126, 2.291$) predicted higher HEI-2010 scores. Authoritative parenting style had a significant indirect effect on HEI-2010 score through mealtime structural practices (*path a*b*, $b=0.045$, $SE=0.028$, $p < .05$, $CI=0.006,0.126$). After adjusting for mealtime structural practices, parent modeling of healthy food, and household food rules, the direct effect of authoritative parenting on HEI-2010 score was insignificant (*path c'*, $b=-0.129$, $SE=0.084$, $p=.13$, $CI=-0.296,.038$, $R^2=0.13$).

Authoritarian parenting style had a positive, although insignificant total effect on HEI-2010 score (*path c*, $b=0.141$, $SE=0.141$, $p=.32$, $CI=-0.138,0.420$, $R^2=0.02$) (see Fig. 3). Authoritarian parenting style predicted less use of mealtime structural practices (*path a*, $b=-0.012$, $SE=0.005$, $p=.02$, $CI=-0.023,-0.002$, $R^2=0.10$) and less parent modeling of healthy food (*path a*, $b=-0.019$, $SE=0.004$, $p < .001$, $CI=-0.028,-0.010$, $R^2=0.19$). Greater use of household food rules (*path b*, $b=1.017$, $SE=0.511$, $p=.05$, $CI=0.007, 2.028$) predicted higher HEI-2010 scores. Authoritarian parenting style had a significant indirect effect on HEI-2010 score through mealtime structural practices (*path a*b*, $b=-0.055$, $SE=0.040$, $p < .05$, $CI=-0.167,-0.001$). After adjusting for mealtime structural practices, parent modeling of healthy food, and household food rules, the direct effect of authoritative parenting on HEI-2010 score was insignificant (*path c'*, $b=0.225$, $SE=0.146$, $p=.13$, $CI=-0.064,0.515$, $R^2=0.11$).

Permissive parenting style had a positive, although insignificant total effect on HEI-2010 score (*path c*, $b=0.062$, $SE=0.174$, $p=.72$, $CI=-0.281,0.405$, $R^2=0.009$) (see Fig. 4). Permissive parenting style predicted less use of mealtime structural practices (*path a*, $b=-0.019$, $SE=0.006$, $p=.003$, $CI=-0.032,-0.007$, $R^2=0.11$), less parent modeling of healthy food (*path a*, $b=-0.018$, $SE=0.006$, $p=.002$, $CI=-0.029,-0.007$, $R^2=0.13$), and less household food rules (*path a*, $b=-0.060$, $SE=0.029$, $p=.04$, $CI=-0.117,-0.002$, $R^2=0.09$). Greater use of mealtime structural practices (*path b*, $b=4.852$, $SE=2.323$, $p=.04$, $CI=0.261, 9.442$) and household food rules (*path b*, $b=1.160$, $SE=0.514$, $p=.03$, $CI=0.145, 2.175$) predicted higher HEI-2010 scores. Permissive parenting style had a significant indirect effect on HEI-2010 score through mealtime structural practices (*path a*b*, $b=-0.093$, $SE=0.062$, $p < .05$, $CI=-0.265,-0.008$). After adjusting for mealtime structural practices, parent modeling of healthy food, and household food rules, the direct effect of authoritative parenting on HEI-2010 score was insignificant (*path c'*, $b=0.226$, $SE=0.175$, $p=.20$, $CI=-0.121,0.573$, $R^2=0.10$). All models adjusted for mother's age, child's gender, mother completing college versus not, mother being Hispanic/Latino versus not, mother being a single parent versus not, and mother working full-time versus not.

These results suggest that HEI-2010 score is affected through parents' use of mealtime structural practices. There were no significant direct effects, nor other significant indirect effects.

4. Discussion

To address the lack of research examining the mechanisms that mediate the relationships among parenting styles (authoritative, authoritarian, and permissive) and dietary intake in children, this study examined whether parenting styles were associated with three specific food-related parenting practices - mealtime structural practices (e.g., eating meals as a family), parent modeling of healthy food, and household food rules and whether these parenting practices mediated the association between parenting styles and children's dietary intake. There was a positive indirect effect of mealtime structural practices between authoritative parenting and HEI-2010 score. Authoritative mothers showed higher mealtime structure which predicted higher dietary quality in children. In contrast, there were negative indirect effects of mealtime structural practices between authoritarian parenting style and HEI-2010 score and between permissive parenting style and HEI-2010 score. Permissive and authoritarian mothers showed lower mealtime structure which predicted lower dietary quality in children. There were no direct effects of parenting styles and consumption of fruits and vegetables and added sugars, nor indirect effects of the three food-related parenting practices. Overall, there were no statistically significant direct effects between parenting styles and dietary intake. Due to the negative indirect effects, there is inconsistent mediation of authoritarian and permissive parenting styles with children's dietary quality. The traditional view of interpretation of mediational analyses indicates that there must be an association between the independent variable and the outcome variable (Baron & Kenny, 1986). However, previous research examining the relationships between independent and dependent variables has shown that a statistically significant association does not need to exist in order to show mediation (MacKinnon & Fairchild, 2009).

The lack of associations among parenting styles and child diet seen in the present study have emerged in previous research showing no differences among parenting styles and FFQ-reported fruit and vegetable intake among European schoolchildren (De Bourdeaudhuij et al., 2009; Vereecken, Rovner, & Maes, 2010). Two similarities between the present study and the larger European studies were the age of children and the ethnic diversity of the samples studied. In contrast to these findings, results from other studies indicated significant associations between parenting style and children's diet. Authoritative parenting style has been associated with higher fruit consumption among preschoolers (Peters, Dollman, Petkov, & Parletta, 2011), whereas permissive parenting style has been associated with lower fruit and vegetable intake among schoolchildren (Langer et al., 2017). In a longitudinal study, boys with authoritarian mothers were less likely to consume fruits and vegetables at 2-years follow-up (Alsharairi and Somerset, 1080). At 4-years follow-up, girls with authoritative mothers were most likely to consume fruits and vegetables (Alsharairi and Somerset, 1080). Among adolescents, those who reported having authoritative parents ate significantly more fruit compared to those who reported that their parents had one of the other three parenting styles (Kremers, Brug, de Vries, & Engels, 2003). Making conclusions

about the role of parenting style on children's dietary behaviors is hampered by the conflicting results from these studies.

Although there were no direct effects of parenting style on children's HEI-2010 score, there were indirect effects seen when including mealtime structural practices as a mediator. While there has been no known previous examination of the mediational relationship of mealtime structural practices with parenting style and HEI-2010 score, other research in addition to ours has shown that frequency of family meals (a component of mealtime structural practices) was positively associated with healthier diet patterns in children and adolescents (Gillman et al., 2000; Hammons & Fiese, 2011), including greater fruit and vegetable intake in adolescents (Neumark-Sztainer, Hannan, Story, Croll, Perry). Cross-sectional data have demonstrated that frequency of family meals among adolescents increases as mothers' authoritative parenting style score increases (Berge et al., 2010b). Longitudinal data have demonstrated that authoritative parenting style predicted higher frequency of family meals 5 years later. This effect, however, has only been reported between opposite sex parent-child dyads (Berge et al., 2010b). Combining the results from these studies together suggests that children of authoritative parents consume more healthful diets through incorporation of specific components of mealtime structural practices. Authoritarian and permissive parents may not utilize all mealtime structural practices as a food-related parenting practice. For example, authoritarian parents may enforce specific aspects of mealtime structural practices (e.g., child eats the same meal as everyone else) but fail to create a supportive environment during mealtime that fosters communication among family members that may ultimately benefit children's diet quality (Berge et al., 2013). Permissive parents may not impose any structure or rules regarding meal time, allowing children to make their own decisions about where and when to eat, potentially resulting in poor dietary habits and ultimately excess weight (Rhee, Lumeng, Appugliese, Kaciroti, & Bradley, 2006). Ultimately, children's diet quality may suffer from failure to use mealtime structural practices.

Parent modeling of healthy eating did not have an indirect effect on parenting styles and children's dietary outcomes. While there has been no known previous examination of the mediational relationships tested in the present study, prior research has shown parent modeling of healthy eating partially mediated the positive association between restrictive parenting practices and adolescents' sugar sweetened beverage (SSB) consumption (van der Horst et al., 2007). However, participants in that study were primarily Dutch, and results from the present study may differ due to the assessment of an ethnically diverse sample in the United States. In another study, parent modeling of healthy eating was positively associated with self-reported healthier diet in adolescents (Zarychta, Mullan, & Luszczynska, 2016), higher HEI-2010 scores and greater fruit/vegetable intake (Couch et al., 2014; Loth, Friend, Horning, Neumark-Sztainer, & Fulkerson, 2016), and negatively associated with parent-reported dietary fat intake in children (Eisenberg et al., 2012). These conflicting results may be due to the age of the participants in these studies, suggesting there are differences in the association between parenting style and children's diets compared to adolescents' diets. As children age, they are exposed to more external social and physical environmental influences related to dietary behaviors including consuming foods with peers and away-from-home foods. To confirm the current study's findings, they will need to be replicated in future research in samples of younger children.

Household food rules did not have an indirect effect on parenting style and children's dietary outcomes. While there has been no previous examination of the mediational relationships tested in the present study, other studies have demonstrated that household food rules are positively associated with children's diet quality (as measured using the DASH score) (Couch et al., 2014) and children's dietary fat intake (Eisenberg et al., 2012), but not associated with children's SSB intake (Lopez et al., 2012). With regards to our findings, research shows that authoritative parents use supportive practices such as modeling of healthy foods, rather than restrictive food-parenting practices, and thus, may negate the need for household food rules for their children (Shloim et al., 2015a, 2015b); whereas, authoritarian parents may demand that their children eat specific foods without explicitly creating household food rules (van der Horst & Sleddens, 2017). Alternatively, permissive parents are less likely to impose any household food rules, which may result in unhealthy eating behaviors (Patrick, Hennessy, McSpadden, & Oh, 2013). Thus, these findings support the lack of mediation effects in the current study.

Strengths of the current study include the use of a socioeconomically and ethnically diverse sample of mother-child dyads, allowing for greater generalizability of study results. Children's diet was measured using data from two 24-hour dietary recalls, rather than being parent-reported. Additionally, previously validated scales of parenting styles and parenting practices were used. Frequency of family meals is often used as a single indicator of mealtime structural practices (McCullough, Robson, & Stark, 2016), while the scale used in the present study is more comprehensive encompassing several components of mealtime structure within families.

However, this study is not without limitations. Because the current study is cross-sectional, we are unable to determine causality. Additionally, this study did not include the influence of maternal concerns or attitudes related to nutrition or the influence of maternal weight on parenting practices, which may influence food-related parenting behaviors. Furthermore, social desirability of mothers who self-reported their parenting style and parenting practices may have biased their responses. Limitations among use of 24-hour dietary recall data include the use of two calls in the present study, with 23 (13.2%) participants having one call, which may not be enough dietary data to generalize about children's usual intake. Children may have underreported their dietary intake during the telephone survey, resulting in reported amounts of added sugars that are lower than the national average. Children's dietary data may be a reflection of the sample studied considering 60% of mothers were college educated and 43% reported household incomes of at least \$75,000 annually. Previous research indicates that higher socioeconomic status and education levels are inversely associated with consumption of added sugars (Thompson et al., 2009). An additional limitation is the small effect sizes of the indirect effects of mealtime structural practices with parenting styles and HEI-2010 scores, suggesting that additional unstudied factors may play a prominent role in understanding the relationships between parenting styles and children's dietary outcomes. Also, survey assessments of other caregivers' parenting styles and food-related parenting practices were not conducted because mothers were the only parent participants recruited for the study. Therefore, we cannot generalize the results of this study to fathers or others who may provide child care services.

5. Conclusions

Implications of the current study include future promotion of mealtime structural practices as a way for parents to assist their children in consuming a higher-quality diet. Evaluating parenting practices within the context of parenting styles may help determine individual practices that need development within a particular parenting style. Considering that authoritative parenting style is most often promoted as the ideal parenting style, this may ultimately help determine which parenting practices are best espoused and will be most effective. Further examination of the features by which mealtime structural practices serve as a mechanism for parents to support healthy eating among their children can be used for parent-based interventions aimed at improving diet quality.

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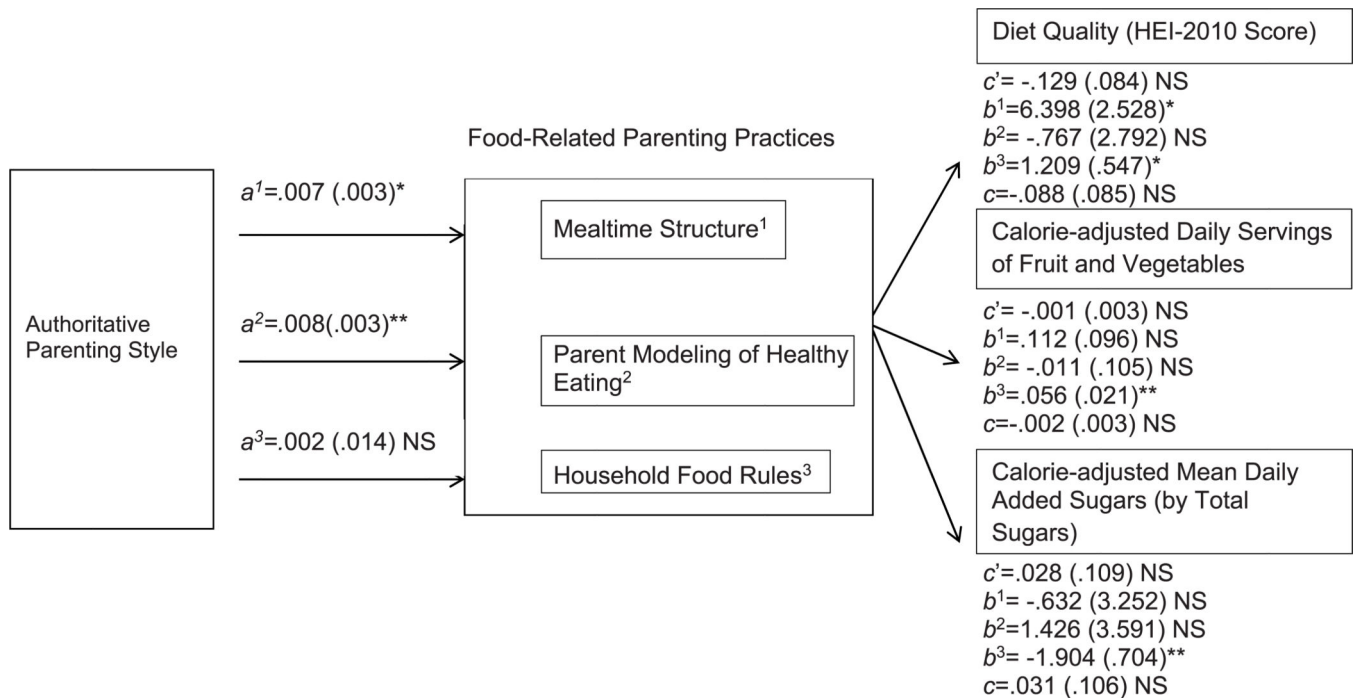
Fig. 1. Schematic of hypothesized relationships among parenting styles, food-related parenting practices, and child dietary outcomes.

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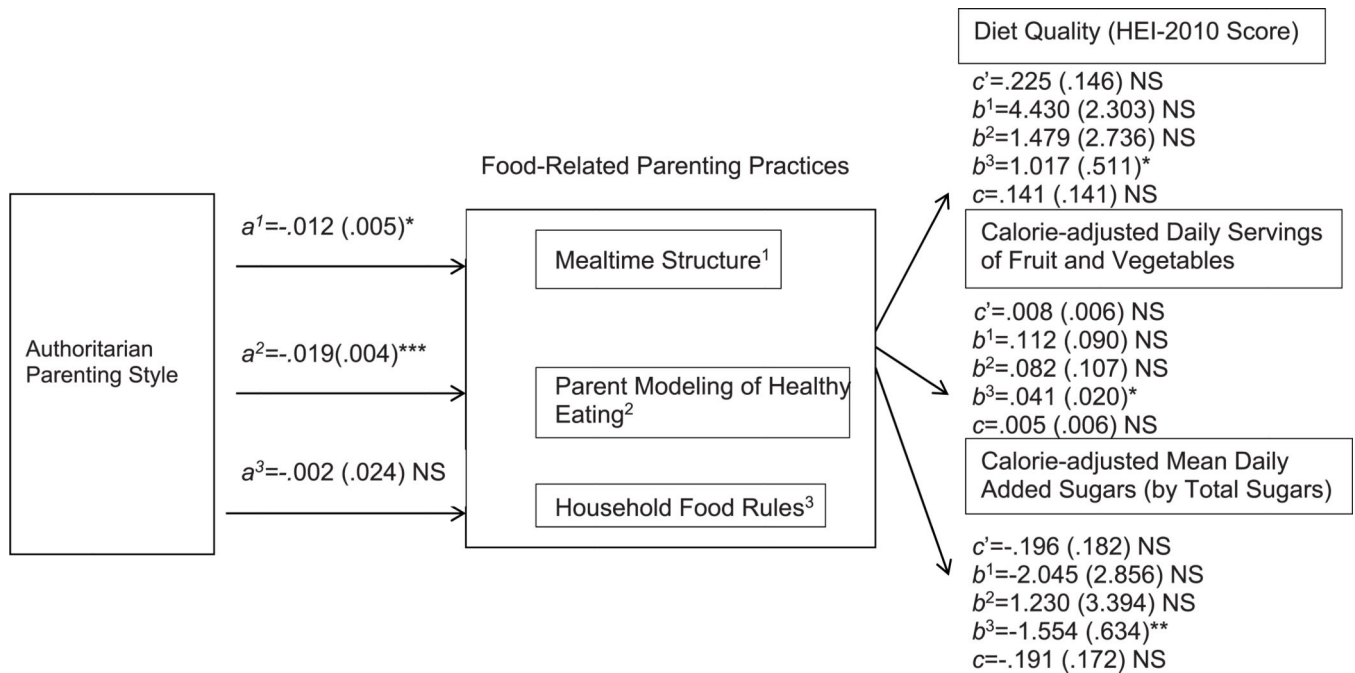
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**Fig. 2.**

Path coefficients, (standard errors), and values representing the association of authoritative parenting style through three food-related parenting practices (mealtimes structural practices, parent modeling of healthy food, and household food rules) on diet quality (HEI-2010 score) ($N=143$), servings of fruit and vegetables ($N=142$), and daily added sugar ($N=143$) in 8–12 year old children. Intermediary variables are numbered 1, 2, and 3 and are represented in the b pathways for each outcome. Direct effects for authoritative parenting style and diet quality (HEI-2010 score), servings of fruit and vegetables, and daily added sugar are represented by c' below each outcome variable. $*p < .05$; $**p < .01$; $***p < .001$; NS=non-significant.

**Fig. 3.**

Path coefficients, (standard errors), and p values representing the association of authoritarian parenting style through three food-related parenting practices (mealtime structural practices, parent modeling of healthy food, and household food rules) on diet quality (HEI-2010 score) ($N=155$), servings of fruit and vegetables ($N=154$), and daily added sugar ($N=155$) in 8–12 year old children. Intermediary variables are numbered 1, 2, and 3 and are represented in the b pathways for each outcome. Direct effects for authoritarian parenting style and diet quality (HEI-2010 score), servings of fruit and vegetables, and daily added sugar are represented by c' below each outcome variable. $*p < .05$; $**p < .01$; $***p < .001$; NS=nonsignificant.

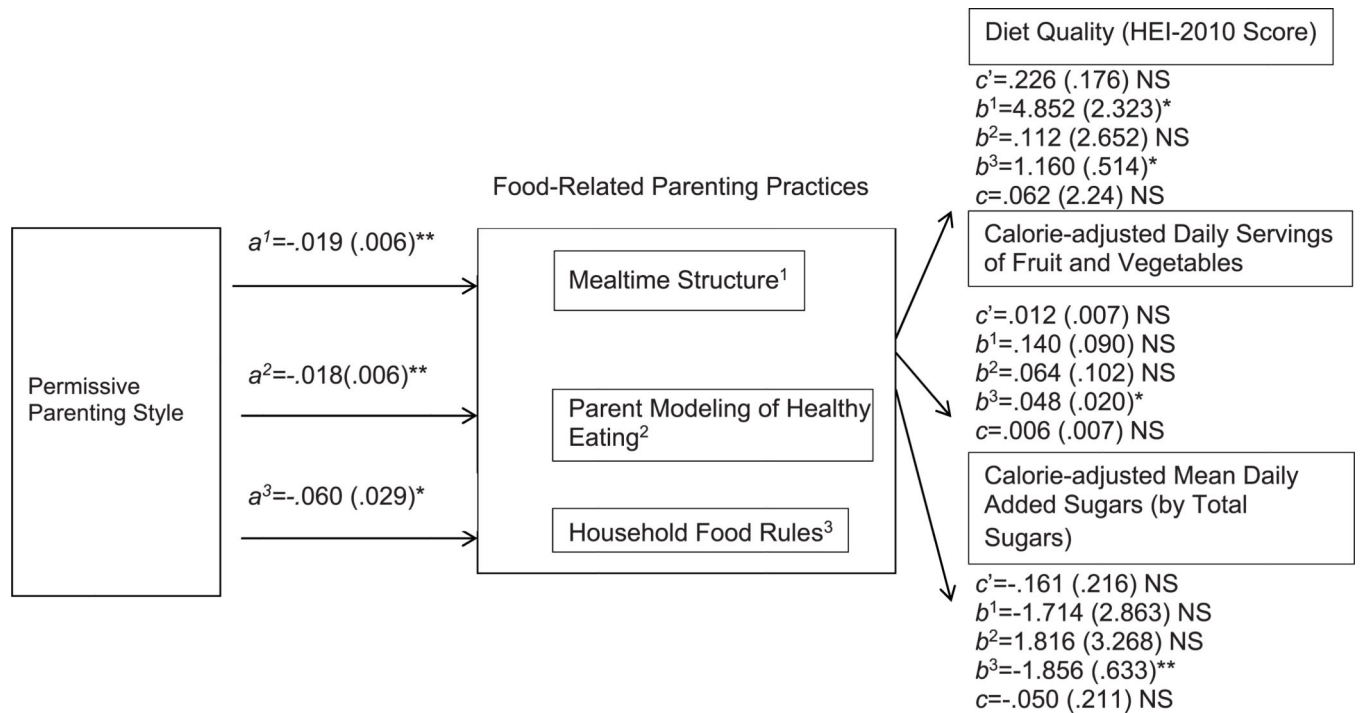


Fig. 4.

Path coefficients, (standard errors), and p values representing the association of permissive parenting style through three food-related parenting practices (mealtimes structural practices, parent modeling of healthy food, and household food rules) on diet quality (HEI-2010 score) ($N=156$), servings of fruit and vegetables ($N=155$), and daily added sugar ($N=156$) in 8–12 year old children. Intermediary variables are numbered 1, 2, and 3 and are represented in the b pathways for each outcome. Direct effects for permissive parenting style and diet quality (HEI-2010 score), servings of fruit and vegetables, and daily added sugar are represented by c' below each outcome variable. $*p < .05$; $**p < .01$; $***p < .001$; NS=nonsignificant.

Table 1Descriptive statistics: Mothers and Their Children's Health (MATCH) Study (overall $n=174$ pairs).

| Variables | <i>n</i> (%) | Range of Responses |
|--|----------------|--------------------|
| <i>Mother's demographic characteristics</i> | | |
| Married or Cohabiting | 118 (67.8) | |
| Race/Ethnicity | | |
| Caucasian/White | 74 (42.5) | |
| African-American/Black | 28 (16.1) | |
| Hispanic/Latino | 79 (45.4) | |
| Asian-American | 21 (12.1) | |
| Alaska Native/American Indian | 3 (1.7) | |
| Native Hawaiian/Pacific Islander | 2 (1.1) | |
| Multi-racial | 12 (6.9) | |
| Income | | |
| \$0–\$35,000 | 46 (26.4) | |
| \$35,001–\$75,000 | 52 (29.9) | |
| \$75,001–\$105,000 | 32 (18.4) | |
| \$105,001 | 43 (24.7) | |
| Education | | |
| < College | 63 (36.2) | |
| College Graduate | 105 (60.3) | |
| Household Type | | |
| Single Parent | 40 (23.0) | |
| Two-Parent | 110 (63.2) | |
| Multi-Generational | 24 (13.8) | |
| | M (SD) | |
| Age, years | 41.0 (6.16) | 26–57 |
| BMI | 28.2 (6.48) | 16.8–57.2 |
| ^a <i>Mother's Parenting Characteristics</i> | | |
| Parenting Style | | |
| Authoritative | 107.62 (13.03) | 27–132 |
| Authoritarian | 36.87 (7.28) | 20–58 |
| Permissive | 27.22 (5.99) | 15–48 |
| Mealtime Structure | 2.86 (0.49) | 1.5–3.9 |
| Parent Modeling of Healthy Foods | 2.91 (0.43) | 1.4–3.8 |
| Household Food Rules | 5.21 (2.17) | 0–12 |
| <i>Child demographic characteristics</i> | | |
| | n (%) | |
| Sex, Girl | 91 (52.3) | |
| Race/Ethnicity | | |
| Caucasian/White | 78 (44.8) | |
| African-American/Black | 33 (19.0) | |

| Variables | <i>n</i> (%) | Range of Responses |
|---|----------------|--------------------|
| Hispanic/Latino | 90 (51.7) | |
| Asian-American | 24 (13.8) | |
| Alaska Native/American Indian | 6 (3.4) | |
| Hawaiian/Pacific Islander | 4 (2.3) | |
| Multi-racial | 32 (18.4) | |
| | M (SD) | |
| Age, years | 9.64 (0.89) | 8–12 |
| BMIz (n = 137) | 0.50 (1.03) | –2.18–2.61 |
| <i>Child Daily Dietary characteristics</i> | | |
| Total Calories (kcal) | 1728.9 (460.6) | 711.0–2869.0 |
| % Daily Calories from Fat | 32.6 (6.49) | 13.0–49.0 |
| % Daily Calories from Saturated Fat | 11.4 (3.06) | 4.0–23.0 |
| % Daily Calories from Carbohydrate | 51.8 (8.26) | 26.0–74.0 |
| % Daily Calories from Protein | 15.6 (4.71) | 7.0–38.0 |
| Calorie-Adjusted Mean Daily Added Sugar (by Total Sugars) (g) | 29.8 (15.1) | 1.0–72.0 |
| Calorie-Adjusted Mean Servings Fruit and Vegetables | 2.0 (1.3) | 0–6.0 |
| HEI-2010 Score (0–100) | 49.29 (12.13) | 22.68–76.56 |

^aTotal possible scores for parenting characteristics are as follows: Authoritative Parenting Style, 27–135; Authoritarian Parenting Style, 20–100; Permissive Parenting Style, 15–75; Mealtime Structure, 0–40; Parent Modeling of Healthy Foods, 0–48; Household Food Rules, 0–12.

Table 2

Bivariate correlations among parenting styles, parenting practices, dietary outcomes, and covariates.

| | Parenting Styles | | | Feeding-related Parenting Practices | | | | Children's Dietary Outcomes | | |
|---|------------------|---------------|------------|-------------------------------------|----------------------------------|----------------------|----------------|------------------------------|--------------------------------|--|
| | Authoritative | Authoritarian | Permissive | Mealtime Structure | Parent Modeling of Healthy Foods | Household Food Rules | HEI-2010 Score | Fruit and Vegetable Combined | Added Sugars (by Total Sugars) | |
| <i>Parenting Styles</i> | | | | | | | | | | |
| Authoritative | – | | | | | | | | | |
| Authoritarian | –.197* | – | | | | | | | | |
| Permissive | –.309** | .462** | – | | | | | | | |
| <i>Feeding-related Parenting Practices</i> | | | | | | | | | | |
| Mealtime Structure | .220** | –.156* | –.281** | – | | | | | | |
| Parent Modeling Healthy Foods | .190* | –.265** | –.246** | .356** | – | | | | | |
| Household Food Rules | –.008 | –.006 | –.160* | .384** | .320** | – | | | | |
| <i>Children's Dietary Outcomes</i> | | | | | | | | | | |
| HEI-2010 Score | –.065 | .082 | .023 | .220** | .119 | .255** | – | | | |
| Calorie-adjusted daily servings combined fruit and vegetables | –.017 | .044 | .024 | .190* | .158* | .297** | .492** | – | | |
| Calorie-adjusted Added Sugars (by Total Sugar) | .031 | –.084 | –.027 | –.118 | –.028 | –.266** | –.357** | –.208** | – | |
| <i>Sociodemographic Variables</i> | | | | | | | | | | |
| Mother's Age | .125 | –.047 | .002 | .057 | .108 | –.006 | –.081 | –.011 | .029 | |
| Child's Sex (Boy vs. no) | –.030 | .101 | .089 | –.026 | .227** | –.042 | –.043 | –.088 | .048 | |
| Single Parent vs. not | .090 | .006 | .015 | .006 | –.025 | .032 | .037 | –.002 | –.046 | |
| College Graduate vs. not | .182* | .024 | –.057 | .108 | –.022 | –.184* | –.007 | –.013 | .142 | |
| Mother Hispanic/Latino vs. not | –.134 | –.056 | –.059 | –.079 | .063 | .037 | .061 | –.010 | –.060 | |
| Mother Works Full-time vs. not | –.041 | –.020 | .094 | –.139 | –.084 | –.142 | .008 | –.018 | .029 | |
| Family Income > \$75,000 vs. not | –.003 | .156* | .063 | .089 | .103 | –.028 | .005 | .070 | .085 | |