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Parental influences on young girls' fruit and vegetable, micronutrient, and fat intakes

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Abstract

Objective—To evaluate parents' fruit and vegetable intake and their use of pressure to eat in child feeding as predictors of their 5-year-old daughters' fruit and vegetable, micronutrient, and fat intakes.

Subjects—Data were obtained from 191 non-Hispanic white families with 5-year-old girls.

Design—Parent data included reports of pressure in child feeding and their own fruit and vegetable intake. Girls' intakes of fruits and vegetables, selected micronutrients, and fat were the main outcomes of interest.

Statistical analysis—Structural equation modeling was used to test a model describing relationships among parents' fruit and vegetable intake, parents' use of pressure in child feeding, and daughters' fruit and vegetable, micronutrient, and fat intakes.

Results—The model provided a good fit to the data, revealing that girls' fruit and vegetable intake was positively related to their parents' reported fruit and vegetable intake. Parents who consumed fewer fruits and vegetables tended to report greater pressure in child feeding and had daughters who consumed fewer fruits and vegetables. Girls' reported fruit and vegetable intakes were positively related to their micronutrient intakes and negatively associated with fat intake.

Applications/conclusions—This research demonstrates that parents' own fruit and vegetable intake may encourage fruit and vegetable intake in their daughters, leading to higher micronutrient intakes and lower dietary fat intakes. Conversely, pressure to eat may discourage fruit and vegetable intake among young girls.

Fruit and vegetable intake among children is low (1–3) despite dietary recommendations that encourage fruit and vegetable consumption (4,5). Data from the Continuing Survey of Food Intakes by Individuals (CSFII), 1989–1991, revealed that only 20% of preschool-age children (1) consume the recommended 5 or more servings of fruits and vegetables per day (4). Children's accessibility and exposure to fruits and vegetables as well as their preferences for fruits and vegetables are important determinants of fruit and vegetable intake (6–9). Parents influence children's food preferences and intake patterns through the foods they make available to the child, the types of child feeding practices they use, and their own eating behavior. Research is needed, however, to investigate the influence of parents' eating behaviors and child feeding practices on children's fruit and vegetable intake.

Parents' "do as I say" pressure on children to "finish your vegetables" is 1 means of encouraging children to eat fruits and vegetables. Persuading children to consume a particular food to obtain a reward, like going outside to play, however, has been shown to decrease preferences for that food (10–12). In addition, 2 studies provide evidence that pressuring children to eat may diminish children's ability self-regulate intake (13,14). The association between parental pressure in feeding and children's fruit and vegetable intake is unclear. In a recent study (15), mothers with higher concerns about the role of fruit and vegetable in disease had children who consumed fewer servings of vegetables. Although the authors did not measure child feeding practices, they suggested that mothers who reported greater concern about the role of fruit and vegetable in disease might have applied more pressure to their children to eat vegetables.

An alternative parental influence on children's fruit and vegetable intake may be the "do as I do" approach, where parents act as models of fruit and vegetable intake. There is limited data that modeling can be effective, at least in inducing children to try new foods (16) or disliked foods (17,18). Parental fruit and vegetable intake may also be an indication of increased availability and accessibility of fruits and vegetables in the home, providing opportunities for children to try and become familiar with new fruits and vegetables during the first years of life. This experience with fruit and vegetables may be particularly important because familiarity is central to children's acceptance of foods (19).

The objective of this research was to evaluate parents' eating behaviors and use of pressure in child feeding on 5-year-old girls' fruit and vegetable intakes. We hypothesized that parents' own fruit and vegetable intake would encourage similar consumption patterns among their daughters, but that pressure to eat in child feeding would discourage girls' fruit and vegetable consumption. Because dietary recommendations regarding fruit and vegetable intake are based on the premise that fruit and vegetable intake should increase intake of selected micronutrients and decrease dietary fat intake, these outcome variables were included in the model.

SUBJECTS AND METHODS

Study Sample

The study participants were 5-year-old girls and their parents living in central Pennsylvania and participating in the first year of a longitudinal study on the development of eating behaviors, including dieting, across middle childhood. Families were recruited for participation using flyers and newspaper advertisements describing the study as focusing on girls' nutrition, early experience, and development. Households with age-eligible female children living in a 5-county radius were identified (Metromail, Inc) and received mailings and follow-up telephone calls. The eligibility criteria for girls' participation included living with both biological parents, the absence of severe food allergies or chronic medical problems affecting food intake, and the absence of dietary restrictions involving animal products. One hundred ninety-seven 5-year-old girls (mean $\pm$ SD=5.4 $\pm$ 0.30, 4.6 to 6.4 years) and their parents (197 mothers, 194 fathers) participated in the study; as detailed in the following sections, 191 complete cases were used in this analysis. The sample was 99% non-Hispanic. On average, parents were in their mid-30s (mothers 35.4 $\pm$ 0.3 years; fathers 37.4 $\pm$ 0.38 years). Most fathers (97%) and almost two-thirds of mothers (63%) were currently employed, reporting an average of 45 hours and 20 hours per week, respectively. Twenty-nine percent of reported family incomes were below \$35,000, 35% between \$35,000 and \$50,000, and 36% above \$50,000. Parents were well-educated; mothers' mean education was 15 $\pm$ 2 years (range=12 to 20) and fathers' was 15 $\pm$ 3 years (range=12 to 20). Parents were, on average, slightly overweight with mean body mass index scores (weight [kg]/height [m²]) of 26 $\pm$ 6 for mothers and 28 $\pm$ 4 for fathers. Girls' average weight-for-height percentile score was 62, indicating that the sample was slightly above the median relative to age- and gender-specific reference data (20). All procedures were approved

by The Pennsylvania State University Institutional Review Board, and parents provided written consent for their own and for their daughters' participation before data collection.

Measures

Parents' pressure on their daughters to eat more—Parents' use of pressure in child feeding was measured using the Child Feeding Questionnaire (21), an instrument that assesses various aspects of child feeding attitudes and practices. This study used the Pressure to Eat subscale, which contains 4 items measuring the extent to which parents pressure children to consume foods, and has response options of 1=disagree to 5=agree. Items are: My child should always eat all of the food on her plate, I have to be especially careful to make sure my child eats enough, If my child says she is not hungry, I try to get her to eat anyway, and If I did not guide or regulate my child's eating, she would eat much less than she should. A total score was created by taking the mean item score. The mean of mothers' and fathers' scores were used to create a parent score. The internal consistency of items on the Pressure to Eat subscale was 0.75. The Child Feeding Questionnaire was completed by 197 mothers and 194 fathers; in those 3 cases where the father's data were not available, the mother's score was used as the parent score for the Pressure to Eat subscale.

Parents' dietary intake—Parents' typical fruit and vegetable intake was measured using summary questions from a food frequency questionnaire (FFQ) (22,23). Each parent completed the FFQ as part of data collection involving a large battery of paper and pencil measures on family life, dietary habits, activity, and parenting. Parents were asked questions about fruit and vegetable intake for the previous 3 months; this information was collected approximately 2 months before assessing their daughter's fruit and vegetable intake. Usual fruit and vegetable intake was calculated using the summary questions, "How often did you eat vegetables, not counting salad or potatoes?" and "How often did you eat fruit, not counting juices?" Response options were: less than 1 per week, 1 to 2 per week, 3 to 4 per week, 5 to 6 per week, 1 per day, 2 per day, 3 per day, 4 per day, 5+ per day. The mean of mother's and father's scores on each question was used as the parent score for fruit intake and for vegetable intake. A single summary variable was created to represent parent fruit and vegetable intake. To ensure that fruit and vegetable intake for mothers and fathers contributed equally to this mean score, the scores for each variable were first standardized to a mean of 0 and a standard deviation of 1 using principal components analysis. FFQs were completed by 191 mothers and 187 fathers; in those 4 cases where the father's data were not available, the mother's score was used as the parent score.

Daughters' dietary intake—Children's fruit and vegetable intake, micronutrient intake, and energy intake were measured using three 24-hour recalls. Recalls were conducted with mothers in the presence of their daughters by trained staff at the Pennsylvania State Diet Assessment Center using the computer-assisted Nutrition Data System (version 2.6, Nutrient database version 12, food database 27, 1996, Nutrition Coordinating Center, University of Minnesota, Minneapolis). Two weekdays and 1 weekend day were randomly selected over a 2-week period during the summer. Food portion posters (2D Food Portion Visual, Nutrition Consulting Enterprises, Framingham, Mass) were used as a visual aid for estimating amounts of foods eaten. Nutrient data were averaged across 3 days to obtain an estimate of average energy and micronutrient intake. Supplement nutrients were not included in the calculation of micronutrient intake. The mean of the following micronutrients was calculated to provide a single micronutrient score: calcium, iron, folate, vitamin A, vitamin C, vitamin B-6, and zinc. To ensure that each of the micronutrients contributed equally to this mean score, the scores for each of the micronutrients were first standardized to a mean of 0 and a standard deviation of 1 using principal components analysis.

Because the relationship between girls' fruit and vegetable and micronutrient intakes was of interest, an epidemiological-like disaggregation approach was employed using all sources of fruits and vegetables (24). The sum weight of all fruits and vegetables consumed was calculated, including those contained in mixed dishes. Nutrition Data System summary file data containing each food consumed were edited to conduct food group analyses. Many foods consumed appear in the summary files as ingredients. For example, muffins may appear as flour, sugar, eggs, oil, salt, and baking powder. The editing involves the summing of ingredient gram weights into a single whole-food weight that can be assigned to food groups according to the Food Guide Pyramid (3). The number of servings were calculated from gram weights of whole foods consumed and were based on closely matched serving sizes used by the Food Guide Pyramid. One summary variable was created to represent combined fruit and vegetable intake. To ensure that fruit and vegetable intake contributed equally to this mean score, both variables were first standardized to a mean of 0 and a standard deviation of 1 using principal components analysis. Dietary recalls were obtained from 196 girls.

Statistical Analysis

Complete data were available on all variables for 191 cases. Descriptive statistics were generated for all variables included in the structural model. Structural equation modeling using LISREL (version 8.20, 1998, Scientific Software International, Chicago, Ill), was employed to test a model describing relationships among parents' fruit and vegetable intake, parents' use of pressure to eat, and girls' fruit and vegetable intake. In addition, relationships between girls' fruit and vegetable, micronutrient, and fat intakes were also included in this model. This model controlled for the influence of girls' energy intakes on parents' pressure to eat more and on girls' own fruit and vegetable and micronutrient intakes.

Variances were estimated for each construct as well as for daughters' energy intake. Parameter estimates above the critical value of 1.98 were considered statistically significant. Four fit indexes were used to assess how well each model fit the data: the χ^2 test, the Non-Normed Fit Index (25), the Comparative Fit Index (26), and the Root Mean Square Error of Approximation (27). The χ^2 test assesses the fit of the model by comparing the sample correlation matrix with the correlation matrix estimated under the model. In this case, small χ^2 values are desirable, indicating a small discrepancy between the structure of the observed data and the hypothesized model. Additional fit indexes were considered because the χ^2 test is extremely sensitive to sample size. The Non-Normed Fit Index and Comparative Fit Index compare the hypothesized model to a null or worst-fitting model, taking into account model complexity, and indicate a well-fitting model with values >0.90, approaching an upper bound of 1. Finally, the Root Mean Square Error of Approximation reflects how close the model fit approximates a reasonably fitted model, and indicates good model fit with values <0.05.

RESULTS

Descriptive statistics on girls' dietary intakes are provided in Table 1. Daughters' energy intakes were approximately 16% below age- and gender-appropriate Recommended Dietary Allowances (RDA) (28) respectively, but were roughly similar to mean energy intakes among similarly aged females in the Third National Health and Examination Survey, 1988–1991 (29). Girls' estimated intake of calcium, iron, vitamin B-6, vitamin C, and vitamin A was consistent with or above dietary recommendations (30–33). Mean zinc intake was approximately 30% lower than the RDA and mean folate intake was slightly (2.5%) below the RDA (30,32).

Girls' total fruit and vegetable intakes were lower than the recommended 5 daily servings (4); the majority of girls consumed 3 or fewer total servings. Mean total fruit and vegetable intake, however, (3.1 ± 1.6 servings per day), was only slightly lower than estimates for 2- to

5-year-old girls (3.6 servings per day) from the CSFII (1). Parents' reported fruit and vegetable intake was low; parents reported consuming 0.9 ± 0.7 servings of fruit per day and 1.0 ± 0.6 servings of vegetables per day. Parents' total fruit and vegetable intake, 1.9 ± 1.1 servings per day, was 2.4 servings less than that reported for CSFII (34). Parents' with higher fruit intakes tended to have higher vegetable intakes ($r=0.56$, $P<.0001$). Most parents tended to report low levels of pressure, with a mean of 2.5 ± 0.8 on a scale of 1 to 5, with 5 indicating the highest agreement with statements about using pressure in child feeding. More than 25% had responses that were in agreement (mean score >3 on scale from 1 to 5) with statements about using pressure in child feeding. Mothers' and fathers' reports of pressuring daughters to eat were positively associated ($r=0.44$, $P<.0001$).

The structural equation model shown in the Figure evaluated parental influences on girls' fruit and vegetable intake and links between girls' fruit and vegetable intake and their fat and micronutrient intake. This model controlled for the potential influence of girls' energy intake on parents' use of pressure to eat and on girls' fruit and vegetable, micronutrient, and fat intakes. Path coefficients in this standardized solution can be interpreted as standardized regression weights, and all path coefficients in the model were statistically significant ($P<.05$).

Parents who consumed more fruits and vegetables had daughters who consumed more fruits and vegetables. Parents' fruit and vegetable intakes were also negatively related to their use of pressure in child feeding. In this case, parents with lower fruit and vegetable intakes tended to report using greater pressure in child feeding. Table 2 shows that girls' total number of combined fruit and vegetable servings were highest among parents who consumed high amounts of fruits and vegetables and used low pressure in child feeding. Pressure in child feeding, in turn, was negatively related to measures of girls' dietary quality; girls who received more pressure to eat tended to have lower fruit and vegetable and micronutrient intakes, even controlling for differences in girls' total energy intake that could influence each variable in these relationships. This model explained approximately 50% of the variance in girls' micronutrient intakes. For descriptive purposes, parents in the highest quintile for use of pressure in child feeding had daughters who consumed 1.6 serving fewer of fruit and vegetable (2.6 servings vs 4.2 servings; $P<.0001$), 155 μg RE less vitamin A (713 μg RE vs 868 μg RE; $P<.05$), and 50 μg less folate (169 μg vs 219 μg ; $P<.001$) than did those girls whose parents were in the lowest quintile for using pressure.

This research indicates that interventions to increase children's fruit and vegetable intake should explicitly target parents' own intake and feeding practices involving fruits and vegetables

The model fit statistics indicated that the aforementioned model fit the data well. A non-significant χ^2 value indicated that the initial specified model structure was not different from the underlying data structure ($\chi^2=8.95$, $\text{df}=5$, $P=.11$). The Non-Normed Fit Index (0.96) and Comparative Fit Index (0.98) also indicated a good fit; both were above the generally accepted cut-offs (Non-Normed Fit Index and Comparative Fit Index >0.90) (35). The Root Mean Square Error of Approximation (0.06) was slightly above the generally accepted cut-off (<0.05) (35). Residual values from the initial test of the model indicated that the model fit would be improved by including the relationship between parents' pressure to eat and girls' micronutrient intake in the model. As a result, an adjusted model that included this relationship was tested and indicated a very good fit ($\chi^2=8.95$, $\text{df}=5$, $P=.11$; Non-Normed Fit Index=0.98; Comparative Fit Index=1.00; Root Mean Square Error of Approximation=0.04). Comparison of the fit statistics between this model and the initial model showed a significant improvement in the fit of the model ($\chi^2=5.32$, $\text{df}=1$, $P<.05$). The model shown in the Figure was also run separately for fruits and for vegetables; although some differences in the parameter estimates were observed, both models had an acceptable fit.

DISCUSSION

Preventative health efforts that encourage fruit and vegetable intake have recently focused on children, attempting to “help young generations grow up with healthful habits from the beginning” (36). Consistent with a previous report (37), this study found that 5-year-old girls who consumed more fruits and vegetables tended to have higher micronutrient intakes and lower fat intakes. This research provides new evidence that girls’ fruit and vegetable intake and its relationship to nutrient intake is positively associated with parents’ own fruit and vegetable intake and negatively associated with their use of pressure in child feeding.

Parent–child similarities in fruit and vegetable intake are consistent with a recent study in which mothers’ fruit consumption predicted their school-age children’s fruit consumption (15). This association may reflect a direct modeling influence. One report suggests that family dinners may provide a particularly salient opportunity for children to observe their parents’ fruit and vegetable eating patterns, as adults tend to consume most fruit, juice, and vegetables at dinner (38). Parent–child similarities in fruit and vegetable intake may also simply represent children’s exposure and accessibility to those fruits and vegetables that parents prefer and bring into the home (39).

The relationship between parent–child fruit and vegetable intake is notable, given a number of factors that likely underestimated the similarity. First, different methods were used to estimate parents’ and daughters’ fruit and vegetable intakes. Second, parent and child reports of fruit and vegetable intake were obtained several months apart, possibly introducing bias due to seasonal variation in fruit and vegetable intake. Third, the summary measures of parent fruit and vegetable intake may have underestimated parents’ consumption (40) due to omissions of fruits and vegetables not consumed as whole foods or due to the exclusion of fruit juices and potatoes, 2 sources that contribute substantially to fruit and vegetable intakes among children (1). The fact that parent and child fruit and vegetable measurements were obtained several months apart as part of a large battery of questionnaires decreases the likelihood that parents’ own fruit and vegetable intake influenced their reporting of their daughters’ fruit and vegetable intake.

The negative association between parents’ use of pressure and girls’ fruit and vegetable intake extends previous research showing undesirable outcomes of high levels of parental control over children’s eating (41,42). Specifically, pressure in child feeding may have negative influences on children’s eating that extends beyond preferences for particular foods (10–12) or intake at specific meals (14) to include more broad characteristics of children’s diet, namely fruit and vegetable consumption. Research is needed to address the directionality of this relationship. Parent–child interactions involving vegetable intake at dinner are of particular interest, because young children consider vegetables a “meal” food (43) and a sizable portion of school-age children’s fruit and vegetable intake occurs at dinner (44).

An unexpected finding was the negative relationship between parents’ own intake of fruits and vegetables and their use of pressure to eat. This association was observed after taking into account the fact that daughters who consumed less energy received more pressure to eat. Although directionality cannot be determined, it is possible that children may be more likely to eat fruits and vegetables when parents eat these items, making pressuring in child feeding less necessary from the parents’ point of view. A second unexpected finding was the direct negative relationship between pressure to eat and micronutrient intake, observed over and above the relationship between girls’ energy intake and parents’ use of pressure in child feeding. These findings provide evidence that negative effects of parental pressure on child intake may not be restricted to fruits and vegetables, but may in fact extend to the consumption of other micronutrient-rich foods (42).

Although this research underscores the role of parental influences on young girls' fruit and vegetable and consequent nutrient intakes, the research has a variety of limitations, including a sample of exclusively non-Hispanic white, 2-parent families. We chose this sample because our longitudinal work investigates the influence of both mothers and fathers on the emergence of dieting in young girls, a problem that is notably prevalent in this population. This restricted sample, however, limits the generalizability of the findings to other ethnic and socioeconomic populations. Research evaluating the role of family environment factors on children's fruit and vegetable intake in low-income and other ethnic populations is needed.

APPLICATIONS

The potential role of fruit and vegetable intake in preventing chronic disease taken together with the difficulty involved in modifying adult eating behaviors underscores the need to understand how fruit and vegetable intake patterns are established in the early years of life. This research indicates that interventions to increase children's fruit and vegetable intake should explicitly target parents' own intake and feeding practices involving fruits and vegetables. Specifically, parents should provide ample opportunities in which children have the repeated experience of consuming fruits and vegetables. Children should be encouraged to try, rather than to always "finish" their vegetables; children's internal cues should be the primary guide to determining when eating begins and ends. Parents can best encourage fruit and vegetable intake in their children by acting as role models of fruit and vegetable intake.

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FIG. Structural equation model of parental influences on girls' fruit and vegetable, micronutrient, and fat intakes (n=191)

^aAdjusted for the influence of girls' 24-hour energy intake.

^bModification to the original model based on residual values.

^cIncludes calcium, iron, folate, vitamin A, vitamin C, vitamin B-6, and zinc.

Table 1

Observed and recommended nutrient intakes in 5-year-old girls (N=191)

Variable	Mean±SD	Range	Recommended amount
Energy (kcal)	1,520±324	831–2,628	1,800 ^a
Fat (%)	31±5	14–51	≤30% of energy ^a
Carbohydrate (%)	57±6	36–76	***
Protein (%)	14±3	7–22	***
Iron (mg)	10±4	4–27	10 ^b
Calcium (mg)	830±329	259–2,011	800 ^c
Zinc (mg)	7±2	3–15	5 ^b
Folate (µg)	195±76	74–454	200 ^d
Vitamin B-6 (mg)	1.2±0.4	0.4–3.2	0.6 ^d
Vitamin C (mg)	83±50	15–280	45 ^c
Vitamin A (µg RE)	803±480	141–3,296	400 ^b
Fruit (No. servings)	1.5±1.0	0–5.3	2 ^f
Vegetable (No. servings)	1.5±1.0	0.3–0.6	3 ^f

SD=Standard deviation.

^aBased on Recommended Dietary Allowances (28).^bBased on Dietary Reference Intakes (30).^cBased on Dietary Reference Intakes (31).^dBased on Dietary Reference Intakes (32).^eBased on Dietary Reference Intakes (33).^fBased on Food Guide Pyramid serving recommendations (3).

Table 2

Five-year-old girls' total daily fruit and vegetable servings across high and low levels of parental fruit and vegetable intake and pressure in child feeding

Parent fruit and vegetable intake	Parent pressure in child feeding	
	Low ^a	High
	←mean±standard deviation→	
Low ^a	2.2±1.5	2.3±1.3
High	3.5±1.3 ^{**}	3.1±1.7

^aMedian splits for pressure in child feeding (median=2.5) and parent fruit and vegetable intake (median= -0.40; standardized score) were used to create low and high groups.

^{**}Significantly higher than all other groups, $P<.01$.