Fruit and Vegetable Intakes of Preschool Children Are Associated With Feeding Practices Facilitating Internalization of Extrinsic Motivation

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ABSTRACT

Objective: To examine the association between feeding practices and both fruit and vegetable intakes of preschoolers.

Design: Cross-sectional; data collected from 2009 to 2010.

Setting: Child care centers enrolled in the cohort of the Synergistic Theory and Research on Obesity and Nutrition Group Kids program.

Participants: Three hundred and sixteen mother–child dyads were recruited in the baseline survey as primary caregivers of children aged 2–5 years.

Main Outcome Measures: Ten aspects of maternal feeding practices were measured using a Comprehensive Feeding Practices Questionnaire. The frequency of children's fruit and vegetable consumption was estimated by mothers.

Analysis: Spearman's rank order correlation and linear regression analysis between parental feeding practices and both fruit and vegetable consumption were adjusted for potential confounders. Pearson's correlation coefficients among 10 parental feeding practices were calculated.

Results: Children in the study consumed fruit 1.7 ± 0.9 times per day and vegetables 1.4 ± 0.8 times per day. Feeding practices of building a healthy home food environment and involvement were positively related and those of restriction for health were negatively related to children's vegetable consumption ($P < .001$); moreover, encouraging balance and variety and monitoring were positively related to children's fruit consumption ($P < .001$).

Conclusions and Implications: The results of this study suggest that both fruit and vegetable intakes of preschool children are more likely to increase if parents employ feeding practices that encourage child autonomy, competence, and relatedness.

Key Words: feeding practice, fruit and vegetable intake, self-determination theory, preschool children (J Nutr Educ Behav. 2016;48:311-317.)

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INTRODUCTION

Early childhood is a developmentally critical period for building healthy eating habits for optimal growth and disease prevention in later years.1-3 Picky eating is a frequent problem among children.4 In addition, childhood obesity is a growing health concern in the US.5,6 Both problems have been associated with inadequate consumption of fruits and vegetables,7-9 with consumption among children aged 2–5 years not reaching the recommended level.10,12

Food acceptance (eg, acceptance of fruits and vegetables) may be determined by food preference, which is genetically predisposed but also shaped by food experiences during early life.3 Therefore, parental feeding practices influence children's food preferences and consumption.13,14 Parents report controlling children's eating through availability and accessibility to healthy foods, modeling, monitoring, restriction, pressure to eat, encouragement, and nutrition education.13,15

Feeding practices can be differentiated by their association with the orientation of children's motivation. Motivation is a theoretical way to understand human behaviors. One motivation theory, the self-determination theory (SDT), addresses intrinsic and
extrinsic motives and internalization through satisfying psychological needs inherent to humans. For children who dislike vegetables and have no intrinsic motives to eat, parents may attempt to offer rewards for eating vegetables. Extrinsically motivated actions may be performed with resistance and/or disinterest, whereas SDT suggests that even extrinsic motivation can be internalized by allowing more autonomy, competence, and relatedness.

Many previous studies on feeding practices and children’s food consumption have dealt with restriction and pressure. Furthermore, whereas there has been a large volume of studies on determinants of fruit and vegetable intakes in older children and adolescents, research on the fruit and vegetable intakes of preschoolers to date has been relatively limited. In addition, studies addressing fruits and vegetables separately are scarce. Thus, this study investigated the associations of various aspects of feeding practices and both fruit and vegetable consumption among US preschoolers in east-central Illinois. This study used SDT to explain how feeding practices influence children’s fruit and vegetable consumption. It was hypothesized that maternal controls related to autonomy (ie, building a healthy food environment), competence (ie, encouragement, teaching nutrition, and involvement in cooking), and relatedness (ie, modeling) in SDT would be positively associated with both fruit and vegetable consumption by preschool children.

**METHODS**

**Participants**

This cross-sectional study used baseline data from 363 mothers enrolled in the cohort for the Synergistic Theory and Research on Obesity and Nutrition Group Kids (STRONG Kids) program. The STRONG Kids program is an interdisciplinary research project that aimed to identify multiple risk factors for childhood obesity by observing preschool children for 3 years. A detailed description of the STRONG Kids program was reported previously. Participants in the program were children aged 2–5 years who were enrolled in 30 licensed child care centers in Illinois. Between 2009 and 2010, in total 424 participants were recruited to take baseline surveys and their primary caregivers completed a self-administered parent survey. The STRONG Kids program was composed of about 26.7% overweight or obese children, which was comparable to the national prevalence of overweight or obese children aged 2–5 years in 2009–2010.

For the statistical analytic sample of mother–child dyads, data from primary caregivers who were not biological mothers were excluded. Of 363 biological mother–child dyads, 13 with > 50% missing responses for any feeding practice and 3 dyads with any missing responses to the other covariates were excluded, which left a total sample of 316. The Institutional Review Board of the University of Illinois at Urbana–Champaign approved all procedures used in this study.

**Maternal Feeding Practices**

Mothers were asked to complete the Comprehensive Feeding Practices Questionnaire (CFPQ). Using the CFPQ, the following 10 aspects of parental feeding practice were measured: emotion regulation (parents use food to regulate children’s emotional states; 3 questions), encouraging balance and variety (parents promote well-balanced food intake, including the consumption of varied foods and healthy food choices; 4 questions), building a healthy home food environment (parents provide healthy foods in the home; 4 questions), food as reward (parents use food as a reward for children’s behavior; 3 questions), involvement (parents encourage children’s involvement in meal planning and preparation; 3 questions), modeling (parents actively demonstrate healthy eating for the children; 4 questions), monitoring (parents keep track of children’s intake of less healthy foods; 4 questions), pressure (parents pressure children to consume more food at meals; 4 questions), restriction for health (parents control children’s food intake with the purpose of limiting intake of less healthy foods; 4 questions), and teaching nutrition (parents use explicit didactic techniques to encourage children’s consumption of healthy foods; 2 questions). Mothers rated their practices based on a 5-point response scale from 1 (never/disagree) to 5 (always/agree). A higher score indicated greater use of a particular feeding practice. The validity of the CFPQ was examined among US children aged 2–8 years. In this study, the internal consistency reliability of each sub-construct ranged from Cronbach α = .62 for building a healthy home food environment to α = 0.90 for monitoring (Table 1).

**Children’s Fruit and Vegetable Consumption**

Fruit and vegetable consumption was estimated separately using the eating habit questions included in the preschool wave of the US Department of Education’s Early Childhood Longitudinal Survey. The question items were developed by the Economic Research Service of the US Department of Agriculture and incorporated the results of cognitive testing for both the preschool and kindergarten parent interviews from the focus groups. Specifically, fruit consumption was estimated using the question, “During the past 7 days, how many times did your child eat fresh fruit, such as apples, bananas, oranges, berries, or other fruit such as applesauce, canned peaches, canned fruit cocktail, frozen berries, or dried fruit? Do not count fruit juice.” Vegetable consumption was estimated by the question, “During the past 7 days, how many times did your child eat vegetables other than french fries and other fried potato items? Include vegetables served as a stir-fry, soup, or stew in your response.” Response categories were: once a day; twice a day; 3 times a day; ≥ 4 times a day; 1–3 times during the past 7 days; 4–6 times during the past 7 days; my child did not eat any during the past 7 days; and do not know. Research staff addressed the importance of away-from-home food consumption. Parents were asked to communicate with their children’s day care providers regarding consumption during day care hours as well as away-from-home meals.

**Confounding Variables**

Data on sociodemographic characteristics and known covariates were obtained from a self-administered questionnaire. Potential confounders included mother’s age, race/ethnicity...
The researchers conducted linear regression analysis to identify maternal feeding practices that had the greatest influences on both fruit and vegetable consumption in children, controlling for potential confounders. A stepwise approach was applied to select independent variables including confounders with $P < .15$ in a model. There was no multicollinearity among variables involved in the regression model considering variance inflation factors.

The significance level was set to $P < .05$. All analyses were performed using Statistical Analysis Software (version 9.2, SAS Institute Inc, Cary, NC, 2008).

**RESULTS**

Average age of the mothers was $31.8 \pm 5.4$ years; 72.5% were married, 78.2% were employed, 67.4% were employed or students, and 62% had a college diploma. Average age of the children was $3.1 \pm 0.6$ years. A total of 65.5% of children were white, 52.9% were female, and 14.6% were exclusively breastfed for 6 months. The children consumed fruits $1.7$ times per day and vegetables $1.4$ times per day on average (Table 1). Approximately 70% of children consumed vegetables at least once per day, and about 85% consumed fruit at least once per day (data not shown). Feeding practices were positively correlated with both fruit and vegetable consumption for 5 feeding practices, whereas 1 feeding practice was positively correlated with fruit consumption only (Table 1). Table 2 shows correlations among the 10 feeding practices.

**DISCUSSION**

Adequate fruit and vegetable intake is key when seeking to promote healthy eating in children and to prevent the development of obesity and other chronic diseases of concern to public health authorities. From a life
course perspective, establishment of healthy eating habits (i.e., adequate consumption of fruits and vegetables) during early life is crucial to ensure good health later in life. Although the intake of both fruits and vegetables needs to increase, fruit is relatively well accepted by children whereas vegetables are less so. Therefore, it is important to identify the factors that influence fruit and vegetable consumption separately.

Zeinstra and colleagues reported that parental feeding practices in terms of vegetables were performed in a more negative context than were fruit. This study examined the effect of various aspects of maternal feeding practices on the intakes of both food groups in preschool-aged children, using the SDT framework. The current study confirmed differences between fruit and vegetable intakes. However, not all of the significant feeding practices detected by correlation analysis were retained in the final regression models, which is attributable in part to the strong associations of these practices with more potent predictors such as monitoring for fruit intake and building a healthy home food environment for vegetables intake.

Restriction of unhealthy foods is an example of a direct control strategy. Previous research has shown that restriction of unhealthy foods can lead to an immediate decrease in unhealthy food intake, whereas other studies revealed that restrictive feeding practices promoted a preference for the restricted foods and eventually generated a counterproductive effect. The current study found that such restrictions reduced vegetable intake but not fruit intake.

By helping children select vegetables themselves, the home food environment may have a positive significant effect on vegetable intake. A recent review of the determinants of fruit and vegetable consumption among children aged 6–18 years identified parental intake and home food availability as significant determinants in addition to sociodemographic status. Several reports on Head Start children revealed that a healthy home food environment was an exclusive and consistent predictor of children's fruit and vegetable intakes, as evidenced by correlation coefficients of 0.20 and 0.26, respectively. The current study

### Table 2. Correlation Coefficients Between Mothers’ Feeding Practices of Children Aged 2 to 3 Years (n = 316)

<table>
<thead>
<tr>
<th>Feeding Practices</th>
<th>Emotion Regulation</th>
<th>Food as Reward</th>
<th>Pressure</th>
<th>Restriction for Health</th>
<th>Monitoring</th>
<th>Involvement</th>
<th>Modeling</th>
<th>Encouraging Balance and Variety</th>
<th>Teaching About Nutrition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emotion regulation</td>
<td>1.00</td>
<td>0.33***</td>
<td>1.00</td>
<td>0.26**</td>
<td>0.31***</td>
<td>0.20***</td>
<td>0.33***</td>
<td>0.32***</td>
<td>0.36***</td>
</tr>
<tr>
<td>Food as reward</td>
<td>-0.13**</td>
<td>-0.18**</td>
<td>-0.09</td>
<td>0.04</td>
<td>0.07</td>
<td>0.04</td>
<td>0.12</td>
<td>-0.05</td>
<td>0.06</td>
</tr>
<tr>
<td>Pressure</td>
<td>0.01</td>
<td>0.04</td>
<td>0.07</td>
<td>0.12</td>
<td>0.32***</td>
<td>-0.30</td>
<td>0.18**</td>
<td>0.18**</td>
<td>0.18**</td>
</tr>
<tr>
<td>Restriction for health</td>
<td>-0.05</td>
<td>0.13*</td>
<td>0.04</td>
<td>0.31***</td>
<td>0.32***</td>
<td>0.36***</td>
<td>0.32***</td>
<td>0.32***</td>
<td>0.32***</td>
</tr>
<tr>
<td>Monitoring</td>
<td>-0.01</td>
<td>0.07</td>
<td>0.04</td>
<td>0.04</td>
<td>0.06</td>
<td>0.04</td>
<td>0.04</td>
<td>0.06</td>
<td>0.04</td>
</tr>
<tr>
<td>Involvement</td>
<td>0.20***</td>
<td>0.31***</td>
<td>0.18**</td>
<td>0.18**</td>
<td>0.32***</td>
<td>0.36***</td>
<td>0.32***</td>
<td>0.32***</td>
<td>0.32***</td>
</tr>
<tr>
<td>Modeling</td>
<td>0.13*</td>
<td>0.04</td>
<td>0.12</td>
<td>0.31***</td>
<td>0.32***</td>
<td>0.36***</td>
<td>0.32***</td>
<td>0.32***</td>
<td>0.32***</td>
</tr>
<tr>
<td>Encouraging balance and variety</td>
<td>0.06</td>
<td>0.04</td>
<td>0.04</td>
<td>0.06</td>
<td>0.11</td>
<td>0.11</td>
<td>0.11</td>
<td>0.11</td>
<td>0.11</td>
</tr>
<tr>
<td>Teaching About Nutrition</td>
<td>-0.05</td>
<td>-0.05</td>
<td>-0.05</td>
<td>-0.05</td>
<td>-0.05</td>
<td>-0.05</td>
<td>-0.05</td>
<td>-0.05</td>
<td>-0.05</td>
</tr>
</tbody>
</table>

*Significant by Pearson’s correlation analysis (P < 0.05, **P < 0.01, ***P < 0.001).
also found that both fruit and vegetable intakes were influenced positively when parents built a healthy home food environment. In addition, a more effective approach to improving preschool-aged children’s competence in eating vegetables may be participation in meal preparation rather than teaching nutrition, as shown by the results in Table 1.

The correlation analysis of the current study showed that mothers monitored children’s eating and restricted unhealthy foods. Regression analysis indicated that just monitoring, which would not weaken children’s autonomy, was associated with increased fruit consumption. Encouraging balance and variety was also associated with fruit intake. Several studies evaluating feeding styles reported that emotionally supportive interaction yielded a favorable influence of children’s healthy eating behaviors. A study on the association between the social-affective context during eating events and the food preference of preschool-aged children revealed that an emotionally warm interaction could have a favorable effect on food consumption. Moreover, warm emotional interactions between parents and children during meal times may enhance children’s healthy eating competence. The current study also found that parental monitoring, involvement, and role modeling were positive influences. The SDT suggests that such practices improve the autonomy, competence, and relatedness of preschoolers to eat fruits and vegetables.

This study measured only frequencies of consumption and could not account for differences in serving size. Previous studies documented a reasonable level of accuracy of maternal or primary caregivers’ reports on young children’s dietary intake, but they consistently reported an underestimation of the intake. Although the Early Childhood Longitudinal Survey team conducted cognitive testing, the validity and reliability of the test methods are unavailable. Because the food frequency method is a good tool for ranking individual intake and thus can be used for relatable epidemiological studies, the associations in this study may be attenuated but not distorted owing to diet measurement errors. In addition, it has been found that portion size estimations of children’s food intake are not accurate. Furthermore, the estimates of fruit and vegetable intakes in the current study were comparable to those in reported national studies. According to a recent nationally representative study of US children, about 75% of children aged 2–3 years consumed 1 distinct portion of vegetables a day.

Whereas this study had several strengths, it also had limitations. First, the researchers could not establish a causal relationship because of the cross-sectional design of the study. Most of the observed associations may not be free from counter-causality (ie, mothers of children who consume enough fruits and vegetables may not need to apply strict rules about fruit and vegetable consumption). The directionality (ie, whether this higher consumption originated from or led to parental feeding practices) could not be confirmed. Second, study variables were measured using a self-reported survey, which is subject to bias owing to personal values and expectations. Third, the practices of pressure and building a healthy home food environment had relatively low alpha coefficients, which suggests that the items used to construct these scales exhibited low internal consistency. Therefore, these 2 feeding constructs are of limited power and should be interpreted cautiously: specifically, the explanation power of building a healthy home food environment in increasing vegetable intake may have been overestimated. Also, the multivariate coefficient value of each regression model was low. Fruit and vegetable intakes are complex behaviors that might not be explained fully by a few demographic characteristics and feeding practices.

This study suggests that both the fruit and vegetable intakes of preschool-aged children are more likely to increase if parents apply SDT-based feeding practices to facilitate children’s internalization of their extrinsic motivation.

**IMPLICATIONS FOR RESEARCH AND PRACTICE**

The results indicated that parents and caregivers may influence preschoolers to consume a greater quantity of fruits and vegetables by practicing feeding behaviors and developing attitudes that encourage child autonomy, competence, and positive relatedness. Establishment of a home food environment with easy access to vegetables could be helpful by allowing more autonomy in food choice. On the other hand, restriction of unhealthy foods may not be effective for encouraging children to eat more vegetables. Preparing meals with children may also improve the competence of the children, enabling a positive experience with vegetables.

### Table 3. Multiple Regression Model for Fruit and Vegetable Intake of Children With Parental Feeding Practices (n=316)<sup>a</sup>

<table>
<thead>
<tr>
<th>Feeding Practices</th>
<th>Fruit Intake&lt;sup&gt;b&lt;/sup&gt;</th>
<th>Vegetable Intake&lt;sup&gt;c&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>β</td>
<td>SE</td>
</tr>
<tr>
<td>Pressure</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Restriction for health</td>
<td>-0.11</td>
<td>0.05</td>
</tr>
<tr>
<td>Monitoring</td>
<td>0.19</td>
<td>0.06</td>
</tr>
<tr>
<td>Building a healthy home food environment</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Involvement</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Encouraging balance and variety</td>
<td>0.27</td>
<td>0.08</td>
</tr>
</tbody>
</table>

<sup>a</sup>Stepwise regression analysis for children’s fruit intake and vegetable intake with 10 feeding practices and potential confounding variables (ie, mother’s age, race/ethnicity, marital status, employment status, and education level; children’s age, gender, and race/ethnicity, exclusive breastfeeding for 6 months) as independent variables;<sup>b</sup>Controlled for parental education, child’s age and race/ethnicity, exclusive breast feeding for 6 months in the final model ($R^2 = 0.18$, $P < .001$);<sup>c</sup>Controlled for parental education, child’s age and race/ethnicity in the final model ($R^2 = 0.21$, $P < .001$).
For fruit, it is useful to monitor what food children eat and to encourage consumption of more fruit, which in turn enhances children’s competence.

The use of SDT in this study yielded a deeper understanding of the relationships between parental feeding practices and both fruit and vegetable intakes in younger children. More research incorporating SDT is needed to evaluate the existence and strength of a potential causal relationship between parental feeding practices and children’s eating patterns during early childhood.

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SUPPLEMENTARY DATA

Supplementary data related to this article can be found at http://dx.doi.org/10.1016/j.jneb.2016.01.003.

REFERENCES


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CONFLICT OF INTEREST
The authors have not stated any conflicts of interest.

SUPPLEMENTARY DATA
The STRONG Kids Team includes Kristen Harrison, Kelly Bost, Brent McBride, Sharon Donovan, Diana Grigsby-Toussaint, Juhee Kim, Janet Liechty, Angela Wiley, Margarita Teran-Garcia, and Barbara Fiese, University of Illinois at Urbana Champaign, Champaign, IL.