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Feeding behaviors of low-income mothers: directive control relates to a lower BMI in children, and a nondirective control relates to a healthier diet in preschoolers[1,2,3,4]

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Abstract

Background: A topic of interest in the etiology of child obesity is whether and how parental feeding behaviors are associated with the food intake and weight status of children.

Objective: The objective was to explore whether and how directive (overt) and nondirective (covert and food environmental structure) types of parental feeding control were associated with children's food intake and weight status.

Design: This was a cross-sectional exploratory study using structural equation modeling to determine directional associations between maternal feeding practices and children's food intake and weight status. Researchers collected data from 330 dyads of children aged 3–5 y and mothers participating in a federal preschool program for low-income families (Head Start) in Michigan. The mothers' feeding practices (directive and nondirective control), the children's food intakes, and the height and weight of both the mothers and children were measured. Structural equation models tested the relations between maternal feeding practices, the children's food intake, and weight status.

Results: The structural equation model confirmed that children's weight status was inversely associated with mothers' directive control, and mothers' nondirective control was associated with children's intakes of more nutrient-dense foods and less energy-dense foods. No association was found between the mothers' directive control and the children's food intakes.

Conclusions: Mothers' use of nondirective feeding practices was associated with children's intakes of more nutrient-dense foods. However, use of more directive feeding control was associated with lower weight status in preschoolers of low-income mothers. These findings need to be examined in longitudinal studies. This trial was registered at clinicaltrials.gov as NCT01525186.

INTRODUCTION

One topic of interest in the etiology of child obesity is whether and how parents influence their children's food intake and weight status (1–3). Highly controlling parental feeding practices, especially pressure to eat and food restriction, have been studied for their effects on children. The literature suggests that asserting "no control" in feeding preschoolers is problematic and that some degree is needed (4, 5), but it is unclear what type and what level are needed. One problem is that pressure and restriction have often been viewed as a single construct, "control," even though each relates differently to children's outcomes (6–10). Previous studies have reported that pressure to eat is negatively associated with children's food intake and weight status or adiposity (11–15), but that restriction can be positively associated with these factors (11, 13–15). Therefore, some researchers and educators concerned about child obesity often advise that food restriction be minimized, but longitudinal studies showing no or positive effects of

food restriction (14, 16, 17). Furthermore, the use of food restriction differs by parental concern about child overweight and occurs less often in low–income groups, in which parents tend not to have such concerns and child obesity is more prevalent than in middle–income groups (18). Perhaps if parents used restriction covertly to structure their children's food environment rather than to overtly restrict a food, it might be a positive means to help children consume a nutritious diet.

Parents can also positively motivate children to eat well by modeling healthy eating and by ensuring a healthy food environment (19–21). Nondirective feeding practices, such as letting children choose from among nutrient–dense foods, making such foods readily available, setting mealtime routines, eating with children, and subtly encouraging children to eat well, are associated with positive outcomes for elementary school–age children and older children (20, 22–26). These nondirective feeding practices, sometimes called "covert" (27), might work better than more directive practices, because people desire freedom of choice and often react negatively to having options removed (28).

Thus, this study expands the concept of "child feeding control" by dividing practices into 2 divergent constructs: "directive control" and "nondirective control." Practices whereby parents put external, observable pressure on the child to eat a healthy diet were considered to be "directive control." Practices whereby parents supported a healthy diet by motivational interactions aimed at child internalization and by an organized home food environment were considered to be "nondirective control." The objectives of this study were to examine the association between directive and nondirective feeding practices and child food intakes and weight in a low–income group. In the current study, we applied and expanded a model of these associations by Kroller and Warschburger (29), who found negative associations between children's BMI (in kg/m^2) and "directive control," which they defined as pressure and rewards. Kroller and Warschburger also found positive associations between children's healthier food intake and parental feeding practices that were less "directive (rewarding)" and more "nondirective (modeling)" (29), Therefore, we define 2 hypotheses: *1*) Child weight is negatively associated with parents' directive feeding control practices, and *2*) less directive control or greater nondirective control is associated with healthier food intakes in children. Although earlier work has shown that parental feeding influences children's eating patterns and weight (6–9), recent longitudinal work has supported a bidirectional relation with child weight also influencing parental feeding practices (30).

SUBJECTS AND METHODS

Sample and recruitment

Data were collected from 330 dyads of female primary feeding caregivers (hereafter called mothers) and their 3–5–y–old children participating in a federal reading readiness and health program for low–income families (Head Start) in Michigan from October 2009 through February 2010. For recruitment, the researchers attended Head Start teacher trainings to distribute the study flyers and sign–up sheets for teachers to post in classrooms. Research staff also attended monthly Head Start social activities for the parents to recruit participants. Excluded were mothers younger than 18 y of age and those who had children with medical conditions, such as cystic fibrosis, requiring special dietary intake and feeding techniques (31, 32).

Procedures

Before data collection, researchers obtained study approval from the university's Institutional Review Board for the study design, instruments, and procedures. Seven trained research staff members collected the data during individual appointments or family social nights at local Head Start sites. After informed consent, the research staff measured the heights and weights of the mothers and their children and assisted mothers in completing questionnaires on child feeding practices and family demographics. Participants received a $25 grocery gift card on completion. Before the actual data collection, the procedures were pilot–tested with 9 Head Start mother–child dyads.

Measurements and variables

Parental control over child feeding

An instrument to measure parental control over child feeding was developed in a previous study and was described previously (33). The instrument included 7 constructs: *1*) "high control" (physical and verbal pressure to eat), *2*) "high

contingency" (using rewards, threats to eat), *3*) "child-centered" (praising, encouraging to eat), *4*) "encouraging nutrient-dense foods" (modeling healthy eating), *5*) "discouraging energy-dense foods" (not keeping high-fat and high-sugar foods at home, not eating those foods in front of the child), *6*) "mealtime behaviors" (family meals, eating at table, no television during meals), and *7*) "timing of meals" (setting times for regular meals and snacks). A Likert scale, bound by never = 1 and always = 5, was used for all 24 items. Confirmatory factor analysis showed an acceptable model fit for a 7-factor structure: chi-square = 330, df = 228, $P < 0.05$, Comparative Fit Index (CFI) = 0.942, and root mean square error of approximation (RMSEA) = 0.037. Internal reliability scores and test-retest results were also acceptable (33).

Childrenrsquos food intakes

Mothers reported their children's food intake for the previous week using the Block Food Screeners for Ages 2–17, 2007 (NutritionQuest Inc). It includes 39 food items and measures the frequency that children ate each food item during the past week by using a 6-point scale (ie, 0 d, 1 d, 2 d, 3–4 d, 5–6 d, and every day). The amount of each food item consumed in 1 d over the past week was rated by using 3-point scales (eg, apples: 0.5 apples, 1 apple, 2 apples; lettuce salad: a little, some, a lot). The evaluation study comparing the food screener with a validated standard version has been completed and submitted for publication. Use of a semiquantitative food-frequency questionnaire was the most appropriate method to obtain children's dietary intakes, because it could address day-to-day variability and it had a lower response burden for this limited-income sample than would multiple days of dietary recalls.

The research staff assisted mothers in determining the portion sizes by using cups, bowls, and photographs of each of the 39 food items with the 3 different food portions. Of the 39 items, the researchers selected 12 nutrient-dense and 16 energy-dense food items for data analysis (**Table 1**). Nutrient-dense foods were those that provided substantial amounts of vitamins and minerals and relatively few calories, ie, whole fruit, 100% fruit juice, vegetables, and milk (34). Energy-dense foods were those that contained >25% of energy from added sugars and/or >35% of energy from solid fat per serving based on the USDA's food and nutrient database, ie, sweets, high-fat meats, salty snacks, and sweetened beverages, including chocolate milk (35), with the exception of unsweetened whole milk. Milk was left in the nutrient-dense category because of its major contributions to calcium, vitamin D, and potassium in the children's diets and the fact that <10% of the milk intake was from milk with ≤1% fat contributing to the energy content. A portion of fruit juice >177 mL (6 fluid oz) (36) was considered excessive and an energy-dense food. Total intakes in grams of 12 nutrient-dense foods or 16 energy-dense foods per day were calculated and used as the children's food intake variables for analysis.

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TABLE 1

Block food-frequency questionnaire food items categorized as nutrient-dense and energy-dense foods

Height and weight of mothers and children

Trained staff members measured participants' height and weight twice each following standard procedures (37). Height was measured to the closest 0.1 cm by using a portable stadiometer (SECA 214; Seca Corp). Weight was measured to the closest 0.2 kg on a digital platform scale accurate to 200 kg (BWB-800AS Digital Scale; Tanita). BMI was calculated for both children and mothers as weight (kg)/height $(m)^2$. Nine mothers were pregnant at the time of data collection. For pregnant mothers, self-reported prepregnancy weight was used to calculate their BMIs. For children, BMI percentile by age and sex (BMI-for-age) was obtained from the 2000 CDC Growth Charts (38). Children's weight status was defined as follows: underweight (<5th percentile), healthy weight (5th–84.9th percentile), overweight (85th–95th percentile), or obese (>95th percentile) (39). For mothers, weight status was defined as follows: underweight (BMI <18.5), normal weight (BMI = 18.5–24.9), overweight (BMI = 25.0–29.9), or obese (BMI ≥30.0) (40). Mothers reported their children's and their own demographic information (sex, race-ethnicity, and age). Researchers also queried the mothers about marital relations, employment status, and the highest educational level attained.

Data analysis

Frequencies, means, and SDs were calculated for descriptive analysis. Structural equation models were evaluated to test the association between maternal feeding control and children's food intake and weight status by using AMOS 18.0 (SPSS Inc). Parameters were estimated by using maximum likelihood methods. All variables were assessed for skewness and kurtosis and then transformed as needed. After this process, skewness and kurtosis of all variables were between −1.5 and 1.5, which indicated that no variable had a distribution that grossly violated the assumption of normality. Model fit was determined by using 2 fit indexes: CFI (satisfactory: >0.90) and RMSEA (satisfactory: <0.05) (41–43).

We also report the chi-square test of the null hypothesis that the model fits perfectly in the population. Note, however, that with a large enough sample, even slight departures from perfect fit lead to rejecting this null hypothesis (44). Therefore, this test is not a basis for rejecting a model.

RESULTS

The demographics of the subjects are shown in **Table 2**. Nearly 75% of the mothers and 40% of the children were overweight or obese. Nearly 33% of the children were classified as mixed race. More than 75% of the mothers had a high school education or less. No significant differences in ethnic distribution or the child's sex ratio were found between the study sample and the entire target population of Head Start parents in central Michigan (data not shown).

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TABLE 2

Demographic characteristics of mothers and children[1]

Measurement models

The measurement model was developed by using the same sample as used in the current study (45). Expanding the constructs developed in a previous study (33), the current study considered "high control" and "high contingency" as directive feeding control and the remaining constructs as nondirective feeding control. On the basis of this theoretical framework, a measurement model with a second-order factor was developed and tested via confirmatory factor analysis. This first model did not have an acceptable model fit (χ^2 = 417, df = 241, P < 0.001, CFI = 0.900, and RMSEA = 0.047). Whereas the RMSEA was acceptable, the CFI was only marginally acceptable (41–43). Because the construct "timing of meals," which had a low loading onto the nondirective control construct, was causing the poor fit, timing of meals was removed from the model to improve the fit. Although setting regular mealtimes was included in the original model as a desirable feeding practice, preschool (ages 3–5 y) might be too early in life for such a practice to be associated with the children's food intakes. As shown in **Figure 1**, after "timing of meals" was removed from the model, the second model provided an improved and acceptable fit (χ^2 = 292, df = 179, P < 0.05, CFI = 0.927, and RMSEA = 0.044). Therefore, "timing of meals" was excluded from the remaining analyses. The correlation between directive control and nondirective control constructs was r = −0.296 (P < 0.01). Note that "energy-dense food discouraging practices" was kept in the model, even though it had low loading onto the nondirective control, because it did not create problems for the model fit.

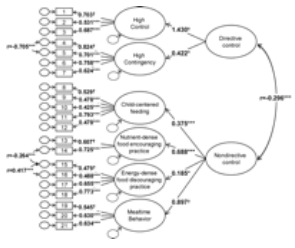

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FIGURE 1.

The factor structure of the measurement model. The values on each one-headed arrow are the standardized regression weights, and those on each 2-headed arrow are the correlations for the model. The shapes in the diagram are defined as follows: large ovals, latent variables (factors); small ovals without text, residuals; rectangles, measured variables; small rectangles without text, questionnaire items; one-headed arrow,

factor loading/constrained parameter; and 2-headed arrow, covariance. $^{*}P < 0.05$, $^{***}P < 0.001$. †The unstandardized regression weights were set as 1; therefore, no significance tests were available. The unstandardized regression weights for all the residuals were set as 1.

Full model

On the basis of the hypotheses, a structural equation model was developed and tested (**Figure 2**). It has 2 second-order factors that the researchers hypothesized affected the variables on the right side of the diagram. The confirmatory factor analysis demonstrated a moderate correlation between directive feeding control and nondirective control, so the researchers assumed that these latent variables covaried. Because the amount of nutrient-dense food and the amount of energy-dense food consumed are likely to have a causal influence on each other, we also assumed that the errors of prediction of these variables were correlated. This model had a $\chi^2 = 400$ (df = 239, $P < 0.001$) and a satisfactory fit with a CFI of 0.904 and RMSEA of 0.045. The R^2 for children's intake of energy-dense foods was 0.039, and the R^2 for children's intake of nutrient-dense foods was 0.155.

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FIGURE 2.

The structural equation model for associations between different types of maternal feeding control and children's intakes of nutrient-dense and energy-dense foods (g/d). The values on each one-headed arrow are the standardized regression weights, and those on each 2-headed arrow are the correlations for the model. The shapes in the diagram are defined as follows: large ovals, latent variables (factors); small ovals without text, error terms; rectangles with text, measured variables in the full theoretical model; small rectangles without text, questionnaire items in the measurement model; one-headed arrow, standardized coefficient with assumed causal direction; and 2-headed arrow, correlation with no assumed causal direction. $^{*}P < 0.05$, $^{***}P < 0.001$. †The unstandardized regression weights were set as 1; therefore, no significance tests were available. The unstandardized regression weights for all the error terms were set as 1.

The coefficient estimates of the paths showed a negative association between the children's BMI and the mothers' directive control, meaning that mothers of heavier children used less directive control with their children. Maternal use of nondirective control was significantly associated with children consuming more nutrient-dense foods and less energy-dense foods.

Directive control was not significantly associated with the children's intake of energy-dense foods; it had a marginally significant association with the children's intake of nutrient-dense foods. The 95% CIs for the standardized coefficient for directive control to the children's intakes of energy-dense foods ranged from −0.202 to 0.088, and the corresponding CI for the standardized coefficient for directive feeding control to the children's intakes of nutrient-dense foods ranged from 0.000 to 0.292. Interestingly, when the parental feeding control variables were controlled for, the children's intakes of nutrient-dense and energy nutrient-dense foods were positively correlated.

DISCUSSION

The dearth of longitudinal research on child feeding has left a vacuum in practical settings when health care professionals, pediatricians, or child development experts give parents advice on their child feeding practices. Findings from this study supported the hypothesis that children's weight status was negatively associated with mothers' directive feeding control and that mothers' nondirective feeding control was associated with healthier dietary intakes by children (ie, more nutrient-dense foods and less energy-dense foods). However, the findings did not provide clear support for the hypothesis that mothers' directive feeding control

would be associated with children's dietary intakes.

Note that the “directive control” used in this study with a low-income group was not synonymous to the concept of “control” as it has been often used in previous child feeding studies that sampled middle-income groups. In other words, this study focused on the practices that parents with limited resources tend to use, the “pressuring a child verbally and/or with food rewards/threats to get child to eat” as directive control. Practices whereby parents pressure children to eat have been linked to children's weight status in both middle- and low-income groups, but the psychological paths for such practices might differ by income status (46). For middle-income parents, pressure to eat might result from concern about the children's risk of being underweight (47) or from the desire to encourage healthy eating and appropriate weight gain by adequate energy intake (11). This can be a problem if the child develops the habit of eating irrespective of appetite. On the other hand, the direction of the association is opposite in low-income groups, possibly because low-income parents have reported less concern about their children's weight status than have middle-income parents (46, 48). This could stem, in part, from cultural or ethnic differences in the perception of children's weight status. African American and Hispanic parents with limited incomes have reported a desire for larger-size children (49, 50), and this might relate to the higher prevalence of child overweight in low-income groups than in other income groups. Thus, the findings from this study suggest that different approaches might be needed to educate parents at various income levels.

One unique aspect of this study was the expansion of the concept of “food restriction.” In previous studies (10, 51), food restriction was viewed as an undesirable child feeding practice that led to negative outcomes in children (6). Instead, current researchers considered that “food restriction” could also be nondirective or covert feeding control, wherein parents “behind the scenes” organize the home food environment and family rules and routines around eating. Results showed that limiting access to high-fat, high-sugar, or energy-dense foods was associated with desirable dietary intakes in children, at least cross-sectionally, which suggests that parents should not keep foods in the house that they do not want their children to eat. This practice appears to have better consequences than telling children not to eat these foods, when others at the table or in the house do eat them. Of course, this means that longitudinal studies are needed to determine whether children later binge on such foods that were limited at home during preschool years.

The association between nondirective control and children's healthier food intakes suggests that if parents positively interact with children during meals, their children will be more likely to consume more nutrient-dense foods and fewer energy-dense foods. Although our model was not designed to estimate causal relations between the subconstructs and children's food intakes, the findings do support previous studies that have consistently reported the relations between positive mother-child interactions during mealtime and desirable dietary outcomes in young children (52–54).

The mealtime environment, especially television viewing during meals, has been found to be related undesirably to children's food intakes (55, 56). One experimental study showed that preschoolers with prior experience of eating during television viewing consumed significantly more food during television viewing than did those without such experiences (57). The context of shared mealtime, such as mealtime conversation and disruption of family meals with phone calls or children getting up and down from their seats, is an important dimension to assess as part of mealtime (58). Family meals without television viewing should be encouraged, although some families with limited resources might not own a table (59). If so, this would limit the location of family meals and increase the chance of eating in front of a television.

The limitations of this study were an insufficient sample size to examine race-ethnicity differences and the use of a self-reporting method to assess the mother's feeding practices and her child's food intakes (60). Future studies should be powered to include race-ethnicity as a variable. Some might concern using the same sample to both develop the questionnaire and to test the model; however, several reports support and even recommend this practice (44, 45). Finally, mealtime observations might reduce the inaccuracy of the data (eg, misunderstanding or misreporting of feeding practices) and increase the data accuracy (sugar and fat contents of the foods).

In conclusion, in this low-income group, the mothers’ directive feeding control

was associated with lower BMIs in their children, and nondirective feeding control was associated with nutritious food intakes in the children. Further investigations in longitudinal studies to explain the paths between these relations can inform parental feeding guidelines to help improve children's diet quality and reduce child obesity.

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The authors' responsibilities were as follows—MM, SLH, SOH, and SAK: designed the research; MM and SLH: conducted the research and wrote the manuscript; MM and SAK: performed the data analysis; and MM: had primary responsibility for the final content. All authors read, commented on, and approved the final manuscript. To our knowledge, no conflicts of interest, financial or other, existed.

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