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Examining the relationship between family meal frequency and individual dietary intake: Does family cohesion play a role?

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INTRODUCTION

Positive associations have been observed for family meals and diet quality, particularly among adolescents, in both cross-sectional (1-4) and longitudinal (5,6) studies. Despite these findings, there is no established theory to explain observed associations between family meals and dietary intake. Some researchers have suggested that family meals provide an opportunity for parents to model healthful eating behaviors or make healthful foods available to family members (3). Another possible explanation is that the frequency of family meals reflects the broader family social environment whereby more frequent family meals are associated with better overall family functioning. One important dimension of family functioning is family cohesion, “the emotional bonding that family members have towards one another” (7). Too little or too much cohesion is thought to characterize a dysfunctional family (8), which may have negative implications for the adoption and maintenance of healthful behaviors, including healthy eating.

The perception of a cohesive family may be associated with healthy eating in a variety of ways, including increased acceptance of family rules and role modeling surrounding food choice, or the development of healthy attitudes and behaviors in general due to improved psychological well-being. While family cohesion has been shown to mediate the effect of family meals on other adolescent health behaviors such as smoking (9), the indirect effect of family meals via family cohesion on food choice has not been reported in the literature. We are aware of only two studies which have directly examined the relationships between family meal frequency, family cohesion, and dietary intake. In their cross-sectional analyses of family cohesion and eating behaviors in 9-19 year old girls, Franko and colleagues found that family cohesion was associated with more days of breakfast consumption and lower quantities of soda intake (10). Results also indicated a trend toward greater quantities of

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milk, fruit, and vegetable consumption as family cohesion increased. In subsequent longitudinal analyses, the authors found that greater frequency of family meals predicted an increase in family cohesion over time (9). These analyses suggest that family meals may influence family cohesion, which in turn is associated with diet quality, at least for girls.

Unfortunately, the relationship between family meals, family cohesion, and dietary intake is not clear. Elucidating the mechanism through which family meals have a positive influence on dietary intake may benefit interventionists seeking to improve diet quality within families. If family cohesion is found to be a mediator of family meals and dietary intake, health promoters can enhance dietary interventions by implementing strategies to improve family cohesion. If family cohesion is not indicated as a mediator of family meals and dietary intake, then it will be important to investigate other potential mediators in order to better understand how family meals influence dietary intake.

Previous research has largely focused on the influence of family meals on adolescents' eating behaviors. We are aware of only one study to date that has reported on the relationship between family meal frequency and dietary intake among adults. Among a sample of 300 women, no association was observed between reported frequency of family meals and dietary intake (11). More research is needed to confirm the association between family meal frequency and dietary intake in adults, as well as to examine the possibility of family cohesion as a mediator of this relationship, if one exists. Improving the understanding of the influence of family meals on adults' eating patterns, in addition to adolescents', is worthwhile due to the importance of diet quality and weight management for adults' health (12).

This study examined the cross-sectional relationships between family meal frequency, family cohesion, and individual dietary intake. In light of previous findings, it was hypothesized that greater frequency of family meals would be associated with higher fruit and vegetable intake, and lower intake of snacks, sweets, and sugar-sweetened beverages among adolescents. It was also hypothesized that greater frequency of family meals would be positively associated with greater family cohesion in adolescents, and that the association between family meal frequency and individual food choice would be partially mediated by family cohesion. We hypothesized similar findings for adults based on the theoretical rationale that family meals have a positive impact on dietary intake via family cohesion, a reflection of general family functioning that pertains to both adults and adolescents.

METHODS

Participants and Recruitment

Ninety households (n=153 adults ages 18+ years, n=75 adolescents ages 12-17 years) were recruited from the [blinded for review] metropolitan area via flyers and brochures posted in community settings, such as schools and libraries, as well as postcards mailed to [blinded for review] employees. Eligible households had at least one child ≥ 12 years of age when only one adult was present or at least one child ≥ 5 years of age when more than one adult was present in order to ensure that each household had at least two individuals available to participate in intervention activities. Additional eligibility requirements for households included: reside within 20 miles of the [blinded for review]; have at least 10 hours of total household television viewing time per week; and no household members with dietary, medical, psychological, or physical limitations that would prevent their participation in intervention activities. Eligibility was assessed during an initial telephone call conducted by trained staff members and confirmed in-person during a baseline clinic visit. The [blinded for review] Institutional Review Board approved this study.

Procedures

Data for the present study were collected at baseline, prior to intervention activities, as part of a 12-month community-based household weight gain prevention trial, the [blinded for review]. All household members attended a baseline clinic visit at the [blinded for review] where participants ≥ 5 years of age were weighed and had their heights measured, and participants ≥ 12 years of age completed a battery of questionnaires about their dietary and physical activity behaviors. Households were compensated \$200 upon completing all baseline data collection activities.

Measures

Demographic information was self-reported by each of the adults and adolescents in the household and included age, sex, and race for all participants, and highest education level attained, employment status, and marital status for adults only. Weight and height of all participants ≥ 5 years of age was assessed by a trained and certified research staff member. Weight was measured using a calibrated digital scale while participants' shoes were removed. Height was measured using a stadiometer. Body mass index (BMI) was calculated by dividing weight in kilograms by height in meters-squared. For adolescents, BMI was plotted on the CDC BMI-for-age growth charts to obtain a percentile ranking (13). Adolescents with a BMI between the 85th and 95th percentiles were considered overweight, while those with a BMI greater than the 95th percentile were considered obese.

Frequency of family meals was reported by adults and adolescents and was assessed with the question, "During the past seven days, how many times did all or most of your household eat a meal together?" Responses were open-ended. Family cohesion was measured as a single construct using the cohesion scale from the FACES-III survey (8). The developers of this survey have demonstrated very good evidence of face and content validity as well as good internal ($r=0.77$) and test-retest ($r=0.83$ after 4-5 weeks) reliability of the cohesion scale (8). The cohesion scale also demonstrated excellent internal consistency in the present sample (Cronbach's $\alpha=0.90$). Participants were asked to "describe [their] family/household as it is now by checking the appropriate number (1-5) in the boxes for each item." Examples of statements which measured family cohesion include, "We like to do things with just our immediate family/household," and "Family/household members feel very close to each other." Responses ranged from "1-almost never" to "5-almost always". The cohesion scale of FACES III was comprised of 10 items, and higher summary scores on the scale indicated greater perceived family cohesion (theoretical range: 0-50).

Parent and adolescent food choice was assessed using a self-administered questionnaire adapted from the Diet History Questionnaire (DHQ) (14), a previously validated food frequency questionnaire developed by the National Cancer Institute (15,16). The DHQ was modified for this study to measure intake of specific food items; however, the original format for questions and response options were retained. This method is not a comprehensive measure of dietary intake, but instead captures intake of foods and beverages within targeted categories that were the focus of intervention messages and activities. Foods and beverages captured by the survey include the following: snacks (3 items: chips, popcorn, and pretzels), sweets (9 items: ice cream, cookies, brownies, cakes, pie, pastries, muffins, chocolate, and candy), fruit (1 item: all fruits), vegetables (2 items: all vegetables, lettuce salad), and sugar-sweetened beverages (2 items: regular soda and fruit drinks).

Individuals were asked to report their frequency of consuming various food and beverage items: "Over the past month, how many times did you eat/drink..." Response options consisted of 6 ordinal categories: never, 1-3 times last month, 1-2 times per week, 3-4 times per week, 5-6 times per week, 7 or more times per week. Response options were recoded to

reflect an average frequency of consumption per week: 0, 0.5, 1.5, 3.5, 5.5, and 7 times per week, respectively. In addition, participants were asked to report their average serving size of consumed items: "Each time you ate [type of food], how much did you usually eat?" Response options consisted of 4 ordinal categories (e.g. about ½ cup, about 1 cup, about 2 cups, more than 2 cups). Average serving sizes were recoded as 0.5, 1, 1.5, and 2 servings. Average number of servings per week of given items was calculated by multiplying frequency of consumption by average servings.

Data Analysis

All data were analyzed using SAS for Windows (SAS version 9.2, SAS Institute Inc., Cary, NC, 2007). Statistical significance was indicated at the $\alpha < 0.05$ level. Simple t-tests and chi-square statistics were used to compare participant demographic characteristics, family cohesion scores, and eating behaviors for adults and adolescents. Pearson correlation coefficients were used to examine cross-sectional associations between participant-reported family cohesion and family meal frequency.

The Baron & Kenny approach to mediation analysis was the primary statistical method used in this paper (17). In mediation analysis, four steps are taken to provide evidence for the presence of a mediator. First, it should be demonstrated that the independent variable X is associated with the outcome variable Y. Second, it should be demonstrated that the independent variable X is associated with the mediator variable M. Third, it should be demonstrated that the mediator variable M is associated with the outcome variable Y after controlling for X. Note that X must be controlled when establishing the relationship between the mediator and the outcome to avoid finding a spurious relationship due to confounding of X. Finally, if the effect of X on Y is reduced when M is included in a regression model, there is evidence that the effect of X on Y is partially mediated by M. If the path between X and Y disappears entirely when M is included, complete mediation by M is indicated.

Figure 1 depicts the various associations that were tested in this paper. A series of hierarchical multiple linear regression models were fit whereby each individual's average weekly servings of a targeted food category (e.g. fruits, vegetables, snacks, sweets, sugar-sweetened beverages) were regressed on frequency of family meals, both of which were entered as continuous variables. In addition, each hierarchical linear regression model included a random effect for household to take into account the correlation of responses for members within a household; individual level demographic covariates to improve statistical precision; an individual level indicator variable for respondent type (i.e. adult vs. adolescent); and the interaction between the respondent type and reported frequency of family meals in order to estimate regression estimates separately for adults and adolescents. Hierarchical linear regression models are appropriate when working with nested data, such as individual-level data nested within households (18).

Similar regression models were subsequently fit regressing family cohesion scores on frequency of family meals, as well as regressing average weekly servings of a targeted food category on family cohesion scores after controlling for frequency of family meals. Finally, regression models regressing weekly servings of a targeted food category on both family meal frequency *and* family cohesion score were fit in order to provide evidence for mediation. When mediation was indicated, the percent reduction for the association of family meals and dietary intake as mediated by family cohesion was calculated by subtracting the adjusted regression coefficient for family meal frequency from its unadjusted counterpart, and then dividing by the unadjusted regression coefficient for frequency of family meals. Sobel's test was used to assess statistical significance of the indirect (mediation) effect (19,20). Note that due to the small sample size in the present study, type II error cannot be ruled out when interpreting results.

RESULTS

Participant Characteristics

Roughly 60% of adult participants were female, 80% White, 58% had a college degree or more education, 86% were currently employed, and 68% were currently married. Approximately 70% of adults and 37% of adolescents were considered overweight or obese. Participant-reported family cohesion and eating behaviors are shown in Table 1. Adults reported significantly higher scores on the FACES cohesion scale, as well as more family meals per week, compared to adolescents. Statistical comparisons of mean servings per week of foods in targeted categories show that adults consumed more vegetables and fewer sugar-sweetened beverages than adolescents.

Relationship between Family Meal Frequency and Dietary Intake ($X \rightarrow Y$)

Regression coefficients (β) for hierarchical linear regression models regressing servings of foods in targeted categories on frequency of family meals are displayed in the first column of Table 2. For adults, significant positive associations were shown for family meal frequency and fruit and vegetable intake. An increase of one meal for the number of family meals per week was associated with increases of 0.18 weekly servings of fruit and 0.30 weekly servings of vegetables. For adolescents, significant negative associations were observed for family meal frequency and sweets and sugar-sweetened beverage intake.

Relationship between Family Meal Frequency and Family Cohesion ($X \rightarrow M$)

Pearson correlations demonstrated a significant positive association between participant-reported family meal frequency and family cohesion score ($r=0.41$, $P<0.01$). The regression coefficient (β) for hierarchical linear regression models regressing family cohesion score on frequency of family meals was slightly higher for adults ($\beta=0.61$, $SE=0.14$) than for adolescents ($\beta=0.51$, $SE=0.17$).

Relationship between Family Cohesion and Dietary Intake ($M \rightarrow Y$)

Regression coefficients (β) for hierarchical linear regression models regressing servings of foods in targeted categories on family cohesion scores are displayed in the second column of Table 2. These estimates are not adjusted for frequency of family meals. For adults, a significant negative association was observed for family cohesion score and sugar-sweetened beverage intake. For adolescents, a significant negative association was observed for family cohesion score and intake of sweets.

Regression coefficients (β) for hierarchical linear regression models regressing servings of foods in targeted categories on family cohesion scores, after controlling for frequency of family meals, are displayed in the third column of Table 2. For adolescents, a significant negative association continued to be observed for family cohesion score and intake of sweets after controlling for frequency of family meals; however, no significant associations were observed for family cohesion and dietary intake for adults after controlling for frequency of family meals.

Mediation Analysis ($X \rightarrow M \rightarrow Y$)

Regression coefficients (β) for hierarchical linear regression models regressing servings of foods in targeted categories on frequency of family meals, after adjusting for family cohesion score, are displayed in the fourth column of Table 2. For adolescents, an increase of one for the number of family meals per week was associated with a decrease of 0.30 weekly servings of sweets after controlling for family cohesion. This indicates a 21% reduction for the association of family meals and sweets intake as mediated by family

cohesion. However, Sobel's test only suggested a trends toward partial mediation by family cohesion for the relationship between family meal frequency and sweets intake in adolescents ($z=1.72$, $P=0.08$).

DISCUSSION

The primary aim of this paper was to examine the relationships between family meal frequency, family cohesion, and average weekly intake of foods in targeted categories. It was hypothesized that family meal frequency would be positively associated with fruit and vegetable intake and negatively associated with snacks, sweets, and sugar-sweetened beverage intake for both adults and adolescents. Among adults, results suggested that greater family meal frequency was associated with significantly more servings per week of fruits and vegetables, and a trend toward fewer sugar-sweetened beverages. In contrast, Boutelle and colleagues found no significant associations between frequency of family meals and parents' dietary intake (11). Such differences may be due to dissimilar research methods, instruments, or sample populations. Boutelle et al. utilized a phone interview to assess usual dietary intake in a sample of women, while the current study used an in-person questionnaire to measure dietary intake of a targeted subset of foods in a sample of men and women.

Among adolescents, family meal frequency was associated with significantly fewer weekly servings of sweets and sugar-sweetened beverages, and there a trend toward greater intake of vegetables. Our findings are somewhat consistent with previous literature, which suggests that among adolescents, greater family meal frequency is positively associated with fruit and vegetable intake (1,2,4), and negatively associated with sugar-sweetened beverage intake (2). We did not observe a significant relationship between family meal frequency and fruit intake among adolescents. Differences in results from the present study may be due to our use of a modified food frequency questionnaire which has only been validated for adults, and may not have been appropriate for use with adolescents (21).

We also hypothesized significant associations between family cohesion and dietary intake. Although significant associations were observed between family cohesion and sweets intake among adolescents, there were no statistically significant associations between family cohesion and dietary intake among adults after adjusting for family meal frequency. These findings suggest that family cohesion is unlikely to explain differences in individual dietary intake for either adolescents or adults, which has implications for our hypothesis that family cohesion partially mediates the association between frequency of family meals and dietary intake. Indeed, there was not strong evidence for mediation by family cohesion in any of our models.

Mediation analysis could only be considered in instances where both frequency of family meals and family cohesion demonstrated significant associations with dietary intake, which only applied to sweets intake among adolescents. A lack of significant findings overall may be due to measurement error associated with our assessment tools, or may simply reflect the fact that family cohesion does not play an important role in explaining the effect of family meals on dietary intake. This latter notion is supported by results from our adjusted models, which indicated that regression estimates for family meal frequency were largely unchanged by the inclusion of the family cohesion covariate.

Limitations of the present study include a small sample size which may yield null results due to inadequate power, and the use of cross-sectional data. Because our data is cross-sectional, it is unknown if family meal frequency determines family cohesion or family cohesion determines frequency of family meals. It is similarly plausible that the two variables continuously influence one another. However, previous longitudinal research suggests that

frequency of family meals predicts improved family cohesion over time (9). Thus, our regression models fit family cohesion as the mediator between frequency of family meals and individual food choice. Additionally, the use of Sobel's test to indicate the statistical significance of a mediated effect may not be appropriate for use with hierarchical models. Finally, results presented from this study may not apply to lower income, minority populations.

This study is unique in that it utilized a validated questionnaire to measure family cohesion among a sample of adolescents and their parents. Previous researchers have considered the role of family dynamics when examining the influence of family meal frequency on adolescent health outcomes. For example, researchers have adjusted for family connectedness in their analyses in order to describe the association between family meal frequency and outcomes such as disordered eating (22), substance use (23), and problem behaviors (24), above and beyond family connectedness. However, in these studies, family connectedness was not measured with validated instruments, but instead characterized by adolescent self-report of their perceived closeness to their mother and/or father using a limited number of questions. In effect, what has been described as family connectedness may not truly reflect perceived family cohesion *per se*. The measure of family cohesion in the present study, on the other hand, provided a valid assessment of both adult and adolescent perceived family cohesion.

The present study also builds upon previous research by examining the association among family meal frequency, family cohesion, and dietary intake in adults. As previously discussed, we observed significant associations between family meal frequency and adult intake of fruits and vegetables. These findings suggest that family meals may have a positive impact on all family members, and not just adolescents. However, evidence for the mediating role of family cohesion for this relationship was lacking.

IMPLICATIONS FOR RESEARCH AND PRACTICE

In summary, current theory explaining the relationship between family meal frequency and dietary intake is not well established. This paper attempted to elucidate one potential mechanism of this association: family cohesion. It was hypothesized that frequency of family meals was positively associated with perceived family cohesion, which in turn would be related to healthier dietary intake. Individuals who report greater closeness to their families may be more apt to mirror modeling of healthful diets, be more likely to accept household food rules, or engage in healthier behaviors in general due to improved psychological well-being. Unfortunately, our findings were unable to establish family cohesion as a consistent mediator of the relationship between family meal frequency and dietary intake in adults or adolescents.

Research in this area would improve from a clearer understanding of why, or perhaps if, family meals are beneficial for dietary intake. Future observational studies should include measures to assess potential mediators in addition to family cohesion, such as role modeling of dietary behavior, household food rules during and outside of mealtimes, and the types and quantities of food offered during meals. Specific factors worth exploring include whether or not parents provide foods for their children at meal time that differ from foods they serve themselves; whether or not families eat meals with the television on; whether parents restrict or allow snacking *ad libitum* outside of meal times; and whether meals consist of pre-packaged versus "homemade" foods. Finally, longitudinal analyses would shed light on temporal effects related to family meals, potential mediators, and individual dietary intake.

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Figure 1.
Mediation analysis

Table 1

Participant-reported family cohesion and eating behaviors for adults and adolescents

	Adults (n=152)	Adolescents (n=75)	P
	Mean (SD)	Mean (SD)	
FACES cohesion score	38.9 (6.8)	33.0 (9.1)	<0.001
Family meals per week	6.3 (4.1)	5.0 (4.4)	0.03
Servings per week:			
Fruits	4.6 (3.1)	4.1 (3.3)	0.26
Vegetables	7.5 (5.3)	4.8 (5.2)	<0.001
Snacks	2.9 (2.5)	3.0 (3.0)	0.95
Sweets	7.1 (6.0)	8.1 (8.4)	0.36
Sugar-sweetened beverages	2.7 (3.8)	3.8 (3.6)	0.05

Table 2

Regression coefficients for food servings per week regressed on family meal frequency and family cohesion among adults and adolescents

Dependent variable	Independent variable			
	Family meal frequency only	Family cohesion score only	Family cohesion score adjusted for meal frequency	Family meal frequency adjusted for cohesion score
Dependent variable	β (SE)	β (SE)	β (SE)	β (SE)
Servings per week:				
Fruits				
Adults	0.18 (0.06)**	0.04 (0.04)	-0.001 (0.04)	0.18 (0.07)**
Adolescents	-0.01 (0.08)	0.01 (0.04)	-0.005 (0.04)	-0.02 (0.08)
Vegetables				
Adults	0.30 (0.11)**	0.02 (0.07)	-0.06 (0.07)	0.34 (0.12)*
Adolescents	0.24 (0.13) [†]	0.10 (0.06)	0.07 (0.07)	0.24 (0.13) [†]
Snacks				
Adults	-0.04 (0.05)	0.002 (0.02)	0.01 (0.04)	-0.05 (0.06)
Adolescents	0.05 (0.07)	0.04 (0.03)	0.04 (0.03)	0.04 (0.07)
Sweets				
Adults	-0.12 (0.13)	-0.14 (0.07) [†]	-0.14 (0.08) [†]	-0.03 (0.14)
Adolescents	-0.38 (0.18)*	-0.17 (0.09)*	-0.15 (0.09)*	-0.30 (0.18) [†]
Sugar-sweetened beverages				
Adults	-0.14 (0.07) [†]	-0.10 (0.04)*	-0.07 (0.05)	-0.09 (0.08)
Adolescents	-0.16 (0.10)*	-0.08 (0.05) [†]	-0.06 (0.05)	-0.12 (0.10) [†]

NOTE: all regression coefficients are adjusted for participant age and gender; regression coefficients for adults are also adjusted for highest education level attained

[†] p<0.10

* p<0.05

** p<0.01