No Time For Family Meals? Parenting Practices Associated With Adolescent Fruit And Vegetable Intake When Family Meals Are Not An Option

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Abstract

Background—Despite research linking family meals to healthier diets, some families are unable to have regular meals together. These families need guidance about other ways to promote healthy eating among adolescents.

Objective—To examine the association between various parenting practices and adolescent fruit and vegetable (FV) intake at different levels of family meal frequency.

Design—Cross-sectional, population-based survey of influences on adolescent weight-related behaviors: EAT 2010 (Eating and Activity in Teens).

Participants/Setting—2,491 adolescents recruited from middle/high schools in Minneapolis/St-Paul

Measures—Adolescent FV intake was ascertained with a food frequency questionnaire. Survey items assessed frequency of family meals and FV parenting practices (availability, accessibility, parent modeling, parent encouragement, and family communication).

Statistical Analyses—Linear regression models were used to examine associations with and interactions among family meals and parenting practices. Models were adjusted for age, sex, socioeconomic status, race/ethnicity, and energy intake (kcal/day).

Results—Family meals, FV availability, FV accessibility, FV modeling, and encouragement to eat healthy foods were independently associated with higher FV intake. Of the 949 (34%) adolescents who reported infrequent family meals (2 days/week), mean FV intake was 3.6 servings/day for those with high home FV availability versus 3.0 servings/day for those with low home FV availability. Similar differences in mean FV intake (0-3-0.6 servings/day) were found for high versus low FV accessibility, parental modeling, and parent encouragement for healthy eating. Frequent family meals in addition to more favorable parenting practices were associated with the highest FV intakes.

Conclusion—Food parenting practices and family meals are associated with greater adolescent FV intake. Longitudinal and intervention studies are needed to determine which combination of parenting practices will lead to improvements in adolescent diet.

Introduction

Families have an important influence on adolescent health behaviors, including fruit and vegetable (FV) intake. Parents shape the home environment in which many food choices are made and employ a variety of intentional or unintentional practices that may contribute to their child's intake, such as modeling, setting routines and establishing rules.[1,2] There is currently a need to identify what parents can do to promote FV intake among adolescents because adolescent obesity has risen dramatically over the last several decades, FV are critical for adequate nutrition, and many adolescents do not meet FV guidelines.[3–5] A key factor that has been identified and recommended as a high priority for parents is to have regular family meals. This recommendation is based on cross-sectional and longitudinal research that links frequent family meals with improved dietary practices, particularly FV intake.[6]

Positive associations between frequent family meals and adolescent FV intake have been consistently identified across studies with diverse samples.[7–11] Moreover, more frequent family meals in adolescence predicts greater FV intake into young adulthood.[12] Although the nutritional benefits of family meals are well documented,[9,13] many families do not sit down for regular family meals for a variety of reasons. Barriers to regular family meals include conflicting work schedules, before/after school activities, stress, financial resources, and a lack of suitable space to sit and eat together,[14,15] many of which are difficult to overcome. This mismatch between recommendations and the reality experienced by many families may lead parents to feel helpless, frustrated, or guilty. Sociologists and the popular

media have also pointed out that this message may lead to unwarranted stress and extreme expectations for caregivers working outside the home.[16,17] The present study was designed to address some of these concerns. Parents who are unable to provide regular family meals need alternative strategies they can use to promote healthier diets among adolescents.

In addition to regular family meals, a variety of other parenting practices have been identified in the literature to promote healthy diets and may act as alternative strategies for parents to employ when they are unable to have regular family meals.[1,2] These practices include home FV availability and accessibility (i.e., in plain view, ready-to-eat), and parental encouragement and modeling of healthy eating.[1,2] Adolescent participants in EAT 2010 were previously found to eat more fruits and vegetables when these foods were present in the home, easily accessible, and when parents modeled or encouraged healthy eating.[11,18] Broader practices related to the family climate were also associated with higher adolescent FV consumption.[11] For example, strong parent-adolescent communication may contribute to an adolescent's willingness to undertake health-promoting behaviors like eating nutrient-dense foods.[19] However, it remains unclear to what extent these parenting practices are important for promoting FV intake in the absence of regular family meals.

This study extends previous research on family meals by identifying parenting practices that are associated with adolescent FV intake independently of family meals and at different levels of family meal participation (infrequent vs. frequent family meals). In particular, this study sought to identify parenting practices associated with increased FV intake among adolescents who have infrequent family meals. It was hypothesized that for adolescents who have infrequent family meals, exposure to other favorable parenting practices such as strong parent-child communication, FV that are readily available and accessible at home, and parents who model and encourage healthy eating, would be positively associated with FV intake.

Methods

Participants and Procedures

Data were drawn from EAT 2010 (Eating and Activity in Teens), a diverse population-based cross-sectional study of 2,793 adolescents attending 20 public middle schools and high schools in the metropolitan area of Minneapolis/St-Paul, Minnesota during 2009-2010. Adolescents completed an in-class survey that included questions about their family/home environment, and a food frequency questionnaire (FFQ) to assess dietary intake. Procedures have been described in detail elsewhere.[11] Adolescents had the opportunity to provide written assent only if their parent/guardian did not return a signed form indicating their refusal to have their child participate. Among adolescents who were at school on the days of survey administration, 96.3% had parental consent and chose to participate. Procedures were approved by the University of Minnesota's Institutional Review Board.

Youth and Adolescent FFQ

The 149-item Youth and Adolescent FFQ was used to estimate adolescent FV and energy intake (kcal/day). The tool's validity and reliability were previously examined for the

estimation of mean nutrient intakes in a sample of youth ages 9-18 years and found to be within acceptable ranges for dietary assessment.[20,21] Previous research with the FFQ has found conceptually-relevant variables to predict mean FV intake, and has used mean FV intake to predict health-related outcomes.[22,23] Responses to the FFQ were excluded for 123 participants that reported a biologically implausible level of total energy intake (<400 kcal/day or >7,000 kcal/day).

FV Intake was the outcome of interest and was assessed in reference to the past year. Usual intake was estimated based on reported intake of 31 items: raisins, grapes, bananas, cantaloupe/melons, apples/sauce, pears, oranges/grapefruit, strawberries, peaches/plums/apricots, orange juice, apple/other juice, mashed potatoes, tomatoes, tomato/spaghetti sauce, string beans, broccoli, beets, corn, peas/lima beans, mixed vegetables, spinach, greens/kale, green/red peppers, yam/sweet potatoes, zucchini/squash/eggplant, cooked carrots, celery, lettuce/salad, coleslaw, potato salad. A daily serving was defined as the equivalent of one-half cup of fruits or vegetables or 1 glass of juice (size of glass interpreted by the participant). Mean intakes across the different items ranged from a low of 0.1 servings/day of beets to a high of 0.5 servings/day of apple juice.

Adolescent Survey

The EAT survey is a 235-item, self-report questionnaire assessing factors of relevance to nutrition and weight-related health.[24] Estimates of test-retest reliability were determined over a one-week period in a diverse sample of 129 middle and high school students. For categorical and dichotomous variables, the Spearman correlation (rho) and percent agreement between the two time points were calculated, respectively, and are presented below. A value of 0.6 or greater is considered acceptable reliability.[25]

Family meals were assessed by asking adolescents: "During the past seven days, how many times did all, or most, of your family living in your house eat a meal together?" Response options included: never, one to two times, three to four times, five to six times, seven times, and more than seven times. Three categories were created to reflect infrequent family meals (2 meals per week), occasional (3-4 meals per week) and frequent family meals (5 meals per week) (rho=0.71). These cut points have been previously shown to predict adolescent diet, weight and health outcomes.[13]

Parent Communication was assessed with the following items, asked separately for mothers and fathers:[26] (1) "How much do you feel your mother/father cares about you?" and (2) "How much do you feel you can you talk to your mother/father about your problems?" Response options were: not at all, a little, somewhat, quite a bit, and very much. Responses were averaged across items (range=1-5). The internal consistency of the scale (i.e., how well the items that make up the scale are correlated to one another and the total scale score) was assessed with Cronbach's alpha and found to have an acceptable value of 0.81. For the analysis described here, a single dichotomous variable was created to allow for comparison between high and low parent communication (1= a score of 4 or 5, and 0=all other responses) (percent agreement=82.4%).

Home Availability of FV was assessed by asking adolescents how frequently fruits and vegetables were available at home with the following four response options: never, sometimes, usually, always. Responses were dichotomized, whereby 1=usually or always having FV at home, and 0=all other responses (percent agreement=90.1%).

Home Accessibility of FV was assessed by asking adolescents how often fruit was on the counter, table or somewhere they could easily get it; and how often there were cut-up vegetables in the fridge. Response options were: never, sometimes, usually, always. A single dichotomous item was computed whereby 1=usually or always having either fruits or vegetables accessible, and 0=all other responses (percent agreement=100%).

Parent modeling of FV intake was assessed by asking adolescents to report if their mother/ father (1) eats a lot of fruit, and (2) eats vegetables with dinner. Response options were: never, rarely, sometimes, on a regular basis. A single dichotomous variable was computed whereby 1=any parent models fruit or vegetable consumption on a regular basis, and 0=all other responses (percent agreement=77.9%).

Parent encouragement for healthy eating was assessed by asking adolescents' if their mother/father encourages them to eat healthy foods. Four response options were: not at all, a little bit, somewhat, and very much. No definitions or explanation were provided for the term 'healthy foods' or the response options. A single dichotomous variable was computed whereby 1=any parent encourages healthy eating very much, and 0=all other responses (percent agreement=76.6%).

Sociodemographic characteristics, including race/ethnicity, socio-economic status (SES), sex and school type (middle vs. high school), were assessed by adolescent self-report. Race/ ethnicity was categorized as (1) White, (2) Black, (3) Hispanic, (4) Asian or (5) Mixed/ Other". The SES variable was derived primarily from the higher education level of either parent.[27] An algorithm using classification and regression trees was developed, whereby a missing variable was replaced by a correlated surrogate variable. Algorithmic classification scores were reduced by 2 levels if the family received public assistance and by 2 if the child was eligible for free or reduced-cost school meals or had 2 unemployed parents. In 4% of adolescents, no data were available on which to assign SES. The 5-level variable was collapsed into three categories: low, middle, and high SES.

Analysis

The analysis was restricted to 2,491 adolescents with complete data on dietary intake and family meal frequency. Those with missing data (n=302) were not socioeconomically different (p=0.2), but were more likely to be male, of younger age and more likely to be Black (p<0.05) than those retained in the analysis. Adolescent sociodemographic and parenting practices were examined by family meal frequency, and group differences examined with Pearson chi-square tests. Linear regression models were used to examine: 1) models assessing FV intake and each parenting practice alone and then a model that included all parenting practices included as one block; and 2) interactions between family meal frequency and exposure to other parenting practices on FV intake. Multiplicative and additive interactions were tested and consistent patterns of interactions with p<0.10 across

the parenting practices were found. Therefore, to simplify the interpretation of interactions, results are presented stratified by family meal frequency. All models were adjusted for adolescent age, sex, SES, race/ethnicity, and energy intake (kcal/day). FV intake was positively skewed; however, square root transformation to approximate normality did not meaningfully change the results and model residual values were approximately normally distributed. Variation inflation factors were examined and there was no indication of collinearity between any of the model variables. Results of models assessing each parenting practice alone and then assessing a model including all parenting practices are presented as unstandardized beta coefficients and standard errors, and adjusted mean FV intake and standard errors for each level of the independent variable. Unstandardized coefficients represent the change in daily mean servings of FV as a function of the independent variable. Stratified results are presented as mean servings of FV and standard errors for those who report frequent, occasional, and infrequent family meals. Other variables had < 3% missing data; therefore, complete cases were used for each particular model. A p-value of p<0.05 was considered statistically significant and all analyses were conducted using Stata Statistical Software.[28]

Results

The mean age and standard deviation (SD) of the analytic sample was 14.5 years (2.0); 44.6% were in middle school (6th-8th grades) and 55.4% were in high school (9th-12th grades). Just over half of participants were female (53.9%) and approximately 60% of participants qualified for free or reduced-price school meals. The racial/ethnic backgrounds of the participants were as follows: 27.8% African American or Black, 19.5% White, 20.8% Asian American, 17.2% Hispanic, 3.6% Native American, and 11.1% mixed or other.

Adolescents consumed an average of 3.7 servings of FV per day (SD=2.9). Across family meal frequency, FV intake was lowest for those who had infrequent family meals (mean servings=3.3, SD=2.6) and highest for those who had frequent family meals (mean servings=4.2, SD=3.1). The proportion of adolescents who consumed five or more servings of FV per day increased as frequency of family meals increased, 19% (infrequent meals), 25% (occasional meals) and 32% (frequent meals) (data not shown in tables).

Thirty-five percent of adolescents (n=864) reported infrequent family meals (Table 1). Adolescents who reported infrequent family meals were more likely to be female, in high school, identify themselves as Black, and from low SES households as compared to adolescents who reported more frequent family meals (p 0.01). Adolescents who reported infrequent family meals also had less favorable parenting practice profiles (e.g., lower FV availability and accessibility) as compared to adolescents who reported frequent family meals (p<0.001).

Associations between family meals, parenting practices and FV intake (Table 2)

In individual and mutually adjusted models controlling for covariates, family meals, FV availability, FV accessibility, parent FV modeling, and parent encouragement for healthy eating were independently associated with higher FV intake. For example, independent of family meals and the other parenting practices examined, adolescents consumed an

additional half serving of FV per day when FV were frequently accessible to them (on the counter/cut up in the fridge) as compared to less frequently accessible. In contrast, parent communication was no longer significantly associated with FV intake after controlling for family meals and the other parenting practices.

Stratified results by family meal frequency (Table 3)

Most parenting practices were associated with higher FV intake in the absence of family meals. Among adolescents who reported infrequent family meals, adolescents who had high home FV availability, FV accessibility, parent FV modeling, or parent encouragement consumed 0.3 to 0.6 more servings of FV per day compared to adolescents with low exposure to these same parenting practices. In contrast, adolescents who reported infrequent family meals consumed fewer servings of FV when parent communication was high as compared to low.

Stratified results allowed for the comparison of adolescents exposed to healthful parenting practices in the absence of regular family meals (parenting practices alone) to those not exposed to healthful parenting practices but reported frequent family meals (family meals alone). Most parenting practices alone were associated with higher FV intake compared to frequent family meals alone. This pattern was found for FV availability, accessibility and parent encouragement. For example, adolescents who had high availability of FV but infrequent family meals consumed 3.6 mean servings of FV per day (95% Confidence Interval=3.4-3.7) as compared to 3.0 mean servings of FV per day (95% Confidence Interval=2.5-3.4) consumed by adolescents with frequent family meals but low availability of FV.

The combination of frequent family meals and other healthful parenting practices were most strongly associated with FV intake. For example, when parents regularly modeled or encouraged FV intake/healthy eating, adolescents consumed more FV as the frequency of family meals increased. Differences ranged from 0.5 to 0.9 mean servings/day for frequent as compared to infrequent family meals. In contrast, when parenting practices were unfavorable, mean servings of FV did not significantly differ across family meal frequency. For example, adolescents who had low FV availability at home consumed about three mean servings of FV per day regardless of family meal frequency.

Discussion

This study aimed to identify ways in which parents could promote FV intake among adolescents in the absence of frequent family meals. This was accomplished by exploring associations between family meals and adolescent FV intake in combination with other parenting practices. Almost a quarter of adolescents who reported infrequent family meals consumed at least five mean servings of FV daily and may be explained by other familial factors. Indeed, healthful parenting practices such as home FV availability and accessibility, and parents who model FV consumption and encourage healthy food choices were associated with greater FV intake among adolescents who reported infrequent family meals. To improve adolescent FV intake, dietitians and health practitioners should support and counsel parents to employ a range of healthful parenting practices.

This study was designed to build on previous research linking family meals to healthier eating and address concerns that many families find it difficult to implement family meals on a regular basis.[6,16] As also documented in previous studies,[7,29] adolescents who have frequent family meals had healthier profiles overall including higher SES, and greater parent communication, FV availability and accessibility, parenting modeling of FV intake, and encouragement for healthy eating. Family meals may encourage or be the result of other healthful practices (e.g. family meals lead to more FV in the house or vice versa), or be influenced by additional factors such as overall parenting style.[30] However, differences emerged when interactions between family meal frequency and parenting practices were explored and these differences provide guidance on what might be helpful in the situation where adolescents do not have regular family meals.

Interestingly, when healthful parenting practices were low, family meals did not have a positive association with FV intake. Conversely, mean servings of FV were highest for adolescents who had both frequent family meals and healthful parenting practices. FV intake might be highest when adolescents have both frequent family meals and other healthful parenting practices because healthier meals are served by families that engage in other healthful practices (e.g. have FV available).[31] To determine how changes in family meals and other parenting practices influence adolescent FV intake, the relative importance of family meals and other FV-related parenting practices needs to be further tested in longitudinal and intervention studies. Additional research is also needed that identifies how health professionals and others who work with parents and families can best support parents to adopt healthful parenting practices.

Another interesting pattern that emerged was that FV intake was higher for adolescents who report infrequent family meals but are exposed to high levels of other healthful parenting practices as compared to adolescents who report frequent family meals but are not exposed to other healthful parenting practices. This pattern was true for each parenting practice examined except for parental encouragement for healthy eating and parental communication. Perhaps it is not surprising that the parenting practices specific to FV were found to be more closely related to adolescent FV intake than family meals, meals that may or may not have included healthy foods. Conversely, parent communication was only associated with greater FV intake when family meals were frequent. A similar construct, family cohesion, has previously been shown to mediate the relationship between family meals and diet quality.[32] Family meals may lead to more connected and communicative families, which in turn, may lead to more positive experiences and attitudes towards healthful eating.[19]

Strengths of this study include its large, diverse, population-based sample of adolescents and the examination of multiple parenting practices in conjunction with family meal frequency. This study did not examine other parenting factors that may influence FV intake such as the amount or variety of healthful foods offered in the home and the quality of family meals (e.g., healthfulness or preparation method of the foods served).[2] Other limitations to consider when interpreting study findings include mismatch in the time period assessed for some measures (e.g. FFQ assessed over one year, family meals assessed over the past week), the cross-sectional nature of the analyses, and the use of self-reported measures, including dietary intake, that may introduce social desirability bias, recall bias, and systematic

measurement error. Furthermore, parenting practices were assessed by adolescent self-report, potentially introducing error if adolescent reports were inaccurate. However, adolescent report may be less prone to social desirability bias than parent report,[33] and adolescent perceptions might be more closely tied to their behavior.[34] Concordance of parenting practices were not explored, but it should be noted that families with discordant practices (e.g. mother but not father models healthful eating) may have attenuated the results, while families with concordant practices (e.g. both mother and father model healthful eating) may have seen even greater benefits to adolescent FV intake. Future research should examine comparisons by same-sex and opposite-sex parent/child dyads.

Conclusions

Healthful parenting practices (FV availability and accessibility, parent FV modeling, and encouragement of healthy eating) and regular family meals were associated with higher FV intake in adolescents. FV intake was highest in adolescents who were exposed to both healthful parenting practices and regular family meals. However, in the absence of healthful parenting practices, family meals were no longer associated with greater FV intake. Family meals may be most helpful in conjunction with other FV-related parenting practices; however, further research is needed that evaluates the impact on adolescent FV intake of targeting both family meals and other parenting practices, such as healthy home food availability and accessibility and modeling and encouragement of desired behaviors.

Acknowledgments

References

1. Birch LL, Davison KK. Family environmental factors influencing the developing behavioral controls of food intake and childhood overweight. Pediatr Clin North Am. 2001; 48(4):893–907. [PubMed: 11494642]

2. Vaughn AE, Ward DS, Fisher JO, et al. Fundamental constructs in food parenting practices: a content map to guide future research. Nutr Rev. 2016; 74(2):98–117. [PubMed: 26724487]

3. Kimmons J, Gillespie C, Seymour J, Serdula M, Blanck HM. Fruit and vegetable intake among adolescents and adults in the United States: Percentage meeting individualized recommendations. Medscape J Med. 2009; 11(1):26. [PubMed: 19295947]

4. Ogden, C., Connor Gorber, S., Rivera Dommarco, J., Carroll, M., Shields, M., Flegal, K. Epidemiology of Obesity in Children and Adolescents. Vol. 2. New York: Springer; 2011. The Epidemiology of Childhood Obesity in Canada, Mexico and the United States; p. 69-93.

5. Golan M. Parents as agents of change in childhood obesity--from research to practice. Int J Pediatr Obes. 2006; 1(2):66–76. [PubMed: 17907317]

6. Fulkerson JA, Larson N, Horning M, Neumark-Sztainer D. A review of associations between family or shared meal frequency and dietary and weight status outcomes across the lifespan. J Nutr Educ Behav. 2014; 46(1):2–19. [PubMed: 24054888]

7. Utter J, Scragg R, Schaaf D, Mhurchu CN. Relationships between frequency of family meals, BMI and nutritional aspects of the home food environment among New Zealand adolescents. Int J Behav Nutr Phys Act. 2008; 5:50. [PubMed: 18947431]

8. Bauer KW, Neumark-Sztainer D, Fulkerson JA, Hannan PJ, Story M. Familial correlates of adolescent girls' physical activity, television use, dietary intake, weight, and body composition. Int J Behav Nutr Phys Act. 2011; 8(25):1–10. [PubMed: 21194492]

9. Woodruff SJ, Hanning RM, McGoldrick K, Brown KS. Healthy Eating Index-C is positively associated with family dinner frequency among students in grades 6–8 from Southern Ontario, Canada. Eur J Clin Nutr. 2010; 64(5):454–460. [PubMed: 20197788]

10. Neumark-Sztainer D, Hannan PJ, Story M, Croll J, Perry C. Family meal patterns: associations with sociodemographic characteristics and improved dietary intake among adolescents. J Am Diet Assoc. 2003; 103(3):317–322. [PubMed: 12616252]

11. Berge JM, Wall M, Larson N, Forsyth A, Bauer KW, Neumark-Sztainer D. Youth dietary intake and weight status: Healthful neighborhood food environments enhance the protective role of supportive family home environments. Health Place. 2014; 26:69–77. [PubMed: 24378461]

12. Larson NI, Neumark-Sztainer D, Hannan PJ, Story M. Family meals during adolescence are associated with higher diet quality and healthful meal patterns during young adulthood. J Am Diet Assoc. 2007; 107(9):1502–1510. [PubMed: 17761227]

13. Neumark-Sztainer D, Larson NI, Fulkerson JA, Eisenberg ME, Story M. Family meals and adolescents: What have we learned from Project EAT (Eating Among Teens)? Public Health Nutr. 2010; 13(7):1113–1121. [PubMed: 20144257]

14. Slater J, Sevenhuysen G, Edginton B, O'neil J. "Trying to make it all come together": structuration and employed mothers' experience of family food provisioning in Canada. Health Promot Int. 2012; 27(3):405–415. [PubMed: 21693474]

15. Blake CE, Wethington E, Farrell TJ, Bisogni CA, Devine CM. Behavioral contexts, food-choice coping strategies, and dietary quality of a multiethnic sample of employed parents. J Am Diet Assoc. 2011; 111(3):401–407. [PubMed: 21338739]

16. Marcotte, A., Ortberg, M. [Accessed April 28, 2016] Let's Stop Idealizing the Home-Cooked Family Dinner. Slate. http://www.slate.com/blogs/xx_factor/2014/09/03/home_cooked_family_dinners_a_major_burden_for_working_mothers.html. Published September 2014

17. Bowen S, Elliott S, Brenton J. The Joy of Cooking? Contexts. 2014; 13(3):20–25.

18. Loth KA, MacLehose RF, Larson N, Berge JM, Neumark-Sztainer D. Food availability, modeling and restriction: How are these different aspects of the family eating environment related to adolescent dietary intake? Appetite. 2016; 96:80–86. [PubMed: 26327222]

19. Welsh EM, French SA, Wall M. Examining the relationship between family meal frequency and individual dietary intake: does family cohesion play a role? J Nutr Educ Behav. 2011; 43(4):229–235. [PubMed: 21536496]

20. Rockett HR, Wolf AM, Colditz GA. Development and reproducibility of a food frequency questionnaire to assess diets of older children and adolescents. J Am Diet Assoc. 1995; 95(3):336–340. [PubMed: 7860946]

21. Rockett HR, Breitenbach M, Frazier AL, et al. Validation of a youth/adolescent food frequency questionnaire. Prev Med. 1997; 26(6):808–816. [PubMed: 9388792]

22. Neumark-Sztainer D, Wall M, Perry C, Story M. Correlates of fruit and vegetable intake among adolescents. Findings from Project EAT. Prev Med. 2003; 37(3):198–208. [PubMed: 12914825]

23. Watts AW, Loth KA, Peterson C, Boutelle KN, Neumark-Sztainer D. Characteristics of a favorable weight status change from adolescence to young adulthood. J Adolesc Health. 2016; 58(4):403–409. [PubMed: 26552739]

24. Larson NI, Wall MM, Story MT, Neumark-Sztainer DR. Home/family, peer, school, and neighborhood correlates of obesity in adolescents. Obes. 2013; 21(9):1858–1869.

25. Landis JR, Koch GG. The measurement of observer agreement for categorical data. Biometrics. 1977; 33(1):159–174. [PubMed: 843571]

26. Resnick MD, Harris LJ, Blum RW. The impact of caring and connectedness on adolescent health and well-being. J Paediatr Child Health. 1993; 29(1):S3–9. [PubMed: 8268019]

27. Sherwood NE, Wall M, Neumark-Sztainer D, Story M. Effect of socioeconomic status on weight change patterns in adolescents. Prev Chronic Dis. 2008; 6(1):A19. [PubMed: 19080025]

28. StataCorp. Stata Statistical Software. College Station, TX: StataCorp LP; 2013.

29. Newman SL, Tumin R, Andridge R, Anderson SE. Family meal frequency and association with household food availability in United States multi-person households: National Health and Nutrition Examination Survey 2007-2010. PloS One. 2015; 10(12):e0144330. [PubMed: 26636976]

30. Berge JM, Wall M, Neumark-Sztainer D, Larson N, Story M. Parenting style and family meals: cross-sectional and 5-year longitudinal associations. J Am Diet Assoc. 2010; 110(7):1036–1042. [PubMed: 20630160]

31. Trofholz AC, Tate AD, Draxten ML, Neumark-Sztainer D, Berge JM. Home food environment factors associated with the presence of fruit and vegetables at dinner: A direct observational study. Appetite. 2016; 96:526–532. [PubMed: 26527254]

32. Welsh JA, Sharma AJ, Grellinger L, Vos MB. Consumption of added sugars is decreasing in the United States. Am J Clin Nutr. 2011; 94(3):726–734. [PubMed: 21753067]

33. Bruening M, Eisenberg M, MacLehose R, Nanney MS, Story M, Neumark-Sztainer D. Relationship between adolescents' and their friends' eating behaviors: Breakfast, fruit, vegetable, whole-grain, and dairy intake. J Acad Nutr Diet. 2012; 112(10):1608–1613. [PubMed: 23017570]

34. Condon EM, Crepinsek MK, Fox MK. School meals: types of foods offered to and consumed by children at lunch and breakfast. J Am Diet Assoc. 2009; 109(2 Suppl):S67–78. [PubMed: 19166674]

Table 1

Proportion of adolescents in Project EAT 2010 having infrequent, occasional, and frequent family meals by sociodemographic characteristics and parenting practices (n=2491)[a]

	Family Meal Frequency, past week[b]			
	Infrequent (≤2 times)	Occasional (3-4 times)	Frequent (≥5 times)	p-value
	n=864	n=534	n=1093	
	%	%	%	
Adolescent Characteristics				
Sex, Female (n=2491)	37.3	20.8	41.9	0.01
School Level (n=2491)				
High School	37.9	23.0	39.1	<0.001
Middle School	30.6	19.5	49.9	
Race/Ethnicity (n=2484)				
White	27.2	20.8	52.0	<0.001
Black	39.9	20.9	39.3	
Hispanic	33.9	20.3	45.8	
Asian	32.1	25.3	42.6	
Mixed/Other	39.6	19.5	40.9	
Socio-economic Status (n=2427)				
Low	39.3	21.7	39.0	<0.001
Middle	33.5	20.8	45.7	
High	22.1	20.2	57.7	
Parenting Practices[c]				
Parent Communication, High (n=2479)	24.1	20.3	55.7	<0.001
Home Availability of Fruits & Vegetables, Usually/Always (n=2486)	32.0	20.8	47.3	<0.001
Home Accessibility of Fruits & Vegetables, Usually/Always (n=2485)	31.1	21.0	48.0	<0.001
Parents Model Fruit & Vegetable Intake, On a Regular Basis (n=2456)	30.2	21.0	48.8	<0.001
Parent Encouragement for Healthy Eating, Very Much (n=2456)	27.4	21.1	51.5	<0.001

[a] Project EAT (Eating and Activity in Teens) participants were adolescents recruited from Minneapolis/St.Paul middle and high schools during 2009/2010.

[b] Cell sizes vary due to a small amount of missing data for individual items; columns may not add to 100 due to rounding; Family meals based on 1-item assessing past week frequency of eating meals together with all or most of your family living in your house (never, 1-2, 3-4, 5-6, 7, or 7+ days/week).

[c] Parenting practice variables are dichotomous. Parent communication scale (score range=1-5) of 2-items assessing mother/father caring and comfort talking to parents about problems (1=not a lot, 2=a little, 3=somewhat, 4=quite a bit, 5=very much; High= a score of 4 or 5; Low is a score of 1-3); Home Availability based on 1-item assessing how frequently fruits and vegetables were available at home (1=never, 2=sometimes, 3=usually, 4=always); Home Accessibility based on 2-items assessing how frequently fruit was on counter, table or somewhere they could easily get it, and how often there were cut-up vegetables in the fridge (1=never, 2=sometimes, 3=usually, 4=always); Parent modeling based on 4-items

assessing if mother/father eats a lot of fruit and eats vegetables with dinner (1=never, 2=rarely, 3=sometimes, 4=on a regular basis), and scores were based on having a least one parent model fruit or vegetable intake on a regular basis; Parent encouragement based on 2-items assessing if mother/father encourages them to eat healthy foods (1=not at all, 2=a little, 3=somewhat, 4=very much), and scores were based on having at least one parent very much encouraging healthy eating.

Table 2

Individual and relative associations between parenting practices and adolescent fruit and vegetable intake among adolescent participants of Project EAT 2010[a]

Fruit and Vegetable Intake[b]

Parenting Practices[e]	Individual Models[c]			Mutually Adjusted Model[d]		
	Unstandardized regression coefficient (standard error)	p-value	Adjusted mean (standard error)	Unstandardized regression coefficient (standard error)	p-value	Adjusted mean (standard error)
Family Meals						
Infrequently (< 3 times/ week)	Ref		3.5 (0.1)	Ref		3.6 (0.1)
Occasional (3–4 times / week)	0.18 (0.12)	0.13	3.6 (0.1)	0.12 (0.12)	0.30	3.7 (0.1)
Frequent (5 times / week)	0.56 (0.10)	<0.001	4.0 (0.1)	0.36 (0.10)	0.001	3.9 (0.1)
Parent Communication						
Low	Ref		3.6 (0.1)	Ref		3.7 (0.1)
High	0.28 (0.09)	0.002	3.9 (0.1)	-0.01 (0.09)	0.95	3.7 (0.1)
Home Availability of Fruits & Vegetables						
Never/Rarely	Ref		3.0 (0.1)	Ref		3.5 (0.1)
Usually/Always	0.82 (0.12)	<0.001	3.9 (0.1)	0.29 (0.14)	0.04	3.8 (0.1)
Home Accessibility of Fruits & Vegetables						
Never/Rarely	Ref		3.1 (0.1)	Ref		3.4 (0.1)
Usually/Always	0.79 (0.11)	<0.001	3.9 (0.1)	0.47 (0.12)	<0.001	3.8 (0.1)
Parents Model Fruit & Vegetable Intake						
Never/Sometimes	Ref		3.3 (0.1)	Ref		3.5 (0.1)
On a Regular Basis	0.76 (0.09)	<0.001	4.0 (0.1)	0.45 (0.10)	<0.001	3.9 (0.1)
Parent Encouragement for Healthy Eating						
Never/Somewhat	Ref		3.3 (0.1)	Ref		3.5 (0.1)
Very Much	0.75 (0.09)	<0.001	4.1 (0.1)	0.46 (0.10)	<0.001	4.0 (0.1)

[a] Project EAT (Eating and Activity in Teens) participants were adolescents recruited from Minneapolis/St.Paul middle and high schools during 2009/2010.

[b] Coefficient represents the change in daily servings of fruits and vegetables with a one unit change in the independent variable adjusted for covariates (e.g., adolescents who have high parent communication consume 0.27 more servings of fruits and vegetables than adolescents who have low parent communication controlling for covariates).

[c] Individual models control for age, gender, socioeconomic status, race/ethnicity and energy intake

[d] Mutually adjusted model additionally controls for each independent variable

[e] Family meals based on 1-item assessing past week frequency of eating meals together with all or most of your family living in your house (never, 1-2, 3-4, 5-6, 7, or 7+ days/week); Parent communication scale (score range=1-5) of 2-items assessing mother/father caring and comfort talking to parents about problems (1=not a lot, 2=a little, 3=somewhat, 4=quite a bit, 5=very much; High= a score of 4 or 5; Low is a score of 1-3); Home Availability based on 1-item assessing how frequently fruits and vegetables were available at home (1=never, 2=sometimes, 3=usually, 4=always); Home Accessibility based on 2-items assessing how frequently fruit was on counter, table or somewhere they could easily get it, and how often there were cut-up vegetables in the fridge (1=never, 2=sometimes, 3=usually, 4=always); Parent modeling based on 4-items assessing if mother/father eats a lot of fruit and eats vegetables with dinner (1=never, 2=rarely, 3=sometimes, 4=on a regular basis), and scores were based on having a least one parent model fruit or vegetable intake on a regular basis; Parent encouragement based on 2-items assessing if mother/father encourages them to eat health foods (1=not at all, 2=a little, 3=somewhat, 4=very much), and scores were based on having at least one parent very much encouraging healthy eating.

Table 3

Adjusted mean fruit and vegetable intake (95% CI) by parenting practices and family meal frequency among adolescent participants of Project EAT 2010[a]

Parenting Practices[c]	Family Meal Frequency, past week[b]		
	Infrequent (2 times)	Occasional (3-4 times)	Frequent (5 times)
Parent Communication			
Low	3.5 (3.3-3.7) †‡	3.6 (3.3-3.8) †‡	3.7 (3.5-4.0) ‡
High	3.3 (3.1-3.6) †	3.7 (3.4-4.0) ‡	4.2 (4.0-4.3) $^{∥}$
Home Availability of Fruits & Vegetables			
Never/Rarely	3.0 (2.7-3.3) †	3.2 (2.7-3.6) †‡	3.0 (2.5-3.4) †
Usually/Always	3.6 (3.4-3.7) $^{‡∥}$	3.7 (3.5-3.9) $^{∥}$	4.1 (4.0-4.3) §
Home Accessibility of Fruits & Vegetables			
Never/Rarely	3.0 (2.7-3.3) †	3.3 (2.9-3.7) †‡	3.2 (2.8-3.5) †
Usually/Always	3.6 (3.5-3.8) ‡	3.8 (3.5-4.0) $^{∥}$	4.2 (4.0-4.3) §
Parents Model Fruit & Vegetable Intake			
Never/Sometimes	3.2 (2.9-3.4) †	3.3 (3.0-3.6) †	3.3 (3.0-3.6) †
On a Regular Basis	3.6 (3.4-3.8) ‡	3.9 (3.6-4.1) ‡	4.3 (4.2-4.5) $^{∥}$
Parent Encouragement for Healthy Eating			
Never/Somewhat	3.3 (3.1-3.5) †	3.3 (3.0-3.5) †	3.5 (3.3-3.7) †‡
Very Much	3.6 (3.4-3.9) ‡	4.0 (3.8-4.3) $^{∥}$	4.4 (4.2-4.6) §

^{a}Project EAT (Eating and Activity in Teens) participants were adolescents recruited from Minneapolis/St.Paul middle and high schools during 2009/2010.

^{b}Mean values are based on five individual linear regression models adjusted for age, gender, ses, ethnicity and energy intake run separately for each of the five parenting practices listed in column one; Family meals based on 1-item assessing past week frequency of eating meals together with all or most of your family living in your house (never, 1-2, 3-4, 5-6, 7, or 7+ days/week).

^{c}Parenting practice variables are dichotomous. Parent communication scale (score range=1-5) based on 2-items assessing mother/father caring and comfort talking to parents about problems (1=not a lot, 2=a little, 3=somewhat, 4=quite a bit, 5=very much; High= a score of 4 or 5; Low is a score of 1-3); Home Availability based on 1-item assessing how frequently fruits and vegetables were available at home (1=never, 2=sometimes, 3=usually, 4=always); Home Accessibility based on 2-items assessing how frequently fruit was on counter, table or somewhere they could easily get it, and how often there were cut-up vegetables in the fridge (1=never, 2=sometimes, 3=usually, 4=always); Parent modeling based on 4-items assessing if mother/father eats a lot of fruit and eats vegetables with dinner (1=never, 2=rarely, 3=sometimes, 4=on a regular basis), and scores were based on having a least one parent model fruit or vegetable intake on a regular basis; Parent encouragement based on 2-items assessing if mother/father encourages them to eat health foods (1=not at all, 2=a little, 3=somewhat, 4=very much), and scores were based on having at least one parent very much encouraging healthy eating.

$^{†‡∥§}$Mean values with different symbol superscripts within each parenting practice family meal frequency combination (comparing 6 values; across rows and columns) represent a statistically significant difference at p<0.05 (e.g., mean fruit and vegetable intake is significantly different when comparing infrequent, occasional and frequent family meals when parent communication is high; when comparing low and high parent communication when family meals are frequent; and when comparing the combination of frequent family meals and high parent communication with any of the other combinations).