



**California Center for Population Research**  
**University of California - Los Angeles**

## **Family Environment, Nutrition and Child Adiposity**

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FAMILY ENVIRONMENT AND CHILD ADIPOSITY

## **ABSTRACT**

**Background:** Family environment may play an important role in child obesity development.

**Objectives:** To determine if frequency of eating family dinner and frequency of fast food consumption are associated with nutrient profile; and examine associations of selected subscales of the Moos Family Environment Scale (FES) with BMI.

**Methods:** We analyzed data from the longitudinal NHLBI Growth and Health Study (N  $\approx$  2,400 Black and White girls aged 9-10 years at entry). Relevant data included Body Mass Index, nutrient intakes, frequency of eating family dinner, frequency of eating fast food, and physical activity measured annually during the first five years of the study; and the FES administered in the third year. Data were analyzed using multiple linear regression; longitudinal data were analyzed using a mixed effects model.

**Results:** Longitudinal analysis: Among White but not Black girls, those who ate family dinner usually were more likely to be eating fast food infrequently (less than once a week). Eating family dinner usually and eating fast food less than once a week were associated with a healthier nutrient profile, adjusting for age, race, parental education and energy intake. Cross-sectional analysis: The organization subscale of the FES was associated with lower BMI ( $p < .01$ ), independent of nutrient profile and physical activity.

**Conclusion:** Eating family dinner is associated with less frequent fast food consumption and a healthier nutrient profile. However, child obesity interventions may need to consider various dimensions of the family environment that influence dietary and physical activity behaviors.

**Key words:** family environment      family dinner      fast food      nutrition      child obesity

## INTRODUCTION

There is an urgency to address the global child obesity crisis (1-3). In the United States, interventions targeting children and adolescents have mostly been school-based (4). However, family interventions are likely to also be helpful. A recent editorial discusses the role of family dinner in improving the health of children and adolescents (5). Eating family dinner is associated with healthier eating habits (5-11) and lower overweight risk in children and adolescents (12,13), and higher diet quality later in life (11). What is the mechanism by which family dinner influences obesity risk?

Family dinner may provide a daily opportunity for adults to model healthy eating behaviors. Yet, it could be argued that frequency of eating family dinner may be a marker for characteristics of the family environment. Moos and Moos (14) have developed a conceptual model to describe the family environment in terms of three dimensions, each of which is assessed by subscales: (1) *relationship* assessed by cohesion, expressiveness, and conflict; (2) *personal-growth* assessed by independence, achievement orientation, intellectual-cultural orientation, active-recreational orientation, moral-religious emphasis, and (3) *system-maintenance* assessed by organization and control. We speculate that some of these subscales measure aspects of the family environment that may influence eating and physical activity behavior. In particular, families that are more cohesive and experience less conflict may spend more time together including mealtime. Further, children raised in non-controlling and non-coercive family environments may be better able to self-regulate the amount of food consumed (15). Such family environments generally value independence although the implications of control and coercion within the family context may vary with culture (16). Finally, families that are more organized may be more likely to find the

time to prepare a dinner meal and experience dinner together; such families may also be eating fast food less frequently. Higher frequency of fast food consumption has been associated with higher BMI in adults (17).

In a previous study using data from the National Heart, Lung, and Blood Institute Growth and Health Study (NGHS), it was found that frequent consumption of fast food was related to higher energy intake, percent of calories from total and saturated fat, and sodium intake (18). This study will also use data from the NGHS (19) to describe race and age variations in frequency of eating family dinner and fast food consumption, and test the following hypotheses for each race, to better understand the role of family environment in obesity development:

- Frequency of eating family is inversely associated with frequency of fast food consumption.
- Girls who frequently eat family dinner have higher intakes of fiber, vitamin C, calcium, and folate, and lower intakes of total fat and saturated fat.
- Girls who frequently eat fast food have lower intakes of fiber, vitamin C, calcium, and folate, and higher intakes of total fat and saturated fat.
- Girls who live in family environments that score lower on conflict and control and higher on cohesion, independence, and organization have lower BMI.

## **METHODS**

### **Data source**

We used existing data collected by the NGHS, a three-center longitudinal study conducted between 1986 and 1997 to examine early life risk factors for obesity development. A total of 1,213 Black girls and 1,166 White girls, aged 9-10 years, were recruited from geographic areas

close to the three examination centers. The protocol for the NGHS was approved by the institutional review boards at each site. A detailed description of the study has been reported previously (19).

Relevant NGHS data were mostly gathered annually during the first five years of the study. The exception was family environment which was assessed by all three centers, in the same year, only at the third examination. Hence, any analysis involving use of the family environment assessments will be limited to data collected at the third examination.

### **Relevant variables**

Age was defined as age at the date of examination. Race was defined based on self reports. Frequency of eating family dinner was operationally defined by categorical responses to the statement, “*I eat with my parent(s),*” gathered by questionnaire in the first three years of the NGHS. This statement was revised to, “*I eat dinner or supper with my parent(s)*” in the fourth and fifth years of the NGHS. (By the sixth year of the study, NGHS had stopped gathering information on eating family dinner.) The three responses were: *Never or Almost Never, Sometimes, Usually or Always*. For analytical purposes, the first two responses (*Never or Almost Never, and Sometimes*) were combined to create a dichotomous variable ‘eating family dinner usually/always’ (yes/no). For the rest of this paper, this dichotomous variable will be referred to as ‘eating family dinner usually’.

Frequency of fast food consumption was defined by categorical responses (*Never or less than once/week, 1-3 times/week, 4-7 times/week, and 8 or more times/week*) to a question asking the participants how often they ate fast food each week. Fast food was defined as food from a place like McDonald’s, Kentucky Fried Chicken or Pizza Hut, “eaten there or carried out”. These

responses were combined to create a dichotomous variable, 'eating fast food less than once a week' (yes/no).

Healthy dietary behavior was operationally defined by nutrients selected to indicate consumption of foods that are good sources of essential micronutrients specifically fruits, vegetables and dairy products, as well as foods that are high in fat and sugar. These nutrients – fiber, vitamin C, folate, calcium, total fat, saturated fat and sugar – were estimated from 3-day food records. They were analyzed as separate variables and also as one index variable. The latter was created by summing the quintile rankings of each nutrient into an index of nutrient intake [= (sum of quintile rankings for fiber, vitamin C, folate, calcium) – (sum of quintile rankings for % saturated fat from kcal, % total fat from kcal, and sugar)]. As illustrated in the Appendix, a higher nutrient intake index indicates a healthier nutrient profile.

Family environment was assessed using the FES, which consists of ten subscales (10,11). For the purposes of this study, we examined the cohesion, conflict, independence, control, and organization subscales, which respectively measure the extent to which:

- a. family members are committed to the family and are helpful and supportive;
- b. there is open expression of anger, aggression and conflictual interactions within the family;
- c. family members have autonomy;
- d. there are hierarchical and rigid rules and procedures; and
- e. there is organization and structuring of family activities and financial planning, and explicitness and clarity of rules and responsibilities.

This family environment assessment was completed by one or both parents/guardians. When both parents/guardians completed the assessment, their scores were averaged. At the third examination, 1041 assessments were completed by only mothers or female guardians; 117 by only fathers or male guardians, and 464 by both parents/guardians.

BMI ( $\text{weight}/\text{height}^2$ ) was calculated from measured weight (kg) and height (cm), and was expressed as BMI z-scores (<http://www.cdc.gov/nccdphp/dnpa/growthcharts/resources/sas.htm>).

### **Potential confounders**

Socioeconomic status was assessed by the education of the parent/guardian with the higher level of education if the participant lived with both parents/guardians. Pubertal maturation, which may confound associations with adolescent BMI, was assessed using a modification of Tanner staging (19). Physical activity was assessed using self reports of habitual activities; scores were derived using metabolic equivalent values and time estimates (20).

### **Statistical analysis**

Summary measures of BMI and nutrient intakes were stratified by race and parental education, which have been shown to be associated with weight status and diet (21-26). Race differences in, and associations between, frequency of eating family dinner, and frequency of fast food consumption, were assessed using the  $\chi^2$  test; the Cochran-Armitage trend test was used to evaluate age trends.

To examine associations of frequency of eating family dinner and frequency of fast food consumption with nutrient intakes, we used a mixed effects model to analyze the annual data gathered during the first five years of the study. Age, race, and socioeconomic status have been shown to be predictors of nutrient intake (23,25, 26) and were adjusted for in the analyses. Since

race may modify relations between health-related behaviors and health outcomes, interactions with race were examined.

To examine associations of selected FES subscales with frequency of eating family dinner and frequency of fast food consumption, we performed a two-way ANOVA adjusted for race. Finally, to investigate the associations of family environment with BMI, independent of frequency of eating family dinner and fast food, and to determine the mediating effect of nutrient intakes, we built a series of regression models that progressively included the variables of interest; pubertal stage, race, parental education, and physical activity were potential confounders and included in all regression equations. BMI was expressed as BMI z scores (BMIz). These analyses involving subscales of the family environment were conducted only at the third examination. For all analyses, p values of less than 0.05 were considered significant; p values greater or equal to 0.05 but less than 0.10 were considered marginally significant.

## **RESULTS**

### Participant characteristics

Racial and socioeconomic differences in BMI and nutrient intakes among NGHS participants have been reported previously (21-26) and are shown in Table 1 for reference purposes.

### Eating dinner with family, fast food consumption, and nutrient intakes

#### *Sociodemographic and age influences*

Proportionately more White than Black girls ate family dinner usually (76.6% vs. 45.7%), and ate fast food less than once a week (58.6% vs. 43.6%). Parental education differences in

frequency of eating family dinner and fast food are shown in Table 1. The higher was parental education, the greater the proportion of girls who ate family dinner usually ( $p < .0001$ ).

The proportion of girls who ate family dinner usually decreased with age among both Black and White girls. The proportion of girls who ate fast food less than once a week decreased with age among Black girls but not White girls (Figure 1).

White girls who ate family dinner usually were more likely to eat fast food less than once a week; this was observed at all ages examined (Figure 2). In contrast, this association was not observed among Black girls.

#### *Associations with nutrient intakes*

Among White girls, after adjusting for age and parental education, ‘eating family dinner usually’ was observed to be associated with higher vitamin C intake, sugar intake, and nutrient intake index, and with lower total fat intake. Among Black girls, ‘eating family dinner usually’ was significantly associated with lower total fat intake and a higher nutrient intake index (Table 2).

‘Eating fast food less than once a week’ was associated with higher intakes of fiber and micronutrients (namely, vitamin C, folate and calcium), and a lower intake of saturated fat among White girls. Among Black girls, with the exception of folate, these associations (between eating fast food less than once a week and nutrient intakes) were observed to be weaker and were generally not statistically significant.

#### *Associations with family environment*

Girls who ate dinner with their families usually had slightly higher cohesion (4% higher) and organization (2.4% higher) scores as reported by their parents ( $p < .05$ ). Frequency of eating fast

food was not associated with the family environment subscales examined (data not shown).

### Family environment and BMI

The effects of family environment on BMI were analyzed by building a series of regression models; interactions with race were not found to be significant and were excluded from the final models. Results are shown in Table 3. In Model I, 'eating family dinner usually' was marginally associated with lower BMIz ( $p < 0.10$ ) but 'eating fast food less than once a week' was not associated with BMIz.

In Model II, when nutrient intake index was included in the regression equation, the coefficient for eating family dinner usually was no longer significant, suggesting that nutrient profile may mediate the effect of eating family dinner usually. In Model III, when the family environment subscales were added, one at a time, the 'organization' subscale was found to be significantly associated with BMIz, independent of frequency of eating family dinner and fast food, and nutrient profile ( $p < .01$ ).

## **DISCUSSION**

The current child obesity epidemic has resulted in increased interest in family environmental influences on children's eating behaviors (5, 27, 28). One important aspect of eating behavior is the family meal. While Gillespie and Achterberg (7) have suggested that eating together may encourage family conversations about healthy eating habits, it is possible that frequent eating family dinner may be associated with a lower frequency of eating fast food, or that it is a marker for family environment in general.

Our analysis of longitudinal data, combined with findings from other studies (5-11), provide evidence for the role of eating family dinner in improving nutrition. Both eating family dinner usually and eating fast food less than once a week were observed to be associated with healthier nutrient intakes in general; the exception was sugar which was higher in White girls who ate family dinner usually. Utter et al. found no relation between frequency of family meals and consumption of high fat/high sugar foods in New Zealand adolescents (9).

We had hypothesized that family environments scoring lower on conflict and control and higher on cohesion, independence, and organization may be associated with lower BMI. We found, after considering pubertal stage, race, parental education, physical activity, nutrient intakes, eating family dinner, and eating fast food as covariates, that only the family environment organization subscale was independently associated with BMI (positively). In a study of over 350 working mothers of young children, Pratt and Doyle found few significant associations between family environment and nutrient intakes (29). However, this study was conducted in the 1980s and examined very young children.

We speculate that children living in more organized family environments not only eat dinner with the family more often and eat healthier but are also less likely to be exposed to other obesity risk factors such as excessive television watching. In a recent study of over 3,000 New Zealander adolescents, frequency of family meals was associated with many positive aspects of the home food environment and behaviors such as parental support for healthy eating and limits on television watching (9). The findings of our study add to this observation by suggesting that more organized family environments may allow for or support practices and behaviors that promote healthy behaviors in children such as preparing healthy foods for dinner.

Age and race are associated with family meals and fast food consumption. The proportion of Black girls that ate family dinner usually, decreased with age as did the proportion that ate fast food less than once a week. The latter observation is consistent with the findings of an earlier study of the NGHS cohort which showed that fast food consumption increased with age throughout adolescence (18). Interestingly, while an association between eating family dinner usually and eating fast food less than once a week was observed at all ages among White girls, this association was not observed among Black girls. Among Black girls, more than 50% ate fast food one or more times a week regardless of how often they ate dinner with the family. Eating fast food less than once a week was associated with increased intakes of fiber, vitamin C, folate and calcium as well as decreased intake of saturated fat. Further research to examine the pathways by which family environment influences obesity risk in different socio-demographic groups is warranted.

We acknowledge several limitations of our study. First, despite the availability of longitudinal data, our analysis of the contribution of family environment to BMI was limited by the use of data gathered only in the third year of the NGHS. Second, while the FES has been used in other studies involving African American families (30,31), it was originally developed using a sample of White middle class families. Further, the FES was completed by mothers (or female guardians) as well as fathers (or male guardians) who may differ in their perceptions of their family environments. (Analysis of the data using family environment assessments completed by only mothers or female guardians revealed similar findings.) Finally, while our analyses involved many outcome variables, we did not adjust for multiple comparisons. Instead,

we showed p values for all comparisons allowing readers to make their own interpretations.

Rothman has argued against the need for adjusting for multiple comparisons (32).

To our knowledge, this is one of the first studies to document the contribution of different aspects of the family environment to weight status in a large sample of girls. In 1984,

Kirschenbaum et al reported that obese children in less organized families were more likely to drop out of treatment, and that those in supportive but unstructured families were less likely to

lose weight (33). More recently, in a study of 149 youth aged 8-16 years and their families, mothers of obese youth reported greater family conflict and psychological distress (34).

The findings of our current study clearly indicate a need for interdisciplinary efforts in designing interventions to prevent child obesity. They confirm that eating family dinner is associated with

less frequent consumption of fast food and a healthier nutrient profile. They also suggest that

other characteristics of the family environment may influence child obesity risk. The relation

between family environment and child obesity risk may be mediated by factors that we did not examine – the types of food available in the home (9,35), time and effort spent in preparing

meals from fresh produce and meats, time spent by children on sedentary activities such as TV watching (36,37), and chronic stresses (38) that may result from living in a disorganized

environment. Our findings have particular significance at a time when family structure is

changing rapidly, and society is experiencing an increase in the number two- working-parent

families, as well as single-parent families (39). Perhaps, to address child obesity, policy changes

made at the societal level to affect changes in the family environment, need to be considered.

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## REFERENCES

1. Hedley AA, Ogden CL, Johnson CL, Carroll MD, Curtin LR, Flegal KM. Overweight and obesity among US children, adolescents, and adults, 1999-2002. *JAMA* 2004; **291**: 2847-50.
2. Ogden CL, Carroll MD, Curtin LR, McDowell MA, Tabak CJ, Flegal KM. Prevalence of overweight and obesity in the United States, 1999-2004. *JAMA* 2006; **295**: 1549-1555.
3. Cali AM, Caprio S. Obesity in children and adolescents. *J Clin Endocrinol Metab.* 2008; **93** (11 Suppl 1):S31-6. Review.
4. Story M, Nannery MS, Schwartz MB. Schools and Obesity Prevention: Creating School Environments and Policies to Promote Healthy Eating and Physical Activity. *Milbank Q* 2009; **87**:71-100.
5. Rockett HR. Family dinner: more than just a meal. *J Am Diet Assoc* 2007; **107**:1498-501.
6. Gillman MW, Rifas-Shiman SL, Frazier, L, et al. Family dinner and diet quality among older children and adolescents. *Arch Fam Med* 2000; **9**: 235-240.
7. Gillespie AH, Achterberg CL. Comparison of family interaction patterns related to food and nutrition. *J Am Diet Assoc* **1989**; 89: 509-12.
8. Woodruff SJ, Hanning RM. Effect of meal environment on diet quality rating. *Can J Diet Pract Res* **2009**;70:118-24.

9. Utter J, Scragg R, Schaaf D, Mhurhu CN. Relationships between frequency of family meals, BMI and nutritional aspects of the home food environment among New Zealand adolescents. *Int J Behavioral Nutrition Physical Activity* **2008**; 5:50-56.
10. Burgess-Champoux TL, Larson N, Neumark-Sztainer D, Hannan PJ, Story M. Are family meal patterns associated with overall diet quality during the transition from early to middle adolescence? *J Nutr Educ Behav.* 2009;41:79-86.
11. 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**:1502-10.
12. Taveras EM, Rifas-Shiman SL, Berkey CS, Rockett HR, Field AE, Frazier AL, Colditz GA, Gillman MW. Family dinner and adolescent overweight. *Obes Res* 2005; **13**: 900-06.
13. Sen B. Frequency of family dinner and adolescent body weight status: evidence from the National Longitudinal Survey of Youth, 1997. *Obesity (Silver Spring)* 2006; **14**:2266-76.
14. Moos RH. Conceptual and empirical approaches to developing family-based assessment procedures: resolving the case of the Family Environment Scale. *Family Process* 1990; 29: 199-208; discussion 209-11.
15. Birch LL, Fisher JO. Development of eating behaviors among children and adolescents. *Pediatrics* 1998; 1010 (3 Pt 2): 539-49 [Review].
16. Hughes SO, Power TG, Orlet Fisher J, Mueller S, Nicklas TA. Revisiting a neglected construct: parenting styles in a child-feeding context. *Appetite* 2005; **44**: 83-92.
17. Duffey KJ, Gordon-Larsen P, Jacobs DR Jr, Williams OD, Popkin BM. Differential associations of fast food and restaurant food consumption with 3-y change in body mass

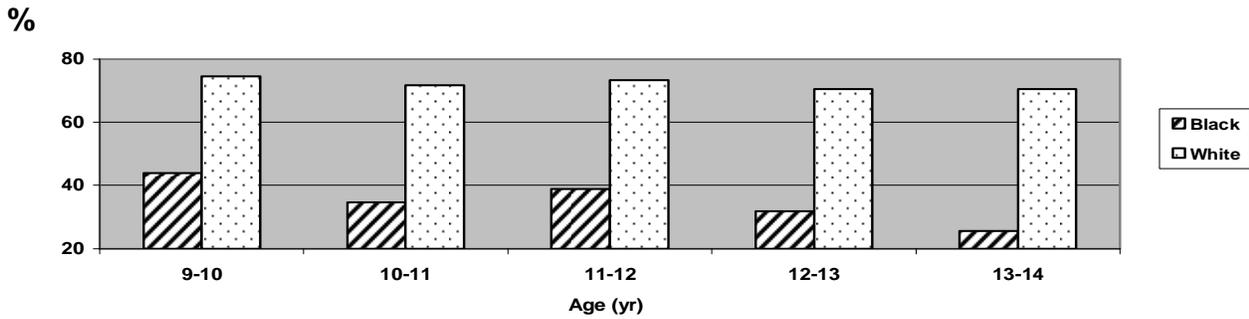
- index: the Coronary Artery Risk Development in Young Adults Study. *Am J Clin Nutr* 2007; **85**:201-8.
18. Schmidt M, Affenito SG, Striegel-Moore R, Khoury PR, Barton B, Crawford P, et al. Fast-food intake and diet quality in black and white girls: the National Heart, Lung, and Blood Institute Growth and Health Study. *Arch Pediatr Adolesc Med* 2005;**159**:626-31
19. NHLBI Growth and Health Study Group. Obesity and cardiovascular disease risk factors in black and white girls: the NHLBI Growth and Health Study. *Am J Public Health* 1992; **82**: 1613-20.
20. Kimm SYS, Glynn NW, Kriska A, Fitzgerald SJ, Aaron DJ, Similo SL, Barton BA. Longitudinal assessment of physical activity from childhood through adolescence. *Med Sci Sports Exer* 2000;**32**:1445-54.
21. Affenito SG, Thompson DR, Franko DL, Striegel-Moore RH, Daniels SR, Barton BA, Schreiber GB, Schmidt M, Crawford PB. Longitudinal assessment of micronutrient intake among African-American and white girls: The National Heart, Lung, and Blood Institute Growth and Health Study. *J Am Diet Assoc* 2007;**107**: 1113-23.
22. Kimm SY, Obarzanek E, Barton BA, Aston CE, Similo SL, Morrison JA, et al. Race, socioeconomic status, and obesity in 9- to 10-year-old girls: the NHLBI Growth and Health Study. *Ann Epidemiol* 1996; **6**: 266-75.
23. McNutt SW, Hu Y, Schreiber GB, Crawford PB, Obarzanek E, Mellin L. A longitudinal study of the dietary practices of black and white girls 9 and 10 years old at enrollment: the NHLBI Growth and Health Study. *J Adolesc Health* 1997; **20**: 27-37.

24. Kimm SY, Barton BA, Obarzanek E, McMahon RP, Sabry ZI, Waclawiw MA, et al. Racial divergence in adiposity during adolescence: The NHLBI Growth and Health Study. *Pediatrics* 2001;**107**: E34.
25. Kronsberg SS, Obarzanek E, Affenito SG, Crawford PB, Sabry ZI, Schmidt M, et al. Macronutrient intake of black and white adolescent girls over 10 years: the NHLBI Growth and Health Study. *J Am Diet Assoc* 2003;**103**: 852-60.
26. Crawford PB, Obarzanek E, Schreiber GB, Barrier P, Goldman S, Frederick MM, et al. The effects of race, household income and parental education on nutrient intakes of 9- and 10-year-old girls: NHLBI Growth and Health Study. *Annals of Epidemiol* 1995; **5**: 360-368.
27. Ritchie LD, Welk G, Styne D, Gerstein DE, Crawford PB. Family environment and pediatric overweight: what is a parent to do? *J Am Diet Assoc* 2005;**105**(5 Suppl 1): S70-9. Review.
28. Birch LL, Davison KK. Family environmental factors influencing the developing behavioral controls of food intake and childhood overweight. *Pediatr Clin North Am* 2001; **48**: 893-907. Review.
29. Pratt C & Doyle M. Nutrient Intake of Working Mothers: Relationships with the Family Environment. *Home Economics Research Journal* 1988; **16**: 247-54.
30. Brinson JA. A comparison of the family environments of black male and female adolescent alcohol users. *Adolescence* 1991; **26**:877-84.
31. Dancy BL & Handal PJ. Effect of gender and age on family climate scores of Black adolescents and preliminary norms. *Psychological Reports* 1981; **48**: 755-57.
32. Rothman KJ. No adjustments are needed for multiple comparisons. *Epidemiology* 1990; **1**:43-6.

33. Kirschenbaum DS, Harris ES, Tomarken AJ: Effects of parental involvement in behavioral weight loss therapy for preadolescents. *Behaviour Therapy* 1984; **15**: 485–500.
34. Zeller MH, Reiter-Purtill J, Modi AC, Gutzwiller J, Vannatta K, Davies WH. Controlled study of critical parent and family factors in the obesogenic environment. *Obesity (Silver Spring)* 2007; **15**:126-36
35. Campbell JJ, Crawford DA, Salmon J, Carver A, Garnett SP, Baur LA. Associations between the home food environment and obesity-promoting eating behaviors in adolescence. *Obesity (Silver Spring)* 2007; **15**: 719-30.
36. van Zutphen M, Bell AC, Kremer PJ, Swinburn BA. Association between the family environment and television viewing in Australian children. *J Paediatr Child Health* 2007; **43**:458-63.
37. Patrick H, Nicklas TA. A review of family and social determinants of children's eating patterns and diet quality. *J Am Coll Nutr* 2005; **24**:83-92.
38. Björntorp P, Rosmond R. Obesity and cortisol. *Nutrition*. 2000;**16**:924-36.
39. U.S. Department of Health and Human Services. Trends in the well-being of America's children and youth 2001. Available at: <http://aspe.hhs.gov/hsp/01trends/index.htm> (accessed Sep 2, 2009).

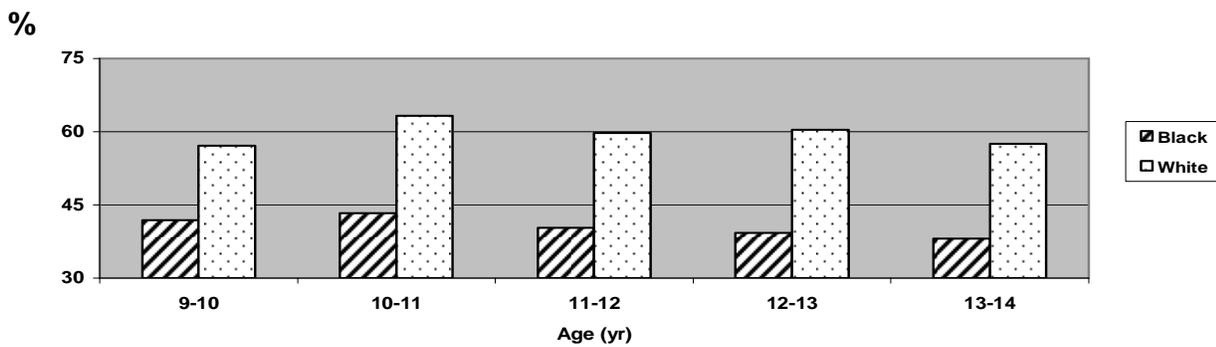
FIGURE 1: Frequency of eating family dinner and fast food by race and age

Percent who eat family dinner usually by race and age<sup>1</sup>



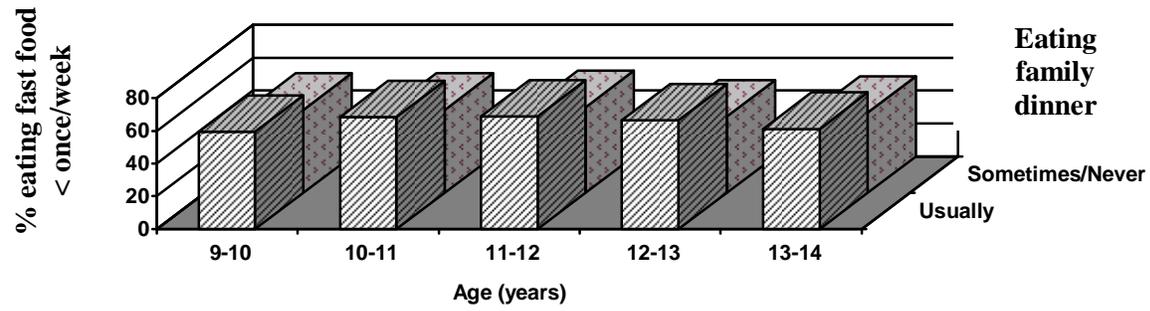
<sup>1</sup> Trend for decreasing percent of girls who ate dinner with their parents as the girls got older is significant for both Whites ( $p < .01$ ) and Blacks ( $p < .0001$ ).

Percent who report eating fast food less than once a week by race and age<sup>2</sup>



<sup>2</sup> Trend for decreasing percent of girls who ate fast food less than once a week as the girls got older is significant only for Blacks ( $p < .05$ )

FIGURE 2: White girls who ate dinner with their family usually were more likely to eat fast food less than once a week <sup>1,2</sup>



<sup>1</sup>Assessed using the  $\chi^2$  test

<sup>2</sup>  $p < .01$

TABLE 1: Participant characteristics by race and parental education at baseline (9-10 yr)

		High school or less (N=510)	Some college (N=840)	College degree (N=796)
		<i>Mean±S.D.</i>		
BMI (kg/m <sup>2</sup> )	Total <sup>a</sup>	18.8±4.0	18.9±3.9	18.1±3.5
	Black	18.9±4.2	19.3±4.2	19.3±4.3
	White	18.5±3.8	18.2±3.3	17.5±3.0
Energy intake (kcal)	Total	1830±532	1826±592	1833±454
	Black	1851±562	1853±653	1875±518
	White	1801±484	1786±484	1815±423
Fiber (g)	Total	10.9±4.7	11.5±5.2	12.0±4.5
	Black	10.9±4.8	11.6±5.5	11.8±4.5
	White	10.9±4.6	11.3±4.7	12.1±4.5
Vitamin C (mg)	Total	79±51	84±55	103±80
	Black	85±57	90±56	102±64
	White	71±38	75±51	103±86
Folate (µg)	Total	228±113	226±115	248±116
	Black	228±113	223±116	238±112
	White	228±116	230±114	253±118
Calcium (mg)	Total	792±294	772±323	857±319
	Black	732±284	709±314	727±281
	White	880±287	866±316	913±318
Saturated fat (g)	Total	28.2± 9.9	27.7±11.2	27.2± 9.2
	Black	27.9±10.0	27.7±12.0	27.5±10.4
	White	28.6±9.7	27.6±9.9	27.1±8.7
Total fat (g)	Total	74.7±25.4	74.6±29.2	71.2±22.5
	Black	75.9±26.7	76.7±32.2	75.7±26.7
	White	72.8±23.3	71.5±23.5	69.3±20.2
Sugar (g)	Total	115±48	113±46	123±45
	Black	116±54	113±49	121±48
	White	114±40	113±42	123±44
Nutrient intake index	Total	1.00±4.26	1.32±4.33	2.85±4.33
	Black	0.99±4.22	1.17±4.41	1.96±4.30
	White	1.02±4.32	1.54±4.20	3.22±4.30
		<i>Percent</i>		
Eat family dinner usually	Total	55.3	54.1	72.5
	Black	44.1	42.9	54.3
	White	73.2	72.4	80.4
Eat fast food < once/wk	Total	44.6	47.2	59.7
	Black	42.6	42.8	47.0
	White	47.7	54.5	65.2

<sup>a</sup> N = 2,146 (Blacks = 1,102; Whites = 1,044); Ns may vary slightly due to missing values

TABLE 2: Regression coefficients and standard errors for frequency of eating family dinner and frequency of eating fast food with selected nutrient intakes as outcome variables<sup>1,2</sup>

	Total fiber (g)	Vitamin C (mg)	Folate (µg)	Calcium (mg)	Total fat (g)	Saturated fat (g)	Sugar (g)	Nutrient intake index <sup>2</sup>
Eating family dinner usually <sup>3</sup> :								
White	0.11±0.13	7.44* ±3.31	-0.3±4.0	7.56±8.96	-0.98* ±0.41	-0.29±0.19	3.36** ±1.14	0.38** ±0.14
Black	0.21±0.11	4.35 ±2.94	6.7±3.5	19.50±7.87	-1.06** ±0.36	-0.36±0.17	-0.38 ±1.00	0.53*** ±0.10
Eating fast food < once/wk <sup>4</sup> :								
White	0.50*** ±0.12	5.94* ±3.00	15.3*** ±3.6	32.50*** ±8.21	-0.98±0.41	-0.50** ±0.18	-0.55 ±1.04	0.67*** ±0.13
Black	0.26* ±0.11	4.10 ±2.86	13.1*** ±3.4	-3.02 ±7.62	-0.27±0.35	-0.29 <sup>§</sup> ±0.16	-2.19* ±0.97	0.39*** ±0.12

<sup>1</sup> Available data gathered annually during the first 5 years of the study were analyzed using a mixed effects regression model that included age, race, parental education, and energy intake as independent variables and the interaction terms: race X eating family dinner usually, and race X eating fast food < once/wk. Numbers shown represent regression coefficient ± S.E. estimated from main effects and interaction terms.

<sup>2</sup> = (sum of quintile rankings for fiber, vitamin C, folate, calcium) – (sum of quintile rankings for % saturated fat from kcal, % total fat from kcal, and sugar)

<sup>3</sup> Compared to eating family dinner less often

<sup>4</sup> Compared to eating fast food more frequently

\*\*\*\* P<.0001; \*\*\* P<.001; \*\* P<.01; \* P<.05; <sup>§</sup> P<.10

TABLE 3: Association of the Moos' 'organization' subscale with BMI z score (BMIz) <sup>1,2</sup>

Independent variables	Regression coefficient $\pm$ S.E.		
	Model I (N=1408)	Model II (N=1408)	Model III (N=1408)
Pubertal stage <sup>3</sup>	0.23 <sup>****</sup> $\pm$ 0.02	0.23 <sup>****</sup> $\pm$ 0.02	0.23 <sup>****</sup> $\pm$ 0.02
Race (Black =1; White =0)	0.08 $\pm$ 0.05	0.11 <sup>*</sup> $\pm$ 0.05	0.12 <sup>§</sup> $\pm$ 0.07
Parental education			
< high school	0.11 $\pm$ 0.06	0.10 $\pm$ 0.06	0.16 <sup>*</sup> $\pm$ 0.08
HS but < college degree	0.16 <sup>**</sup> $\pm$ 0.05	0.14 <sup>*</sup> $\pm$ 0.05	0.18 <sup>**</sup> $\pm$ 0.06
Eating family dinner usually <sup>a</sup>	-0.09 <sup>§</sup> $\pm$ 0.04	-0.07 $\pm$ 0.05	-0.02 $\pm$ 0.06
Eating fast food < once/week	-0.007 $\pm$ 0.045	-0.006 $\pm$ 0.46	-0.005 $\pm$ 0.06
Physical activity	-0.25 <sup>****</sup> $\pm$ 0.04	-0.25 <sup>****</sup> $\pm$ 0.04	-0.33 <sup>****</sup> $\pm$ 0.05
Index of nutrient intake <sup>b</sup>	--	-0.008 $\pm$ 0.005	-0.01 <sup>§</sup> $\pm$ 0.006
Organization dimension of the Moos' Family Environment Scale <sup>b</sup>	--	--	-0.007 <sup>**</sup> $\pm$ 0.002

<sup>1</sup> Using multiple linear regression

<sup>2</sup> Data from visit 3 (ages 11-12 years) only

\*\*\*\* P<.0001; \*\*\* P<.001; \*\* P<.01; \* P<.05; § P<0.10

<sup>3</sup> Pubertal stage was assessed using a modification of Tanner staging (19)

## APPENDIX

### Calculation of the Nutrient Intake Index

An example:

	Dietary Intake	Quintile ranking
Dietary fiber	8.59 g	1
Vitamin C	82.4 mg	2
Folate	180 mcg	1
Calcium	851 mg	3
Saturated fat (% of energy)	16%	4
Total fat (% of energy)	35%	2
Sugar	82 g	1

Nutrient Intake Index = (sum of quintile rankings for fiber, vitamin C, folate, calcium) – (sum of quintile rankings for % saturated fat from kcal, % total fat from kcal, and sugar)

$$= (1+2+1+3) - (4+2+1) = 0$$

Note: The higher the nutrient intake index, the healthier the nutrient profile.

The index can take on values that range from -11 [= (1+1+1+1) – (5+5+5)]

to 17 [= (5+5+5+5) – (1+1+1)]