

Relationships Between Use of Television During Meals and Children's Food Consumption Patterns

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ABSTRACT. *Objective.* We examined relationships between the presence of television during meals and children's food consumption patterns to test whether children's overall food consumption patterns, including foods not normally advertised, vary systematically with the extent to which television is part of normal mealtime routines.

Methods. Ninety-one parent-child pairs from suburbs adjacent to Washington, DC, recruited via advertisements and word of mouth, participated. Children were in the fourth, fifth, or sixth grades. Socioeconomic data and information on television use were collected during survey interviews. Three nonconsecutive 24-hour dietary recalls, conducted with each child, were used to construct nutrient and food intake outcome variables. Independent sample *t* tests were used to compare mean food and nutrient intakes of children from families in which the television was usually on during 2 or more meals (*n* = 41) to those of children from families in which the television was either never on or only on during one meal (*n* = 50). Multiple linear regression models, controlling for socioeconomic factors and other covariates, were used to test strength of associations between television and children's consumption of food groups and nutrients.

Results. Children from families with high television use derived, on average, 6% more of their total daily energy intake from meats; 5% more from pizza, salty snacks, and soda; and nearly 5% less of their energy intake from fruits, vegetables, and juices than did children from families with low television use. Associations between television and children's consumption of food groups remained statistically significant in multiple linear regression models that controlled for socioeconomic factors and other covariates.

Children from high television families derived less of their total energy from carbohydrate and consumed twice as much caffeine as children from low television families. There continued to be a significant association between television and children's consumption of caffeine when these relationships were tested in multiple linear regression models.

Conclusion. The dietary patterns of children from families in which television viewing is a normal part of meal routines may include fewer fruits and vegetables and more pizzas, snack foods, and sodas than the dietary patterns of children from families in which television viewing and eating are separate activities. *Pediatrics* 2001;107(1).

URL: <http://www.pediatrics.org/cgi/content/full/107/1/e7>; television, food consumption patterns, dietary patterns.

ABBREVIATION. NKAN, nutrition knowledge, attitudes, and norms.

This article examines relationships between the use of television during meals and children's consumption of major food groups. Contemporary American diets have a significant impact on health and longevity.¹ Dietary patterns that result in high intakes of fats and saturated fats and low intakes of fruits and vegetables are linked to increased risks of coronary heart disease, certain cancers, diabetes, hypertension, and obesity.² Although these diseases typically manifest themselves in midlife or later, diet-influenced physiologic variables associated with chronic disease track from childhood into adulthood,³⁻⁶ and evidence suggests a positive association between obesity in adolescence and morbidity in later life.⁷ For these reasons there is considerable interest in deepening our understanding of the influences on children's diets.

Children's food choices are shaped by individual, societal, and cultural factors. Some are endogenous to the individual child, but others are environmental. These include the foods made available to children inside and outside the home and the modeling of food behaviors by caregivers, especially parents.⁸⁻¹³ American children are also exposed to a plethora of verbal and nonverbal messages about food from parents, peers, teachers, and the media. These messages shape their expectations of what constitutes appropriate foods in different settings and at different times.¹⁴⁻¹⁷

Television is the largest single media source of messages about food. The vast majority of money spent on food advertising comes from branded food manufacturers and fast-food chains, and television is the primary medium used by these companies.¹⁸ The food products advertised most intensively on television also tend to be overconsumed relative to federal dietary guidelines, whereas fruits and vegetables, which are almost never advertised, are underconsumed.¹⁸ It is, therefore, of considerable importance to determine the relationship between use of television and children's food consumption patterns.

Previous studies of the relationship of television to children's diets have examined the content of nutrition messages on television¹⁹⁻²² and behavioral links

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between television and children's food consumption patterns. These latter studies have documented a positive correlation among the number of hours of television viewed by children, their requests for and consumption of advertised foods, and the willingness of parents to purchase foods requested by their children.^{23–29} Although the number of weekly meals eaten with television on has been documented,^{28,30} associations between television and children's overall food consumption patterns have never been examined.

Because children learn television-viewing habits, as well as eating habits, primarily from parents,^{31–34} the choices parents make about the use of television during meals may be associated with choices that they make regarding the foods they buy and make available to their children, independently of children's direct requests for advertised foods. If this hypothesis is correct, it should be evident in children's overall food consumption patterns.

The research presented in this article examines the relationship between the presence of television at meals and children's overall food consumption patterns, including foods not normally advertised on television. We reasoned that children's food consumption patterns would vary systematically with the extent to which television was a part of normal mealtime routines. In addition, because the foods advertised on television generally promote ease of use as one of their desirable attributes,³⁵ the presence of television at meals should be positively related to food preparation routines emphasizing minimal effort and quick results. Because an interaction between mothers' nutrition knowledge and their responsiveness to children's purchase requests has been documented,²³ use of television during meals should be inversely correlated with parents' nutrition knowledge, attitudes, and norms (NKAN).

METHODS

Data were collected in the Maryland suburbs adjacent to Washington, DC, from September 1993 through June 1995 as part of a study on family behaviors and children's diets. The study was limited to weekdays during the elementary school year, to control for variance caused by shifts in schedules on weekends and holidays.

Sample

Participants consisted of parent-child pairs from 117 participating families. Thirteen were eliminated from analyses because of missing food intake data and 13 were eliminated because of missing sociological data, leaving a sample of 91 families. Most families (85%) were recruited through advertisements placed in free local newspapers available in shopping malls, libraries, and restaurants or delivered unsolicited to people's homes. The rest were recruited through notices in libraries and by word of mouth. To be eligible, families had to have a child in the fourth, fifth, or sixth grade living with at least one biological or legally adoptive parent.

Parents in the study were better educated than a randomly selected sample from the same area would have been, although the median family income of study participants was the same as the median for Prince George's County, Maryland, where the majority of the study families lived.³⁶

Data Collection

Socioeconomic and family behavior data were collected using a structured survey developed based on ethnographic interviews.

The survey was administered to the participating parent(s) and child during a face-to-face interview in the family's home. Data on parents' NKAN were collected using a self-administered questionnaire that parents filled out after the main interview. Data on children's diets were collected in 3 nonconsecutive 24-hour recall interviews conducted with one child from each family. All recall data pertained to school days.

Variables and Measures

Parents were asked whether the television was usually on or off in the presence of children while they ate meals. The question was repeated 3 times over the course of the interview: once in relation to breakfast; once in relation to after-school snacks; and once in relation to supper. (Lunch was not included because children were at school.) Responses for each eating occasion were summed to create the index variable used to measure presence of television at meals in the analyses.

The question pertaining to food preparation routines emphasizing minimal effort and quick results focused on supper. This was done because supper routines are less affected by exogenous factors, such as school or activity schedules, than are meals during the day. The question was worded as follows: "About how many nights a week, that's Monday through Friday, do you prepare foods for supper which you have bought specifically because they are quick and easy to fix and because you know that the kids will eat them without fussing?" This resulted in a variable ranging from 0 to 5 for Monday through Friday. The question contained no reference to specific foods because foods that are quick and easy in one family can be difficult for others. Instead, the common denominator underlying the question had to do with parents' conscious choice of an array of foods that minimized the work it took to feed their children.

Two variables were used to measure parents' NKAN, both based on scales developed and validated by Kristal et al³⁷ for measuring psychosocial factors related to low-fat diet selection among adult women. The first variable, a summed 23-item scale, assessed parents' knowledge of fats in foods and links among diet and cancer risk, attitudes toward processed foods, and the presence of friends who were switching to healthier eating patterns. The second variable, a 4-item scale, measured parents' indifference versus attachment to having meat at meals. High scores indicated greater attachment to meat-based meal patterns. The 2 scales were tested for reliability using Cronbach's α . Cronbach's α for the 23-item scale was .75; for the 4-item scale, .80. These measures were used because they reflect concerns about dietary fat and cancer that were widespread at the time the study was conducted^{38–39} and were included in the analyses to control for the effects parents' concern with these issues might have on foods they made available to their children.

Twenty-four-hour dietary recall interviews were based on protocols published by Posner and Morgan⁴⁰ and used the Nutrition Consulting Enterprise Two-Dimensional Food Portion Visuals for portion size estimation. The system uses a printed poster with schematic depictions of models and shapes based on traditional wooden and plastic models used in the second National Health and Nutrition Examination Survey.⁴¹ Children were taught to use the poster for estimating portion size during the first recall interview, which occurred in the child's home. The poster was then left with the child to use with the second and third recall interviews, which were conducted by telephone.

Data from children's 24-hour recall interviews were used to construct outcome variables at both the level of nutrients and food groups. Although accuracy regarding quantity estimation is a source of error in food intake data with children's 24-hour recalls, relative differences among children have been shown to be adequately measured using 3 days of intake.^{42–44}

Recall data were entered into the Minnesota Nutrient Data Base, a standard program for translating food consumption over 3 days into average daily consumption of nutrients.⁴⁵ Nutrients used as outcome variables in the analyses presented were energy intake; percent of energy from carbohydrate, from total fat, and from saturated fat; total dietary fiber (g); cholesterol (mg); sodium (mg); caffeine (mg); calcium (mg); retinal equivalents of vitamin A (μg); vitamin C (mg); and folate (μg).

To generate food group variables, ingredient level variables were aggregated back into whole foods and assigned to 1 of 47 food groups, based on similarity of nutrient content, considering

TABLE 1. Food Group Classification for Foods*

Milk	Vegetables	Grain
Whole milk	Orange vegetables	Cold cereal
Low fat and skim milks	Dark green vegetables	Hot cereal
Other dairy	Tomatoes	White bread
Cream	Other vegetables	Wheat bread
Yogurt	Potatoes	Rice
Cheese	White potatoes	Pasta
Ice cream	Nuts and beans	Other grains
Other dairy	Beans	Pizza and salty snacks
Fats	Soybeans, tofu	Pizza
Butter	Nuts and nut butters	Salty snacks and chips
Margarine	Chicken, eggs, and fish	Sweets
Oils and dressings	Chicken	Baked sweets
Other fats	Eggs	Candy
Fruit	Fish	Sugar
Citrus fruit and citrus juice	Red meats	Sodas
Other whole fruit	Beef	Soda pops
Juice and juice drinks	Pork	Diet drinks
Other fruit juices	Lamb	Coffee/tea
Juice drinks	Processed meats	

* Two of the original 47 food groups—soups and miscellaneous—were not included in the final 15 food group categories. Together they accounted for 1.4% of average daily energy intake of children.

both macronutrients and micronutrients. These were then collapsed into 15 food groups for use in the analysis (Table 1). The final classification reflects different nutritional attributes of foods used by children in this age group. For the most part, these are standard groups, like grain, fruit, vegetables, potatoes, red meat, milk, other dairy, added fats, and sweets. Processed meat was separated because of both its high consumption by children and its convenience nature. Chicken, eggs, and fish were grouped together as remaining protein foods. Pizza and salty snacks were grouped together based on their high-fat and sodium content.

To increase the power to examine patterns of food consumption, 8 of the 15 food groups were further aggregated into 3 combined food groups based on major nutrient content: juice with fruit and vegetables to get an aggregated intake of these nutrient-dense foods; meat with poultry and eggs, to group these protein sources; and pizza and salty snacks with soda, to group these less nutrient-dense, but commonly consumed, foods. The 3 combined food groups were also used in the analysis.

Children's average intake of each of the 15 food groups were calculated as: 1) consumption frequencies that express the number of times per day a given child ate foods from each food group; and 2) percentages of a given child's total daily energy that came from each food group. Children's average intake of the 3 combined groups were calculated as percentages of a given child's total daily energy.

Statistical Analysis

Descriptive statistics for all the variables in the study and bivariate relationships among the presence of television at meals and demographic and socioeconomic control variables, parent's nutrition knowledge, parents' attitude toward meat, and parent's use of quick suppers were calculated before further analyses. Independent sample *t* tests on the 15 food groups, 3 combined food groups, and nutrients included in the study were used to compare mean intakes of children from families in which the television was on for 2 or 3 meals (*n* = 41) with those of children from families in which the television was either never on at meals or only on for 1 meal (*n* = 50).

Multiple linear regression was used to test relationships between the presence of television at meals and children's consumption of food groups and nutrients. The model controlled for the following variables: child's age, sex, and race; number of years that the mother was in school and the number of hours per week that the mother worked for pay; 2-parent households and family income; parent's score on the 23-item NKAN scale; and number of nights per week that parents prepared quick suppers.

Pearson's 2-tailed tests of bivariate association were examined among the presence of television during meals and the 15 food groups, 3 combined food groups, and selected nutrients. Seven of the 15 food groups, all 3 combined food groups, and 4 of the selected nutrients exhibited significant bivariate associations with

television (*P* ≤ .05) and were used as dependent variables in the multiple linear regression analysis. Only results of the regressions where the association between presence of television during meals and the dependent variable remained statistically significant at the *P* ≤ .05 level have been reported.

RESULTS

Sample Characteristics and Independent Variables

The average age of children in this study (all fourth, fifth, or sixth graders) was 10 years (Table 2). Thirty-five percent of the children were black, the rest were white, and 58% of the children were girls. Mothers averaged 15 years in school and worked an average of 33 hours per week in paid employment. Only 10% of the mothers in the sample were full-time homemakers. Seventy-nine percent of the children lived in married 2-parent households; the remaining 21% lived in single-parent households. Family in-

TABLE 2. Description of Study Population and Variables (*n* = 91)

Variable	Mean ± SD	Scale Range
Child's age (y)	10 ± 1	
Mother's education (y in school)	15 ± 3	
Hours per wk mother works for pay	33 ± 18*	
Number of meals per d television is on	1.4 ± 1	0-3
Number of nights per wk parents prepare quick suppers	2 ± 1.5	0-5
Parent's NKAN scale	84 ± 9	23-105
Parent's attitude towards meat scale	10 ± 4	4-20
	Percent Frequency	
White	65	
Black	35	
Female children	58	
2-parent households		
Family income (annual)	79	
<\$25 000	13	
\$25 000-\$44 999	24	
\$45 000-\$64 999	30	
\$65 000 or more	33	

SD indicates standard deviation.

* Only 10% of the sample have zero values.

comes ranged from less than \$25 000 per year (13% of the sample) to more than \$64 000 per year (33% of the sample).

Socioeconomic patterns were evident in observed covariance between mother's education and family income and between number of parents in household and family income (Table 3). Televisions were more likely to be on during meals in households with lower incomes, less educated mothers, or single parents. The presence of television during meals was inversely related to parents' general knowledge and concern about nutrition and diet, as measured by parent's scores on the NKAN scale ($P \leq .05$). Presence of television during meals exhibited strong positive relationships with parents' scores on the scale measuring attachment to meat at meals ($P \leq .01$) and with the number of nights per week parents prepared quick suppers ($P \leq .01$).

Children's Consumption of Food Groups and Nutrients by Level of Television Use

Children from families with television on during 2 or more meals per day consumed grains, fruit, green and yellow vegetables, potatoes, beans, and nuts less frequently than did children from families in which the television was either not on at meals or was on only for one meal (Table 4). Children from families with television on during 2 or more meals consumed more red meat and processed meat and less chicken, eggs, and fish, compared with other children.

Overall dairy consumption was similar between the 2 groups of children, but children from families with television on during 2 or more meals per day derived more of their dairy intake from fluid milk and less from other sources—cheese, yogurt, and ice cream—than did children from families in which the television was off. Added fats were consumed less often by children from families with television on during 2 or more meals than by other children.

Consumption of the pizza/salty snacks and soda groups were higher among children from families with television on during 2 or more meals than they were among other children. The sweets and juice

drinks groups were consumed slightly less often by children from families with television on during 2 or more meals than by other children.

Overall, children from families with television on during 2 or more meals per day derived 6% more of their total daily energy from all 3 meat groups combined ($P \leq .01$); 5% more of their total daily energy intake from pizza, salty snacks, and sodas combined ($P \leq .01$); and nearly 5% less of their total daily energy intake from fruits, vegetables, and juices combined ($P \leq .001$) than did children from families in which the television was either not on at meals or was on only for one meal (Table 4).

Differences between the 2 groups of children's energy and nutrient intakes were consistent with the differences in their consumption of food groups. Children from families in which the television was on during 2 or more meals per day derived less energy from carbohydrate and more from total fat and saturated fat than did other children, although only the difference in percent of energy from carbohydrate was statistically significant ($P \leq .05$ level; Table 5). Children from families with high television use consumed more caffeine ($P \leq .01$) than did children from families with low television use.

Presence of Television at Meals in Multiple Linear Regression Models

Multiple linear regression models that controlled for socioeconomic factors, parent's scores on the NKAN scale, and parents' use of quick foods for family suppers measured the strength of association between the presence of television during meals and children's consumption of the 5 food groups described in Table 6. These models confirmed: 1) the positive associations between presence of television during meals and children's consumption of red meats, pizza and salty snacks, and sodas; and 2) the negative associations between presence of television during meals and children's consumption of fruits and vegetables. Results of the 3 models testing percent of daily energy children derived from combined food groups (Table 6) indicate that the association between television and children's food consumption

TABLE 3. Relationships Between Sample Characteristics and Variables Bivariate Correlation Matrix

	Mother's Education (Year in School)	Number of Hours Per Week Mothers Work For Pay	Two-Parent Household	Family Income	Parent's NKAN Scale	Parent's Attitude Towards Meat Scale	Number of Nights Per Week Parents Prepare Quick Suppers
Number of h per wk mothers work for pay	-.03						
2-parent household	.09	-.19					
Family income	.25*	-.02	.46***				
Parent's NKAN scale	.35***	-.19	.39***	.24*			
Parent's attitude towards meat scale	-.40***	.01	-.07	-.09	-.50***		
Number of nights per wk parents prepare quick suppers	-.07	.02	-.08	-.11	-.15	.19	
Television at meals	-.25*	.14	-.25*	-.29**	-.21*	.28**	.28**

* $P \leq .05$; ** $P \leq .01$; *** $P \leq .001$. Asterisks refer to significance of bivariate correlations based on Pearson's 2-tailed test of association.

TABLE 4. Children's Consumption of Food Groups: Mean and SD of the Sample Split by the Number of Meals Television is Usually On

Food Group (#)§	Consumption Frequency/Day†		Percent of Total Daily Energy‡	
	0TV and 1TV (<i>n</i> = 50)¶	2TV and 3TV (<i>n</i> = 41)¶¶	0TV and 1TV (<i>n</i> = 50)	2TV and 3TV (<i>n</i> = 41)
	(Mean ± SD)	(Mean ± SD)	(Mean ± SD)	(Mean ± SD)
Grain (91)	2.19 ± .9	2.06 ± .7	19.0 ± 10.2	16.2 ± 6.7
Fruit (83)	1.32 ± .8	1.02 ± .6	5.3 ± 4.4	3.7 ± 3.5
Vegetable (80)	.95 ± .6	.66 ± .5*	2.1 ± 2.3	1.4 ± 1.7
Potatoes (61)	.40 ± .3	.39 ± .3	3.0 ± 4.0	3.3 ± 4.4
Beans and nuts (47)	.35 ± .4	.22 ± .2	3.6 ± 5.8	2.0 ± 3.2
Red meat (71)	.40 ± .43	.80 ± .47***	5.1 ± 7.0	10.2 ± 9.1**
Processed meat (59)	.37 ± .4	.52 ± .4	4.0 ± 4.9	5.5 ± 5.9
Chicken, eggs, and fish (77)	.78 ± .6	.65 ± .5	8.7 ± 7.3	8.1 ± 7.1
Milk (88)	1.29 ± .7	1.43 ± .8	6.4 ± 4.8	8.5 ± 6.4
Other dairy (78)	.98 ± .6	.78 ± .7	9.1 ± 6.9	6.2 ± 6.4*
Added fats (74)	.94 ± .9	.68 ± .5	2.9 ± 3.6	2.2 ± 2.5
Pizza and snack (71)	.54 ± .4	.71 ± .5	5.8 ± 6.5	8.6 ± 7.9
Sweets (90)	2.06 ± 1.0	1.76 ± .7	14.3 ± 8.4	13.4 ± 7.6
Juice and juice drinks (79)	1.13 ± .7	.91 ± .7	6.9 ± 6.1	4.6 ± 4.3*
Sodas (68)	.50 ± .5	.91 ± .7**	1.8 ± 2.8	4.1 ± 4.0**
Combined Food Group (#)	0TV and 1TV	2TV and 3TV	0TV and 1TV	2TV and 3TV
Fruit, vegetables, juice and juice drinks (91)	3.40 ± 1.3	2.59 ± 1.1**	14.4 ± 6.9	9.7 ± 5.2***
All meat (red meat, processed meat, chicken, egg, and fish) (88)	1.56 ± .9	1.98 ± .6*	17.8 ± 10.7	23.8 ± 10.0**
Pizza and snacks, and soda (82)	1.04 ± .7	1.63 ± .9**	7.7 ± 6.8	12.8 ± 9.2**

SD indicates standard deviation.

* $P \leq .05$; ** $P \leq .01$; *** $P \leq .001$. Asterisks refer to significance of differences between sample means based on independent sample *t* test.

† The average number of times per day children ate food from that food group, averaged over 3 days.

‡ The average percentage of total daily energy intake contributed by that food group, averaged over 3 days.

§ Numbers in parentheses are the number of children of the total sample (*n* = 91) who ate food from that food group at least once in 3 days.¶ Means and SDs of children from families in which the television is usually off during meals plus children from families in which the television is usually on during one meal only (*n* = 50).¶¶ Means and SDs of children from families in which the television is usually on during 2 meals plus children from families in which the television is usually on during 3 meals (*n* = 41).**TABLE 5.** Children's Intakes of Energy and Nutrients: Mean and SD of the Sample Split by the Number of Meals Television is Usually On

Nutrient	0TV and 1TV (<i>n</i> = 50)†	2TV and 3TV (<i>n</i> = 41)‡
	(Mean ± SD)	(Mean ± SD)
Energy (Mj)	8.37 ± 2.31	8.56 ± 1.85
Carbohydrate (% energy)	56.6 ± 6.8	53.7 ± 5*
Total fat (% energy)	31.3 ± 5	32.9 ± 4
Saturated fat (% energy)	11.5 ± 2.8	12.5 ± 2.4
Cholesterol (mg)	217.7 ± 119.5	213 ± 75.3
Sodium (mg)	3041.1 ± 1031.2	3168.5 ± 739.6
Caffeine (mg)	12.4 ± 15	24.7 ± 24**
Calcium (mg)	919.9 ± 444	921.3 ± 330
Iron (mg)	14.4 ± 7	13.6 ± 3
Vitamin A (μg RE)	948.8 ± 630	810.2 ± 417
Vitamin C (mg)	109.7 ± 60	94.5 ± 49
Folate (μg)	258.2 ± 152	238.9 ± 91
Fiber (g)	15.1 ± 5	14.1 ± 4

SD indicates standard deviation.

* $P \leq .05$; ** $P \leq .01$. Asterisks refer to significance of differences between sample means based on independent sample *t* test.† Means and SDs of children from families in which the television is usually off during meals plus children from families in which the television is usually on during one meal only (*n* = 50).‡ Means and SDs of children from families in which the television is usually on during 2 meals plus children from families in which the television is usually on during 3 meals (*n* = 41).

patterns persists for broad categories of foods. Results of the linear regression model confirmed the positive association between television and milligrams of caffeine children consumed (Table 7).

Although the association between the number of nights per week that parents prepared quick suppers and the frequency of children's vegetable consumption was negative, it was not significant at the $P \leq .05$ level. Parents' general knowledge and concern with nutrition, as measured by the NKAN scale, was not significantly associated with children's consumption of any of the food groups tested in these models.

DISCUSSION

These results contribute to our understanding of the relationships between television and children's diets. Although previous research has established a link between television and children's requests for and consumption of advertised foods, the results of this research suggest that there are also associations between television and children's consumption of foods not normally advertised, such as fruit and vegetables.

The hypothesis that children's overall food consumption patterns would vary systematically with the extent to which television was part of their family's daily food routines seems to be substantiated by the data. Although the regression model used to measure the association between television and children's consumption of food groups controlled for 4 separate measures of socioeconomic status, associations between the presence of television at meals and children's consumption of fruits, vegetables, and juices; all meats; and pizza, salty snacks, and soda

TABLE 6. Associations Between Children’s Consumption of Food Groups and Presence of Television at Meals, Controlling for Covariates and Sociodemographic Factors†

	Multiple Linear Regression Coefficients (β ; $n = 91$)				
	Television at Meals	Female Child	Black Child	Two-Parent Household	Family Income
Consumption frequency per d‡					
Fruit	-.16	.34	.12	.18	-.23*
Vegetable	-.16**	-.09	-.13	.06	-.07
Red meat	.14**	-.01	.04	-.11	.01
Pizza and snack	.12*	-.03	-.15	.13	.05
Soda	.15*	-.00	-.40*	-.30	.12
Percent of total daily energy§					
Fruit	-.01*	.02*	.02	.01	-.01*
Vegetable	-.01**	-.00	.00	-.01*	.00
Red meat	.02	.01	.02	-.01	-.01
Pizza and snack	.02*	.00	-.03	.01	.00
Soda	.01*	-.01	-.01	-.01	.01
Fruit, vegetables, and juice¶	-.02***	.00	.04**	.02	-.01
All meat#	.02*	.02	.08**	-.02	-.00
Pizza, snacks, and soda***	.03***	-.00	-.04*	.00	.00

* $P \leq .05$; ** $P \leq .01$; *** $P \leq .001$. Asterisks refer to significance of multiple linear regression coefficients (β).

† Regression equation also adjusted for: parent’s NKAN; number of nights per week parents prepared quick and easy suppers that their children would eat without fussing; child’s age; mother’s education; and mother’s work. None of these were significant in any model.

‡ The average number of times per day children ate food from that food group.

§ The average percentage of total daily energy intake contributed by that food group.

¶ Percent of total daily energy from fruits, vegetables and juice, and juice drinks.

Percent of total daily energy from red meat, processed meat, chicken, eggs, and fish.

*** Percent of daily energy from pizza, salty snacks, and soda.

TABLE 7. Associations Between Children’s Intakes of Caffeine and Presence of Television at Meals, Controlling for Covariates and Sociodemographic Factors† Multiple Linear Regression Coefficients (β ; $n = 91$)

	Television at Meals	Black Child
Caffeine (mg)	5.05*	-11.78*

* $P \leq .05$. Asterisks refer to significance of multiple linear regression coefficients (β).

† Regression equation also adjusted for: parent’s NKAN; number of nights per week parents prepared quick and easy suppers that their children would eat without fussing; child’s age; child’s sex; mother’s education; mother’s work; number of parents in household; and family income. None of these were significant in the model.

remained significant. The hypothesis that relationships between parents’ nutrition knowledge and the presence of television at meals would be negative was confirmed, although it was weaker than expected. The hypothesis that parents’ use of quick suppers would be related to the presence of television during meals was supported by the data.

Although we failed to detect significant differences in fat intake by television usage, the significantly lower percentage of energy contributed by carbohydrates among children from families with television on during 2 or more meals and their tendency toward higher fat is consistent with other studies as characteristic of children who were at high risk of obesity.^{46–49} Additionally, in a recent school-based trial that reduced children’s television, videotape, and video game time, decreases in adiposity of third and fourth graders were accompanied by de-

creases in the number of meals children ate in front of the television, but there were no significant changes in children’s snacking behaviors or in 3 separate measures of children’s physical activity or fitness.³⁰

The convergence of evidence from the above studies with the findings reported in this article suggests that future research into relationships between television, as it relates to children’s overall food consumption patterns, and factors associated with children’s adiposity has potential to expand our understanding of the role of diet in the behavioral pathways linking television to children’s risk of obesity.

The findings reported in this article need to be qualified by the study’s limitations. The sample was not randomly selected, so the findings cannot be generalized beyond the types of households included. Study recruitment was based on self-selection and this may have imparted biases to the sample in terms of participants’ characteristics, especially in the quality of relationships between parents and their children. Study enrollment required initiative and cooperation between parent and child, so parent-child pairs who participated tended to have these qualities. Given this, it is possible that the associations between television and children’s food consumption patterns found in this sample might be more robust in a sample that included families with weaker structures.

The final sample of 91 families, with 3 days of dietary recall per child, was small given the nature of dietary data, which typically exhibit considerable variation. Despite limitations imposed by the rela-

tively small sample, the overall pattern of associations between the presence of television at meals and children's consumption of food groups was clear and consistent with what one would expect, given the foods advertised on television. Finally, the examination of these relationships required the use of multiple comparisons. Although the total patterns of results should be valid, any single, specific result must be viewed with caution.

The shifts in children's food consumption patterns linked to the presence of television at meals raises theoretical questions about the nature of the pathways connecting the two. Does television itself discourage consumption of fruits and vegetables and encourage consumption of red meats, pizza, salty snacks, and soda? Or is the presence or absence of television actually the marker for a complex set of attitudes and behaviors pertaining to how families feed themselves, which together lead to the observed associations between television and children's diets? The results of this study suggest that both these pathways may function in the nexus of behaviors linking television to children's food consumption patterns, although the exact nature of the linkage may vary from one food group to the next.

Television and Children's Consumption of Vegetables

The presence of television at meals and the number of nights per week parents chose foods for supper "because they are quick and easy to prepare and because the children eat them without complaining" were closely related, suggesting a link between television at meals and family behaviors that minimize the work of feeding children. Several studies have documented widespread cultural attitudes in the United States that define vegetables as tasting bad to children, expensive, and trouble for adults to prepare.^{50,51}

In light of these attitudes, it makes sense that vegetables would be consumed less frequently by children whose parents value ease in their family food routines. This hypothesis is also suggested by the negative relationship between number of nights per week parents prepared quick and easy suppers and the frequency of children's vegetable consumption ($r = -.27$; $P = .01$, Pearson's 2-tailed test).

Parent's nutrition knowledge had little or no relationship to children's vegetable consumption, which suggests that the cluster of family food behaviors associated with television displaced or crowded out the beneficial effects of nutrition education in regard to children's vegetable intake.

Television and Children's Consumption of Red Meats

Parent's scores on the scale measuring attachment to meat-based meal patterns, their general level of knowledge and concern about nutrition, and the presence of television at meals were all closely related to one another and to mother's educational levels. Less educated women were more likely to run households in which the television was on at meals, to have strong attachment to meal plans that included meat, and to have low scores on the 23-item scale measuring general nutrition awareness. This

pattern of associations suggests the hypothesis that, in certain cases, the presence of television during meals is part of a cluster of attributes, which includes attachment to meat-based meal patterns and poor understanding of relationships between diet and disease, and that this cluster is more likely to characterize households in which the parents have lower, rather than higher, educational attainment.

Television's Direct Association With Children's Diets

In addition to indirect associations, the observed association between family television use and children's food intake patterns may also be affected by ways that television itself shapes a family's expectations of what constitutes a normal diet. This interpretation is strengthened by the observation that the associations among television and children's consumption of fruits, vegetables, and juices; all meats; and pizza, salty snacks, and soda remained statistically significant in the full regression models, where the effects of socioeconomic and other confounding factors were controlled.

Television's influence on diet has usually been modeled in terms of a stimulus-response paradigm: the more minutes or hours of advertising a person is exposed to, the more likely that person is to purchase and consume the advertised foods. That paradigm focuses attention on foods that are brought into or increased in a person's diet as a result of advertising, rather than on advertising's potential effects on foods that are not advertised. However, it is possible that selective promotion of certain types of foods may crowd ignored foods out of a typical diet over the long run.

Television's role in contemporary American food culture is intricately linked to the entry of women into the paid labor force and to the growth of the processed and ready-to-eat food industries. Women's labor force participation has reduced time spent cooking at home while increasing the purchase of foods prepared outside of the home.⁵² Television advertising and prime time shows mainly promote and model the use of ready to eat cereals, snacks, convenience foods, shortcuts for home meal preparation or ready made sauces, and fast foods.^{18,53-55}

It makes sense that there would be a relationship between the extent to which children's food consumption patterns have shifted in directions promoted and modeled by television and the extent to which television has become an active part of their families' food routines.⁵⁶ Families who turn the television off during meals are separating the act of eating from the world contained inside the television set, and to that extent there is a boundary between private family food culture and the food culture promoted on television. In contrast, a television that is on in the presence of family members while they are eating is implicitly part of the family's commensal unit, and the boundary between private family food culture and the food culture promoted on television is reduced. If this is true, the number of meals in which the television is usually on in the presence of family members while they are eating should be correlated to children's food consumption patterns.

Significance of the Findings

The research presented in this article expands our understanding of the relationships between television, as it functions in our families, and children's diets. Although previous studies have established a relationship between hours of television viewed by individual children and their requests for and consumption of advertised foods, the results of this research suggest that the association between television and the foods children eat extends to foods not normally advertised and that the presence of television at meals acts as a marker of fundamentally different dietary patterns for children whose families have incorporated television as a habitual part of their food cultures.

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