

FOOD GROUP CONSUMPTION
IN A SAMPLE OF CHILDREN IN THE HOUSTON AREA
AND ITS RELATED INFLUENCING FACTORS

A Thesis

by

LU PENG

Submitted to the Office of Graduate Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE

May 2011

Major Subject: Nutrition

Food Group Consumption
in a Sample of Children in the Houston Area
and Its Related Influencing Factors
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Co-Chairs of Committee,	W. Alex McIntosh
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ABSTRACT

Food Group Consumption in a Sample of Children in the Houston Area and Its Related
Influencing Factors. (May 2011)

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Co-Chairs of Advisory Committee: Dr. W. Alex McIntosh
Dr. Karen S. Kubena

The objective of this research is to discover if significant relationships exist among age, gender, household income, locations where children/adolescents ate, whom they ate with, whether they considered the food as a meal or a snack and their consumption of food by food group.

Three hundred and twelve children (9-11 years old)/adolescents (13-15 years old) completed a 24-hour dietary intake recall and a 2-day dietary record. The subject was asked to indicate the amount of food he/she consumed, where he/she consumed it, who was with him/her when he/she consumed the food, and whether he/she considered the food to be a meal or a snack. The information was coded and all the foods were grouped into 12 groups. Data were analyzed with the Statistical Analysis System (SAS). The results showed that children had higher intakes of breads and cereals, dairy products, fruits and fruit juices, snacks and desserts than adolescents. Girls consumed more snacks

and desserts and condiments than boys. Children/adolescents in families with higher household incomes consumed more snacks and desserts, but fewer meats than those with lower household incomes. Children and adolescents consumed more breads and cereals, dairy products, fruits and fruit juices, vegetables, fats, meats, and snacks and desserts when they ate at home than when they ate away from home. Children/adolescents ate more breads and cereals, dairy products, fruits and fruit juices, vegetables, fats, meats and condiments when they ate with various family members than when they ate alone, with only one family member or with non-family members. Children/adolescents consumed more breads and cereals, dairy products, fruits and fruit juices, burgers and sandwiches, snacks and desserts, condiments, but fewer fats when they ate with their friends as compared to eating with others. Children/adolescents who ate breakfast had higher intakes of breads and cereals, dairy products, fruits and fruit juices, vegetables, fats, meats, snacks and desserts, and condiments than those who did not eat breakfast. Children/adolescents who ate more fruit and fruit juices had consumed significantly more breads and cereals, dairy products, vegetables, snacks and desserts, but consumed fewer sweetened beverages than those who did not eat fruits and fruit juices.

DEDICATION

To Quan, my beloved husband for his unconditional love and support

ACKNOWLEDGEMENTS

I would like to thank my committee co-chairs, Dr. McIntosh and Dr Kubena, for their constant guidance. Without their knowledge and encouragement, I could not have done this. Also, I would like to thank my committee member, Dr. Sharkey, for his time and invaluable advice.

Thanks also to my friends and the department faculty and staff for making my time at Texas A&M University a great experience.

Finally, thanks to my mother and father for their encouragement and to my husband for his patience and love.

NOMENCLATURE

NHANES	National Health and Nutrition Examination Survey
SAS	Statistical Analysis System
USDA	United States Department of Agriculture

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CHAPTER I

INTRODUCTION

Obesity is becoming a worldwide problem, especially affecting the US population (1, 2). The prevalence of childhood and adolescence overweight is increasing rapidly in the United States. Childhood obesity not only affects children psychologically, but also can lead to life-threatening conditions such as diabetes, hypertension, cardiovascular disease, certain cancers and other disorders including liver disease, eating disorders, etc. (3-5). Studies have shown that overweight children and adolescents are more likely to grow up to be overweight adults (6), which is worrisome because overweight and obesity are associated with greater overall morbidity and mortality and higher spending on medical care (7).

Dietary intake is widely considered as an important cause of overweight and obesity. Overall, most American children and adolescents have lower intakes of fruits, vegetables, grains, and dairy products, and higher intakes of sodium, fat and refined sugars than recommended (8). Calorie-rich foods and drinks are easily available (9).

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Families are eating outside home more frequently, which brings large portion sizes, high amounts of soft drink consumption and less healthful foods (10, 11). The frequency of skipping meals, consuming snacks and fast food among children and adolescents is increasing (12-14).

Many studies have attempted to determine the effects of eating habits on childhood obesity. Frank B. Hu suggested that these dietary patterns represent a broader picture of food and nutrient consumption, and may thus be more predictive of disease risk than individual foods or nutrients (15). Food group consumption analysis is one method of dietary pattern analysis. It provides a measure of the total diet, emphasizing the overall eating pattern rather than a single food or nutrient (16).

Unfortunately, few studies, which focus on the relationship between food group consumption and factors that influence it, have not received adequate attention. This study will examine the role of demographic, economic, environmental factors, including age, gender, household income, locations where children/adolescents ate, whom they ate with and whether they considered the food as a meal or a snack, on food group consumption.

CHAPTER II

LITERATURE REVIEW

Eating Pattern Analysis of Children and Adolescents

Childhood and adolescence are critical periods of forming eating habits. Eating patterns analysis plays an important role not only in growth and development of children and adolescents, but also in preventing disease (17). The incidence of nutrition-related chronic diseases, such as obesity, metabolic syndrome, cardiovascular disease, diabetes and cancer, is increasing rapidly in the United States (18, 19). An unbalanced diet (e.g., high intakes of sugar and fat, low intakes of vegetable and fruit) in childhood and adolescence may be a risk factor for these chronic diseases since it may interact with some other risk factors (e.g., overweight) which may appear during this period (20). Moreover, eating habits formed during childhood and adolescence may persist throughout life (21); consequently, dietary intake patterns among children and adolescents have important implications for health in adulthood. Therefore, understanding food consumption patterns during childhood and adolescence is important.

Many studies tested the relationship between the nutrition-related diseases mentioned above and a single or a few dietary components or foods such as saturated fat,

sodium and sugar (22). Although these studies are valuable, they have several limitations. First of all, people do not eat independent dietary components. Instead, they eat complex combinations of foods as meals. The single nutrient or food may be inadequate for taking into account complicated relationships between nutrition-related diseases and food intake (23). Second, the high intercorrelation among some nutrients (e.g., potassium and magnesium) makes it difficult to assess their separate effects (24). Third, the effect of a single nutrient may be too small to detect, but the cumulative effects of multiple nutrients in a dietary pattern may be large enough to detect (22). Finally, single nutrient analysis may be confounded by the effect of dietary patterns because nutrient intakes are commonly associated with certain dietary patterns (25). For example, researchers found that low dietary fat intake was associated with high intakes of vegetables, fruits, fiber, folate and whole grains (26). Based on these limitations, analyzing overall food consumption patterns by considering how foods are consumed in combinations may provide more information than the traditional single nutrient analysis.

Trends of Overweight and Obesity in US Children and Adolescents

In the United States, the prevalence of overweight among children and adolescents is increasing at an alarming rate. High body mass index (BMI) among children and adolescents continues to be a public health concern. Obese children and adolescents tend to become obese adults, and obese adults are at greater risk for

cardiovascular disease, diabetes, hypertension and certain cancers than normal weight adults (6). The term overweight is used to describe a child or adolescent whose BMI is between 85-95th percentile for age; and the term obese is used to describe a child or adolescent whose BMI is equal to or greater than 95th percentile for age (27). Since 1980, the prevalence of BMI for age at or above the 95th percentile has tripled among school-age children and adolescents, and it remained high at approximately 17% from 2007 to 2008 (28). Severe obesity among children and adolescents is classified as BMI equal to or greater than 99th percentile for age and gender by American Medical Association, the Centers for Disease Control and Prevention, and the Department of Health and Human Services (27). Researchers found that about 4% of children and adolescents in the United States had a BMI equal to or greater than the 99th percentile based on the National Health and Nutrition Examination Survey (NHANES) 1999-2004 (29). The overall prevalence of BMI equal to or greater than 99th percentile has increased by more than 300% since NHANES II (1976), and over 70% since NHANES III (1994) in children and adolescents (27).

Children's Food Consumption

The development of eating behaviors of school-aged children, is affected by a variety of family and social factors such as food availability and preference, portion size, cultural values regarding food types and preparation, parents' beliefs and practices,

mealtime structure, and feeding styles (6).

An important determinant of food choice is food preference in young children because children eat what they like and leave the rest (30). The family factor, which includes food availability and accessibility and parents' preferences, beliefs and attitudes, strongly influences childhood eating patterns. Generally, children prefer the foods that they are served most often and/or are readily available at home (6). In other words, parents or caregivers in the family provide the food availability and accessibility which affect children's preferences. For example, some researchers have shown that when fruit and vegetables are often served and available at home, children are more likely to eat fruit and vegetables compared to children who are less exposed to fruit and vegetables (31). In addition, parents or caregivers serve as models whom children can observe and from whom they can learn eating behavior (32). Children's preferences and food availability are related to parents' preferences because children's food-related knowledge is limited (33). Researchers demonstrated that children's intake is associated with parents' beliefs about which foods were healthy and their own food preferences (34). Children are more likely to taste unfamiliar foods after they have seen their parents eating the food (32).

Although families provide the strongest influence on children's eating behaviors, children's peers at school also influence their eating habits (6). The school food

environment can have an impact on children's food choice, because foods eaten at school (including school lunch, vending machines and cafeterias) compose 35%-40% of school children's total daily energy intake (35). Researchers found that when subjects observed their peers eating vegetables that the observing subjects did not like, the possibility of the observing subjects' intake of disliked vegetables increased (31).

Adolescents' Food Consumption

Adolescence is one of the most dynamic and complex transitions through the life (36). Food habits of adolescents are largely influenced by the physical, developmental, and social changes that occur during adolescence (37). Parents lose some control of food selection of their children in this period. Behavioral and psychological changes also occur in the period of adolescence. Independence, including making decisions of what to eat, is growing at this time (37). Also, physical changes make adolescents more interested in body shape, size and appearance, which influence the food choices, too (37).

Adolescents spend more time away from home as a result of social, school, and community activities. The amount of time an adolescent "has or wants to spend on food" is one of the most important factors influencing food choices (38). Some research shows that having meals regularly and eating dinner with family members is associated with healthy dietary intake patterns, including more fruits and vegetables, but less fried foods,

soda, and saturated and trans fatty acids (14, 39, 40). However, skipping breakfast and lower frequency of eating dinners with their families are commonly found in adolescents (41). Adolescents also rely on fast foods. A project reported that, between 1999 and 2004, a secular increase in the percent of high school-aged adolescents' fast food consumption frequency was observed (females: 18.9% to 27.3%, $p < .01$, males: 23.6% to 30.2%, $p = .06$) (42). Longitudinal increases in fast food consumption frequency were seen from early to middle adolescence (females: 15.8% to 27.3%, $p < .01$, males: 16.8% to 30.2%, $p < .01$), and among males, from middle to late adolescence (23.6% to 32.0%, $p < .01$) (42).

The need for peer acceptance is considered to be another strong influential factor of adolescents' eating behavior. Adolescents spend more time with friends than children, and eating is an important form of social behavior. Because adolescents seek peer approval and social identity, peer influence is important in food choice (36). In one study, researchers found that adolescents consumed 19% of foods similar to their friends (43). Specifically, type of milk used in coffee, alcoholic drinks, and several snack foods including French fries were the foods most often influenced by peers (43). Moreover, concern with physical appearance and body weight has an effect on eating patterns and food choices, especially in adolescent girls. In 1999, a nationwide survey in high school reported that 59% of girls and 26% of boys were trying to lose weight during the 30 days

preceding the survey; almost 20% of girls had gone without eating for 24 hours or more to lose weight during the past 30 days (36).

Factors that Influence Food Group Consumption

Food group consumption not only provides a measure of the total diet, but also emphasizes the overall eating pattern rather than a single food or nutrient (16). It has been noted that intake of fast foods, snacks and desserts, and sugar-sweetened beverages has increased among children and adolescents; however, intake of fruits, vegetables, and dairy products has decreased (24). An analysis of adolescents' food intakes from 1965 to 1996 indicates that total fat intake increased, but intake of fruits, non-potato vegetables, and milk consumption decreased during this period (44). In a study of 1797 second-through fifth- grade children, 40% of the children had no vegetable consumption on the days studied, and 36% ate at least four different types of snack foods (45). Overall, most American children and adolescents have lower intakes of fruits, vegetables, grains, and dairy products, and higher intakes of sodium, fat and refined sugars than recommended (8).

Various factors including physiological, psychological, socioeconomical, environmental, and cultural factors have been reported to influence food choices in children and adolescents.

Eating dinner with family members is associated with healthful dietary intake

patterns (46, 47). Researchers demonstrate that children and adolescents who eat meals with their family members consume more healthy foods and nutrients (39, 47, 48). For example, when adolescents ate meals with all or most of their family more frequently, intake of calcium-rich food was greater (49). Some researchers also found a positive association between frequency of eating dinner with family members and higher intakes of fruits and vegetables, grains, dairy products and lower intakes of fried food and soft drinks among children and adolescents (6, 39, 47). Past work suggests that at mealtimes parents provide healthy food choices and an example of good eating (37, 50). A nationally representative sample showed that the presence of at least one parent during the evening meal was associated with a lowered odds of poor consumption of fruits, vegetables, and dairy foods and a lowered odds of skipping breakfast among adolescents (37).

The food choices of individuals are additionally influenced by interactions with others beyond the family unit, including coworkers, peers, and close friends (51). As stated earlier, the attitudes, encouragement, and behaviors of friends and peers influence the food choices of children, adolescents and adults (52-55). This perception has been supported by a number of cross-sectional and prospective studies, especially in relation to fruits, vegetables, snack foods and fast foods intake (56-58). For example, working-class adults enrolled in a health promotion program had greater improvements

in fruit and vegetable intake if they reported having more supportive social norms (e.g., number of coworkers/friends who ate at least five servings of fruits and vegetables a day) (58). Some researchers also found significant correlation of peer effects on snacks and fast food among adolescents (59, 60).

Breakfast provides a good source of nutrients and energy of the day. Breakfast improves the nutritional quality of children and adolescents' diets, especially when including ready-to-eat cereal (61). Studies have indicated that breakfast is strongly correlated with milk and calcium intake (62). The habit of eating breakfast is associated with more healthful food choices, and the habit of skipping breakfast has been linked to poor eating habits in children and adolescents (14, 63). Breakfast skipping is highly prevalent in the United States and Europe (10% to 30%), depending on age group, population, and definition (64). Skipping breakfast is a concern among children and adolescents in the United States (36, 65). Breakfast consumers among children and adolescents tended to make better food choices throughout the day (63, 66), such as consumption of more vegetables and milk, fewer soft drinks, and a lower intake of French fries (67). One study showed that breakfast skipping is associated with increased snacks intake in children (68). Another study suggested that pre-school children who ate breakfast every day generally consumed more grains, vegetables and milk products than those who regularly skipped breakfast (14). This result is in accordance with other

studies in children and adolescents, showing that eating breakfast is associated with more healthful food choices (63, 66). Interestingly, Dubois and his colleague found that in pre-school children, breakfast skippers consumed less grain and milk products from meals and more from snacks compared with breakfast eaters; breakfast skippers also consumed fewer servings of grain and milk products in the morning, and more servings of fruit after lunch than breakfast eaters (14).

The foods have been shifted away from home in the recent years in the United States (69). Away-from-home foods are generally defined as “full meals and single ready-to-eat items (including takeaway foods) purchased at restaurants, prepared-food counters at grocery stores, and other outlets (69). Away-from-home foods contain less fiber, calcium, and iron but more fat, saturated fat, sugars, sodium and 55% more energy, tend to be more calorie dense and of poorer nutritional quality than foods prepared at home (9, 70). Increased consumption of away-from-home foods is associated with reduced calcium intake (70) and overweight prevalence (71). In a study conducted by Cluskey and colleagues, almost all participants indicated that children typically drink carbonated soft drinks when eating away from home (72).

People eat foods at different places. Food is the core of some social occasions. Relatives, neighbors and friends often gather to celebrate life events during which high-fat foods are provided (9). Foods consumed in other people’s homes are unlikely to

have the same diet quality as food prepared at one's own home. Ayala et al. did research on the influence of children's dietary intake at relatives/neighbors/friends home. They found that children, who ate at relatives/neighbors/friends homes weekly or greater, drank more sugar-sweetened beverages than children who ate at home more frequently (9). A high overall diet quality of school meals has been confirmed in several studies (73, 74). Children participating in school lunch consumed more calcium, 4 times more milk, and less carbonated soft drinks and /or fruit drinks over 24 hour compared to nonparticipants (74).

Americans are eating out more often from restaurants than before. The number of food establishments in the U.S. has nearly doubled in the past three decades (10). In 2008, 47.9% of all food expenditures are spent eating out, up from 34% in 1974 and nearly double from what it was in 1955 (11). Restaurants serve food high in fat which promotes good taste, plus larger portions that tend to be high in calories (75). Recent research shows that children consumed larger portion sizes, more soft drinks, less fruits, vegetables and dairy products in the restaurant than at home (6, 76). Ayala et al. also found that children whose families ate at restaurant at least weekly consumed more sugar-sweetened beverages, more sweet/savory snacks, and less water than those who did not eat at restaurant this often (9). Several studies have reported that eating out more frequently is associated with obesity, higher body fatness, and higher body mass index in

children, adolescents and adults (71, 77, 78).

Fast food has become an increasingly important part of the US diet (12). Adolescents want quick, good-tasting, convenient, and low-cost meals, which are the main features of fast food (36). In addition to good taste and smell, playground and toys are reasons why children like fast food restaurants (79, 80). Fast food restaurants provide almost one third of away-from-home meals to children and adolescents (79). Fast food and food prepared away from home are more likely to be fried, making them a common source of saturated and partially trans fat, which are known to increase cardiovascular disease risk (71). Fast food may often displace healthier food options such as fruits, vegetables, milk and breads and cereals (81). Children and adolescents who report eating more fast food consume more total energy than those who eat less fast food (81). This may be due to the large portion sizes, high energy density and palatable of fast foods (82). In a study conducted in Houston, TX, researchers assessed the nutrient quality of fast food kids meals and reported that only 3% of kids meals met all the National School Lunch Program criteria (83). National data indicate that on any given day nearly 40% of high-school-aged adolescents report consuming food from a fast-food restaurant (81). A survey also showed that approximately 75% of students aged 11 to 18 years ate at a fast food restaurant during the prior week (84). High intake of fast foods is associated with low intake of milk, vegetables and fruits, but high intake of soda and fat (85). National

survey data also show that fast food consumers eat more fat, sugar, and soft drinks and less milk, fruit, and vegetables than non-fast food consumers (81). Wiecha et al. reported that fast food restaurant use is associated with overall sugar-sweetened beverage intake (86). Taveras et al. discovered that frequency of eating fried foods away from home was associated with greater intakes of total energy, sugar-sweetened beverages, and trans fatty acids, lower consumption of low-fat dairy foods and fruits and vegetables (71). Previous studies indicate an inverse correlation for milk and a positive correlation for sugar-sweetened soft drinks with the odds for becoming obese in children or young adults (87, 88). Fruits and vegetables may protect against excessive weight gain and obesity-related morbidities such as cardiovascular disease and diabetes, because of their low energy density, high fiber content, and low glycemic index (89).

The types of foods available to children and adolescents at school can impact the types of foods consumed. For example, some researchers found that as vending machine availability increased, fruit and/or vegetable consumption decreased in younger grade school children (90). The consumption of sugar-sweetened beverages continues to grow among children and adolescents (91). Wiecha et al. reported that among 646 students who reported using school vending machines, 456 (71%) reported purchasing sugar-sweetened beverages (86). Some researchers found that children who consume high amounts of soft drinks have higher energy intakes, and lower intakes of milk, fruit

juice and micronutrients compared to children who consume low amounts of soft drinks (92, 93).

In previous studies, age difference in food group intakes also has been found: as children enter adolescence, skipping breakfast is more prevalent (94) and the frequency of eating dinner with their families decreases (46), which results in lower intakes of some healthful food groups such as fruits, vegetables and dairy products (46, 95), and higher intakes of soft drinks (96) and fast food (42).

Gender difference exists in eating behaviors, too. Skipping breakfast is typically more prevalent in females (64, 97), and females are more likely to consume lower intakes of dairy products which are good sources of calcium (98, 99). Dieting occurs commonly among adolescent girls, which may be the reason of inadequate dietary intake of certain foods (100). In a national sample of adolescents, girls were at risk for inadequate intakes of fruits and vegetables (101). Gillis et al. found that boys consumed significant greater amount of sugar-sweetened drinks than girls in a one-year cross-sectional study (75). Also in a large cohort of preadolescents and adolescents throughout the United States, boys consumed more snack foods than girls (102). Cavadini et al. did research on gender difference in food group consumption among US adolescents in the USDA surveys (98). They found that girls tend to ingest less milk, grains, vegetables and beverages than boys. Hanson et al. examined the influence of

household food availability among adolescents. They reported that fruits and vegetables intake was positively associated with household food availability; soft drink consumption was inversely related to dairy intake among girls (103). Among boys, serving milk at meals was positively associated with dairy intake (103).

Income is also an important predictor of eating patterns (6). The diets of children and adolescents in low-income families tend to be characterized by higher intake of foods such as meat products, fats, full cream milk, sugars, cereals, and relatively low intake of vegetables and fruits than those in high-income families (104, 105).

Purpose and Objectives

Although there are some studies related to assessment of the relationship between food group consumption and its related influencing factors, the literature about food group consumption is still limited. The purpose of this study is to find some of the influential demographic, economic, environmental factors on food group consumption. The objective of this research is to discover if significant relationships exist between age, gender, household income, locations where children/adolescents ate, whom they ate with, the way they considered food as a meal or a snack, and food group consumption. In addition, the hypotheses are:

1. Adolescents have a greater intake of breads and cereals, dairy products, fruits and

fruit juices, vegetables than children.

2. Boys have a higher intake of fats, meats, burgers and sandwiches, mixed dishes than girls.
3. Children/adolescents in families with higher household incomes consume more fruits and fruit juices, vegetables, but less meats, burgers and sandwiches, mixed dishes than those with lower household incomes.
4. Children/adolescents consume more breads and cereals, dairy products, fruits and fruit juices, vegetables, and fewer fats, sweetened beverages when they eat at home as compared to eating away from home.
5. Children/adolescents consume more breads and cereals, dairy products, fruits and fruit juices, vegetables, and less sweetened beverages when they eat with various family members as compared to eating alone or with only one family member or with non-family members.
6. Children/adolescents consume more snacks and desserts, sweetened beverages when they eat with their friends as compared to eating with others.
7. Children/adolescents who eat breakfast have higher intake of breads and cereals, dairy products, fruits and fruit juices, vegetables than those who do not eat breakfast.
8. Children/adolescents who consume more fruits and fruit juices have a greater intake

of vegetable and lower intake of snacks and desserts, sweetened beverages than those who consume less fruits and fruit juices.

CHAPTER III

MATERIALS AND METHODS

The project of “Parental Time, Income, Role Strain, Coping, and Children’s Diet and Nutrition” was funded by USDA-ERS-Food Assistance and Nutrition Research Program. The data were collected between July 2001 and June 2002.

Survey Sampling

A sample of approximately 300 families in the Houston Metropolitan Statistical Area (MSA) was generated by random digit dialing. In order to obtain significant results at the .05 level (one tailed tests) with a statistical power of 90% in bivariate analyses, a minimum of 212 families were needed (106). Multivariate analysis techniques were planned to test hypotheses, so a sample greater than 212 was needed. The Houston MSA was chosen because it has high concentration of minority groups and wide range of incomes.

Survey Sampling Inc provided a sample of 10,000 randomly generated telephone numbers. Unassigned, disconnected and non-household telephone numbers were excluded. Trained student workers from Texas A&M University made initial contacts and eligibility determinations with households. Eligible families included mother, father (where present in the household) and one child aged either 9–11 or 13–15.

These two groups provided data of children (pre-pubertal) and adolescents (post-pubertal). In addition, children under 9 years old may have a problem with providing detailed information about themselves, and parents have been shown to have less influence on adolescents over 15 years old (107). Twelve-year-old children were excluded because they are in a state of pubertal transition between these two groups of children (108, 109). Survey data were collected from over 300 eligible families who were willing to participate. Three hundred and twelve children/adolescents (159 boys, 153 girls) completed the face-to-face interview at the child's home about parenting, eating habits, a 24-hour dietary intake recall, and a 24-hour activity recall. Their anthropometric measurements, such as height, weight, waist/hip circumference and triceps and subscapular skinfold, were recorded by trained interviewers following procedures described by Lohman et al. and Lee and Nieman (110, 111). A total of 58 single mothers and 254 two-parent households (245 fathers) responded to telephone interviews about their employment, working conditions, personal health / health practices, and the monitoring and control of children's eating. In addition, they completed self-administered questionnaires about income and time use.

24-hour Dietary Recalls and 2-day Dietary Records

Daily dietary intakes of subjects were estimated by conducting a multiple-pass 24-hour recall, which was supplemented by a 2-day dietary record. The 24-hour diet

recall indicated the dietary intake of the child in the previous 24-hour period of the interview day. With the multiple-pass 24-hour recall method, a free-recall list of all foods consumed in the previous 24-hour period of the interview day was provided by the subject. Then, the interviewer assisted the subject with food descriptions and amounts. Finally, the subject reviewed the recall information and made changes if necessary.

During the 24-hour recall, amounts of foods eaten were estimated with the use of measuring cups and spoons, a ruler, and a food model book (adapted from Hess, 1997). The subject was asked to indicate the amount of food he/she consumed, where it was consumed, who was with him/her when he/she consumed the food, and whether he/she considered the food to be a meal or a snack. The information was collected for all the foods consumed during the 24-hour period.

For the 2-day dietary record, the subjects were asked to write down intakes for two consecutive days. Two weekdays and one weekend day during either the summer or school year were selected for the 24-hour dietary recall and the 2-day dietary record. The two days for keeping the 2-day dietary record depended on the date of the interview day. As indicated above for the 24-hour recall, measuring cups and spoons, a ruler, and the same food model book (adapted from Hess, 1997) were used to help the subject estimate the amount he/she consumed for the 2-day dietary record. The information of the amount of food he/she consumed, where he/she consumed, who was with him/her when he/she

consumed the food, and whether he/she considered the food was a meal or a snack was kept by the subject. The same interviewer who conducted the face-to-face interview called the subject after the final food record day. The interviewer asked the subject to read his/her record entries and asked for more details if there were unclear entries.

Data from 24-hour dietary recalls and 2-day dietary records were entered into the Food Processor SQL Nutrition Analysis and Fitness Software (SQL edition, ESHA Research, Salem, OR, 2002-2003) for analyzing daily energy and nutrient intakes. Daily averages were converted into the Statistical Analysis System (SAS version 9.2, SAS Institute Inc, Cary, NC, 2008) for further analysis.

Coding and Categorizing Procedures

The current study used data from the study described above. In 24-hour dietary recalls and 2-day dietary records, for each individual food item, information of “when did the child eat”, “where did the child eat”, “whom did the child eat with”, “was it a meal or a snack” were provided by participants. In the current study, locations of eating occasions were coded as 0-19 (Table 1). Persons who ate with the subjects were coded as 0-13 (Table 2). The ways that participants defined the food occasion were coded as 1-6 (Table 3). All the coded data were entered into the Microsoft Excel software.

All the food items in 24-hour dietary recalls and 2-day dietary records were categorized into 12 groups (Table 4) according to methods described by

Deshmukh-Taskar for the Bogalusa Heart Study, 1995-1996 (24).

Data Analysis

Statistical analyses were performed using the Statistical Analysis System (SAS version 9.2, SAS Institute Inc, Cary, NC, 2008). Descriptive statistics (i.e., means, standard deviation) of food consumption by food groups, by the locations where subjects consumed food, by persons who were with subjects when they consumed food, by whether the subjects considered the food consumed as a meal or a snack were calculated. One tailed t-tests were used to detect the differences in food group consumption by age, gender, household income differences, respectively. Correlation analysis and the Pearson product-moment correlation coefficients were used to detect the relationship between variables, including locations where children/adolescents ate, whom they ate with, the way they considered food as a meal or a snack and food group consumption. The Pearson product-moment correlation coefficients of every two food group consumption were also calculated to identify the intercorrelations among any two variables of food group consumption. The statistical significance was set at $P < 0.05$.

Table 1 Codes for locations of eating occasions

Code	Location
0	Home
1	School
2	Restaurant
3	Fast Food Restaurant
4	Grandparents' home
5	Friends' home
6	Aunts'/Uncles' home
7	Neighbors' home
8	Car/bus
9	Park
10	Movies
11	Church
12	Scouts
13	Sports
14	Grocery store
15	Parent's place of work
16	School nurse office
17	Mall
18	Astrodome
19	Hotel

Table 2 Codes for persons who ate with the subjects

Code	Person who ate with the subjects
0	Alone
1	Family
2	Parents
3	Siblings
4	Grandparents
5	Friends
6	Friends and Family
7	Friends and Siblings
8	Friends and Grandparents
9	Sitter and Siblings
10	Friends and Friends Family
11	Aunt/uncle
12	Neighbor
13	School nurse

Table 3 Codes for meal patterns

Code	Meal pattern
1	Breakfast
2	Lunch
3	Dinner
4	Morning snack (before 1PM)
5	Afternoon snack (1PM to 6PM)
6	Evening snack (after 6PM)

Table 4 Codes for food groups

Code	Food Group
1	Breads and cereals
2	Dairy products
3	Fruits and fruit juices
4	Vegetables
5	Fats
6	Meats
7	Burgers and sandwiches
8	Mixed dishes
9	Snacks and desserts
10	Sweetened beverages
11	Alcoholic beverages
12	Condiments

CHAPTER IV

RESULTS

From a total of 312 subjects, 27 subjects were excluded from the analyses due to missing data.

Descriptive Statistics of Food Group Consumption

We began by calculating means and standard deviation of food consumption over three days by food groups, by the locations where subjects consumed food, by persons who were with subjects when they consumed food and by whether the subjects considered the food consumed as a meal or a snack.

Table 5 shows the mean values and standard deviation of food consumption over 3 days by the 12 food groups among 285 children and adolescents who completed 24-hour dietary recall and 2-day dietary record. Among the 12 food groups consumption, snacks and desserts group had the largest mean (7.6 items), followed by breads and cereals (4.5 items), dairy (4.4 items), and sweetened beverages (4.1 items).

Table 5 Means and standard deviation of food consumption by food group (in numbers of food group items over 3 days)

Food Group	Mean	Standard deviation
Breads and cereals	4.5	2.2
Dairy products	4.4	2.7
Fruits and fruit juices	2.8	2.8
Vegetables	3.6	2.7
Fats	0.7	1.1
Meats	3.0	1.9
Burgers and sandwiches	1.5	1.3
Mixed dishes	2.6	1.7
Snacks and desserts	7.6	4.4
Sweetened beverages	4.1	2.4
Alcoholic beverages	0.0	0.1
Condiments	2.4	1.7

Table 6 shows the mean values and standard deviation of food consumption over 3 days by the locations where it was consumed among the 285 subjects. The subjects consumed more foods at home (21.1 items); a distant second was school where 5.4 items were consumed on average.

Table 7 shows the mean values and standard deviation of food consumption over 3 days by the persons who were with the subjects when they consumed the food among the 285 subjects. The subjects consumed most foods with various family members (10.8 items); the second greatest number of foods were consumed with friends (7.9 items).

Table 8 shows the mean values and standard deviation of food consumption over 3 days by meal patterns. Among breakfast, lunch, dinner, morning snack, afternoon snack and evening snack, dinner had the largest mean value of food intake (10.4 items).

Table 6 Means and standard deviation of where food consumption took place (in numbers of food group items over 3 days)

Location	Mean	Standard deviation
Home	21.1	12.1
School	5.4	5.7
Restaurant	1.5	3.6
Fast Food Restaurant	1.8	3.4
Grandparents' home	0.3	1.6
Friends' home	1.1	2.6
Aunts'/Uncles' home	0.3	2.2
Neighbors' home	0.0	0.4
Car/bus	0.8	1.6
Park	0.4	1.9
Movies	0.1	0.5
Church	0.3	1.2
Scouts	0.0	0.5
Sports	0.2	1.2
Grocery store	0.1	0.6
Parent's place of work	0.1	0.8
School nurse office	0.0	0.2
Mall	0.1	0.5
Astrodome	0.1	0.5
Hotel	0.0	0.3

Table 7 Means and standard deviations of with whom food was consumed (in numbers of food group items over 3 days)

Whom ate with	Mean	Standard deviation
Alone	4.6	5.1
Family	10.8	10.5
Parents	5.8	7.8
Siblings	2.7	4.0
Grandparents	0.2	0.9
Friends	7.9	7.1
Friends and Family	0.8	2.6
Friends and Siblings	0.3	1.3
Friends and Grandparents	0.0	0.2
Sitter and Siblings	0.1	0.6
Friends and Friends Family	0.3	1.2
Aunt/uncle	0.0	0.7
Neighbor	0.0	0.1
School nurse	0.0	0.1

Table 8 Means and standard deviations of meals at which food was consumed (in numbers of food group items over 3 days)

Meal pattern	Mean	Standard deviation
Breakfast	6.0	3.9
Lunch	9.5	5.6
Dinner	10.4	5.7
Morning snack	1.8	2.2
Afternoon snack	3.4	3.2
Evening snack	2.7	2.8

T-tests

We performed t-tests of food group consumption between adolescents and children, boys and girls, and children and adolescents in families with higher household incomes and lower household incomes. In this study, household incomes, which were equal to or greater than \$69500 (the first quartile of household incomes of the sample families), were defined as higher household incomes; household incomes, which were less than \$69500, were defined as lower household incomes. For hypotheses 1-3, significant results are reported below if they were at or below p-value of 0.05.

For hypothesis 1, we found that children had higher intakes of breads and cereals ($p < 0.05$), dairy products ($p < 0.01$), fruits and fruit juices ($p < 0.05$) and snacks and desserts ($p < 0.001$) than adolescents (Table 9).

For hypothesis 2, however, we found that girls consumed more snacks and desserts ($p < 0.01$) than boys (Table 10). Girls had a higher intake of condiments ($p < 0.05$) than boys, as well (Table 10).

For hypothesis 3, we found that children/adolescents in families with higher household incomes consumed more snacks and desserts ($p < 0.05$), but fewer meats ($p < 0.05$) than those with lower household incomes (Table 11).

Table 9 T-test results of food group consumption between children and adolescents (in numbers of food group items over 3 days)

Food group	Adolescents	Children
Breads and cereals	4.2	4.7*
Dairy products	3.9	4.9**
Fruits and fruit juices	2.4	3.2*
Vegetables	3.3	3.8
Fats	0.7	0.8
Meats	2.9	3.1
Burgers and sandwiches	1.5	1.5
Mixed dishes	2.5	2.6
Snacks and desserts	6.6	8.5****
Sweetened beverages	4.1	4.1
Alcoholic beverages	0.0	0.0
Condiments	2.3	2.4

*p<0.05

**p<0.01

***p<0.001

****p<0.0001

Table 10 T-test results of food group consumption between boys and girls (in numbers of food group items over 3 days)

Food group	Boys	Girls
Breads and cereals	4.5	4.5
Dairy products	4.5	4.4
Fruits and fruit juices	2.6	3.1
Vegetables	3.5	3.6
Fats	0.7	0.8
Meats	3.1	2.9
Burgers and sandwiches	1.5	1.5
Mixed dishes	2.5	2.6
Snacks and desserts	6.8	8.3**
Sweetened beverages	4.2	4.0
Alcoholic beverages	0.0	0.0
Condiments	2.1	2.6*

*p<0.05

**p<0.01

***p<0.001

****p<0.0001

Table 11 T-test results of food group consumption between subjects in families with higher household incomes and lower household incomes (in numbers of food group items over 3 days)

Food group	Low-income	High-income
Breads and cereals	5.0	4.8
Dairy products	4.8	4.9
Fruits and fruit juices	2.1	3.0
Vegetables	3.7	3.4
Fats	0.8	0.8
Meats	3.6	2.8*
Burgers and sandwiches	1.4	1.5
Mixed dishes	2.8	2.5
Snacks and desserts	6.3	8.2*
Sweetened beverages	4.1	4.3
Alcoholic beverages	0.0	0.0
Condiments	2.5	2.6

*p<0.05

**p<0.01

***p<0.001

****p<0.0001

Correlations

We performed correlation analysis between variables, including locations where children/adolescents ate (Table 12), whom they ate with (Table 13), whether they considered food as a meal or a snack (Table 14) and food group consumption. The Pearson product-moment correlation coefficients were calculated. Also, correlation analyses of every two food group consumption were used to detect the intercorrelations among the food group consumption variables (Table 15). For hypotheses 4-8, significant results are reported below if they were at or below p-value of 0.05.

For hypothesis 4, we found that children/adolescents consumed more breads and cereals ($p < 0.001$), dairy products ($p < 0.001$), fruits and fruit juices ($p < 0.001$), vegetables ($p < 0.0001$) when they ate at home than when they ate away from home (Table 12). However, children/adolescents consumed more fats ($p < 0.001$), meats ($p < 0.001$), and snacks and desserts ($p < 0.0001$) when they ate at home as compared to eating away from home, too (Table 12).

For hypothesis 5, we found that children and adolescents ate more breads and cereals ($p < 0.0001$), dairy products ($p < 0.0001$), fruits and fruit juices ($p < 0.001$), vegetables ($p < 0.0001$) when they ate with various family members than when they ate alone or with only one family member or with non-family members (Table 13). However, children/adolescents also consumed more fats ($p < 0.0001$), meats ($p < 0.001$) and

condiments ($p < 0.001$) when they ate with various family members as compared to when they alone or with only one family member or with non-family members (Table 13).

For hypothesis 6, we found that children/adolescents consumed more breads and cereals ($p < 0.001$), dairy products ($p < 0.01$), fruits and fruit juices ($p < 0.05$), burgers and sandwiches ($p < 0.001$), snacks and desserts ($p < 0.001$), condiments ($p < 0.05$), and fewer fats ($p < 0.01$) when they ate with their friends as compared to having eaten with others (Table 13).

Hypothesis 7 was supported by our data ($p < 0.0001$; $p < 0.0001$; $p < 0.001$; $p < 0.001$). In addition, we found that children/adolescents who ate breakfast consumed more fats ($p < 0.0001$), meats ($p < 0.001$), snacks and desserts ($p < 0.01$), and condiments ($p < 0.001$) than those who did not eat breakfast (Table 14).

For hypothesis 8, we found that children/adolescents who ate more fruits and fruit juices had significant higher intakes of breads and cereals ($p < 0.001$), dairy products ($p < 0.01$), vegetables ($p < 0.001$), and snacks and desserts ($p < 0.001$), but lower intakes of sweetened beverages ($p < 0.001$) than those who ate less fruits and fruit juices (Table 15).

Table 12 Correlations between food group consumption and where the foods were eaten (the Pearson product-moment correlation coefficients)

Place	Breads and cereals	Dairy products	Fruits and fruit juices	Vegetables	Fats	Meats	Burgers and sandwiches	Mixed dishes	Snacks and desserts	Sweetened beverages	Alcoholic beverages	Condiments
Home	.334***	.286***	.326***	.299****	.317***	.177***	-.021	-.088	.220****	.058	.019	.109
School	.223***	.212****	.112*	.113**	-.129**	-.042	.100	-.004	.238****	-.074	-.096	.125*
Restaurant	-.030	.121**	.072	.231***	.063	.029	.025	.162***	.010	.156***	.080	.175***
Fast food	-.066	-.046	.014	.090	-.047	-.025	.093	-.081	.118*	.004	-.011	.186***
Grand-Parents' home	.168**	.044	.038	.076	-.053	.059	-.060	-.092	.015	-.036	-.020	.001
Friends' home	-.061	.022	.014	.004	-.012	.059	-.022	-.049	.123*	.091	-.030	.019
Aunts'/Uncles' home	.114*	.024	-.038	-.054	.095	.143***	.161***	.066	-.021	-.064	-.015	.066
Neighbors' home	.065	.118*	.052	.034	-.028	-.084	.088	-.021	.016	.013	-.011	.039
Car/bus	-.019	.078	.082	.145***	.092	-.010	.098	-.007	.142***	.051	-.010	.143***
Park	.061	.112*	.115*	.069	-.002	.042	.039	-.053	.129*	.038	-.023	.081
Movies	.008	-.062	-.012	-.088	-.035	-.113*	-.034	-.102	-.001	-.012	-.021	-.035
Church	-.047	-.020	-.032	-.060	-.015	-.082	.149***	-.067	.125*	.080	-.029	.065

Table 12 continued

Scouts	.084	-.017	.038	-.000	.063	.026	.026	-.010	.011	.030	-.010	.038
Sports events	.084	-.042	.153***	.039	.054	-.040	.134*	.041	.099	.168***	-.023	.085
Grocery store	-.017	.091	.047	-.002	.040	-.020	.034	.074	.034	.058	-.015	.069
Parent's work	-.023	-.086	-.001	.034	-.072	.048	-.000	.085	.030	.001	-.015	-.133*
After school	.018	.033	.050	-.032	-.018	-.087	.001	.046	.008	.049	-.008	-.040
Mall	-.060	.086	-.099	.110*	-.008	.009	-.004	.093	-.032	.069	-.018	-.016
Astro-dome	.084	.065	-.028	-.012	-.012	-.100	.050	-.087	-.011	.025	-.011	.021
Hotel	.066	.095	-.019	.045	.022	.047	.098	.079	-.007	.189***	-.009	.110*

*p<0.05

**p<0.01

***p<0.001

****p<0.0001

Table 13 Correlations between food group consumption and with whom the foods were eaten (the Pearson product-moment correlation coefficients)

Whom ate with	Breads and cereals	Dairy products	Fruits and fruit juices	Vegetables	Fats	Meats	Burgers and sandwiches	Mixed dishes	Snacks and desserts	Sweetened beverages	Alcoholic beverages	Condiments
Alone	.071	.097	.040	-.015	-.027	-.006	.039	-.118*	.159***	.039	-.065	-.022
Family	.191***	.271***	.157***	.339***	.334***	.162***	-.022	.092	.105	-.065	.079	.188***
Parents	.067	.070	.257***	.155***	.053	.032	.013	-.058	.123*	.153***	-.002	.002
Siblings	.220***	.127*	.087	.064	.030	.182***	.055	-.082	.085	-.071	-.018	.162***
Grandparents	.094	.016	-.010	.088	-.070	.074	-.069	.010	-.107	.013	-.016	.019
Friends	.149***	.139**	.121*	.082	-.136**	-.083	.146***	-.057	.272***	.103	-.093	.131*
Friends and family	.117*	.044	.056	.111*	.194***	.044	.038	-.086	.102	.064	-.007	.194***
Friends and siblings	.102	.053	.026	.030	.027	-.044	-.040	.025	.023	.040	-.020	.022
Friends and grandparents	.101	.053	.026	.030	.027	-.092	.068	.050	-.008	.047	-.006	.019
Sitter and siblings	-.039	-.012	.079	-.027	-.063	.104	-.057	-.024	.028	-.033	-.009	-.113*

Table 13 continued

Friends and friends' family	-.005	-.019	.070	-.037	.020	.016	.003	-.017	.104	.059	-.023	.023
Aunts & uncles	.122*	.012	.027	-.038	.020	.120*	.118*	-.019	.006	-.076	-.006	-.042
Neighbors	-.013	-.094	-.038	-.055	-.040	-.061	.113*	-.019	-.086	-.002	-.005	.019
School Nurse	-.039	-.012	.079	-.027	-.063	-.092	-.067	-.019	.058	-.052	-.006	-.074

*p<0.05

**p<0.01

***p<0.001

****p<0.0001

Table 14 Correlations between food group consumption and meal patterns (the Pearson product-moment correlation coefficients)

Meal Pattern	Breads and cereals	Dairy products	Fruits and fruit juices	Vegetables	Fats	Meats	Burgers and sandwiches	Mixed dishes	Snacks and desserts	Sweetened beverages	Alcoholic beverages	Condiments
Breakfast	.371****	.352****	.353***	.141***	.277****	.158***	.001	-.063	.153**	-.060	.034	.150***
Lunch	.268****	.339****	.241****	.291****	.040	.059	.131*	.009	.210**	.063	-.039	.218****
Dinner	.271****	.247****	.299****	.493****	.201****	.156****	.011	-.033	.126*	.056	.029	.253****
Morning snack	.057	.015	.075	.119*	.035	.058	.065	-.125*	.356****	-.019	-.052	.054
Afternoon Snack	.210***	.161***	.169***	.041	.117*	.033	.095	-.060	.471****	.138**	-.066	.065
Evening Snack	.058	.075	.079	.132*	.164****	.089	.105	-.046	.282****	.240****	-.050	.136****

*p<0.05

**p<0.01

***p<0.001

****p<0.0001

Table 15 Intercorrelations among food group consumption variables (the Pearson product-moment correlation coefficients)

Food groups	Breads and cereals	Dairy products	Fruits and fruit juices	Vegetables	Fats	Meats	Burgers and sandwiches	Mixed dishes	Snacks and desserts	Sweetened beverages	Alcoholic beverages	Condiments
Breads and cereals	1.0	.404***	.206***	.133*	.138***	.198***	.082	-.142***	.091	-.011	-.008	.169** *
Dairy products		1.0	.162**	.151**	.065	.045	-.089	.010	.191***	-.151***	.046	.104
Fruits and fruit juices			1.0	.275***	.054	.052	.010	.046	.176***	-.151***	.031	.058
Vegetables				1.0	.151***	.241***	-.046	-.017	-.012	-.052	-.008	.209** **
Fats					1.0	.109*	-.068	-.050	.058	.003	.055	.163** *
Meats						1.0	-.076	-.060	-.136***	-.032	-.036	.082
Burgers and sandwiches							1.0	-.128**	.012	.104	-.064	.223** **
Mixed dishes								1.0	-.087	.051	.087	-.078
Snacks and desserts									1.0	.075	-.036	.091

Table 15 continued

Sweet-ened beve-rages										1.0	-.004	.015
Alcoho-lic beve-rages											1.0	.159***
Condi-ments												1.0

*p<0.05

**p<0.01

***p<0.001

****p<0.0001

CHAPTER V

DISCUSSION

Although a large amount of research has been devoted to nutrient intake analysis, relatively few investigators have assessed food group consumption. Compared to daily nutrient intake analysis, the daily intake of individual foods tends to be more variable. However, food group intake may reduce this variability by combining similar foods into a more general category. This study adds to previous studies, establishing the association of food group intake with influencing factors in children and adolescents.

Findings from our research reveal that food group consumption varies by demographic, economic and environmental factors in children and adolescents. Of greatest interest in this study was the relationship between the factors of location where the food was consumed, persons who were with the subjects when they consumed food, meal patterns and food group consumption. Although the amount of each food item is not specified, food group consumption may reflect subjects' willingness to make choices about food group consumption.

Children and adolescents consumed more breads and cereals, dairy products, fruits and fruit juices, vegetables, fats, meats, snacks and desserts when they ate at home as compared to eating away from home in our study. Similar results for dairy products,

fruits and vegetables groups had been reported (6, 76). Eating at home can create a healthy food and eating environment (10). Foods from away-from-home are significantly higher in fat (70), and frequent consumption of fast food is associated with poor diet quality among children and adolescents (81). The reason of the subjects consumed fewer breads and cereals, dairy products, fats, meats, snacks and desserts when they ate away-from-home as compared to at home may due in part to the higher energy and fat content of many foods obtained away-from-home. More energy and fat in the foods would be expected to result in satiety. Also, children and adolescents tend to consume larger portion sizes at restaurant than at home (112), which may result in lower intake from other food groups.

Our results showed that children and adolescents consumed more breads and cereals, dairy products, fruits and fruit juices, vegetables, fats, meats and condiments when they ate with more than one family members as compared to having eaten alone or with only one family member or with non-family members. The results for breads and cereals, dairy products, fruits and fruit juices, and vegetables groups were consistent with previous studies (6, 39, 47). Regarding fats and meats groups, a possible explanation is: the subjects (especially adolescents) may use avoiding eating with family members as a way to diet.

The results for the influence of peers on food group consumption in the present

study were mixed, yet interesting. The subjects consumed more breads and cereals, dairy products, fruits and fruit juices, burgers and sandwiches, snacks and desserts, and condiments, but less fats when they ate with their friends as compared to having eaten with others. The results of fruits and fruit juices, burgers and sandwiches, snacks and desserts groups agreed with the findings that children and adolescents consumed more fruits, fast food and snack foods with friends (56-58). For breads and cereals, dairy products groups, it may be possible that the subjects had frequent breakfast with friends during the investigated period. This may have occurred because of eating breakfast at school in the accompaniment of friends.

In our study, we found that children and adolescents who ate breakfast had significantly higher intakes of breads and cereals, dairy products, fruits and fruit juices, vegetables, fats, meats, snacks and desserts, and condiments than those who did not eat breakfast. It has been reported that breakfast eaters among children and adolescents consumed more vegetables and milk than breakfast skippers (63, 66). The results from our study and previous studies suggest that breakfast eaters have better food choices than breakfast skippers.

Skipping breakfast is typically more prevalent in females (64, 97), and females are more likely to consume lower intakes of dairy products, which are good sources of calcium (98, 99). In a national sample of adolescents, girls were at risk for inadequate

intakes of fruits and vegetables (101). Also in a large cohort of preadolescents and adolescents throughout the United States, boys consumed more snack foods than girls (102). However, in the present study, the results for gender differences in food group consumption indicated that girls consumed more snacks and desserts and condiments than boys. This result is consistent with previous study of adults in Sweden; women consumed more snack foods than men (13). Regionally, specific samples provide sometimes inconsistent findings. For example, there were no significant differences in snacking frequency between boys and girls among Northern Ireland adolescents and children (113, 114).

In our study, children consumed more breads and cereals, dairy products, fruits and fruit juices and snacks and desserts than adolescents. In previous studies, age difference in food group intakes also has been found. As children enter adolescence, skipping breakfast is more prevalent (94) and the frequency of eating dinner with their families decreases (46), which results in lower intakes of some healthful food groups such as fruits, vegetables and dairy products (46, 95), and higher intakes of soft drinks (96).

Children and adolescents who ate more fruits and fruit juices had significantly higher intakes of breads and cereals, dairy products, vegetables, snacks and desserts and lower intakes of sweetened beverages than those who ate less fruits and fruit juices in

our study. Although not many studies have examined this issue, Gonzalez and colleagues found that children in schools with restricted snack availability had significantly higher frequency of fruit and vegetable consumption than children in schools without restricted snack availability (115). From these findings one can hypothesize that a certain food group intake tends to influence other food groups intake, although more studies are needed in this area.

Some previous studies have also reported that children and adolescents in low-income families had greater intakes of meat products, fats, sugars and cereals, and lower intakes of vegetables and fruits compared to those in high-income families (104, 105). In our study, we found that children/adolescents in families with lower household incomes consumed more meats, and fewer snacks and desserts than those with higher household incomes. One study found that after controlling for education which had a negative effect on meat consumption, that income was positively related to meat consumption (116).

Our research does have some limitations. First, the results of this study may not be completely applied to other populations. Our sample consisted primarily of white children and adolescents with well-educated and high-income parents, who were willing to complete the survey, interview, 24-hour dietary recall and 2-day dietary record. Second, dietary recalls and records were used during this study in order to estimate the

food group intake over 3 days among the subjects. A very common flaw is the underestimation of food and beverage intake due either to psychological factors or to poor subject compliance (20, 117, 118). Third, food group intake does not specify the amount of each food item consumed; thus we cannot link the results to the USDA Dietary Guidelines. Despite all these shortcomings, this study makes a contribution to the literature on factors that influence food group consumption in children and adolescents from Houston, TX in the United States.

CHAPTER VI

CONCLUSION

In summary, the findings presented here support earlier work showing that various factors including demographic, economic, environmental factors play an important role in influencing food choices in a sample of children and adolescents in the Houston area. The findings from this study add to the body of research on food group intake by providing detailed influencing factors among children and adolescents.

The hypotheses tested were supported to some degree; a surprise was the lack of difference between girls and boys, as previous studies suggested boys tended to consume greater amounts of food. Not only was this not the case, but girls tended to consume more items from the snack and dessert and condiments food groups. These findings may be unique to this sample or they may reflect a significant cultural change with regard to gender norms and food consumption.

Eating at both home and school were associated with greater numbers of foods from various food groups being consumed. The former finding was hypothesized but no hypothesis had been formed for the latter finding. Both make sense in terms of both opportunity and availability. Children and adolescents are at home for many of their eating opportunities and food availability is generally controlled by their parents.

Similarly, for much of the year children and adolescents are consuming one to two of their weekday meals at school, where again others control availability. Eating in full service restaurants also influenced food intake to a certain degree, where menus place certain limits on availability. In addition, the majority of these eating occasions occur with parents present.

Few of the children and adolescents in the sample ate alone; thus this eating pattern had little impact on the intake of items from the various food groups. The two patterns of eating involving others that did influence food intake were eating with family and eating with friends. Not surprisingly the more often children and adolescents ate with family, the more foods eaten from the various food groups. The food groups most associated with this eating pattern tended to be among the groups recommended as healthy. However, it was not anticipated that the more food children ate with their friends, the greater number of food choices that would emerge from food groups like breads and cereals, dairy, and fruits and fruit juices, and the less from the fat group. However, before pronouncing that eating with friends puts children and adolescents at no more of a risk of a less healthy eating pattern than eating with family, a closer examination of the foods actually consumed should be undertaken. Perhaps children and adolescents eat more fruit with family and consume more juice with friends or drink

more milk with family but consume more ice cream with friends. These eating patterns thus require further investigation.

Finally, all three meals of the day made significant contributions to children's and adolescents' intake from the various food groups, underscoring the importance of all three meals.

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