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Is ready-to-eat-cereal consumption associated with nutrient adequacy and weight status in Hispanic-American children and adolescents?

Solange Stella Pineda Vargas
Louisiana State University and Agricultural and Mechanical College

IS READY-TO-EAT-CEREAL CONSUMPTION ASSOCIATED WITH NUTRIENT ADEQUACY AND WEIGHT STATUS IN HISPANIC-AMERICAN CHILDREN AND ADOLESCENTS?

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Solange Stella Pineda Vargas
B.S., Universidad Industrial de Santander, Colombia, 1994
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DEDICATION

This thesis is dedicated to my children, Andres Felipe, Laura Isabel and Carolina; and my husband Nicolas Gil who supported me through my graduate studies. I think of my children as my inspiration.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS AND ACRONYMS

AI: Adequate Intake

AT: Alpha-tocopherol

BMI: Body Mass Index

CAPI: Computer- Assisted Personal Interview

CDC: Centers for Disease Control and Prevention

DFE: Dietary folate equivalent

DGA: Dietary Guidelines for Americans

FNDDS: Food and Nutrient Database for Dietary Studies

HA: Hispanic-American

Kcal: Kilocalories

LSM: Least square mean

MAR: Mean adequacy ratio

MEC: Mobile examination centers

MUFA: Monounsaturated fat

NCHS: The National Center for Health Statistics

NHANES: The National Health and Nutrition Examination Survey

NWCR: National Weight Control Registry

PE: Physical examination

PUFA: Polyunsaturated fat

RAE: Retinol activity equivalents

RDA: Recommended Dietary Allowance

RTEC: Ready to eat cereal

SAS: Statistical Analysis System

SE: Standard error

SFA: Saturated fatty acid

SUDAAN: Survey Data Analysis

USDA: The United States Department of Agriculture

ABSTRACT

Breakfast consumption has been associated with an improved nutrient intake and diet quality in children and adolescents. Ready to eat cereal (RTEC) breakfast contributes to macro and micronutrient intake, because it is usually fortified with vitamins and minerals, and is low in fat and high in fiber content. The objective of this study was to examine the impact of RTEC consumption on nutrient intake and weight status in Hispanic-American (HA) children and adolescents using data from 1999 to 2002 The National Health and Nutrition Examination Survey (NHANES). Participants were categorized by breakfast skippers, RTEC breakfast, and other breakfast consumers.

Hispanic-American children and adolescents consumed more other types of breakfast than an RTEC breakfast. Skipping breakfast was more common in HA adolescents than in children. Hispanic-American children and adolescents who consumed an RTEC breakfast had on average a lower intake of total fat and cholesterol than those who consumed other breakfast. Children between 1 to 5 years of age who consumed an RTEC breakfast had a higher mean energy intake from protein and a higher fiber intake than HA children who skipped breakfast. Hispanic-American in all age groups who consumed an RTEC breakfast had a better intake of vitamin B6, thiamin, riboflavin, niacin, folate, iron and zinc than those who consumed other breakfast and those who skipped breakfast. Children and adolescents met on average two-thirds of the Recommended Dietary Allowance (RDA) for Vitamin C and K, but did not average of the two-thirds of the RDA for vitamin E and fiber for any age regardless of the breakfast consumption pattern. Moreover, Adolescents who consumed an RTEC breakfast had a higher adequacy ratio (MAR) for shortfall nutrient intake than those who consumed others breakfast. . Children between 6 to 12 years of age who skipped breakfast had a significantly higher mean of

waist circumference than those who ate other breakfast; but this study found no significant association between the consumption of breakfast and skipped breakfast with the risk of overweight or being overweight in HA children and adolescent.

CHAPTER 1
INTRODUCTION

Statement of the Research Problem

Consumption of ready to eat cereal (RTEC) at breakfast, contributes positively to the nutritional quality of the diets of children and adults (1-3). Some studies have shown a possible role of RTEC breakfast consumption in reducing body weight (2, 4, 5). Nutrient intake in relation to the breakfast meal of Hispanics in the United States (US) has not been well studied. The purpose of this study was to determine if RTEC consumption at breakfast improved nutrient intake and weight status of Hispanic-American (HA) children and adolescents in the US using nationally representative data.

Rationale for the Study

The Hispanic population of the US includes individuals from Mexico, Puerto Rico, Cuba, and other countries from the Caribbean and Central and South America. In the US, this population has increased almost 100% from 22.4 million in 1990 to 42.7 million in 2005. Mexican-Americans are the largest Hispanic-origin group in the US (67% of Hispanics) (6). Data from the National Health and Nutrition Examination Survey (NHANES1999-2002) showed that the prevalence of overweight/obesity among Mexican Americans is increasing. Approximately 37% of Mexican American children 2 to 19 years of age are overweight or at risk of overweight (7, 8). There are many potential causes of overweight, but diets low in fiber and high in fat in children and adults, have been associated with overweight (9, 10). Obesity is a precursor of major health problems, including type 2 diabetes mellitus (9, 11) hyperlipidemia (12), and hypertension (11).

Breakfast consumption has been associated with improved nutrient intake and diet quality in children and adolescents (1, 5, 13, 14). A breakfast of RTEC contributes to macro and micronutrient intake, because the cereal is usually fortified with vitamins and minerals, and is low in fat and high in fiber content (1-3, 15). Moreover, an RTEC breakfast is often accompanied by milk that increases intake of protein (16, 17), calcium (13, 18), and vitamins A and D (1, 2, 5, 17, 18). Some studies have shown a possible role of breakfast, especially an RTEC breakfast in reducing body weight (2, 4, 5, 16) and maintaining weight loss (19, 20). The purpose of this study was to examine the impact of RTEC consumption on nutrient intake and weight status in HA using data from NHANES 1999 to 2002.

Objectives

The objectives of the current study are to determine whether there is an:

1. association between skipping breakfast, or consuming an RTEC breakfast or other breakfast, with nutrient profiles in HA children and adolescents aged 1 to 18 years.
2. improved nutrient intake when milk is consumed with RTEC.
3. association between skipping breakfast, or consuming a RTEC breakfast or other breakfast, and measures of weight status in HA children and adolescents aged 2 to 18 years.

Hypotheses

The study has the following hypotheses:

1. HA children and adolescents who consume RTEC for breakfast will have a better nutrient profile than those who do not eat RTEC.
2. HA children and adolescents who consume RTEC will consume more protein, calcium, and vitamin A than those who do not consume it.
3. HA children and adolescents who consume RTEC for breakfast will be less likely to be at risk of or overweight than those who do not consume RTEC.

Assumptions

The assumptions of this study were:

1. Participants or caregivers provided accurate responses to the NHANES surveys and questions about breakfast consumption and other questionnaire items.
2. The sample size is adequate to reflect accurately dietary intake in this population.

Limitations

Limitations of this study were:

1. Because of its cross sectional nature, the NHANES data set cannot be used to provide causal evidence between RTEC breakfast intake with nutrient adequacy and weight measures.
2. The 24-hour diet recalls have several inherent limitations: they may not reflect usual intake; they depend on memory; and subjects tend to under- or over-report.
3. Parents or caregivers who reported or assisted children with the recalls may not know all foods that children in daycare or school consumed the previous day.
4. RTECs were grouped together; and although the majority are fortified, those consumed may have varied considerably in energy, total carbohydrate, fiber, total and added sugar content, and exact fortification; whether RTEC were pre-sweetened was also not considered.
5. The category of RTEC also included other foods and these may contribute to the impact on weight parameters or nutrient intake.
6. Given the multi-colinearity in diet, there are a number of eating patterns that have been shown to be potentially associated with overweight.
7. The sample studied is primarily Mexican American, therefore the results may not be generalized to all HA populations in the US.

Definitions

Breakfast: Breakfast is the first meal of the day consisting of any consumption of solid food, beverage, or both eaten in the morning, named by respondent as breakfast (English) or desayuno (Spanish) (21).

Hispanic: The national survey NHANES defines persons of Hispanic-origin as those from Mexico, Puerto Rico, Cuba, and other countries from Central and South America (21).

National Health and Nutrition Examination Survey (NHANES) is a national survey conduced by the National Center for Health statistics (NCHS) of the Centers for Disease Control and Prevention (CDC). NHANES collects broad health information from personal interviews and medical examinations (21).

Ready to eat cereal: Ready to eat cereal is a cereal food that is processed to the point that it can be eaten without additional preparation (*e.g*. boxed cereal) (22). In some studies RTEC is called breakfast cereal or fortified breakfast cereal (5, 13). The name RTEC is preferred since these cereals are not necessarily eaten only for breakfast (16, 18); however, for the purpose of this study only RTEC consumed at breakfast was considered.

Shortfall Nutrients: are nutrients with an average intake lower than recommended intake for a group. The shortfall nutrients for children and adolescents are calcium; vitamin E; Potassium; calcium; magnesium; and fiber (23).

CHAPTER 2
REVIEW OF LITERATURE

Breakfast

For this thesis, the definition of breakfast used by NHANES: the first meal of the day consisting of any consumption of solid food, beverage or both eaten in the morning, named by respondent as breakfast (English) or desayuno (Spanish) (21) was used. However, breakfast may have different meanings for different individuals. In one study, breakfast was defined as any food or beverage consumed between 5 to 10 AM (5). Another study defined breakfast as the first meal that involved solid food or beverage which occurred after waking up and before 10 AM on week days and before 11 AM on weekends (15). The different meanings of the word breakfast make studies of breakfast intake difficult to compare.

The foods typically eaten at breakfast by the general population in the US are milk (46%), RTEC (28%), and breads/rolls (27%) (24). Eighty two percent of non-Hispanic whites and Mexican Americans eat breakfast on any given day (25). There are differences in consumption patterns when people eat breakfast at home or away from home; one difference is that 77% of non-Hispanic whites eat breakfast at home in comparison to 69% of Mexican Americans (24, 25). The type of food that non- Hispanics whites choose to eat at breakfast is different from what HA eat. For example, 20% of non-Hispanic whites reported eating RTEC at breakfast in comparison to 12% of HA; and 14% of non-Hispanic whites reported eating eggs in comparison to 18% of HA (26).

Traditionally breakfast has been acknowledged as the most important meal of the day since it is associated with numerous benefits, including improved nutrient intake (1, 5, 14, 27, 28). A healthy breakfast meal or one that gives the "required nutrient intake" is undefined.

Although a National School Breakfast Program breakfast must provide 25% of the Recommended Dietary Allowance (13) for energy, protein, calcium, iron, vitamin A and C (29). The other most cited benefits of breakfast consumption are its possible relationship to decreased the prevalence of overweight (2, 4, 13, 27), and improved academic performance in children and adolescents (13, 30). The latter is beyond the scope of this thesis and is not discussed further here.

Breakfast and Nutrient Intake

The importance of breakfast in improving nutrient intake has been observed in several studies (1, 5, 14, 27, 28). One study in children aged 5 to 12 years found that breakfast provided approximately one-third of daily requirements for most nutrients (1). In a study in France, breakfast consumption was divided into three categories (based on the energy of RDA in France): low-energy (< 15% of the energy RDA), medium-energy (15-25% RDA), and high-energy (>25 % RDA) breakfast. The study showed that a high-energy breakfast contributed more than 50% of the RDA for riboflavin, 45% of the RDA for calcium and phosphorus, 33% of the RDA for magnesium, and 10-15% of the RDA for iron in children. This study also found that a high-energy breakfast was associated with a lower serum cholesterol intake than other breakfast categories; suggesting that a higher energy breakfast has a positive impact on nutrient intake of children and adolescents (27). Another study conducted in ninth-grade students found that the percentage of adolescents who consumed at least two-thirds of the daily RDA was higher for those who consumed breakfast than for those who skipped breakfast (14).

A study in children 5 to 12 years of age found that those who consumed an RTEC breakfast more frequently had a higher intake of fiber; thiamin, niacin, riboflavin, iron, folate, and vitamins A, B12, and D, and a lower intake of fat and cholesterol than children who did not

(1). Similarly, the Growth and Health Study showed that girls between 9 to 19 years of age who consumed breakfast more frequently had a higher intake of calcium, iron, zinc, vitamin C, folate, and fiber than those who ate breakfast less frequently. However, the prevalence of those consuming decreased as they grew older (5). The Bogalusa Heart Study found that adolescent breakfast skippers had lower daily intakes of energy and protein per 1,000 Kilocalories (kcal) and did not meet two-thirds of the RDA for some vitamins and minerals (28).

Eighty percent of Americans eat breakfast on any given day; however, breakfast consumption declined between 1965 and 1991; those most likely to skip breakfast are teens and young adults, particularly those adolescents who live in households with low incomes, headed by a single parent (31). Skipping breakfast could be one reason why children have decreased intake vitamins and minerals per 1,000 kcal as they grew older (32); and why many adolescents do not meet two-thirds of the RDA of vitamins A, C, K, E, and folate; calcium and magnesium (28, 32).

Breakfast and Weight Status

Skipping breakfast has been reported to be inversely associated with body mass index (BMI) (2, 4, 5, 16). Children who consumed breakfast had a lower BMI for age than children who did not (5, 16). In the Growth and Health Study, girls between 9 to 19 years of age who consumed breakfast had a lower risk of overweight than those who did not eat breakfast (5). As girls grew older there was a lower prevalence of breakfast; and their BMI increased as they get older suggesting that as girl mature and skip breakfast an increase of BMI would be expected (5).

Another study in children between 4 to 14 years of age showed an inverse relationship between breakfast intake and risk of overweight (16). The National Longitudinal Study of Adolescent Health, a prospective study of 9,919 adolescents (aged 11- 21 years of age in 1996

and 18 to 27 years of age in 2002), associated skipping breakfast during the transition to adulthood with increased weight gain from adolescence to adulthood (33). The inverse relationship between BMI for age and breakfast cereal consumption may be due to the fact that most of the fortified cereals are low fat and because people who eat cereal may eat less energy dense snacks (4, 5, 16).

Overweight (defined as a BMI for ages at or above the sex-specific 95th percentile) among children has increased in the past decades in the US. Overweight in children increased by nearly 40% from 1976 to 2004 (7, 8). Diet quality is one element that has been inversely related with BMI (34). Diet quality and changes in eating patterns, such as increases in the number of meals away from home, large portion sizes, snacking and meal-skipping, may explain, in part, the increase of overweight (34, 35). However, some studies did not show an increase in eating frequency, snack, or evening eating, but did show breakfast consumption declined recently and this was associated with increased of overweight (19, 31). Eating breakfast may be related to maintaining weight loss (19, 20). A cross-sectional study, with 2,959 adult subjects in the National Weight Control Registry (NWCR), found that eating breakfast was a common characteristic in people who maintained weight loss (20).

Ready to Eat Cereal

Ready to eat cereal is a cereal grain product which has been processed to the point that it can be eaten without additional preparation (22). The first cereal package produced in the 1900s was corn flakes flavored with malt, sugar, and salt (36). After World War II when it observed that cereal was well accepted by large sector of the population, the decision was made to fortified cereal with B vitamins, including thiamin, riboflavin, niacin, and with iron to restore the micronutrient content of the whole grain lost during the manufacturing process (37). In the1950s and 1960s the popularity of RTEC led the development of cereals in many grain combinations,

shapes, flavors, and colors. In the 1980s, protein fortification was introduced to some cereals, to provide approximately 25% of the daily value of most nutrients per serving (36, 37). A breakfast meal containing RTEC has been shown to have a greater impact on nutrient intake than breakfast without RTEC (1, 3, 15).

The principal nutritional benefit of RTEC results from fortification with vitamins and minerals; an RTEC breakfast has also been associated with decreased intake of fat and cholesterol, and increased intake of fiber (2, 5, 17, 27). These improved nutrient profiles have been associated with lower risk of disease. Decreased intake of total fat, saturated fatty acid (SFA) and cholesterol has been related to a decreased risk of coronary heart disease (38). Low dietary fiber intake has been associated with reduction of some types of cancer (9). A study of ninth-grade students showed that adolescents who consumed an RTEC breakfast had a lower intake of SFA and a higher intake of fiber per 1,000 kcal than those who consumed a fast food or another type of breakfast (17).

Ready-to-eat-cereal consumption has been found to be related to desirable macro and micronutrient profiles. Ready-to-eat-cereal consumption also improved the recommended intake of fiber, carbohydrates, proteins and total fat (39). A study of Mediterranean children, adolescents, and young adults 2 to 24 years of age showed that intakes of thiamin, riboflavin, vitamin B6, vitamin D, folate, niacin, calcium, and iron increased with increasing consumption of RTEC; and subjects who consumed RTEC more frequently had lower total fat and higher fiber intakes than those with lower RTEC intakes. That study also showed increased consumption of dairy products with increased RTEC consumption (15).

Ready-to-eat-cereal breakfast is often accompanied by milk which increases intake of protein (16, 17), calcium (13, 18), and vitamins A and D (1, 2, 5, 17, 18). Consumption of

RTEC with milk was associated with lower prevalence of dietary inadequacy of calcium in all age-sex categories (18). Another study of children 4 to 12 years of age found that children with a higher intake of RTEC had a higher intake of calcium than children with lower intake or RTEC (16).

Ready-to-eat-cereal breakfasts have also been associated with a possible role in maintaining a healthful BMI. Studies in children showed a possible role of RTEC with maintaining healthy body weight (2, 4, 5, 16). In the Growth and Health Study three day food records were used to show that girls between 9 to 19 years of age who consumed RTEC had a lower mean BMI than girls who did not consume cereal. Girls who consumed cereal on only one or two days did not have a lower BMI when compared with those not consuming cereal; however, the analysis of this study may not have been appropriate because the BMI was not compared by age. Girls who consumed any cereal, regardless of how often they did so, had lower risk of overweight than those who did not eat cereal (5). Another study that followed 603 children between 4 to 12 years of age for 14 days found that children with higher intakes of cereal had lower risk of overweight than children with lower intakes (16).

National Health and Nutrition Examination Survey

History of NHANES

The NHANES is a national cross-sectional survey guided by the NCHS that is part of the CDC and it is intended to evaluate the health and nutrition of the US Population (21). The information collected is strictly confidential and the privacy of the participants is protected by public laws (40). The NHANES program began in 1960 as the National Health Examination Survey, and it gathered information about known diseases and the distribution of a variety of physical, physiologic, and psychological measurements. In 1971, the nutrition component was

added and the name was changed to the NHANES. From 1971 to 1999 NHANES was conduced as a series of surveys that included a representative sample of the US population. In 1999, the program became continuous; this flexibility allows changes to the program that can to meet emerging needs (21, 40).

Survey Participants

This survey examines 5000 individuals every year from different regions of the country (21). Participants of this survey are from a broad range of age categories and different ethnic groups. In 1982-1984 a study of HA, called Hispanic Health and Nutrition Examination Survey with 16,000 participants between 6 months to 74 years of age was conducted by NHANES (21). The NHANES 1999 to 2002 survey includes Hispanic populations from Mexico, Puerto Rico, Cuba and other countries from Central and South American (21); however, the majority of the participants were Mexican-Americans (67%). To produce valid information for HA, this group was over-sampled for the survey years used in this study. Each selected survey participant represents approximately 50,000 other US residents (40).

NHANES Use and Contents

The NHANES data are used in health sciences research and epidemiologic studies to assess nutritional status of the population and its association with health problems. The purpose is to document what people are eating and what their risk factors are for chronic disease. This survey collects information about the prevalence of chronic conditions in the population and disease risk factors and information on aspects of reproductive health, such as oral contraceptive use and breastfeeding practices (40).

Health information from personal interviews and medical examinations is gathered by NHANES. The interview includes questions related to demographics, socioeconomic status, diet,

and health. The examination includes medical and dental examinations, anthropometric measurements including weight and height, and laboratory tests (21) including measurement of serum cholesterol and micronutrient levels. In the dietary interview, the information reported by the participant is recorded in a computer-assisted dietary interview software program that was developed by the survey. In this data set, a single 24-hour diet recall was used to determine intake of food and beverages; from this nutrient and total energy intake could be estimated (41, 42). Measurement aids and visuals including charts and drawings were used to quantify the foods and beverages reported by the participants. When the information provided by the participant was incomplete, interviewers performed data recovery by telephone. During the physical examination, the weight of the participant was measured by a digital scale that is connected to the injury surveillance information system; and the stature or recumbent length is measured with an electronic stadiometer that is also connected to the ISIS.

Hispanics

Hispanics are a heterogeneous ethnic group included in NHANES data collection. "Hispanic" is the term that describes people who are from or whose ancestors are from Mexico, Puerto Rico, Cuba, and other countries from the Caribbean and Central and South America. This population is the fastest growing minority group in the US and has increased by almost 100% since 1990 (22.4 million). At the end of 2005 Hispanics in the US numbered approximately 42.7 million (6). Mexican-Americans are the largest Hispanic-origin group in the US. Almost 67% of Hispanics, in NHANES are Mexican American and most studies are about this group (9, 11, 38).

Nutrient Intake in Hispanic-American

Few studies have been conducted on the diet of HA children; however, since children and adolescents usually eat food that their parents prepare, it is important to know the dietary patterns of HA adults. Nutrient intakes of HA are different depending on their country of birth, the

length of time they have lived in the US, and their acculturation level. Acculturation occurs when people of one cultural group adopt the behavior and beliefs of another group (43). Dietary intake varies in different generations of Hispanics in the US as a result of the effects of acculturation (44). Food choices of Hispanics can reflect positive or negative effects of acculturation (45).

Acculturation has been associated with negative effects on diet quality in Mexican Americans (44). A study that analyzed dietary data on 2,853 Mexican-American women and men from the NHANES III found that Mexicans born in Mexico consumed more fiber; vitamins A, C, E, and B6, folate, calcium, potassium, and magnesium and less fat than did those born in the United States (46). Second generation Mexican American women had a lower average intake of protein; vitamins A and C; folate; and calcium than did the first generation of Mexican Americans women (44). The Massachusetts Hispanic Elders study found that more acculturated Hispanic elders consumed more SFA and less fiber than less acculturated Hispanics (47). These negative effects may be the result of poor food choices replacing traditional foods; for example, corn tortillas may be replaced by white bread. However, few studies have been conducted in Hispanics to demonstrate positive effects of acculturation on dietary quality and nutrient intake in this population. A study showed that the dietary quality and diversity of Puerto Rican elders was positively associated with acculturation (45).

Obesity in Mexican Americans

The prevalence of at risk of overweight or overweight among Mexican American male children increased from 21% in 1995 to 37% in 2003-2004. Mexican American male children and adolescents have a greater prevalence of overweight (BMI $\geq 95^{th}$ percentile) than non-Hispanic white male children and adolescents (22% for Mexican American males and 17% for non-Hispanic white males) (7). Obesity in children and adolescents can track into adulthood.

Overweight adolescents are likely to remain obese as adults (33, 48) with the associated increased risk of obesity-related health problems, such as hypertension, type 2 diabetes (9, 11), dyslipidemia, coronary artery disease (11), and joint problems (9).

Mexican Americans aged 2-19 years have a 37% of prevalence of at risk of overweight (BMI $\geq 85^{th}$ percentile) or overweight in comparison with 25 % of non-Hispanic whites of the same age (7). The difference in the prevalence of diabetes in Mexican Americans could be due to many factors such as genetic differences, but another important factor can be the higher incidence of overweight and obesity in Mexican Americans in comparison with non-Hispanic whites. The Viva la familia study found evidence of a strong genetic contribution to the high prevalence of obesity and its risk factors for metabolic diseases in Hispanic children (49). The prevalence of obesity among Mexican Americans may be attributable to changes in dietary habits as a result of their acculturation overlaid onto a specific genetic background; both factors are important. Therefore, evaluation of the nutrient intake in Mexican Americans in the US is an important component of the overall nutritional risk factors for overweight/obesity

Breakfast in Hispanics

The types of food eaten at breakfast by Hispanics are different from the type of food eaten by non-Hispanic whites. A study that investigated the different food patterns of breakfast for adults aged 18-65 in the US from 1994 to 1996 found that bread, eggs, and coffee were the most commonly consumed foods at breakfast by Hispanics. Twenty-five percent of Hispanics consumed some type of bread, 18% ate eggs, 15% drank coffee, and 12% consumed RTEC. That study also found that the variety of food consumed at breakfast provided different nutrient adjusting for caloric energy intake. For example, eggs were high in cholesterol, low in fiber, and low in iron and calcium, while RTEC were high in fiber, high in calcium density, and very low

in fat (26). A low fat and high fiber diet was associated with adequate nutrient intake of several vitamins and micro minerals in 15 years old adolescents (50).

CHAPTER 3
SUBJECTS AND METHODS

Research Design

This is a correlation study that used data from the NHANES 1999-2002 survey to examine the impact of RTEC consumption at breakfast on nutrient intake and weight status in HA children and adolescents in the US. The survey was a stratified, multistage design since the data sets from 1999-2000 and 2001 to 2002 were combined. Each participant represented approximately 50,000 non-institutionalized civilian Americans (40).

Participants

Participants were HA 1 to 18 years of age (n= 3,236) who participated in NHANES during 1999-2002. For the 24 hour recalls, caregivers, usually parents, provided information for children 6 years of age or younger; children 12 years of age or younger were assisted by and adult; and children older than 12 provided their own information (51). Pregnant and lactating adolescents were excluded from this study. Participants were classified for gender and age (1 to 5 years, 6 to 12 years, 13 to 18 years) (52). Children were also categorized into one of three breakfast consumption groups: breakfast skippers (those who did not eat breakfast or brunch), RTEC breakfast consumers (regardless of what else was consumed at the breakfast/brunch meal), and other breakfast consumers (no RTEC was consumed at the breakfast/brunch meal). Due to the nature of the analysis (secondary data analysis), and the lack of personal identifiers, this study was exempted by the Institutional Review Board of the Louisiana State University AgCenter.

Procedures

The NHANES survey used standardized questionnaires and physical examinations to collect data at the mobile examination centers (MEC) (51). Interviews were conducted in

English, Spanish, or both by trained interviewers. Dietary intake information was collected using a single 24-hour food recall. During the MEC examination, participants completed additional questionnaires, including a dietary questionnaire. Computer-Assisted Personal Interview (CAPI) was also used to collect data (40, 52). The dietary interview room at MEC contains a standard set of measuring guides to help the respondents to estimate portion sizes of the food items consumed (53).

The physical examination (PE) occurred within 1 to 2 weeks of the interviews. Physical examinations were performed in a MEC that was designed and equipped to survey participants. In the PE, waist circumference, height and weight were measured using standardized protocols and calibrated equipment. Waist circumference was measured at the narrowest part of the torso between the lowest rib margin and the iliac crest at the end of a gentle expiration. Measurements were taken to the nearest centimeter (cm) using a flexible tape (54).

Body mass index was calculated from these heights and weight (21). Body mass index was calculated as weight in kilograms divided by height in meters squared and was rounded to the nearest tenth. In children and adolescents between 2 to 18 years, overweight and at risk of overweight were defined based on the sex-specific BMI for age growth charts (BMI-for- age z scores) from the CDC (21). The risk of overweight for children was defined as a BMI for age at or above the sex-specific 85th percentile but less than the 95^{th} percentile. Overweight was defined as a BMI for ages at or above the sex-specific 95^{th} percentile (21, 40).

Variables

Twenty-four hour diet recalls were used to estimate daily intake of total energy, fat, SFA, monounsaturated fat (MUFA), polyunsaturated fat (PUFA), total carbohydrates, added sugar, protein, and micronutrients vitamins A, E, C, K, B1, B2, B6, B12; niacin; folate; calcium; phosphorus; magnesium; iron; zinc; sodium; and potassium. The USDA Food and Nutrient

Database for Dietary Studies (FNDDS), version 1 (USDA database for dietary studies) was used in NHANES, 2001-2002, while the USDA 1994-98 Survey Nutrient Database was used to process the dietary interview data in NHANES, 1999-2000 (55, 56). In the original release of NHANES, 1999-2000, data on vitamin A intake were only available in μg retinol equivalents, vitamin E intake data were only available in mg alpha-tocopherol equivalents, only total folate (μg) intake data, and no vitamin K (mg) or sugars (g) intake data were available as well. Currently, Dietary Reference Intakes for vitamin A, vitamin E, and folate are expressed as μg retinol activity equivalents (μg RAE), mg alpha-tocopherol (mg AT), and dietary folate equivalents (DFE), respectively (57-59).

We used the special database released by USDA to determine vitamin A as mg RAE and vitamin E as mg AT (USDA Database information for A and E). The FNDDS was used to append the intakes of folate (DFE), vitamin K (μg), and total sugars (g) to the NHANES, 1999-2000, database. Added sugars food composition data were obtained from the Pyramid Servings Database for USDA Survey Food Codes version 2.0 (41). Added sugars were defined by the USDA as white sugar, brown sugar, raw sugar, corn syrup, corn syrup solids, high fructose corn syrup, malt syrup, maple syrup, pancake syrup, fructose sweetener, liquid fructose, honey, molasses, anhydrous dextrose, crystal dextrose, and dextrin that are eaten separately or used as ingredients in processed or prepared foods.

To rule out the possibility that the nutrient contribution of eating RTEC for breakfast was attributable to milk added to the cereal, the daily nutrient intake of breakfast consumption groups was compared after deleting the nutrient intake from milk combined with RTEC consumed at breakfast. Daily nutrient intake from all foods except milk combined with RTEC consumed at breakfast was determined by summing the nutrient intake from all foods reported

in the 24-hour recall after excluding any fluid milk, other than soy milk, combined with RTEC eaten at breakfast.

Dietary adequacy for micronutrients was examined as mean adequacy ratio (MAR), which was calculated by expressing micronutrient intake as a percentage of the RDA/Adequate Intake (AI), which was truncated to no more than 100%. The MAR for 5 shortfall nutrients (vitamin E and K, calcium, magnesium and fiber) in children age 1-18 years was also calculated by expressing nutrient intake as a percentage of the RDA/AI, truncated to no more than 100%. The percentage of energy from macronutrients was calculated using 24-hour dietary recall and estimates of the daily intake of total energy (60).

The daily nutrient intake of breakfast consumption groups was also compared after subtracting the nutrient intake from milk that was combined with RTEC consumed at breakfast, in order to exclude the possibility that the nutrient contribution of eating RTEC at breakfast was attributable to the milk poured onto the cereal. The daily nutrient intake from all foods was calculated by summing the nutrient intake from all foods reported in the 24-hour recall after excluding any fluid milk.

Statistical Analysis

The Statistical Analysis System SAS (version 9, SAS Institute Inc, Carry, NC) and Survey Data Analysis for multistage sample design professional software package (SUDAAN) (version 9.0, Research Triangle Institute, Research Triangle Park, NC) were used for the analysis. SUDAAN takes into account the sampling weights and complex sample design for calculating variance estimates and was used to calculate standard errors of the mean (40). SUDAAN was also used to estimate sample-weighted least-square mean and standard errors for all nutrients examined. The Bonferroni correction was used to determine the statistical significances between means of breakfast skippers vs. RTEC breakfast consumers, breakfast

skippers vs. other breakfast consumers, and RTEC breakfast consumers vs. other breakfast consumers (52); there was an effective p-value of <0.01667.

Percentiles and z-scores of weight-for-age, and BMI-for-age were calculated using the SAS program for CDC Growth charts. For the analysis of BMI or BMI z-score the mean and standard errors were weighted and calculated by an estimation method in SUDAAN. Least squares means (LS means) defined as adjusted means were calculated after adjustment for age, gender, ethnic groups, and energy intake (40, 52).

CHAPTER 4
RESULTS

Breakfast Consumption

The prevalence of breakfast consumption by HA aged 1 to 18 years is presented in Figure 1. There was a higher prevalence of skipping breakfast for those aged 13 to 18 years when compared with those aged 1 to 5 or 6 to 12 years. Five and a half percent of HA boys and 4.4% of HA girls between 1 to 5 years of ages; and 8.6% of HA boys and 9.3 % of HA girls between 6 to 12 years of age skipped breakfast in comparison with 26 % of boys and 30 % of girls between 13 to 18 years of ages.

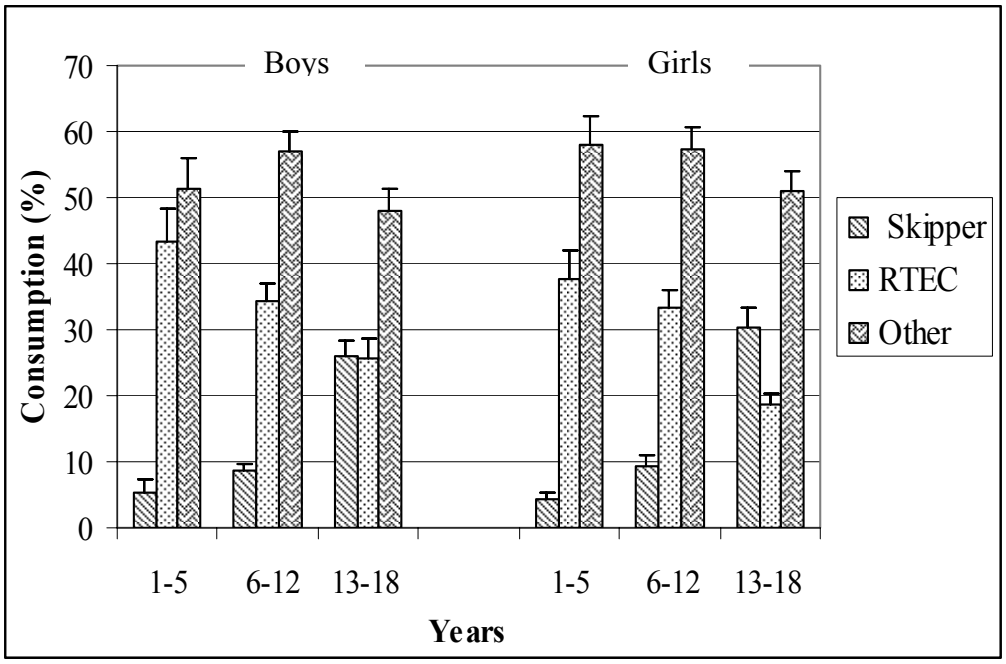

Figure 1: Breakfast consumption (%) by category by Hispanic children aged 1-18 years.

There was a lower prevalence of RTEC consumption breakfast in those aged 13 to 18 years than in those aged 1 to 5 or 6 to 12 years. Forty three percent of HA boys and 38% of HA

girls between 1 to 5 years of age and 35% of HA boys and 33 % of HA girls between 6 to 12 years of age consumed RTEC breakfast compared with 25.8 % of HA boys and 18 % of HA girls between 13 to 18 years of age.

Of the HA children and adolescents eating breakfast, fewer consumed an RTEC breakfast than other breakfast. Thirty five percent of HA boys and 30% of HA girls consumed RTEC breakfast in comparison with 52% of HA boys and 55% of HA girls who consumed other breakfast.

Breakfast and Macronutrient Intake

Table 1: Mean daily macronutrient intake by breakfast consumption category: Hispanic-American children aged 1-5 years.

Macronutrient[1] % of energy[2]	Breakfast Skippers	RTEC Breakfast	Other Breakfast
Protein (g) (% of energy)	50.3 ± 4.2 12.5 ± 0.9[a]	60.6 ± 1.3 15.1 ± 0.3[b]	59.3 ± 0.7 14.8 ± 0.2[b]
Carbohydrate (g) (% of energy)	228 ± 19[ab] 56.5 ± 3.9[ab]	227 ± 4[a] 55.7 ± 0.8[a]	217 ± 3[b] 53.3 ± 0.7[b]
Total Sugar (g) (% of energy)	141.1 ± 15.1 35.6 ± 3.1	121.9 ± 3.3 29.9 ± 0.7	121.1 ± 2.0 29.9 ± 0.5
Added Sugars (g) (% of energy)	93.3 ± 20.3 22.2 ± 4.4	55.3 ± 2.5 13.4 ± 0.5	60.4 ± 2.4 13.9 ± 0.7
Total Fat (g) (% of energy)	59.3 ± 6.2[ab] 32.6 ± 2.9[ab]	55.2 ± 1.5[a] 30.7 ± 0.7[a]	59.9 ± 1.1[b] 33.2 ± 0.8[b]
Saturated Fat (g) (% of energy)	24.1 ± 3.1 13.5 ± 1.6	21.9 ± 0.7 12.3 ± 0.3	22.6 ± 0.5 12.5 ± 0.3
Monounsaturated Fat (g) (% of energy)	22.5± 2.5[ab] 12.1 ± 1.1[ab]	19.6 ± 0.6[a] 10.8 ± 0.3[a]	21.8 ± 0.5[b] 12.0 ± 0.4[b]
Polyunsaturated Fat (g) (% of energy)	8.3± 0.8[a] 4.6 ± 0.4[a]	9.2 ± 0.3[a] 5.0 ± 0.1[a]	10.6 ± 0.2[b] 6.0 ± 0.2[b]
Cholesterol (mg)	177 ± 32[a]	176 ± 9[a]	264 ± 10[b]
Total Dietary Fiber (g)	8.7 ± 0.8[a]	11.7 ± 0.4[b]	10.8 ± 0.4[b]

Source: NHANES, 1999-2002, sample with complete, reliable 24-hr recall dietary interview. [a,b,c] Means not sharing an alphabetic character differ significantly ($p < 0.05$) (Bonferroni corrected); breakfast skippers vs. RTEC breakfast consumers, breakfast skippers vs. other breakfast consumers, RTEC breakfast consumers vs. other breakfast consumers.

[1]Least square mean and standard error (LSM + SE) nutrient intakes were adjusted for age, gender, and energy intake.

[2] Least square mean and standard error (LSM + SE) percent energy from nutrients were adjusted for age and gender only.

Table 1 shows the mean daily macronutrient intake by breakfast consumption in HA children between 1 to 5 years. Those who consumed an RTEC breakfast had higher percent of energy from protein, and a higher intake of total dietary fiber than those who skipped breakfast. These children who consumed an RTEC breakfast had a higher intake of carbohydrates (grams[g]) and a higher percent carbohydrate intake than those who consumed other breakfast. Children who consumed an RTEC breakfast also had a lower energy intake and percent intake of total fat, MUFA and PUFA; and cholesterol than HA children who consumed other breakfast.

Table 2: Mean daily macronutrient intake by breakfast consumption category: Hispanic-American children aged 6-12 years.

Macronutrient[1] % of energy[2]	Breakfast Skippers	RTEC Breakfast	Other Breakfast
Protein (g) (% of energy)	68.6 ± 2.0 13.9 ± 0.4	69.9 ± 1.8 13.8 ± 0.4	70.0 ± 1.2 14.0 ± 0.3
Carbohydrate (g) (% of energy)	276 ± 5 55.0 ± 1.1	284 ± 4 56.1 ± 0.7	270 ± 4 53.3 ± 0.9
Total Sugar (g) (% of energy)	148.4 ± 7.6 29.9 ± 1.4	151.5 ± 3.3 29.8 ± 0.6	140.8 ± 4.8 27.8 ± 1.2
Added Sugars (g) (% of energy)	103.8 ± 5.1 20.7 ± 1.0^{a}	96.0 ± 4.5 18.8 ± 0.9^{ab}	90.7 ± 4.5 17.5 ± 1.0^{b}
Total Fat (g) (% of energy)	75.4 ± 2^{ab} 32.3 ± 0.7	71.5 ± 1.3^{a} 31.4 ± 0.6	77.1 ± 1.4^{b} 33.8 ± 0.7
Saturated Fat (g) (% of energy)	26.1 ± 0.5 11.2 ± 0.2	27.1 ± 0.4 11.9 ± 0.2	27.3 ± 0.6 12.1 ± 0.3
Monounsaturated fat (g) (% of energy)	29.0 ± 0.8^{a} 12.4 ± 0.3^{ab}	26.4 ± 0.6^{b} 11.6 ± 0.2^{a}	29.3 ± 0.6^{a} 12.8 ± 0.3^{b}
Polyunsaturated Fat (g) (% of energy)	14.6 ± 0.9^{ab} 6.2 ± 0.3^{ab}	12.4 ± 0.5^{a} 5.4 ± 0.2^{a}	14.5 ± 0.4^{b} 6.3 ± 0.2^{b}
Cholesterol (mg)	227 ± 17^{ab}	205 ± 21^{a}	290 ± 18^{b}
Total Dietary Fiber (g)	12.7 ± 0.6	13.5 ± 0.4	13.3 ± 0.4

Source: NHANES, 1999-2002, sample with complete, reliable 24-hr recall dietary interview. ^{a,b,c} Means not sharing an alphabetic character differ significantly ($p < 0.05$) (Bonferroni corrected); breakfast skippers vs. RTEC breakfast consumers, breakfast skippers vs. other breakfast consumers, RTEC breakfast consumers vs. other breakfast consumers.

[1]Least square mean and standard error (LSM + SE) nutrient intakes were adjusted for age, gender, and energy intake.

[2] Least square mean and standard error (LSM + SE) percent energy from nutrients were adjusted for age and gender only.

Table 2 shows the mean daily macronutrient intake by breakfast consumption category in HA children between 6 to 12 years. Hispanic children aged 6 to 12 years who consumed RTEC breakfast had a lower intake of total fat (g), MUFA (g and percent), PUFA (g), and cholesterol intake, than children who consumed other breakfast. HA children aged 6 to 12 years who skipped breakfast had a higher percent intake of energy from added sugars than HA children who consumed other breakfasts.

Table 3: Mean daily macronutrient intake by breakfast consumption category: Hispanic-American adolescents aged 13-18 years.

Macronutrient[1] % of energy[2]	Breakfast Skippers	RTEC Breakfast	Other Breakfast
Protein (g) (% of energy)	75.3 ± 2.0 13.9 ± 0.4	74.5 ± 1.6 13.7 ± 0.3	77.1 ± 1.6 14.3 ± 0.4
Carbohydrate (g) (% of energy)	286 ± 7[a] 53.0 ± 0.9[a]	311 ± 5[b] 57.1 ± 0.8[b]	293 ± 3[a] 53.8± 0.6[a]
Total Sugar (g) (% of energy)	146.9 ± 7.1 27.1 ± 1.1	161.4 ± 5.2 29.5 ± 0.7	156.1 ± 3.7 28.7 ± 0.8
Added Sugars (g) (% of energy)	115.8 ± 8.3 21.3 ± 1.2	106.07 ± 5.8 19.6 ± 0.9	112.8 ± 3.4 20.2 ± 0.8
Total Fat (g) (% of energy)	84.3 ± 2[a] 33.4 ± 0.7[a]	75.3 ± 1.9[b] 30.3 ± 0.6[b]	80.7 ± 0.9[a] 32.4 ± 0.4[a]
Saturated Fat (g) (% of energy)	29.1 ± 1.0 11.4 ± 0.3	26.7 ± 0.6 10.9 ± 0.2	27.8 ± 0.5 11.1 ± 0.2
Monounsaturated fat (g) (% of energy)	33.0 ± 0.8[a] 13.0 ± 0.3[a]	28.1 ± 0.8[b] 11.3 ± 0.3[b]	30.5 ± 0.5[b] 12.2 ± 0.2[a]
Polyunsaturated Fat (g) (% of energy)	15.8 ± 0.7 6.4 ± 0.3[a]	14.5 ± 0.9 5.6 ± 0.2[b]	15.8 ± 0.5 6.5 ± 0.2[a]
Cholesterol (mg)	216 ± 10[a]	212 ± 13[a]	307 ± 9[b]
Total Dietary Fiber (g)	13.4 ± 0.6	14.4 ± 0.5	13.7 ± 0.4

Source: NHANES, 1999-2002, sample with complete, reliable 24-hr recall dietary interview. [a,b,c] Means not sharing an alphabetic character differ significantly ($p < 0.05$) (Bonferroni corrected) breakfast skippers vs. RTEC breakfast consumers, breakfast skippers vs. other breakfast consumers, RTEC breakfast consumers vs. other breakfast consumers.

[1]Least square mean and standard error (LSM + SE) nutrient intakes were adjusted for age, gender, and energy intake.

[2] Least square mean and standard error (LSM + SE) percent energy from nutrients were adjusted for age and gender only.

Table 3 shows the mean daily macronutrient intake by breakfast consumption in HA adolescents between 13 to 18 years. Adolescents aged 13 to 18 years who consumed RTEC breakfast had a higher intake (g) and percent intake from carbohydrates than HA adolescents who consumed either other breakfast or skipped breakfast. Those consuming an RTEC breakfast also had a lower intake of total fat (g) and percent energy from total fat and MUFA than those in the other categories. HA adolescents who consumed an RTEC breakfast also had lower cholesterol intake than those who consumed other breakfast.

Breakfast and Micronutrient Intake

Table 4: Mean daily micronutrient intake by breakfast consumption category: Hispanic-American children aged 1-5 years.

Micronutrients	Breakfast Skippers	RTEC Breakfast	Other Breakfast
Vitamin A (μg RAE)	427 ± 31^{a}	621 ± 33^{b}	530 ± 23^{b}
Alpha Tocopherol (mg)	4.4 ± 0.3	4.2 ± 0.2	4.5 ± 0.1
Vitamin C (mg)	66.7 ± 14.6^{a}	108.7 ± 5.8^{b}	104.0 ± 5.9^{ab}
Thiamin (mg)	1.00 ± 0.08^{a}	1.54 ± 0.05^{b}	1.23 ± 0.04^{c}
Riboflavin (mg)	1.76 ± 0.15^{a}	2.34 ± 0.07^{b}	1.95 ± 0.06^{a}
Niacin (mg)	10.9 ± 1.1^{a}	18.4 ± 0.8^{b}	14.1 ± 0.8^{c}
Vitamin B-6 (mg)	1.04 ± 0.1^{a}	1.81 ± 0.05^{b}	1.44 ± 0.08^{c}
Folate (μg DFE)	344 ± 25^{a}	645 ± 45^{b}	392 ± 18^{a}
Vitamin B12 (μg)	3.7 ± 0.5^{b}	5.1 ± 0.3^{a}	4.2 ± 0.2^{b}
Calcium (mg)	940 ± 107	1084 ± 52	965 ± 30
Phosphorus (mg)	1073 ± 78	1198 ± 31	1135 ± 21
Magnesium (mg)	200 ± 9^{a}	227 ± 6^{b}	210 ± 3^{a}
Iron (mg)	8.9 ± 0.6^{a}	15.8 ± 0.8^{b}	10.8 ± 0.4^{c}
Zinc (mg)	7.4 ± 0.7^{a}	10.8 ± 0.3^{b}	8.0 ± 0.2^{a}
Sodium (mg)	2396 ± 288	2416 ± 55	2373 ± 38
Potassium (mg)	2021 ± 153	2407 ± 54	2282 ± 35
Vitamin K (μg)	23.8 ± 4.3	31.5 ± 2.5	39.5 ± 5.3

Source: NHANES, 1999-2002, sample with complete, reliable 24-hr recall dietary interview. [a,b,c] Means not sharing an alphabetic character differ significantly ($p < 0.05$) (Bonferroni corrected) ; breakfast skippers vs. RTEC breakfast consumers, breakfast skippers vs. other breakfast consumers, RTEC breakfast consumers vs. other breakfast consumers.

Table 4 shows the mean daily micronutrient intake by breakfast consumption in HA children aged 1 to 5 years. Children aged 1 to 5 years who consumed RTEC breakfast had a higher consumption of vitamins B 6 and B 12, thiamin, riboflavin, niacin, folate, magnesium, iron, and zinc than those who consumed other breakfast and those who skipped breakfast. In addition, HA children between 1 to 5 years of age who consumed RTEC had higher intake of vitamin A and C than those who skipped breakfast.

Table 5: Mean daily micronutrient intake by breakfast consumption category: Hispanic-American children aged 6-12 years.

Micronutrients	Breakfast Skippers	RTEC Breakfast	Other Breakfast
Vitamin A (μg RAE)	541 ± 138[b]	722 ± 32[a]	557 ± 38[b]
Alpha Tocopherol (mg)	6.2 ± 0.5	5.2 ± 0.2	5.9 ± 0.4
Vitamin C (mg)	89.2 ± 10.6	102.0 ± 6.6	96.2 ± 6.6
Thiamin (mg)	1.38 ± 0.06[a]	1.87 ± 0.04[b]	1.51 ± 0.04[a]
Riboflavin (mg)	1.80 ± 0.09[a]	2.60 ± 0.05[b]	1.96 ± 0.06[a]
Niacin (mg)	18.0 ± 0.6[a]	22.1 ± 0.6[b]	17.9 ± 0.5[a]
Vitamin B-6 (mg)	1.40 ± 0.06[a]	2.07 ± 0.07[b]	1.51 ± 0.06[a]
Folate (μg DFE)	448 ± 22[a]	752 ± 24[b]	458 ± 12[a]
Vitamin B12 (μg)	5.4 ± 1.5[a]	5.2 ± 0.3[a]	4.0 ± 0.2[b]
Calcium (mg)	839 ± 33[a]	1114 ± 34[b]	923 ± 32[a]
Phosphorus (mg)	1160 ± 24[a]	1318 ± 25[b]	1239 ± 25[ab]
Magnesium (mg)	214 ± 8[a]	245 ± 4[b]	230 ± 6[ab]
Iron (mg)	12.8 ± 0.8[a]	18.3 ± 0.6[b]	12.7 ± 0.3[a]
Zinc (mg)	9.9 ± 0.5[a]	13.1 ± 0.4[b]	9.7 ± 0.2[a]
Sodium (mg)	2931 ± 80	2961 ± 43	3133 ± 110
Potassium (mg)	2111 ± 52[a]	2433 ± 63[b]	2369 ± 70[b]
Vitamin K (μg)	41.6 ± 3.8	42.4 ± 2.8	49.1 ± 7.3

Source: NHANES, 1999-2002, sample with complete, reliable 24-hr recall dietary interview. [a,b,c] Means not sharing an alphabetic character differ significantly ($p < 0.05$) (Bonferroni corrected); breakfast skippers vs. RTEC breakfast consumers, breakfast skippers vs. other breakfast consumers, RTEC breakfast consumers vs. other breakfast consumers.

Table 5 shows the mean daily micronutrient intake by breakfast consumption category in HA children aged 6 to 12 years. Children who consumed an RTEC breakfast had significantly higher mean intakes of vitamins A and B-6, thiamin, riboflavin, niacin, folate, calcium, iron, and zinc than those in either of the breakfast consumption categories. HA children who consumed an RTEC breakfast had significantly higher mean intake of B12 than those who ate other breakfast; RTEC consumers also had a higher mean intakes of magnesium, phosphorus, and potassium than those who skipped breakfast.

Table 6: Mean daily micronutrient intake by breakfast consumption category: Hispanic-American adolescents aged 13-18 years.

Micronutrients	Breakfast Skippers	RTEC Breakfast	Other Breakfast
Vitamin A (μg RAE)	356 ± 25^{a}	729 ± 34^{b}	501 ± 39^{c}
Alpha Tocopherol (mg)	6.2 ± 0.2	5.9 ± 0.2	6.0 ± 0.3
Vitamin C (mg)	80.0 ± 5.9^{a}	126.6 ± 12.7^{b}	113.2 ± 6.3^{b}
Thiamin (mg)	1.37 ± 0.05^{a}	2.05 ± 0.05^{b}	1.53 ± 0.03^{c}
Riboflavin (mg)	1.62 ± 0.07^{a}	2.67 ± 0.07^{b}	1.88 ± 0.05^{c}
Niacin (mg)	19.1 ± 0.8^{a}	26.0 ± 0.7^{b}	19.7 ± 0.6^{a}
Vitamin B-6 (mg)	1.43 ± 0.06^{a}	2.35 ± 0.08^{b}	1.59 ± 0.05^{c}
Folate (μg DFE)	443 ± 16^{a}	829 ± 29^{b}	474 ± 12^{a}
Vitamin B12 (μg)	4.0 ± 0.3^{a}	6.1 ± 0.3^{b}	4.2 ± 0.2^{a}
Calcium (mg)	845 ± 45^{a}	1079 ± 53^{b}	877 ± 26^{a}
Phosphorus (mg)	1191 ± 35^{a}	1350 ± 32^{b}	1280 ± 20^{ab}
Magnesium (mg)	224 ± 5^{a}	256 ± 5^{b}	238 ± 5^{b}
Iron (mg)	12.8 ± 0.3^{a}	20.8 ± 0.8^{b}	13.5 ± 0.3^{a}
Zinc (mg)	10.9 ± 0.4^{a}	13.8 ± 0.6^{b}	10.6 ± 0.2^{a}
Sodium (mg)	3291 ± 81	3166 ± 80	3401 ± 80
Potassium (mg)	2149 ± 72^{a}	2530 ± 81^{b}	2389 ± 54^{b}
Vitamin K (μg)	48.5 ± 4.8	41.5 ± 3.0	49.1 ± 2.1

Source: NHANES, 1999-2002, sample with complete, reliable 24-hr recall dietary interview. [a,b,c] Means not sharing an alphabetic character differ significantly ($p < 0.05$) (Bonferroni corrected); breakfast skippers vs. RTEC breakfast consumers, breakfast skippers vs. other breakfast consumers, RTEC breakfast consumers vs. other breakfast consumers.

Table 6 shows the mean daily micronutrient intake by breakfast consumption in HA adolescents aged 13 to 18 years. Adolescents who consumed an RTEC breakfast had significantly higher mean intakes of vitamins A, B 6, and B12; thiamin, riboflavin, niacin, folate, calcium, iron, and zinc than those who consumed other breakfast or those who skipped breakfast. Moreover, adolescents who consumed an RTEC breakfast also had significantly higher mean intakes of vitamin C, magnesium, potassium and phosphorus than those who skipped breakfast.

Nutrient Intake after Subtracting Milk

Table 7: Mean daily macronutrient intake by breakfast consumption category without milk on cereal: Hispanic-American children aged 1-5 years.

Macronutrient[1] % of energy[2]	Breakfast Skippers	RTEC Breakfast	Other Breakfast
Protein (g) (% of energy)	49.1± 4.2 12.5 ± 0.9^{a}	57.1 ± 1.4 14.6 ± 0.3^{ab}	58.1 ± 0.7 14.8 ± 0.2^{b}
Carbohydrate (g) (% of energy)	223 ± 19^{ab} 56.5 ± 3.9^{ab}	226 ± 4^{a} 57.0 ± 0.8^{a}	212 ± 3^{b} 53.3 ± 0.7^{b}
Total Sugar (g) (% of energy)	138.3 ± 15 35.6 ± 3.1	117.6 ± 3.3 29.5 ± 0.8	118.3.1 ± 2 29.9 ± 0.5
Added Sugars (g) (% of energy)	91.6 ± 20.2 22.2 ± 4.4	57.7 ± 2.7 14.1 ± 0.5	58.6 ± 2.3 13.9 ± 0.7
Total Fat (g) (% of energy)	58.1 ± 6.2^{ab} 32.6 ± 2.9^{ab}	52.8 ± 1.5^{a} 29.9 ±0.7^{a}	58.6 ± 1.1^{b} 33.2 ± 0.8^{b}
Saturated Fat (g) (% of energy)	23.6 ± 3.1^{ab} 13.5 ± 1.6^{ab}	20.0 ± 0.7^{a} 11.4 ± 0.3^{a}	22.2 ± 0.5^{b} 12.5 ± 0.3^{b}
Monounsaturated Fat (g) (% of energy)	22.0 ± 2.5^{ab} 12.1 ± 1.1^{ab}	19.1 ± 0.6^{a} 10.8 ± 0.3^{a}	21.3 ± 0.5^{b} 12.0 ± 0.4^{b}
Polyunsaturated Fat (g) (% of energy)	8.1 ± 0.8^{a} 4.6 ± 0.4^{a}	9.3 ± 0.3^{a} 5.2 ± 0.1^{a}	10.4 ± 0.2^{b} 6.0 ± 0.2^{b}
Cholesterol (mg)	173 ± 32^{a}	166 ± 9^{a}	264 ± 10^{b}
Total Dietary Fiber (g)	8.4 ± 0.8^{a}	12.1 ± 0.4^{b}	10.6 ± 0.4^{c}

Source: NHANES, 1999-2002, sample with complete, reliable 24-hr recall dietary interview. ^{a,b,c} Means not sharing an alphabetic character differ significantly ($p < 0.05$) (Bonferroni corrected); breakfast skippers vs. RTEC breakfast consumers, breakfast skippers vs. other breakfast consumers, RTEC breakfast consumers vs. other breakfast consumers.

[1]Least square mean and standard error (LSM + SE) nutrient intakes were adjusted for age, gender, and energy intake.

[2] Least square mean and standard error (LSM + SE) percent energy from nutrients were adjusted for age and gender only.

The daily nutrient intake was also compared after subtracting the nutrient intake from milk that was combined with RTEC consumed at breakfast. Tables 7, 8, and 9 show the mean daily macronutrient intake by breakfast consumption without milk on cereal in HA children and adolescents aged 1 to 5, 6-12, and 13-18 years respectively.

Table 8: Mean daily macronutrient intake by breakfast consumption category without milk on cereal: Hispanic-American children aged 6-12 years.

Macronutrient[1] % of energy[2]	Breakfast Skippers	RTEC Breakfast	Other Breakfast
Protein (g) (% of energy)	67.3 ± 1.9 13.9 ± 0.4	65.3 ± 1.7 13.2 ± 0.4	68.8 ± 1.1 14.0 ± 0.3
Carbohydrate (g) (% of energy)	271 ± 5 55.0 ± 1.1^{ab}	284 ± 4 57.50 ± 0.7^{a}	265 ± 4 53.3 ± 0.9^{b}
Total Sugar (g) (% of energy)	145.6 ± 7.6 29.9 ± 1.4	145.9 ± 3.4 29.2 ± 0.7	138.1 ± 4.9 27.8 ± 1.2
Added Sugars (g) (% of energy)	101.8 ± 5.0 20.7 ± 1.0^{a}	99.8 ± 4.7 19.9 ± 0.9^{ab}	88.6 ± 4.5 17.5 ± 1.0^{b}
Total Fat (g) (% of energy)	73.8 ± 2^{ab} 32.3 ± 0.7^{ab}	69.3 ± 1.3^{a} 30.7 ±0.6^{a}	75.5 ± 1.4^{b} 33.8 ± 0.7^{b}
Saturated Fat (g) (% of energy)	26.1 ± 0.5 11.2 ± 0.2	24.8 ± 0.4 11.0 ± 0.2	26.8 ± 0.6 12.1 ± 0.3
Monounsaturated Fat (g) (% of energy)	28.4 ± 0.8^{ab} 12.4 ± 0.3^{ab}	26.1 ± 0.6^{a} 11.6 ± 0.3^{a}	28.6 ± 0.6^{b} 12.8 ± 0.3^{b}
Polyunsaturated Fat (g) (% of energy)	14.2 ± 0.9 6.2 ± 0.3	12.8 ± 0.5 5.6 ± 0.2	14.2 ± 0.4 6.3 ± 0.2
Cholesterol (mg)	222 ± 17^{ab}	194 ± 22^{a}	285 ± 18^{b}
Total Dietary Fiber (g)	12.5 ± 0.6	14.0 ± 0.4	13.0 ± 0.4

Source: NHANES, 1999-2002, sample with complete, reliable 24-hr recall dietary interview. ^{a,b,c} Means not sharing an alphabetic character differ significantly ($p < 0.05$) (Bonferroni corrected); breakfast skippers vs. RTEC breakfast consumers, breakfast skippers vs. other breakfast consumers, RTEC breakfast consumers vs. other breakfast consumers.

[1]Least square mean and standard error (LSM + SE) nutrient intakes were adjusted for age, gender, and energy intake.

[2] Least square mean and standard error (LSM + SE) percent energy from nutrients were adjusted for age and gender only.

Children aged 1-5 years (Table 7) who consumed an RTEC breakfast had a significantly higher mean fiber intake than those who consumed other breakfast or skipped breakfast. HA children who consumed an RTEC breakfast had a significantly higher mean consumption from

carbohydrate (g) and percent energy from carbohydrate, and lower consumption of gram amounts percentage energy from total fat, SFA, MUFA, PUFA and cholesterol than those who consumed other breakfast.

Children aged 6-12 years (Table 8) who consumed an RTEC breakfast had a significantly higher mean consumption of percent energy from carbohydrate and lower consumption of energy from total fat and MUFA (g and percent); and lower cholesterol intake than those who consumed other breakfast. In addition, HA children who skipped breakfast had a higher consumption of energy from added sugars than those who consumed other breakfast.

Table 9: Mean daily macronutrient intake by breakfast consumption category without milk on cereal: Hispanic-American adolescents aged 13-18 years.

Macronutrient[1] % of energy[2]	Breakfast Skippers	RTEC Breakfast	Other Breakfast
Protein (g) (% of energy)	74.4 ± 2.0^{ab} 13.9 ± 0.4^{ab}	69.1 ± 1.7^{a} 12.8 ± 0.3^{a}	76.1 ± 1.6^{b} 14.3 ± 0.4^{b}
Carbohydrate (g) (% of energy)	282 ± 7^{a} 53.0 ± 0.9^{a}	312 ± 5^{b} 58.9 ± 0.8^{b}	289 ± 3^{a} 53.8 ± 0.6^{a}
Total Sugar (g) (% of energy)	144.7 ± 7.1 27.1 ± 1.1	155.2 ± 5.2 28.9 ± 0.8	153.9 ± 3.7 28.7 ± 0.8
Added Sugars (g) (% of energy)	114.1 ± 8.2 21.3 ± 1.2	112.8 ± 5.8 21.0 ± 1.0	111.0 ± 3.3 20.2 ± 0.8
Total Fat (g) (% of energy)	83.0 ± 2.2^{a} 33.4 ± 0.7^{a}	73.5 ± 1.9^{b} 29.4 ± 0.7^{b}	79.3 ± 0.9^{a} 32.4 ± 0.4^{a}
Saturated Fat (g) (% of energy)	28.7 ± 1.0^{a} 11.4 ± 0.3^{a}	24.4 ± 0.6^{b} 9.9 ± 0.3^{b}	27.4 ± 0.5^{a} 11.1 ± 0.2^{a}
Monounsaturated Fat (% of energy)	32.5 ± 0.8^{a} 13.0 ± 0.3^{a}	28.1 ± 0.8^{b} 11.2 ± 0.3^{b}	30.0 ± 0.5^{b} 11.1 ± 0.2^{a}
Polyunsaturated Fat (% of energy)	15.5 ± 0.7 6.4 ± 0.3	15.1 ± 0.9 5.9 ± 0.2	15.6 ± 0.5 6.5 ± 0.2
Cholesterol (mg)	216 ± 10^{a}	200 ± 13^{a}	307 ± 9^{b}
Total Dietary Fiber (g)	13.2 ± 0.6^{ab}	15.0 ± 0.5^{a}	13.5 ± 0.4^{b}

Source: NHANES, 1999-2002, sample with complete, reliable 24-hr recall dietary interview. [a,b,c] Means not sharing an alphabetic character differ significantly ($p < 0.05$) (Bonferroni corrected); breakfast skippers vs. RTEC breakfast consumers, breakfast skippers vs. other breakfast consumers, RTEC breakfast consumers vs. other breakfast consumers.

[1]Least square mean and standard error (LSM + SE) nutrient intakes were adjusted for age, gender, and energy intake. [2] Least square mean and standard error (LSM + SE) percent energy from nutrients were adjusted for age and gender only.

Adolescents aged 13-18 years (Table 9) who consumed an RTEC breakfast had a significantly higher mean consumption of carbohydrate (g) and percent energy from carbohydrates; and a lower mean consumption of total fat (g), SFA (g); and MUFA (g and percent) than those who consumed other breakfast or who skipped breakfast. Moreover, HA adolescents who consumed RTEC breakfast had a significantly higher mean consumption of protein (g) and percent energy from protein, as well as a higher mean fiber intake and a lower mean cholesterol intake than those who consumed other breakfast.

Table 10: Mean daily micronutrient intake by breakfast consumption category without milk on cereal: Hispanic-American children aged 1-5 years

Micronutrients	Breakfast Skippers	RTEC Breakfast	Other Breakfast
Vitamin A (μg RAE)	415 ± 30^{a}	576 ± 32^{b}	519 ± 23^{b}
Alpha Tocopherol (mg)	4.3 ± 0.3	4.3 ± 0.2	4.4 ± 0.1
Vitamin C (mg)	64.9 ± 14.6^{a}	110.9 ± 5.8^{b}	102.0 ± 5.9^{ab}
Thiamin (mg)	0.97 ± 0.08^{a}	1.52 ± 0.05^{b}	1.20 ± 0.04^{c}
Riboflavin (mg)	1.72 ± 0.15	2.13 ± 0.07	1.91 ± 0.06
Niacin (mg)	10.5 ± 1.1^{a}	18.8 ± 0.8^{b}	13.8 ± 0.7^{c}
Vitamin B-6 (mg)	1.01 ± 0.1^{a}	1.79 ± 0.05^{b}	1.41 ± 0.08^{c}
Folate (μg DFE)	331 ± 24^{a}	654 ± 47^{b}	381 ± 18^{a}
Vitamin B12 (μg)	3.6 ± 0.5	4.6 ± 0.3	4.1 ± 0.2
Calcium (mg)	918 ± 106	927 ± 53	945 ± 29
Phosphorus (mg)	1048 ± 77	1082 ± 33	1112 ± 20
Magnesium (mg)	195 ± 9	215 ± 6	205 ± 3
Iron (mg)	8.6 ± 0.6^{a}	16.1 ± 0.8^{b}	10.5 ± 0.3^{c}
Zinc (mg)	7.2 ± 0.7^{a}	10.5 ± 0.3^{b}	7.8 ± 0.2^{a}
Sodium (mg)	2343 ± 288	2421 ± 58	2321 ± 37
Potassium (mg)	1976 ± 151	2231 ± 56	2239 ± 34
Vitamin K (μg)	22.9 ± 4.4	32.5 ± 2.4	38.6 ± 5.1

Source: NHANES, 1999-2002, sample with complete, reliable 24-hr recall dietary interview. [a,b,c] Means not sharing an alphabetic character differ significantly ($p < 0.05$) (Bonferroni corrected); breakfast skippers vs. RTEC breakfast consumers, breakfast skippers vs. other breakfast consumers, RTEC breakfast consumers vs. other breakfast consumers.

Tables 10, 11, and 12 show the mean daily micronutrient intake by breakfast consumption without milk on cereal in Hispanic children and adolescents aged 1 to 5, 6 to 12, and 13 to 18 years, respectively. Children aged 1-5 years (Table 10) who consumed an RTEC breakfast had significantly higher mean intakes of vitamin B-6, thiamin, niacin, folate, iron, and zinc than those who consumed other breakfast or skipped breakfast. HA children who consumed an RTEC breakfast also had significantly higher mean intake of vitamins A and C than those who skipped breakfast.

Table 11: Mean daily micronutrient intake by breakfast consumption category without milk on cereal: Hispanic-American children aged 6-12 years.

Micronutrients	Breakfast Skippers	RTEC Breakfast	Other Breakfast
Vitamin A (μg RAE)	530 ± 138	655 ± 30	548 ± 38
Alpha Tocopherol (mg)	6.1 ± 0.5	5.3 ± 0.2	5.7 ± 0.4
Vitamin C (mg)	87.9 ± 10.6	103.7 ± 6.8	94.8 ± 6.5
Thiamin (mg)	1.35 ± 0.06[a]	1.84 ± 0.04[b]	1.48 ± 0.04[a]
Riboflavin (mg)	1.76 ± 0.09[a]	2.31 ± 0.05[b]	1.93 ± 0.06[a]
Niacin (mg)	17.7 ± 0.6[a]	22.5 ± 0.7[b]	17.6 ± 0.5[a]
Vitamin B-6 (mg)	1.37 ± 0.06[a]	2.04 ± 0.07[b]	1.48 ± 0.06[a]
Folate (μg DFE)	439 ± 22[a]	758 ± 24[b]	450 ± 11[a]
Vitamin B12 (μg)	5.3 ± 1.5	4.6 ± 0.2	3.9 ± 0.2
Calcium (mg)	819 ± 33	897 ± 36	908 ± 32
Phosphorus (mg)	1136 ± 24	1162 ± 23	1218 ± 25
Magnesium (mg)	210 ± 7	228 ± 4	226 ± 6
Iron (mg)	12.6 ± 0.8[a]	18.6 ± 0.6[b]	12.5 ± 0.3[a]
Zinc (mg)	9.7 ± 0.5[a]	12.6 ± 0.4[b]	9.5 ± 0.2[a]
Sodium (mg)	2884 ± 78	2963 ± 41	3083 ± 111
Potassium (mg)	2070 ± 51[a]	2190 ± 63[ab]	2333 ± 69[b]
Vitamin K (μg)	40.9 ± 3.8	43.5 ± 2.9	48.3 ± 7.4

Source: NHANES, 1999-2002, sample with complete, reliable 24-hr recall dietary interview. [a,b,c] Means not sharing an alphabetic character differ significantly ($p < 0.05$) (Bonferroni corrected); breakfast skippers vs. RTEC breakfast consumers, breakfast skippers vs. other breakfast consumers, RTEC breakfast consumers vs. other breakfast consumers.

Children aged 6-12 years (Table 11) who consumed an RTEC breakfast had significantly higher mean intakes of vitamin B-6, thiamin, riboflavin, niacin, folate, iron, and zinc than those who consumed other breakfast or skipped breakfast. HA children who consumed other breakfast had significantly higher mean intakes of potassium than those who skipped breakfast.

Table 12: Mean daily micronutrient intake by breakfast consumption category without milk on cereal: Hispanic-American adolescents aged 13-18 years.

Micronutrients	Breakfast Skippers	RTEC Breakfast	Other Breakfast
Vitamin A (μg RAE)	349 ± 25[a]	638 ± 32[b]	494 ± 38[c]
Alpha Tocopherol (mg)	6.1 ± 0.2	6.1 ± 0.2	6.0 ± 0.3
Vitamin C (mg)	78.8 ± 5.8[a]	129.6 ± 13.2[b]	112.0 ± 6.3[b]
Thiamin (mg)	1.35 ± 0.05[a]	2.01 ± 0.05[b]	1.51 ± 0.03[c]
Riboflavin (mg)	1.60 ± 0.07[a]	2.30 ± 0.07[b]	1.86 ± 0.05[c]
Niacin (mg)	18.9 ± 0.8[a]	26.6 ± 0.7[b]	19.4 ± 0.6[a]
Vitamin B-6 (mg)	1.41 ± 0.06[a]	2.30 ± 0.08[b]	1.57 ± 0.05[a]
Folate (μg DFE)	437 ± 16[a]	837 ± 29[b]	468 ± 11[a]
Vitamin B12 (μg)	3.9 ± 0.3[a]	5.2 ± 0.3[b]	4.2 ± 0.2[a]
Calcium (mg)	832 ± 47	807 ± 49	865 ± 25
Phosphorus (mg)	1174 ± 34[ab]	1157 ± 30[a]	1263 ± 20[b]
Magnesium (mg)	221 ± 5[a]	235 ± 5[b]	235 ± 5[b]
Iron (mg)	12.7 ± 0.3[a]	21.3 ± 0.8[b]	13.3 ± 0.2[a]
Zinc (mg)	10.8 ± 0.4[a]	13.2 ± 0.6[b]	10.5 ± 0.2[a]
Sodium (mg)	3247 ± 81	3204 ± 78	3356 ± 80
Potassium (mg)	2121 ± 71[a]	2220 ± 83[ab]	2355 ± 55[b]
Vitamin K (μg)	47.9 ± 4.8	43.4 ± 3.0	48.5 ± 2.1

Source: NHANES, 1999-2002, sample with complete, reliable 24-hr recall dietary interview. [a,b,c] Means not sharing an alphabetic character differ significantly ($p < 0.05$) (Bonferroni corrected); breakfast skippers vs. RTEC breakfast consumers, breakfast skippers vs. other breakfast consumers, RTEC breakfast consumers vs. other breakfast consumers.

Similarly, adolescents aged 13-18 years (Table 12) who consumed an RTEC breakfast had significantly higher mean intakes of vitamins A, B-6, and B12; thiamin, riboflavin, niacin, folate, iron, and zinc than those who consumed other breakfast or skipped breakfast. HA

adolescents who consumed an RTEC breakfast also had significantly higher mean intakes of vitamin C, and magnesium than those who skipped breakfast; and those who consumed other breakfast had a significantly higher intake of phosphorus than those who consumed RTEC breakfast.

Mean Adequacy Ratio and Micronutrients

The MAR of children and adolescents age 1-18 years is presented in the Table 13. With the exception of boys aged 1 to 5 years, Hispanic American children and adolescents who skipped breakfast had lower MAR than those who consumed an RTEC breakfast.

Table 13: Mean adequacy ratio (MAR) as defined by the Recommended Dietary Allowance (13) level of micronutrients by breakfast consumption category: Hispanic-American Boys and Girls aged 1-5 years, 6 -12 years, and 13-18 years.

Gender	Years	Breakfast Skippers	RTEC Breakfast	Other Breakfast
Boys	1 - 5	85.8 ± 3.2	92.8 ± 0.5	91.2 ± 0.8
	6-12	74.6 ± 1.8[a]	90.4 ± 0.8[b]	86.8 ± 1.4[b]
	13-18	74.7 ± 2.1[a]	84.6 ± 0.8[b]	77.2 ± 1.3[a]
Girls	1-5	83.1 ± 2.5[a]	92.7 ± 0.5[b]	88.6 ± 0.8[a]
	6-12	75.9 ± 2.4[a]	87.8 ± 1.5[b]	84.8 ± 1.2[b]
	13-18	62.3 ± 1.9[a]	81.3 ± 1.5[b]	71.2 ± 1.8[c]

Source: NHANES, 1999-2002, sample with complete, reliable 24-hr recall dietary interview. The mean adequacy ratio (MAR) was calculated by expressing micronutrient intake as a percentage of the RDA/AI, truncated to no more than 100%, and averaged over 17 micronutrients: vitamins A, E, C, B1, B2, niacin, vitamins B6, B12. folate, calcium, phosphorus, magnesium, iron, zinc, sodium, potassium & vitamin K. [a,b,c] Means not sharing an alphabetic character differ significantly ($p < 0.05$) (Bonferroni corrected); breakfast skippers vs. RTEC breakfast consumers, breakfast skippers vs. other breakfast consumers, RTEC breakfast consumers vs. other breakfast consumers.

Hispanic American girls between 1 to 5 years of age who consumed RTEC breakfast had a significantly higher MAR than HA girls who consumed either other breakfast or skipped

breakfast. Children between 6 to 12 years of age who consumed RTEC breakfast or other breakfast had significantly higher MAR than those who skipped breakfast. Moreover, HA adolescent boys and girls between 13 to 18 years of age who consume RTEC breakfast had a significantly higher MAR than those who consumed other breakfast or skipped breakfast.

Table 14: Mean adequacy ratio (MAR) as defined by the Recommended Dietary Allowance (13) level of shortfall nutrients by breakfast consumption category: Hispanic-American Boys and Girls aged 1-5 years, 6 -12 years, and 13-18 years.

Gender	Years	Breakfast Skippers	RTEC Breakfast	Other Breakfast
Boys	1 - 5	69.0 ± 4.6	76.4 ± 1.4	74.8 ± 1.5
	6-12	51.1 ± 3[a]	71.0 ± 1.8[b]	66.8 ± 2.2[b]
	13-18	52.4 ± 3.1[b]	59.9 ± 1.4[a]	54.8 ± 1.2[b]
Girls	1-5	60.8 ± 3.3[a]	76.2 ± 1.6[b]	70.1 ± 1.4[c]
	6-12	54.6 ± 2.7[a]	65.4 ± 2.9[b]	63.8 ± 1.8[b]
	13-18	40.6 ± 1.8[a]	55.6 ± 2.4[b]	48.5 ± 2.1[c]

Source: NHANES, 1999-2002, sample with complete, reliable 24-hr recall dietary interview. The mean adequacy ratio (MAR) was calculated by expressing nutrient intake as a percentage of the RDA/AI, truncated to no more than 100%, and averaged over 5 shortfall nutrients (vitamin E, calcium, magnesium, vitamin K & fiber) for children age 1-18 years. a,b,c Means not sharing an alphabetic character differ significantly ($p < 0.05$) (Bonferroni corrected); breakfast skippers vs. RTEC breakfast consumers, breakfast skippers vs. other breakfast consumers, RTEC breakfast consumers vs. other breakfast consumers.

The MAR consumption of shortfall nutrients by HA boys and girls aged 1-5 years, 6 -12 years, and 13-18 years is presented in the Table 14. HA girls between 1 to 5 years of age who consumed RTEC breakfast had a significantly higher MAR for shortfall nutrient than HA girls who consumed other breakfast or shipped breakfast. HA children boys and girls between 6 to 12 years who consumed RTEC breakfast or other breakfast had a significantly higher MAR for short fall nutrient than those who skipped breakfast. In addition, HA adolescent boys and girls

between 13 to 18 years of age who consume RTEC breakfast had a significantly higher MAR for shortfall nutrient than those who consumed other breakfast or skipped breakfast.

Breakfast and Weight Status

The mean waist circumference in (cm) by breakfast consumption category in HA children and adolescents aged 1- 18 years is presented in Table 15. Children between 6 to 12 years of age who skipped breakfast had a significantly higher mean waist circumference than those in the other breakfast group, but not compared with those who consumed an RTEC breakfast.

Table 15: Mean waist circumference in cm by breakfast consumption category: Hispanic-American children aged 1- 18 years.

Age (yrs)	Breakfast Skippers	RTEC Breakfast	Other Breakfast
1-5	(n = 18) 51.7 ± 0.7	(n = 209) 52.8 ± 0.4	(n = 255) 52.5 ± 0.4
6-12	(n = 131) 71.8 ± 1.4[a]	(n = 347) 67.6 ± 1.1[b]	(n = 564) 66.3 ± 0.6[b]
13-18	(n = 383) 83.9 ± 1.4	(n = 310) 81.0 ± 1.0	(n = 689) 82.3 ± 0.9

Source: NHANES, 1999-2002, sample with complete, sample with complete, reliable 24-hr recall dietary interview. Percentile of BMI-for-age and Z-score of BMI-for-age calculated using SAS program for CDC Growth Charts. a,b,c Means not sharing an alphabetic character differ significantly ($p < 0.05$) (Bonferroni corrected); breakfast skippers vs. RTEC breakfast consumers, breakfast skippers vs. other breakfast consumers, RTEC breakfast consumer vs. other breakfast consumer.

The mean z-score of BMI-for-age and mean percentile of BMI-for-age by breakfast consumption category in Hispanics children and adolescents aged 2-18 years is presented in the Table 16 and 17. Hispanic American boys and girls had a mean percentile of BMI-for-age within the normal range in all breakfast categories. Boys between 2 to 5 years of age who skipped breakfast had a significantly lower mean z-score of BMI-for-age than those who consumed breakfast regardless of the type of breakfast.

Table 16: Mean z-score of BMI-for-age and mean percentile of BMI-for-age by breakfast consumption category: Hispanic- American Boys aged 2 -18 years.

Age	Age-Years	Breakfast Skippers	RTEC Breakfast	Other Breakfast
2-5		(n=11)	(n=118)	(n=127)
	z-score of BMI	0.06 ± 0.09[a]	0.62 ± 0.09[b]	0.50 ± 0.1[b]
	Percentile of BMI	52.1 ± 3.1	65.8 ± 2.5	62.7 ± 2.6
6-12		(n=65)	(n=183)	(n=291)
	z-score of BMI	1.16 ± 0.17	0.58 ± 0.12	0.67 ± 0.11
	Percentile of BMI	80.1 ± 4.2	63.6 ± 3.2	68.3 ± 2.7
13-18		(n=186)	(n=168)	(n=333)
	z-score of BMI	0.72 ± 0.13	0.52 ± 0.12	0.66 ± 0.10
	Percentile of BMI	67.0 ± 3.6	64.4 ± 3.4	66.5 ± 2.5

Source: NHANES, 1999-2002, sample with complete, sample with complete, reliable 24-hr recall dietary interview. Percentile of BMI-for-age and Z-score of BMI-for-age calculated using SAS program for CDC Growth Charts. a,b,c Means not sharing an alphabetic character differ significantly ($p < 0.05$) (Bonferroni corrected); breakfast skippers vs. RTEC breakfast consumers, breakfast skippers vs. other breakfast consumers, RTEC breakfast consumer vs. other breakfast consumer.

Table 17: Mean z-score of BMI-for-age and mean percentile of BMI-for-age by breakfast consumption category: Hispanic- American Girls aged 2 -18 years.

Age	Age-Years	Breakfast Skippers	RTEC Breakfast	Other Breakfast
2-5		(n=9)	(n=101)	(n=145)
	z-score of BMI	0.93 ± 0.43	0.61 ± 0.11	0.03 ± 0.31
	Percentile of BMI	72.9 ± 8.3	66.9 ± 2.9	57.3 ± 3.3
6-12		(n=70)	(n=166)	(n=272)
	z-score of BMI	0.63 ± 0.10	0.68 ± 0.17	0.47 ± 0.09
	Percentile of BMI	67.7 ± 2.6	68.1 ± 4.7	63.5 ± 2.7
13-18		(n=198)	(n=142)	(n=355)
	z-score of BMI	0.62 ± 0.13	0.60 ± 0.13	0.65 ± 0.07
	Percentile of BMI	65.9 ± 3.1	65.6 ± 4.0	67.8 ± 2.0

Source: NHANES, 1999-2002, sample with complete, sample with complete, reliable 24-hr recall dietary interview. Percentile of BMI-for-age and Z-score of BMI-for-age calculated using SAS program for CDC Growth Charts. a,b,c Means not sharing an alphabetic character differ significantly ($p < 0.05$) (Bonferroni corrected); breakfast skippers vs. RTEC breakfast consumers, breakfast skippers vs. other breakfast consumers, RTEC breakfast consumer vs. other breakfast consumer.

The percentage of children who were at risk of overweight or overweight by breakfast consumption category in HA children and adolescents aged 2-18 years is presented in Table 18.

Boys between 2 to 5 years of age who consumed other breakfasts and who consumed an RTEC breakfast had a higher risk of overweight or overweight than those who skipped breakfast; and there was a significant difference between boys who consumed breakfast and who skipped breakfast.

Table 18: Percentage of children who were at risk of overweight or overweight by breakfast consumption category: Hispanic-American children aged 2 -18 years.

Gender	Age-Years	Breakfast Skippers	RTEC Breakfast	Other Breakfast
Boys	2-5	(n=11)	(n=118)	(n=127)
	At risk and overweight	0.0 ± 0.0[a]	27.7 ± 4.4[b]	32.3 ± 4.1[b]
	Overweight	0.0 ± 0.0	16.2 ± 4.3	16.4 ± 3.3
	6-12	(n=65)	(n=183)	(n=291)
	At risk and overweight	57.3 ± 8.0	34.8 ± 5.3	47.8 ± 3.7
	Overweight	36.7 ± 6.3	23.4 ± 3.9	24.6 ± 3.9
	13-18	(n=186)	(n=168)	(n=333)
	At risk and overweight	43.0 ± 5.3	37.4 ± 6.3	37.7 ± 3.6
	Overweight	26.3 ± 5.1	16.1 ± 4.5	25.3 ± 3.7
Girls	2-5	(n=9)	(n=101)	(n=145)
	At risk and overweight	27.5 ± 18.5	29.8 ± 5.5	24.6 ± 4.9
	Overweight	27.5 ± 18.5	15.0 ± 3.8	12.9 ± 4.5
	6-12	(n=70)	(n=166)	(n=272)
	At risk and overweight	30.7 ± 6.0	47.7 ± 7.4	26.4 ± 3.4
	Overweight	15.7 ± 5.0	20.5 ± 4.3	11.1 ± 2.7
	13-18	(n=198)	(n=142)	(n=355)
	At risk and overweight	34.8 ± 5.3	37.1 ± 4.9	34.4 ± 4.8
	Overweight	22.1 ± 4.6	17.1 ± 3.6	19.2 ± 3.2

Source: NHANES, 1999-2002, sample with complete, reliable 24-hr recall dietary interview. Children age 2-18 years with BMI ≥ 85th percentile of BMI-for-age were at risk of overweight or overweight. a,b,c Means not sharing an alphabetic character differ significantly ($p < 0.05$) (Bonferroni corrected); breakfast skippers vs. RTEC breakfast consumers, breakfast skippers vs. other breakfast consumers, RTEC breakfast consumers vs. other breakfast consumers.

CHAPTER 6
DISCUSSION

Breakfast Consumption

This study evaluated nutrient intake and weight status of HA children and adolescents aged 1 to 18 years by breakfast consumption category. The low number of skippers in HA children 1 to 5 years of age is similar to results from another study, that showed that 8% of children between 1-4 years of age skipped breakfast (5). A possible explanation for the low prevalence of breakfast skippers in youngest children may be due to the fact that parents may be able to guide the youngest children to healthier eating behaviors, as opposed to than adolescents who have more autonomy over the food they consume.

Another study that evaluated the prevalence of breakfast skippers showed that 20% of fourth-grade students reported skipping breakfast (61), compared with the result of this study that the percentage of HA children between 6-12 years of age who skip breakfast was low (12%). The Bogalusa Heart study which evaluated 10-year-old black and white children during 15 years (1973 to 1988) in Bogalusa, Louisiana also showed a high prevalence (30%) of breakfast skippers in 1978-1979. However, after the introduction of the School Breakfast Program (SBP), the number of children who skipped breakfast decreased to 13% from 1981 to 1982 (62). This shows that the SBP has the ability to reduce the prevalence of breakfast skippers. The low prevalence of skippers in HA children 6-12 years of old may result from the finding that HA students in elementary school are more likely to participate in the School Breakfast Program (63).

Skipping breakfast was more common in HA adolescents than in younger children; HA adolescents girl are more like to have skipped breakfast that HA adolescents boys, which is consistent with previous studies in other ethnic groups (5, 31, 64). The largest decline in the

prevalence of breakfast consumption between 1965 and 1991 was shown in adolescents aged 15 to 18 years (31); and there was an increased prevalence of breakfast skipping during the transition from adolescent to adulthood in the National Longitudinal Study of Adolescent Health from 1996 to 2002 (33). Another study of ninth grade students (84% white) conducted in New Orleans, Louisiana, showed that 19% of this population skipped breakfast; and that female adolescents were more likely to skip breakfast than male adolescents (23% vs 14% respectively) (14). Similarly, the consumption of breakfast by female adolescents declined from 84.4% in 1965 to 64.7% in 1996 in comparison to 89.7% to 74.9% for male adolescents in the same years (31).

Adolescents living in households with low incomes, a less well-educated female, or a head of household who works outside the home, consumed breakfast less frequently, (31) as did adolescents girls trying to lose weight or who are responsible for preparing their own meals (31, 65). The National Longitudinal Study of Adolescent Health which included a Hispanic population found that adolescents who made their own decisions about their eating behaviors were 25% more likely to skip breakfast (66) than those who did not. The reasons described above may explain why skipping breakfast was more common in HA adolescents.

Children and adolescents who skip breakfast have a lower intake of micronutrients when compared with those who regularly consume breakfast and this low micronutrient intake is not compensated for others meal (1, 5, 28, 64). Moreover, children who did not eat breakfast failed to meet two-thirds of the RDA for vitamin A, B6, D, riboflavin, folate, calcium, iron, magnesium, phosphorus, and zinc (28).

The tendency to decrease RTEC intake in HA children as they grow older reflected in this study is also consistent with the results of previous studies in other ethnic groups. Girls, as

compared with boys, tended to reduce the consumption of RTEC as they grew older (5). Similar results were obtained from a study conducted in Spain that evaluated the contribution of RTEC to daily nutrient intake and breakfast quality in 3,534 subjects aged 2 to 24 years. That study found that the consumption of RTEC at breakfast was higher in the youngest children than in adolescents and young adults (15).

The greater consumption of other types of breakfast than an RTEC breakfast by HA children and adolescents is similar to results presented in previous study that investigated the different food patterns of breakfast in HA adults. The type of food eaten at breakfast by HA was different from the type of food eating by non-Hispanic whites. Hispanic Americans were more likely to eat a cooked cereal and egg-plus-fruit breakfast rather than RTEC breakfast (26). We did not look at the composition of other breakfasts in this population of HA children. The breakfast consumption pattern of HA may depend of what they are accustomed to eating in their country of birth, the time they have lived in US, and their acculturation level.

Breakfast and Macronutrient Intake

The present study evaluated mean daily intake of total energy, protein, carbohydrate, total sugar, added sugar, total fat, SFA, MUFA, PUFA, cholesterol and fiber by breakfast consumption category in HA children and adolescents. Mean cholesterol intake was the highest in children and adolescents consuming other breakfast. Hispanic American children and adolescents who consumed an RTEC breakfast had on average a lower intake of total fat and cholesterol than those who consumed other breakfast. The mean total fat and cholesterol intake by children who consumed an RTEC breakfast was consistent with the American Heart Association's recommendation for total fat and cholesterol intake which are 20 to 35 % of energy and < 300 mg/day, respectively (67). However, this study did not look at a child- by-

child comparison to determine how many met these recommendations; and the mean intake of the other breakfast consumers and the skippers also met the cholesterol and total fat guidelines.

Hispanic American children between 1 to 5 and 13 to 18 years of age who consumed an RTEC breakfast had on average a higher energy intake from carbohydrates and a higher percent carbohydrate intake than those who consumed other breakfasts; and HA children between 1 to 5 years of age who consumed an RTEC breakfast had a higher energy intake from protein and higher fiber intake than HA children who skipped breakfast. The desirable macronutrient profile was consistent with results of previous studies (5, 17, 27). A study in France, which associated high-energy breakfast with the consumption of RTEC, found that children (ages 2 to 10) and adolescents (10 to 18) who ate an RTEC breakfast had a greater proportion of energy intake from carbohydrate and lower proportion of energy intake from fat (27). Another study showed that adolescents (15 years old) who consumed an RTEC breakfast had a higher intake of fiber and a lower intake of SFA per 1,000 kcal than those who consumed a fast food breakfast (17). Similarly, a study in children between 5 to 12 years found that children who consumed an RTEC breakfast more frequently had lower fat and cholesterol intakes, but higher fiber intakes than children who did not (1). This better macronutrient profile of RTEC breakfast can be explained, because some RTEC contain fiber (36) and are low in fat. High fiber intake may reduce energy intake by decreasing overall energy density and absorption of energy-yielding nutrient, and promotes satiety; therefore low fiber intake by HA children could lead to an excess of energy intake (10, 68).

Breakfast and Micronutrient Intake

The present study evaluated mean daily intakes of vitamins A, E, C, K, B1, B2, B6, B12; niacin; folate; calcium; phosphorus; magnesium; iron; zinc; sodium; and potassium by breakfast

consumption category in HA children and adolescents. Hispanics American children and adolescents who consumed an RTEC breakfast had a better micronutrient intake profile than those who consumed other breakfast or those who skipped breakfast. The best micronutrient profile is reflected in the fact that HA children and adolescents who consumed RTEC breakfast had a higher intake of vitamin B6, thiamin, riboflavin, niacin, folate, iron and zinc than those who consumed other breakfast and those who skipped breakfast.

The mean intake for almost all selected groups of vitamins and minerals studied met the recommended levels of intake for HA children and adolescents regardless of their breakfast consumption pattern. The only exception was for the mean intake of vitamin E in all groups and vitamin A and calcium for those who skipped breakfast or consumed other breakfast in the same age group. These findings differ from the Bogalusa study where two-thirds of the RDA for thiamin, iron, folate, zinc and vitamin B6 were not met by 10-y-old children who skipped breakfast. It was also found that a large percentage of children who consumed breakfast at home did not meet two-thirds of the RDA for vitamins A, calcium and magnesium (3, 62).

Results from the present study confirmed those of the Growth and Health Study which showed that girls between 9 to 19 years of age who ate an RTEC breakfast had higher intakes of iron, zinc, and folate (5). Another study that looked at Mediterranean children, adolescents, and young adults between 2 to 24 years old reported that the intakes of thiamin, riboflavin, vitamin B 6, folate, niacin, calcium, and iron increased with increasing consumption of RTEC (15). In the Bogalusa Heart Study, 96% of 10-y-old children who consumed RTEC also reported consumption of an item from the dairy group along with the cereal, and the mean intakes of thiamin, riboflavin, niacin, folic acid, vitamin A, vitamin B-6, and iron were showed to be higher among those who consumed RTEC than did not eat it (3).

The present study also showed that the mean number of HA children between 6 to 12 years of age and adolescents who ate an RTEC breakfast had a greater mean intake of vitamins A, B12 and C, calcium, and magnesium than those who ate other breakfast and those who skipped breakfast. The high mean intakes of calcium and vitamin A with RTEC breakfast are likely due to the fact that RTEC is often accompanied by milk which increases intake of these micronutrients (1, 2, 5, 13, 17, 18). Consumption of RTEC with milk has been associated with a lower prevalence of dietary inadequacy of calcium in all age-sex categories (18). Another study in children between 4 to 12 years old, found that children with a higher intake of RTEC with milk had a higher consumption of calcium than children with lower intake of RTEC (16). Calcium is an important mineral for bone and soft tissue development in children and adolescents (18, 68). Low calcium intake in children and adolescents may be a particular risk for osteoporosis in later life (68).

Nutrient Intake after Subtracting Milk

After subtracting the nutrient intake from milk that was combined with RTEC consumed at breakfast a big change in macro and micronutrient intake was observed. This was not surprising since most individuals eat RTEC with milk (1). The dietary components of milk such as protein, fat, vitamin A, calcium, and magnesium decreased in the RTEC breakfast without milk in comparison with RTEC breakfast with milk. The difference in consumption of protein and SFA between adolescents 13-18 years of age who consumed an RTEC breakfast and those who ate other breakfast was not significant after subtracting milk from the RTEC. The decrease in calcium after subtracting milk from the RTEC in HA children between 6-12 and 13- 18 years of age who ate RTEC breakfast was of such magnitude that no significant differences were found

between an RTEC breakfast and the other breakfast categories. However, most children commonly consume RTEC with milk (69) so this source of calcium is not lost to them.

Mean Adequacy Ratio (MAR) and Micronutrient intake

The principal finding when looking at the MAR is that HA children and adolescents who skipped breakfast had lower mean intakes of micronutrients than those who consumed breakfast regardless of the type of breakfast consumed. The same trend was observed with the MAR of shortfall nutrients. Shortfall nutrients are nutrients with an average intake lower than recommended intake for a group. The shortfall nutrients for children and adolescents are calcium; vitamin E; Potassium; calcium; magnesium; and fiber (23). Adolescents who consumed an RTEC breakfast had a higher MAR for shortfall nutrient intake than those who consumed others breakfast.

Breakfast and Weight Status

This study also evaluated adiposity and weight status by breakfast consumption category in HA children and adolescents. Hispanic American children between 6 to 12 years of age who skipped breakfast had on average a significantly higher waist circumference than those who ate other breakfast and those who consumed RTEC breakfast. Hispanic male children between 1 to 5 years of age who skipped breakfast had significantly lower mean z-score of BMI-for-age than those who ate breakfast; however all three mean BMI percentile scores were in the healthy weight range. Our result do not agree with finding reported by other studies which showed that children who skipped breakfast had a higher mean BMI than those who consumed breakfast (13, 64). These differences may be explained by the fact that the sample size of HA children 1 to 5 years of age who skipped breakfast may not have adequately represented of the population. Further, these children may have been too young to detect differences in BMI. Normal changes

of BMI occur in the first years of age in all children. Around the first year, BMI-for-age begins to decline. It continues to fall during the preschool years until it reaches its lowest point at 4 to 6 years of age, when BMI-for-age begins a gradual increase through adolescence and most of adulthood. The rebound or increase in BMI that occurs after it reaches its lowest point is referred to as "adiposity" rebound (70).

This study found no significant association between the consumption of breakfast and skipped breakfast with the risk of overweight or overweight in HA children and adolescents. This is inconsistent with the Growth and Health Study that showed that girls who consumed breakfast had lower risk of overweight than girls who did not consumed it; and another study in children between 4 to 12 years that found that children who consumed RTEC breakfast had lower risk of overweight than children who skipped it (6, 16). Our results about the relationship between weight status and RTEC breakfast consumption lead us to reject our hypothesis HA children and adolescents who consume RTEC for breakfast have better weight measures than those who do not consume RTEC. An explanation may be due to that the sample size of HA who skipped breakfast is very small and it may not be representative enough for this population. Another may be that ethnic differences in the weight and body composition of HA children preclude detection of differences in weight status.

Conclusions

This study used a recent nationally representative population and adds to the evidence that the consumption of RTEC breakfast contributes positively to the nutritional quality of the diets of HA children and adolescents. Hispanic American children and adolescents who consumed an RTEC breakfast had on average a better nutrient profile than children who skipped breakfast or consumed other breakfasts.

Milk added to RTEC at breakfast contributes to the greater consumption of protein, vitamin A, and calcium in HA children who consumed RTEC breakfast. A campaign to increase the consumption of breakfast and especially RTEC breakfast as a fast option in HA adolescents should be encouraged since it improved nutrient intake and increased consumption of milk.

Our results showed an inverse relationship between RTEC breakfast and waist circumference in HA children between 6 -12 years suggesting RTEC consumption was associated with improved measures of adiposity. This is important since risk factors such as this may track into adulthood. Results failed to show any association between the consumption of RTCE breakfast and the risk of overweight or be overweight in HA children and adolescents. This suggests ethnic differences among children with regard to RTEC consumption and weight status. Despite the lack of association between breakfast consumption and weight status in HA children and adolescents; consumption of RTEC breakfast makes a significant contribution to macro and micronutrient and improves overall dietary intake.

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VITA

Solange Stella Pineda Vargas was born in San Gil Colombia, to parents Manuel Pineda and Amparo Vargas. Solange received her Medicine and Surgery MD degree from Universidad Industrial de Santander, in Bucaramanga, Colombia, in December of 1994. Solange received her master degree in College Education from Universidad Santiago de Cali, Colombia, in December of 2002. After graduating as an MD, Solange did her rural service for one and a half year in a small town where she gained experience in the treatment of patients. In 1996, Solange move to Cali with her husband and children. She worked there for 7 years at Hospital San Juan de Dios de Cali at the emergency room and internal medicine department. In internal medicine Solange gained experience working with chronic patients suffering diabetes, lung and cardiovascular disease. She designed and developed the protocol for HIV testing to implement the program Prevention of Perinatal HIV. Solange also worked as Assistant Professor in semiology, part of internal medicine curriculum, in Universidad Santiago de Cali from 2000 to 2002. In 2003 she moved to Baton Rouge with her husband and children. In the fall of 2005, she began a graduate program at Louisiana State University. She plans to graduate in the fall of 2007 with a Master of Science degree in nutrition.