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Childhood obesity has more than tripled over the past four decades and disproportionately affects low-income and minority populations. The objective of this study was to examine and compare obesity rates and diet and physical activity behaviors of low-income Black and Hispanic children (2-18 y) by age as well as gender within each ethnic group. Secondary data analysis was conducted on parent/self reported diet and physical activity questionnaires for child patients (n=2,722) of a community medical clinic. Questionnaires were specifically designed for toddlers 2-4 years (n=1017), school aged, 5-12 years (n=1287) and adolescents aged 13-18 years (n=418) and were available in Spanish and English. Variables included measured heights and weights , body mass index (BMI) percentile based on CDC growth charts, intake of fast food, salty snacks, sweets, fruits, and vegetables and level of physical activity. Descriptive statistics and bivariate analyses were used identify associations among variables. Results showed obesity prevalence differences between Black and Hispanic children in all age groups as well as gender differences within Black children.

OBESITY, DIETARY BEHAVIORS, AND LEVEL OF PHYSICAL ACTIVITY AMONG LOW-INCOME CHILDREN IN GUILFORD COUNTY

by

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APPROVAL PAGE

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CHAPTER I

INTRODUCTION

Introduction

According to the Centers for Disease Control and Prevention (CDC), obesity has not only become an epidemic among the adult U.S. population it has also become an epidemic for U.S children (1). Approximately 17% of children (2-19 y) in the United States are obese, with a Body Mass Index (BMI) greater than or equal to the 95th percentile (2). Obesity during childhood increases the risk for adult obesity and related health problems such as diabetes, hypertension and heart disease (3, 4). Over the past two decades, the prevalence of obesity has increased across all age groups, the most dramatic of which occurred in children 6-11 y and 12-19 y. Since 1980, obesity for both age groups has more than tripled, from 6.5% to 19.6% in children 6-11y and from 5.0% to 18.1% in children 12-19 y (2).

Dietary habits and level of physical activity are the leading factors related to obesity. Following the recommendations set forth by the United States Department of Agriculture (USDA) for both behaviors is critical for weight management. Together a healthy diet and daily physical activity are not only required for weight management, but more importantly, are necessary for normal functioning of physiological processes such as blood pressure, renal function, blood sugar metabolism, and overall heart health. The epidemic of obesity has given rise to the need to assess the health practices of children.

Literature shows two that two leading factors associated with obesity are ethnicity and income (19). The prevalence of childhood obesity is highest among minority groups (primarily Hispanic and non-Hispanic Black) and among low-income populations (19). Over half of the children in the US from these two minority groups come from low-income families (11). Therefore, interventions addressing childhood obesity are most needed in low-income Hispanic and non-Hispanic Black populations. However, the culture of food for these two ethnic groups is different (29, 30, 31) and according to Ventura et al (32) dietary behaviors vary by ethnicity. Assessments comparing the behaviors of children from these two groups are needed before determining which behaviors should be targeted.

In addition to the cultural differences, characteristics such as age and gender also influence dietary behavior (33). Research has shown that the dietary practices of children change with age often times getting worse, suggesting that as children become older they are more likely to have unhealthy eating behaviors and become more physically inactive (5). As children grow, their energy needs change. Factors such as increases in height and muscle mass will increase a child's energy needs and appetite. In addition, growth rates and body composition differ between genders, making energy needs/appetites different for males compared to females throughout the various stages of life (34). Given that age and gender both affect a child's dietary intake, assessment of the health practices of children need to be age and gender specific.

North Carolina

Understanding nutrition and physical activity behaviors among children is particularly relevant to North Carolina (NC) as it exceeds national averages for childhood obesity as well as child poverty. As of 2009, NC ranks 11th in childhood obesity and is among the top 12 states with the highest rates of child poverty (9, 10). Almost half (46%) of NC children are from low-income (defined as at or below 200% of the federal poverty level) families (11). Given the large proportion of children at increased risk for obesity (low-income children) and the already high prevalence of obesity, research focusing on the dietary behaviors and physical activity of children in NC is needed. Currently, no studies have compared the dietary behaviors and physical activity level of Black and Hispanic children ages 2-18 yr by gender from low-income families. The purpose of this study is to identify specific dietary and physical activity patterns among children (ages 2-18) from low-income families of diverse ethnicities using secondary data analysis. Using data collected by Guilford Child Health assessing health related behaviors, we examined health related behaviors of children from low-income families. Furthermore, we identified specific differences in diet and physical activity behaviors by age, gender, and ethnicity.

The specific research questions are:

1) How do the dietary and physical activity behaviors of low-income Hispanic children differ from low-income black children?

2) Within each cultural group (Hispanic vs. Black) are there differences in obesity prevalence, dietary behaviors, and physical activity between males and females of each age group?

3) What are the determinants of weight status among 2-4y, 5-12y and 13-18 y old children and adolescents?

CHAPTER II

LITERATURE REVIEW

Literature Review

Childhood obesity

From 1963 to 2008, obesity in U.S. children 2-19 years old has more than tripled (5.0 to 16.9%), yet the cause is still not directly understood (12). National data show that the prevalence of obesity is higher among adolescent children compared to preschool aged (10.4% vs 18.1% respectively) (2). This alarming increase over the past four decades has gained national attention as a major public health issue. Efforts to reduce/prevent childhood obesity have become a priority not only for researchers but also by the federal government. In 2010, the United States Department of Health and Human Services released its Healthy People 2020 objectives which included a goal to reduce the proportion of children and adolescents (2-19 y) who are considered obese by 10% (13).

The implications of overweight or obesity in early years are grave. Overweight or obese children are more likely to remain or become overweight/obese in adolescence and adulthood (14, 15) and more likely to develop one or more associated health problems (diabetes, hypertension, hyperlipidemia, asthma, sleep apnea, coronary heart disease, stroke, gallbladder disease, respiratory problems, osteoarthritis, and some types of cancer) (16, 17). Additionally, the development of one or more of these diseases in childhood or adolescence increases one's risk of experiencing severe complications that

reduce the quality of life as early as young adulthood. Research has shown that as children get older, the quality of their diets declines (18). Therefore, efforts to prevent childhood obesity are needed not only so children maintain healthy weights but also so children have the knowledge they need to make healthy choices as they get older. Unhealthy dietary behaviors and physical inactivity are major contributors to obesity; but, sociodemographic characteristics, such as income and ethnicity, are also associated with obesity.

Socioeconomic determinants of obesity

Obesity disproportionately affects children from low-income (defined as being at or below 200% of the Federal Poverty Limit) populations and minority groups in the U.S. According to Singh et al., these two characteristics (income and ethnicity) are independent determinants of obesity (19). Using a nationally representative sample (n=46,707) of U.S. children and adolescents (10-17 y) researchers sought to identify the prevalence of obesity by ethnicity, socioeconomic status (SES), physical inactivity, television viewing, and computer use; to examine whether differences by ethnicity could be accounted for by physical inactivity and sedentary behaviors; and to identify any age, gender, ethnicity, and SES differences in obesity. Data were collected using the National Survey of Children's Health (NSCH). The survey was conducted by a computerized telephone interview in 2003-2004. Households were randomly selected and information was given by the parent with the most knowledge of the child's behaviors. Obesity was classified using the age and gender specific BMI cut-offs from the 2000 CDC growth charts. Results identified disparities based on individual and joint determinants. Obesity

was more prevalent in males of all ages and ethnicity. The odds of obesity were 46% and 55% higher for Hispanic and black males compared to white males and 113% higher for black females compared to non-Hispanic white. Children below the federal poverty level had 83% higher odds of obesity than those above the limit. Poor Hispanic, non-Hispanic white and black children had 2.7, 1.9, and 3.2 higher odds of obesity compared with affluent non-Hispanic white children. This study is one of the first to describe the prevalence of obesity in the context of social and behavioral factors. The results indicated that income and ethnicity are independent determinants of obesity (19).

These results indicate that minority groups (specifically, black and Hispanic) that are also low-income have the highest risk of obesity. Of all of the children in the United States, almost half (42%) are from low-income families and a disproportionately high percent of black (62%) and Hispanic (63%) children are from low-income families compared to white (29%) children (20). Given that a large portion of US children fall into the highest risk for obesity, there is great need for research specific to these two ethnic groups, specifically from low-income families.

Dietary intake and physical activity of low-income children

Although low-income black and Hispanic children are at the highest risk for obesity, research identifying dietary behaviors and physical activity among this population is limited. The literature focuses more on a single ethnic group as a whole or a low-income population not specific to any ethnic group. Only one study has observed the dietary patterns of low-income children in the US. Knol et al identified two dominant dietary patterns for younger children, 2-3 y, (n=1,242) and older children, 2-8 y,

(n=1,506) (21). The dominant (48.6%) eating pattern for the younger children was classified as "Big Eaters" and characterized by high intakes of energy, discretionary fats, and added sugars. The dominant (73.4%) eating pattern for the older children was classified as "Light Eaters" and characterized by low energy intakes but 40% of energy came from discretionary fat and added sugars. Findings revealed that children rarely met the recommended needs for food guide pyramid groups and most commonly consumed non-whole grains, milk, and red meats (in addition to discretionary foods). This study did not specifically examine food group intake by ethnic group but showed that both Hispanic and black children fell into categories with high intakes of discretionary fats and added sugars.

Low-income Black children

Research identifying dietary patterns of low-income black children is limited. Wang et al examined the dietary intake patterns and physical activity of low-income African-American adolescents (n=382-498), 10-14 years old (22, 23). This study was a cross-sectional study of participants in a randomized intervention trial testing the effectiveness of an obesity prevention program titled, Health-Kids. Researchers observed whether obesity was disproportionately high in this population and if so what factors, dietary intake patterns and/or physical activity, were directly related to weight status.

Participants were students in grades 5-8 from randomly selected schools where >80% of the students were African-American and >70% were from low-income families. Data used for this cross-sectional study were primarily collected from self-reported questionnaires with some information obtained from parents and measurements (such as

height and weight) from trained interviewers. Dietary behavior and physical activity assessments contained questions adapted from the Youth Risk Behavior Surveillance System and the Child and Adolescent Trial for Cardiovascular Health questionnaires.

Researchers not only found a high prevalence of obesity, they also identified high intake of several nutrients and foods. Obesity was disproportionately high in this population and specifically among females (27.3% vs 16.1% for boys). The mean energy intake for both boys and girls was high (3,144 ± 1575 kcal) with no significant sex differences. More than half of the study population consumed >300 mg of cholesterol/day and >75% consumed ≥2,400 mg of sodium/day. Overall, children consumed 120g of added sugars/day. Intake of fried foods was high with an average of 1.4 servings/day and 58.4% consuming fast food at least once a day. Adolescents consumed an average of 5.4 snacks per day, the majority of which were sweet. Over half (55.1%) of the participants reported drinking at least one sweetened beverage a day and 15.7% drank at least three sweetened beverages per day. Inadequate intake was found for fiber (23-25 g average) and half of the participants consumed less than the recommended intakes for calcium and vitamin D. Physical activity in this population was also below the recommendations. During the week prior to the survey, only 36.2% had at least 20 minutes of hard exercise ≥5 days and only 23.2% had at least 30 minutes of light exercise ≥5 days. The results from this study have identified multiple behaviors for future dietary interventions to target in this population.

The disproportionately high prevalence of obesity found in black adolescent females compared to black males and adolescent females of other ethnicities makes the

study of their dietary and physical activity patterns a priority (2, 22). Although Wang et al found a high energy intake with no significant sex differences, sex differences were found in fat intake and physical activity. Boys were more likely to have exercised vigorously ≥5 days, exercise in a PE class, and walk to school (23). Boys were also less likely to spend ≥5 hours per day watching TV or playing video games than girls. Girls also had significantly higher intakes of total and saturated fats (22). These differences suggest there may be a need to develop gender specific research projects and interventions.

Some studies have expanded on this concept and identified foods that may explain the high energy/fat intakes and low level of physical activity among females. Talpade identified foods most frequently consumed by black adolescent females to be breads/grains, meats, milk and milk products, fats oils and sugars, and chips (24). According to Frenn et al, gender differences in physical activity among black adolescent males and females could be explained by the presence of total social support (from both peers and parents) for physical activity. For black adolescent females, physical activity depended on the level of social support for being physically active (25).

The few studies focusing on low-income black children have provided the foundation for future interventions. However, there is still a great deal that remains unknown. The current studies have focused on adolescents and the study on low-income preschoolers in the U.S. does not describe patterns by ethnic groups. Studies describing the dietary behaviors and physical activity of low-income black preschool and school-aged children are needed.

Low-income Hispanic children

Similar to low-income black children, the dietary and physical activity patterns specific to low-income Hispanic children are not well studied. The Viva La Familia Study is one of the only studies to examine dietary and physical activity patterns among low income Latino children (26). The Viva La Familia study identified genetic and environmental factors associated with obesity in Hispanic children 4-19 years old (n=993). Wilson et al used information from participants in this study to identify diet quality and nutrient adequacy in children from low-income families (27). Families were invited to participate if they had at least one child $\geq 95^{th}$ BMI percentile and $\geq 85^{th}$ percentile. Diet intake was obtained using multiple-pass 24-hour recalls recorded on two random weekdays. Diet quality was determined using the Dietary Guidelines for Americans and nutrient adequacy was determined using estimated average requirement or adequate intake values.

Results showed poor diet quality. Nutrient intake was adequate for most nutrients but exceeded the recommended guidelines for percent total fat, percent saturated fat, cholesterol, added sugar, and sodium. Intake of fruits and vegetables was low. Results for the overall study population showed that 68% of total energy intake came from soda, desserts, pizza, snack chips, fruit drinks, fruit juice, processed meats, and burgers high in fat, sugar and/or sodium (27).

This study only vaguely identifies dietary behaviors (but not physical activity) of low-income Hispanic children. The lack of results provided for the low-income subgroup participating in the Viva La Familia Study reduces the reliability of its use for this

population. However, results from the overall study are useful for future interventions targeting obesity because all children were either overweight or obese. The wide range of ages included in this study make patterns by age group and gender difficult to determine.

The literature identifying the dietary behaviors and physical activity of low-income Hispanic children is limited. Specific research examining dietary and physical activity behaviors is needed. Research among preschool, school-aged, and adolescent children in this group is necessary to appropriately target the obesity disparity that exists in this population.

CHAPTER III

RESEARCH ARTICLES

Introduction

According to the Centers for Disease Control and Prevention (CDC), obesity has not only become an epidemic among the adult U.S. population it has also become an epidemic for U.S children (1). Over the past two decades, the prevalence of obesity has increased across all age groups, the most dramatic of which occurred in children 6-11 y and 12-19 y (2). Literature shows two that two leading factors associated with obesity are ethnicity and income (19). The prevalence of childhood obesity is highest among minority groups (primarily Hispanic and non-Hispanic Black) and among low-income populations (19). Over half of the children in the US from these two minority groups come from low-income families (11). Obesity disproportionately affects children from low-income (defined as being at or below 200% of the Federal Poverty Limit) populations and minority groups in the U.S. (19). Research has shown that as children get older, the quality of their diets declines (18). The odds of obesity were 46% and 55% higher for Hispanic and black males compared to white males and 113% higher for black females compared to non-Hispanic white. Children below the federal poverty level had 83% higher odds of obesity than those above the limit. Poor Hispanic, non-Hispanic white and black children had 2.7, 1.9, and 3.2 higher odds of obesity compared with

affluent non-Hispanic white children. These results indicate that minority groups (specifically, black and Hispanic) that are also low-income have the highest risk of obesity. Findings revealed that children rarely met the recommended needs for food guide pyramid groups and most commonly consumed non-whole grains, milk, and red meats (in addition to discretionary foods) (21). The disproportionately high prevalence of obesity found in black adolescent females compared to black males and adolescent females of other ethnicities makes the study of their dietary and physical activity patterns a priority (2, 22). Nutrient intake was adequate for most nutrients but exceeded the recommended guidelines for percent total fat, percent saturated fat, cholesterol, added sugar, and sodium. Intake of fruits and vegetables was low. Results for the overall study population showed that 68% of total energy intake came from soda, desserts, pizza, snack chips, fruit drinks, fruit juice, processed meats, and burgers high in fat, sugar and/or sodium (27). The purpose of this project was to identify differences in obesity prevalence, dietary behaviors, and physical activity level between Black and Hispanic children. Furthermore, this project aimed to identify differences by age and gender within each ethnic group.

Methods

Guilford Child Health

This secondary data analysis project describes child patients at Guilford Child Health (GCH), now known as Triad Adult and Pediatric Medicine (TAPM). GCH is a medical facility in Guilford County with just over 40,000 patients; the majority of which are either Black or Hispanic. Patients were seen at one of three locations within the

community: High Point, Wendover, and Spring Valley. GCH provides healthcare to children from birth to 18 y from low-income families. Patients are eligible if they have: government medical insurance (Medicaid or Health Choice), or, do not have Medicaid or Health Choice but the family's income is at or below 200 percent of the federal poverty level. GCH's mission is to meet the physical, emotional, and personal needs of patients and their families through a community-based approach in order to provide services such as behavioral counseling, reading programs, weight management programs, and speech therapy (28).

Survey

Data were collected using a parent-reported/self-reported frequency questionnaire/survey created and distributed by staff members at GCH prior to the start of this study. Surveys were collected between 2007-2010. The survey contained questions about dietary behaviors, physical activity, time spent watching TV/DVD/Videos, family meal time practices, as well as interest in speaking with a health educator. Questionnaires were distributed based on language preference, English or Spanish, and age group (infant 0-24 mo, toddler 2-4 y, school age 5-12 y, and adolescent 13-18 y) in the waiting room of the clinic. Parents or caretakers completed surveys for infants, toddlers, and school-aged children. Adolescents self-reported their behaviors. After surveys were filled out, nurses recorded (on the survey) the patients' measured heights and weights at the time of visit. Ethnicity and gender information were obtained from medical records.

Data management

Survey responses were recorded either manually in excel or scanned using Remark Office OMR software and analyzed using SPSS statistical software. The majority of data were entered manually due to technical difficulties early into the analysis stage. Data were excluded if missing information such as ethnicity or age; child's age did not match the survey age group; and if the majority of the survey was not completed. A total of 2,722 surveys were used for analysis. The focus of this project is on toddlers, school-aged children and adolescents. Of the toddler surveys, 1,042 were entered, 25 were excluded due to missing data or incorrect survey for age. Total sample size for toddlers was 1,017. Of the school-aged surveys 1,568 were entered, 281 were excluded due to missing data (mostly ethnicity data) or incorrect survey for age. Total sample size for school-aged children was 1,287. Of the adolescent surveys, 449 were entered, 31 were excluded due to missing data or wrong age for survey. Total adolescent sample size was 418.

Surveys contained an average of sixteen questions. Questions chosen for analysis were those that were the same for both language versions of all three age groups. Table 1 shows the questions selected for analysis:

Table 1. Survey Questions Selected for Analysis

Question	**Responses**
Our family eats "fast food" (McDonalds, pizza, KFC, Chinese, etc.)…	1 time a week or less 2-3 times a week 4 or more times a week
My child eats chips or other salty snacks…	1-2 times a week 3-5 times a week Every day

My child eats sweets, desserts, or candy…	1-2 times a week 3-5 times a week Every day
My child eats fruit…	Every day Most days Rarely
My child eats vegetables…	Every day Most days Rarely
My child plays actively (running, play on playground, etc.)…OR I play sports or do something physically active…	At least 60 minutes every day 30-60 minutes a day Less than 30 minutes a day

Table 2. Analysis Variables

Variable	**Definition**	**Categorical OR Continuous**
BMI	Based on heights and weights	Continuous
BMI percentile	Calculated using EPI Info Software	Continuous
Weight Status	1= underweight 2= normal weight 3= overweight 4= obese	Categorical
Ethnicity	B =1 =Black H =2= Hispanic	Categorical
Fast Food	1= 1 time a week or less 2= 2-3 times a week 3= 4 or more times a week	Categorical
Salty Snacks	1= 1-2 times a week 2= 3-5 times a week 3=Every day	Categorical
Fruit	1= Every day 2= Most days 3=Rarely	Categorical
Vegetables	1= Every day 2= Most days	Categorical

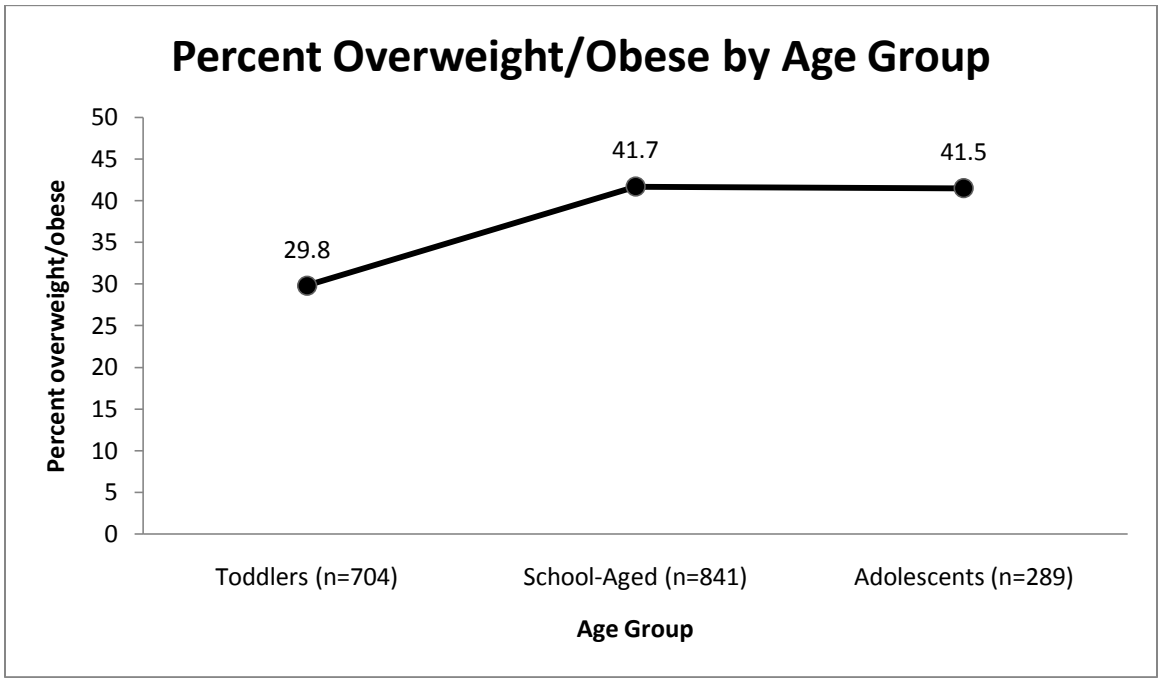
	3=Rarely	
Physical Activity	1= at least 60 minutes every day 2= 30-60 minutes a day 3= less than 30 minutes a day	Categorical
Age	Based on date of birth and date of appointment	Continuous
Age Group	1= 2.0-4.9 2= 5-12.9 3=13-18.9	Categorical

Descriptive analysis was used to describe the sample. Chi square for categorical and t tests for continuous variables was used to compare diet and physical activity behaviors between African American and Hispanic children as well as between age and gender within each cultural group. Hierarchical regression was used to identify determinants of weight status for each age group. The dependent variable was defined as a continuous variable, calculated BMI from measured heights and weights. Independent variables included the following categorical variables: gender, ethnicity, fruit, vegetable, fast food, and salty snack consumption, as well as physical activity level. Variables remained in the final model if they were significant at $p<0.05$.

Results

Figure 1 presents the number of overweight and obese combines in each of the three age groups.

Figure 1. Percent of Overweight/Obese Children in Each Age Group



One third of the toddlers were overweight/obese and the prevalence found in school-aged children and adolescents was nearly one half (~42%). These results show the high prevalence of overweight and obesity in our study population. The remainder of our analysis aimed to identify potential differences in the prevalence of overweight/obese children and behaviors by ethnic group, age, and gender.

Data for each age group is presented by ethnic group (Black vs. Hispanic) and gender. Weight status (the percent of overweight/obese vs. underweight/normal weight) and behaviors are compared by ethnicity then by gender within each ethnic group.

Following these comparisons are results of hierarchical regression analysis that used ethnicity, gender (in Block 1), and physical activity, and intake of fruit, vegetables, fast food, salty snacks and sweets (in Block 2) as independent predictors of BMI. For all statistical comparisons, p-value of <.05 was used to determine significance.

Toddlers

Weight status

Table 3. Weight Status for Toddlers by Ethnicity and Gender within Each Ethnic Group

Weight Status	%Black (n=406)	%Hisp (n=338)	p	%Black Male (n=182)	%Black Female (n=220)	p	%Hisp Male (n=181)	%Hisp Female (n=157)	p
Under/norm	73.4	66.0	.028	75.3	71.8	.435	69.6	61.8	.130
Over/obese	26.6	34.0		24.7	28.2		30.4	38.2	

Table 3 displays a comparison by ethnicity of the proportion of underweight and normal weight toddlers to overweight and obese toddlers. It also displays a comparison by gender within each ethnic group. Among this age group, a significantly higher proportion of Hispanic children were overweight/obese compared to Black (34.0% vs. 26.6% respectively). A higher proportion of both Hispanic males and females were overweight/obese than Black males and females. Hispanic females had the highest prevalence of overweight/obese toddlers compared to Hispanic males and Black toddlers of both genders. No significant gender differences were found overall or within either ethnic group.

Behaviors

Table 4. Behaviors Among Toddlers Identified by Ethnic Group and by Gender within Ethnic Group

Behavior	%Black	%Hisp	p	%Black Male	%Black Female	p	% Hisp Male	% Hisp Female	p
Physically Active	(n=402)	(n=322)	.000	(n=182)	(n=216)	.247	(n=175)	(n=147)	.352
• At least 60min/day	65.2	38.8		61.0	69.0		42.3	34.7	
• 30-60 min/day	29.6	42.9		33.0	26.4		41.1	44.9	
• <30min/day	5.2	18.3		6.0	4.6		16.6	20.4	
Fruit Intake	(n=403)	(n=327)	.671	(n=170)	(n=214)	.059	(n=176)	(n=151)	.165
• Everyday	59.3	60.9		56.5	65.9		57.4	64.9	
• <Everyday	40.7	39.1		43.5	34.1		42.6	35.1	
Vegetable Intake	(n=402)	(n=329)	.000	(n=180)	(n=218)	.012	(n=174)	(n=155)	.413
• Everyday	56.5	30.7		49.4	61.9		28.7	32.9	
• <Everyday	43.5	69.3		50.6	38.1		71.3	67.1	
Fast Food Intake	(n=396)	(n=328)	.000	(n=178)	(n=214)	.136	(n=176)	(n=152)	.465
• 1x or less/wk	76.5	90.9		73.0	79.4		89.8	92.1	
• 2 or more x/wk	23.5	9.1		27.0	20.6		10.2	7.9	
Salty snack Intake	(n=399)	(n=318)	.000	(n=178)	(n=217)	.037	(n=166)	(n=152)	.181
• 1-2x/wk	68.7	89.0		63.5	73.3		86.7	91.4	
• 3 or more x/wk	31.3	22.3		36.5	26.7		13.3	8.6	
Sweet Intake	(n=395)	(n=309)	.000	(n=179)	(n=212)	.665	(n=162)	(n=147)	.381
• 1-2 x/wk	77.0	87.4		76.0	77.8		85.8	89.1	
• 3 or more x/wk	23.0	12.6		24.0	22.2		14.2	10.9	

Table 4 displays a comparison of the physical activity level and dietary behaviors between Hispanic and Black toddlers. It also displays a comparison of behaviors by gender within each ethnic group. Significant differences between the two ethnic groups were found for males and females for all behaviors except fruit consumption. A higher proportion of Black toddlers was physically active, and, consumed: vegetables every day, fast food 2 or more times per week, salty snacks 3 or more times per week, and sweets 3 or more times per week. No significant gender differences in behavior were found among Hispanic toddlers. Significant gender differences were observed among

Black toddlers for vegetable and salty snack intake. Significantly more Black females consumed vegetables daily compared to Black males (61.9% vs. 49.4% respectively) and significantly more Black males consume salty snacks 3 or more times a week than Black females (36.5% vs. 26.7% respectively). Noted gender differences were found for fruit intake within the Black ethnic group (females consumed more fruits everyday than males).

Table 5. Regression

Coefficients[a,b]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	15.819	.242		65.367	.000
	Ethnic Group	.672	.157	.161	4.269	.000
2	(Constant)	16.428	.379		43.330	.000
	Ethnic Group	.609	.160	.146	3.806	.000
	Fast food	-.442	.212	-.080	-2.083	.038

a. Age Group = toddler

b. Dependent Variable: BMI

*adjusted R^2: .029

Results of the regression predicting BMI by the demographic and behavior variables are presented in Table 5. Among toddlers, ethnicity and fast food consumption were found to be independent predictors of BMI. However, a very small adjusted R^2 indicates little strength in the relationship between these variables and BMI.

School-aged children

Weight status

Table 6. Weight Status for School-Aged Children by Ethnicity and Gender within Each Ethnic Group

Weight Status	%Black (n=593)	%Hisp (n=270)	p	%Black Male (n=297)	%Black Female (n=288)	p	%Hisp Male (n=135)	%Hisp Female (n=132)	p
Under/norm	62.9	50.0	.000	63.6	61.8	.647	48.1	52.3	.500
Over/obese	37.1	50.0		36.4	38.2		51.9	47.7	

Table 6 displays a comparison by ethnicity of the proportion of underweight and normal weight school-aged children to overweight and obese school-aged children. It also displays a comparison by gender within each ethnic group. Overall, significantly more Hispanic school-aged children were overweight/obese than Black school-aged children. Half of the Hispanic children in this age group were either overweight or obese. The percent of overweight/obese Hispanic males was over half (51.9%) and the highest of all for males and females of both ethnic groups for all ages. No significant gender differences in weight status for either ethnic were found among school-aged children.

Behaviors

Table 7. Behaviors Among School-Aged Children Identified by Ethnic Group and by Gender within Ethnic Group

Behavior	%Black	%Hisp	p	%Black Male	%Black Female	p	% Hisp Male	% Hisp Female	p
Physically Active	(n=579)	(n=267)	.000	(n=291)	(n=280)	.006	(n=132)	(n=132)	.818
• At least 60min/day	61.5	41.9		55.7	66.7		43.2	40.9	
• 30-60 min/day	32.8	43.1		39.3	26.8		40.9	44.7	
• <30min/day	5.7	15.0		5.0	6.5		15.9	14.4	
Fruit Intake	(n=585)	(n=264)	.316	(n=294)	(n=283)	.793	(n=130)	(n=131)	.122
• Everyday	46.7	50.4		46.3	47.3		45.4	55.0	
• <Everyday	53.3	49.6		53.7	52.7		54.6	45.0	
Vegetable Intake	(n=586)	(n=264)	.000	(n=294)	(n=284)	.251	(n=132)	(n=129)	.968
• Everyday	56.8	24.2		54.4	59.2		24.2	24.0	
• <Everyday	43.2	75.8		45.6	40.8		75.8	76.0	
Fast Food Intake	(n=584)	(n=262)	.000	(n=293)	(n=283)	.025	(n=181)	(n=128)	.422
• 1x or less/wk	80.7	93.5							
• 2 or more x/wk	19.3	6.5		77.5	84.8		94.7	92.2	
				22.5	15.2		5.3	7.8	
Salty snack Intake	(n=588)	(n=263)	.000	(n=296)	(n=284)	.257	(n=133)	(n=127)	.136
• 1-2x/wk	66.3	86.3		63.9	68.3		83.5	89.8	
• 3 or more x/wk	33.7	13.7		36.1	31.7		16.5	10.2	
Sweet Intake	(n=574)	(n=267)	.000	(n=287)	(n=280)	.458	(n=133)	(n=131)	.656
• 1-2 x/wk	70.2	83.1		71.8	68.9		82.7	84.7	
• 3 or more x/wk	29.8	16.9		28.2	31.1		17.3	15.3	

Table 7 displays a comparison of the physical activity level and dietary behaviors between Hispanic and Black school-aged children. It also displays a comparison of behaviors by gender within each ethnic group. Significant ethnic differences were found in both genders for all behaviors except fruit intake. For both genders, a higher proportion of Black school-aged children were physically active and consume vegetables every day, fast food 2 or more times per week, salty snacks 3 or more times weekly, and sweets 3 or more times weekly compared to Hispanic school-aged children. Significant gender differences were only found for physical activity and fast food intake in Black

school-aged children. Black males are significantly more active and consume significantly more fast food than black females. No significant gender differences were observed among Hispanic children in this age group; however, 10% more Hispanic females consumed fruit everyday compared to Hispanic males.

Table 8. Regression

Coefficients[a,b]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	17.560	.526		33.410	.000
	Physical Activity	.992	.344	.100	2.888	.004
2	(Constant)	16.360	.709		23.065	.000
	Physical Activity	.918	.344	.093	2.672	.008
	Fruit intake	.859	.342	.087	2.510	.012

a. Age Group = school aged

b. Dependent Variable: BMI

*adjusted R^2: .015

Table 8 shows the results of running a regression analysis of all variables (ethnicity, gender, physical activity, and intake of fruit, vegetables, fast food, salty snacks, and sweets) as independent predictors of BMI for school-aged children. Among school-aged children, physical activity and fruit intake were found to be independent predictors of BMI. However, a small adjusted R^2 value indicates little strength in these variables prediction of BMI.

Adolescents

Weight status

Table 9. Weight Status for Adolescents by Ethnicity and by Gender within Each Ethnic Group

Weight Status	%Black (n=219)	%Hisp (n=80)	p	%Black Male (n=113)	%Black Female (n=105)	P	%Hisp Male (n=44)	%Hisp Female (n=36)	p
Under/norm	58.0	61.3	.612	61.1	54.3	.311	61.4	61.1	.982
Over/obese	42.0	38.8		38.9	45.7		38.6	38.9	

Table 9 displays a comparison by ethnicity of the proportion of underweight and normal weight adolescents to overweight and obese adolescents. It also displays a comparison by gender within each ethnic group. No significant ethnic differences were found in the proportion of overweight/obese adolescents. No significant gender differences within either ethnic group were found for proportion of overweight/obese adolescents.

Behaviors

Table 10. Behaviors Among Adolescents Identified by Ethnic Group and by Gender within Ethnic Group

Behavior	%Black	%Hisp	p	% Black Male	%Black Female	p	% Hisp Male	%Hisp Female	p
Physically Active	(n=215)	(n=78)	.469	(n=113)	(n=101)	.001	(n=43)	(n=35)	.096
• At least 60min/day	43.3	38.5		53.1	32.7		48.8	25.7	
• 30-60 min/day	33.0	30.8		32.7	33.7		23.3	40.0	
• <30min/day	23.7	30.8		14.2	33.7		27.9	34.3	
Fruit Intake	(n=167)	(n=80)	.426	(n=112)	(n=104)	.765	(n=44)	(n=36)	.291
• Everyday	23.0	27.5		22.3	24.0		22.7	33.3	
• <Everyday	77.9	72.5		77.7	76.0		77.3	66.7	
Vegetable Intake	(n=215)	(n=78)	.002	(n=110)	(n=104)	.316	(n=42)	(n=36)	.333

• Everyday • <Everyday	34.4 65.6	15.4 84.6		37.3 62.7	30.8 69.2		19.0 481.0	11.1 88.9	
Fast Food Intake • 1x or less/wk • 2 or more x/wk	(n=205) 62.9 37.1	(n=79) 82.3 17.7	.002	(n=106) 57.5 42.5	(n=98) 68.4 31.6	.110	(n=43) 83.7 16.3	(n=36) 80.6 19.4	.714
Salty snack Intake • 1-2x/wk • 3 or more x/wk	(n=215) 50.7 49.3	(n=80) 82.5 17.5	.000	(n=112) 47.3 52.7	(n=102) 53.9 46.1	.335	(n=44) 84.1 15.9	(n=36) 80.6 19.4	.679
Sweet Intake • 1-2 x/wk • 3 or more x/wk	(n=210) 51.4 48.6	(n=79) 70.9 29.1	.003	(n=109) 49.5 50.5	(n=100) 53.0 47.0	.617	(n=43) 79.1 20.9	(n=36) 61.1 38.9	.080

Table 10 displays a comparison of the physical activity level and dietary behaviors between Hispanic and Black adolescents. It also displays a comparison of behaviors by gender within each ethnic group. Significant ethnic differences in behavior were different for each gender. Black male adolescents consumed significantly more vegetables, fast food, salty snacks, and sweets than Hispanic male adolescents. Black female adolescents consumed significantly more vegetables and salty snacks than Hispanic females. Overall, Black adolescents consumed significantly more vegetables, fast food, salty snacks, and sweets than Hispanic adolescents. A significant gender difference within an ethnic group was only observed for physical activity within the Black ethnic group. Black male adolescents were significantly more physically active than Black female adolescents. The difference in Hispanic males vs. females indicate that a much larger proportion of Hispanic males are physically active at least 60 min/day than Hispanic females (48.8% vs. 25.7% respectively). Other noted gender differences for Hispanic adolescents include a higher intake of fruit every day and sweets 3 or more times/week among Hispanic females compared to Hispanic males (33.3% vs. 22.7% and 38.9% vs. 20.9% respectively).

Table 11. Regression

Coefficients[a,b]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	20.856	1.093		19.076	.000
	Physical Activity	1.881	.660	.169	2.849	.005

a. Age Group = adolescent

b. Dependent Variable: BMI

*adjusted R^2: .025

Table 11 shows the results of running a regression analysis of all variables (ethnicity, gender, physical activity, and intake of fruit, vegetables, fast food, salty snacks, and sweets) as independent predictors of BMI for adolescents. Among adolescents, only physical activity was an independent predictor of BMI and the low adjusted R^2 value indicate physical activity is not a strong predictor of BMI.

Discussion

The purpose of this cross-sectional study was to compare dietary behaviors and level of physical activity of low-income children (2-18 yr) by ethnicity, gender, and age group using secondary data collected from a parent or self reported frequency questionnaire. We aimed to analyze the data to show that behaviors may vary based on ethnic group. Furthermore, we examined the potential for behaviors of children within an ethnic group to vary by gender and/or age group. We examined the prevalence of overweight/obese children in our study and then for the purposes of this study focused on behaviors of Black and Hispanic children.

Low-income populations are among the highest risk groups for overweight and obesity (1, 8). In this study, one third of toddlers and almost one half of school-aged children and adolescents were either overweight or obese, all of which were higher than the national average for the corresponding age group (28). In a review of NHANES data over the last 4 decades, Wang et al also observed a higher prevalence of overweight and obesity among low-income children (22). Our data showing the lowest prevalence of overweight and obesity among younger children (toddlers) and a higher prevalence in school-aged children and adolescents has also been shown in NHANES data over the past four decades (17, 22).

Toddlers

Weight status: ethnic and gender differences

Over a quarter (26.6%) of Black toddlers and over a third (34%) of Hispanic toddlers were either overweight or obese. Hispanic toddlers of both genders had a significantly higher prevalence of overweight/obese children compared to Black toddlers which has also been observed in recent NHANES data. Sekhobo et al found this same trend among toddlers in a study of WIC participants in New York (35). In 2007, a study using a national sample of toddlers from a low-income population found that Hispanic toddlers were twice as likely as either Black or white children to be overweight or obese (22). For Hispanic children in this age group, researchers have found that mothers significantly underestimate a child's weight status and do not perceive their children as overweight (36, 37). This could be one reason behind the relatively high prevalence of

overweight/obese Hispanic children in this age group. Weight status among children in this age group was similar among both genders.

Behavior and ethnicity

Statistically significant ethnic differences in behavior were found for every behavior (physical activity, and consumption of vegetables, fast food, salty snacks, and sweets) except fruit consumption. Black toddlers were more physically active, and consume more vegetables, fast food, salty snacks and sweets than Hispanic toddlers. High consumption of sweets but low consumption of fruits and vegetables has been observed in low-income black toddlers by Papas et al (38). National Youth Behavior Risk Surveys have shown that intake of fruits and vegetables low-income and/or minority toddler groups is inadequate; however, this has also been found to be a common characteristic of children in this age group in general (39, 40).

Behavior and gender

We found differences in behaviors within each ethnic group and significant differences between males and females within the Black toddler group but none among the Hispanic toddler group. Among the differences found between genders for Black toddlers was consumption of vegetables and salty snacks. Black males consumed less vegetables and more salty snacks than Black females. According to O'Connor et al, one possible explanation for the gender differences found and not found in vegetable consumption among Black and Hispanic toddlers could be explained by different feeding practices of the parents. The relationship between a child's weight and the parents feeding practices depended on ethnicity and (child) gender (40).

Determinants of BMI

Our regression model identified ethnicity and fast food consumption as independent predictors of BMI among toddlers. The significantly higher prevalence of overweight/obese Hispanic children compared to Black is supported by our regression results. Ethnicity has often been cited as a predictor of overweight and obesity (19) for both adults and children. In many cases, non-Hispanic white groups are used for reference groups. In our study Hispanics and Blacks were compared and we found that Hispanics are more likely to be heavier than Blacks. Although not specific to toddlers, fast food consumption has been identified as a determinant of weight (19).

School-aged children

Weight status: ethnic and gender differences

Hispanic school-aged children of both genders had a significantly higher prevalence of overweight/obese children compared to Black school-aged children, which has also been observed in recent NHANES data. In our study, half of the Hispanic school-aged children were overweight or obese-a proportion well above the national average. Fifty-two percent of Hispanic males were either overweight or obese. According to the CDC, not only has the prevalence of overweight/obese Hispanic school-aged boys risen in the last few decades, it is the largest increase compared to males and females of all ages and ethnicities in US children (41). No significant gender differences were observed within each ethnic group; however, the distribution of overweight and obesity by gender within Black school-aged children in this study was similar to that of a recent study. Wang et al found that more girls were overweight than boys and more boys

were obese than girls (22). In our study, 20.5% of Black school-aged girls vs. 17.7% of Black school-aged boys were overweight, and 27.3% of Black girls vs. 34.1% of Black boys were obese. The age range for this age group spans several years and it is possible that this trend could be related to growth pattern differences between males and females of this ethnicity. It is also possible both genders have very different eating patterns over this age range that could be related to these differences.

Behavior and ethnicity

As with toddlers in this study, statistically significant ethnic differences were found for all behaviors except fruit consumption. Black school-aged children were more physically active, and consumed more vegetables, fast food, salty snacks and sweets than Hispanic school-aged children. One study showed that 55.1% of Black children ages 10 to 14 consumed fried foods 2 or more times daily and 19.1% consumed fried foods 4 or more times daily (23). Considering the high consumption of fried foods indicated above, our finding of a high frequency of fast food could suggest that many of the fried foods come from fast food sources. This same study also noted Black children frequently snacking, but of those snacks only 24% of them were healthy snacks (23). Similarly our data suggest that frequency of unhealthy snacking among Black school-aged children is high. For both ethnic groups 40-50% of the children were not active at least 60 minutes daily. In a study examining the influence of socioeconomic status on physical activity, children from lower SES families were less likely to be active than higher SES children (42). Our results show a large proportion of children from both ethnic groups with low activity levels.

Behavior and gender

In this age group, significant gender differences were also observed only within the Black ethnic group. Black school-aged males were more physically active and consumed more fast food than Black school-aged females. Both of these findings are supported by the literature. Females for both ethnic groups have been found by other authors to be less physically active than males (43, 22). Bowman et al analyzed a nationally representative sample of children 4-19 yr old, and found fast food consumption was independently associated with male gender and non-Hispanic black race/ethnicity (44).

Determinants of BMI

Physical activity and fruit intake among school-aged children in this study were independent predictors of BMI. In another study analyzing the independent and joint determinants of obesity using a nationally representative sample of children, the odds of obesity were two to three times higher for children who were physically inactive across all income groups (3). In this study, lower fruit intake was associated with a higher BMI. Fruit intake among low-income school-aged children has been found low along with very high rates of overweight and obesity (45). Our data suggest that low fruit intake is associated with obesity in low-income school-aged children.

Adolescents

Weight status: ethnic and gender differences

The adolescent group is the only group where the difference in the prevalence of overweight and obesity between the two ethnic groups was not significant; Black adolescents were only slightly heavier (~4%) than Hispanics. Nearly 40% of adolescents in each group are overweight or obese. These numbers are consistent with national data; however, Hispanics are slightly heavier than Blacks in national data. In our data, the higher prevalence among Blacks is likely due to a very high prevalence (nearly half) among Black females. In many other studies among low-income adolescents as well as NHANES data, the prevalence of overweight and obesity was highest among Black adolescent females (1, 2, 8, 17).

Behavior and ethnicity

The ethnic differences observed among adolescents in this study were unlike the differences found in the other two age groups. Significant ethnic differences were found for consumption of vegetables, salty snacks and sweets as found in the other two age groups but unlike the other two age groups, ethnic differences were found for fruit consumption and not for physical activity. According to NHANES data and the Youth Risk Behavior Surveillance Study (YRBSS), healthy dietary behaviors and level of physical activity are lowest among adolescents (46, 47). Among adolescents, physical inactivity as well as intake of fast food, sodas/sweetened beverages, and unhealthy snacking increases while intake of fruits and vegetables decreases (46, 47). These behaviors are similar to those found in this study and may explain the shift in behaviors

in this age group compared to the other two age groups. Overall, behaviors for both ethnic groups in this study indicated unhealthier patterns compared to the other two age groups. NHANES data indicate that only 25% of children over 8 yrs old consumed the recommended servings of fruits; only 25% consumed the recommended servings of vegetables, and only 18% of high school students (14-18yr) met the recommendations for physical activity. The very low proportion of children meeting the recommendations is also what we observed in this study. However, this was the only age group with self reported instead of parent reported data and different reported behaviors could indicate parent and child perceptions of behavior are not consistent.

Black adolescents in this study consumed significantly more fruits, vegetables, salty snacks, and sweets compared to Hispanic adolescents. Although Black adolescents in our study consumed significantly more fruits and vegetables than Hispanic adolescents, consumption of these foods daily among Black adolescents was still very low-less than a quarter consumed fruits everyday and just over a third consumed vegetables daily. High intake of energy dense, low nutrient foods such as snacks and fried foods along with low intakes of fruits and vegetables has been characterized in several populations of Black adolescents of all income groups (23, 19). Wilson et al found that diets in low-income Hispanic adolescents exceeded recommendations/guidelines for percent total fat, saturated fat, cholesterol, added sugars and sodium (27). Our results indicate consumption of fast food, salty snacks and sweets among Hispanic adolescents was highest of all age groups within this ethnicity and diet quality found by Wilson et al could be described by the behaviors found in our study.

Adolescents have more freedom in food choices than younger children and it is likely that the increase in unhealthy behaviors for both ethnic groups in this study is a result of poor choices. The differences found between the two ethnic groups could be explained by results from O'Dougherty et al analyzing parent perspectives of Hispanic and Black children 10-14 yr old. Black parents described their children as always being hungry, which was not a characteristic of Hispanic children described by parents (48). The higher frequency of unhealthy behaviors could be attributed to appetite differences between the two groups.

Behavior and gender

Physical activity within Black adolescents was the only behavior with significant gender differences. Black adolescent males were significantly more active than Black females. Using data from the National Longitudinal Study of Adolescent Health, Robinson et al found that Black females were less physically active than Black males. This pattern was also observed among Hispanic adolescents in our study. Physical activity among low-income females in this age group has been found to be more dependent on social influence (peer and parent support) as well as the school they attend more than males (25, 49).

Determinants of BMI

Among adolescents in this study only physical activity was found to be an independent determinant of BMI; the more physically active the child the lower the BMI. Physical activity in this age group was the lowest for both ethnic groups with some of the

highest prevalence of overweight and obesity. Weight status has been associated with physical activity as described in the school-aged discussion of determinants of BMI.

Behaviors and USDA Recommendations

Although our study is not longitudinal, our data were consistent with literature indicating an increase in unhealthy behaviors as children get older. Not only are recommendations for physical activity (at least 60 min/daily), and intake of fruit and vegetables (at least 5 servings daily), not met by children of all age groups in this study, the percent of each age group not meeting these recommendations increases ~40% to 80% from toddlers to adolescents. Changes in these behaviors alone, could not only reduce the prevalence of obesity among these children, they could reduce all children's' risk for health problems such as heart disease, high blood pressure, diabetes, and cancer.

Implications/conclusions

Childhood obesity is an epidemic. At highest risk are low-income children from minority groups (Black and Hispanic). Therefore, efforts nationwide will be and have been made to reduce the prevalence of obesity among this population. The results of our study show behavioral differences in Black and Hispanic low-income children, suggesting the need to develop ethnic specific interventions in the future. Our study identified overall behaviors that serve as potential targets for future intervention. Among Black children (from all age groups), interventions may want to focus their efforts on reducing consumption of fast food, salty snacks, and sweets while increasing consumption of fruits and vegetables (for toddlers, school-aged children, and adolescents). However, among Hispanic children, interventions may want to focus on

increasing physical activity and consumption of fruits and vegetables. Furthermore, our data suggest the need to further tailor an intervention within an ethnic group based on gender and age. The greatest gender differences were found among Black children; they varied slightly depending on age group. Interventions among young Black children (toddlers) may need to emphasize increasing intake of fruits and vegetables while decreasing intake of salty snacks among Black male toddlers more than Black female toddlers. Among Black school-aged children adolescents, interventions may need to emphasize increasing physical activity among females while decreasing fast food consumption of males.

To conclude, our data provides a foundation for target areas based on identified differences between ethnic groups, gender, and age as well as suggests an approach that could increase the effectiveness of future interventions.

Limitations

The primary limitation to our study is that the survey was not developed for research purposes. Although our survey was not validated prior to its distribution, many of our results were consistent with the literature. However, when comparing our data to the literature another limitation was the age range for each group in our study was slightly different than that of national data and available literature. Another limitation to our analysis was sample size. Although, we had a large sample overall (2,722), detailed analysis of behaviors (number of cases for each response to a question) by gender within an ethnic group of a certain age (toddlers for example) led to small samples for comparison especially among adolescents. Our results are based on a convenience

sample and not a representative sample. Therefore, more research is needed to verify our results. Lastly, data was entered and handled by several members of the research team. Because of this there was potential human error in data entry and analysis.

CHAPTER IV

EPILOGUE

Epilogue

The main lesson I have learned from this project is the complexity of data analysis. Although the idea of controlling a study through development and distribution of a survey seems like the most complex part of a project, the analysis portion is just as if not even more complex than the initial steps (especially when the questionnaires were not developed or distributed by your research team). Our dataset was a mess and cleaning and analyzing was a lengthy process. I have learned from this that data analysis is a very time consuming process and a lot goes into correctly interpreting self and parent reported data.

The process has shaped my ability to critique research projects. I have learned what questions should be asked as well as how to look for statistics in articles that would appropriately test the research questions. The results have provided me with a direction to take in the future. I want to work with low-income populations (specifically children) and the results highlight key areas for future focus.

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