Prevalence of Childhood Obesity among Latinos and non-Latinos in Virginia

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Southern Rural Development Center
Final Report

December 15, 2003

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Abstract

Obesity is a growing problem among U.S. children. Nationwide 2000 data show that an estimated 15% of children and adolescents ages 6 – 19 years are overweight. The rate has tripled within 30 years. Risk of obesity crosses all socio-economic and ethnic groups, but is slightly more prevalent in low-income groups, Native American, Hispanic and African American populations. In Virginia, little data exist on the prevalence of overweight or obesity among youth populations, particularly Latinos, a growing population in the south. The main purpose of this study was to investigate the prevalence of overweight among Latino and non-Latino limited resource Virginia youth, while identifying potential contributors as well as alternative methods for assessing overweight. Data were gathered through two mechanisms: Latina mothers (Part I) and Latino and non-Latino children (Parts II & III). Eighty-five Latina mothers were recruited through the Virginia Expanded Food and Nutrition Education Program (EFNEP) and the Special Supplemental Nutrition Program for Women, Infants and Children (WIC) program. Demographic information, acculturation, and dietary and physical activity patterns were assessed using bilingual written survey instruments. The results indicated that the Latinas in this study were mainly from Bolivia and El Salvador, and were not highly acculturated and spoke primarily Spanish. Almost half of the participants reported being overweight or obese (based on height and weight), nearly 50% reached the 5-A-Day goal for fruits and vegetables, and only 15% met the recommendations for physical activity. Height, weight, waist circumference data were collected from 217 children from five ethnically diverse and limited resource elementary and middle schools in rural and urban areas of Virginia, with a sub-sample of this population used to evaluate body figure scales developed specifically for Latinos. A short survey instrument exploring dietary and physical activity patterns was also administered. Informed consent was obtained from all subjects and parents. Fifty-percent of subjects were female, 41.7% white, 25.0% black, and 20.7% Latino. BMI percentiles, based on age and sex, ranged from 3.6 to 99.9, with the mean percentile being 64.9 and the median 68.5. Less than five percent (4.5%) of subjects were considered underweight, one-sixth (14.7%) at-risk of overweight, and almost one-quarter (22.6%) overweight, based on CDC cut-offs. Girls had significantly higher BMI percentiles than boys, with means of 67.4 and 64.5. Based on multivariate regression, an interaction was found between rural/urban and ethnicity. White, rural children were significantly heavier and had larger waist circumferences than those living in urban areas. Conversely, Latino and black children living in urban areas were significantly heavier than those living in rural areas. The results from the body figure assessment indicated that BMI was a predictor of a person's figure choice. Findings from that component of the study will help guide the refinement and production of body figure scales for further research studies. While the results of this study suggest alarming trends among Latino and non-Latino limited resource youth and mothers, the subjects of his study comprised a convenience sample, so may not be representative of other regions and/or populations. Further research is warranted.

Introduction and Problem Statement

Eating patterns have changed significantly over the past few decades within the US. Under-nutrition was once considered the largest nutrition-related problem facing adults and children in the US. Now over-nutrition or over-consumption is a far greater problem (Kennedy and Powell, 1997).This shift is reflected in changes in the nutrient content of the U.S. food supply over time and the increasing rate of overweight and obesity among Americans (US Department of Agriculture, 1998).

Definitions of Overweight and Obesity. Body mass index or BMI is the gold standard for determining weight status for adults and children. BMI, body mass index, is calculated by dividing weight in kilograms by height in meters squared. For adults, a body mass index (BMI) of 25 – 29.9 is considered overweight and at or above 30.0 obese. For children, weight status depends upon the gender- and age-specific growth charts (Centers for Disease Control and Prevention, 2003):

Underweight	BMI-for-age < 5th percentile
At risk of overweight	BMI-for-age ≥ 85th percentile
Overweight	BMI-for-age ≥ 95th percentile

As shown above, in the case of children, there is not a technical classification for "obese." As a result, overweight and obesity are often used interchangeably. In this paper, we will use "obesity" to refer to "overweight, with the understanding that CDC only refers to "overweight."

Prevalence. Overweight is a growing problem among U.S. children. Nationwide data show that 15% of children in the United States between the ages of 6 and 17 is overweight, with the rate nearly doubled from 30 years ago (Ogden and co-workers, 2002). Risk of obesity crosses all socio-economic and ethnic groups, but is slightly more prevalent among Native American, Hispanic and African American populations (Goodman, 1999; Troiano and Flegal, 1998). In fact, a recent set of epidemiological studies with 66,772 children ages 5 to 17 indicated that the highest percentage of overweight existed among Hispanic boys and African American and Hispanic girls (Rosner et al., 1998). The National Longitudinal Survey of Youth indicated that 21.5% of African-American children, 21.8% of Hispanic children, and 12.3% of white children were considered overweight (Strauss and Pollack, 2001).

Prevalence of Childhood Overweight in Virginia. The current estimate of overweight among adults in Virginia is 17.5%. There are limited studies and data specific to Virginian children, however. One valuable tool that has been used to assess overweight/obesity rates (along with other health risks) among American youth is the Youth Risk Behavioral Surveillance Study (YRBSS), sponsored by the Centers for Disease Control (Centers for Disease Control and Prevention, 2003). The YRBSS is used to:

1. Determine the prevalence and age of initiation of health risk behaviors, such as: tobacco

use; unhealthy dietary behaviors; inadequate physical activity; alcohol and other drug use; sexual behaviors that may result in HIV infection, other sexually transmitted diseases, and unintended pregnancies; behaviors that may result in violence and unintentional injuries motor vehicle crashes.

2. Assess whether health risk behaviors increase, decrease, or remain the same over time.
3. Examine the co-occurrence of health risk behaviors among young people.
4. Provide comparable national, state, and local data.
5. Monitor progress toward achieving the Healthy People 2010 objectives, leading health indicators, and the National Education Goals.

The YRBSS is administered by state and local health and education agencies. Despite the strengths and merits of the YRBSS, Virginia is one state that does *not* administer it. To date, the YRBSS has not been approved for the next survey period. This is one of the main reasons that data are lacking for statewide overweight prevalence rates. In turn, this is a limiting factor in addressing childhood obesity too. Without consistent baseline data, it is difficult to justify the need for funding and to demonstrate successes from a program.

Still, some research exists in Virginia, which can be built upon. Research conducted by the Virginia Department of Health in five health districts using BMI and parent surveys found that more than 12% of children fell into the overweight category using the CDC guidelines (Virginia Department of Health, 2000). Little data were collected on contributing factors to overweight and differences based on ethnicities/cultures.

Consequences of Obesity. Obesity has wide-ranging impacts on a child's health – including physical health, persistence into adulthood, and psychological and social health. Obesity has been linked to several diseases and conditions in adults, such as heart disease, cancer and diabetes. Many risk factors associated with these diseases, such as high cholesterol, blood pressure, and triglyceride levels, can be followed from childhood to adulthood. For example, overweight children are more than two times likely to have high levels of cholesterol. Aortic fatty streaks, the first stages of atherosclerosis, begin to appear in childhood, maybe even as early as three years old. Type 2 diabetes is also increasing among children, a debilitating disease with huge societal and economic consequences. Another concern is that obese children have an increased chance of becoming obese adults, with all of the subsequent health, social, and psychological ramifications (Simic, 1983;Whitaker et al., 1997a; Whitaker et al., 1997b). Obesity has social, psychological and emotional consequences. Our society emphasizes slimness, and we have misconceptions about overweight and obesity. As a result, overweight and obese children are often treated differently. Obese children may feel isolated and lonely. Preoccupation with body image, disordered eating practices, lack of self-confidence, lower self-concept, depression, and peer rejection are psychological consequences of overweight (Counts et al., 1986; Strauss et al., 1985; Wadden and Stunkard, 1985).

Genetic and Environmental Factors. Debate continues concerning the role of genetic and environmental factors in overweight. Estimates of the contribution of heredity to weight range from 25% to 80% (Bouchard and Perusse, 1993). In any case, it is clear that genetics plays a role, along with environmental factors. Despite compelling physical and emotional health benefits, nearly half of youths aged 12 to 21 years old are not vigorously active on a regular basis, a major decline over the past few decades (Gordon-Larsen et al., 1999;Gordon-Larsen et al., 2000).

Furthermore, about 14 percent of young people report no recent physical activity.

Contributing factors and solutions for these issues prove to be extremely complex involving a wide-range of genetic, cultural, socio-economic, psycho-social and behavioral factors. Nevertheless, it is extremely important to understand how these factors interact with different populations in order to foster healthy behaviors to promote lifelong health and prevent disease.

Challenges with Weight Assessment Methods. Health professionals have encountered several impediments while attempting to gather data regarding weight and body fat. Particular difficulties have included the negative emotional impact of weight assessment (Ogden & Evans, 1995), the difficulty and expense in gathering accurate height and weight data, the problems of accepting self-report height and weight data (Crawley & Portides, 1995), and issues with body mass index BMI) as a measure in children Dwyer et al., 2000), BMI as a measure of fatness (Wells, 2001)) and BMI as a predictor of body fat for individuals (Ellis, Abrams, & Wong, 1999).

A study by Ogden and Evans (1995) of the psychological effects of weight assessment being measured and categorized as under-, normal-, or over-weight) found an association between being categorized as overweight, and increased depression and decreased self-esteem. Interestingly, it did not matter that the subject was not actually overweight deliberately mislabeled weight charts were hung near the weighing station to make the normal weight subjects think that they were overweight), decreased mood still occurred. Similarly, they found that normal-weight subjects (assessed as underweight deceived by weight charts) demonstrated decreased self-esteem. The researchers concluded that weighing and comparing results against height and weight charts "may not be as benign as believed and may contribute to the negative psychological state of the individual" (Ogden & Evans, 1995).

The other option, simply relying on subjects to report their own height and weight data, offers its own challenges. Crawley & Portides (1995) found that self-reported data from teenagers was consistently incorrect. Tall and thin individuals tended to under-estimate their height, while shorter and heavier subjects over-estimated their height and under-estimated their weight. The researchers cautioned against using self-reported data, especially when computing BMI, as the calculations would under-estimate the number of overweight teens.

Although BMI is considered a gold standard for assessing overweight, it has come under some scrutiny, particularly when used in assessing certain populations (such as children) or characteristics. Dwyer et al. (2000) noted that, as children of moderate BMI enter puberty, "fat, muscle, and bone components of weight are all changing rapidly, the interpretation of changes in fatness from changes in BMI alone is complicated." The researchers felt that it was better to measure both BMI and skinfold data. Several researchers have concluded that it would be better to not use BMI as a proxy for assessment of fat mass in individuals. Ellis, Abrams, and Wong (1999) found that BMI was a poor predictor of adiposity in individual children, as the standard error for percent fat ranged from 4.7 to 7.3% of body weight. Wells (2001) agreed that BMI had "poor accuracy" as an absolute measure of fatness in individuals. Even Healthy People 2010 acknowledged that: "...BMI does not provide information concerning body fat distribution, which has been identified as an independent predictor of health risk" (USDHHS, 2000). Regardless of criticism, body mass index remains the gold standard.

Body Figure Scales. Collecting weights and heights from children can be difficult. Accurate measurement requires calibrated and reliable equipment, rigorous and standardized protocols, trained staff, significant time commitments, and consent of parents. Ideally, a rapid assessment would exist which would be capable of screening overweight and obesity among children. It would be inexpensive, easy to use, and require little equipment and no specially trained administrators.

A body figure scale is a paper-and-pencil tool used for assessment of body fatness. It consists of a series of pictures – either drawings, photographs, or silhouettes – of "standard" bodies ranging from thin underweight) to heavy obese (Stunkard, Sørensen, & Schulsinger, 1983). The test may either be self-administered or computed by an independent observer (Sherman, Iacono, & Donnelly, 1995). Either way, the assessor chooses a figure that looks most like the subject from the continuum of choices the actual figure). The subject may also select a figure that most closely resembles the way they would like to look their ideal figure), a figure that the subject believes the opposite sex would choose as their ideal figure opposite-sex ideal), or other diagnostic choices.

Body image has been defined as "the perception of one's own body size, shape, and appearance, with attendant emotional and sociocultural responses to this perception" (Patt et al., 2002). Awareness and assessment of body image disturbance is important in the prediction of disordered eating habits (Littleton & Ollendick, 2003) and the creation of healthy eating patterns (Stice & Shaw, 2002). Body image dissatisfaction may be apparent when the body figure scales show that a subject's choice of "actual figure" is far from actual size, or when there is a large discrepancy between actual and ideal sizes Williamson et al., 1993). This aspect may be important as research has shown that among American ethnic groups, Caucasians and Hispanic-Americans displayed more "weight-related body image disturbance than African-Americans or Asian-Americans" (Altabe, 1996).

The first published body figure scale was developed by Stunkard, Sørensen, and Schulsinger (1983) when they were attempting to parse out the influence of genetics versus environment on obesity, using Danish adoptees living in Copenhagen. The adoptees were, at the time of the Stunkard study, 34-57 years old. The scale was developed so that the adoptees could give information about the approximate adult-aged body size under, normal, or overweight) of their often deceased) biological and adoptive parents. Since those findings, there has been a veritable explosion of use of body figure scales in body image-related projects. Various scales have been used in recent studies to assess body image in adults (Altabe, 1998; McElhone et al., 1999), adolescent females (Sherman, Iacono, & Donnelly; 1995), children and preadolescents (Veron-Guidry & Williamson, 1996), body dissatisfaction in children (Williamson & Delin, 2000) and obese adults (Williamson et al., 2000), and differences in gender preferences of ideal body size (Fallon & Rozin, 1985; Cohn et al., 1987; Collins, 1991).

Although a variety of body figure scales have been developed since their inception, there is no existing scale targeting Latino – or any other ethnic minority group – children. Additionally, there has never been systematic preference testing of the differences that regularly appear between scales in terms of format, stance of figures, or ethnicity-related body shape differences.

Latino Health. Since the Report of the Secretary's Task Force on Black and Minority Health in 1985, it has been recognized that distinct differences exist in health status among racial and ethnic minority groups (Department of Health and Human Services, 1985). Numerous studies have investigated these differences further with the shift in demography setting the stage for these studies. The Hispanic population alone has altered the demographic profile of the U.S. It is estimated that Hispanics will soon be the largest minority group in the U.S. (US Bureau of the Census, 2003). In the past ten years alone, the Hispanic population has grown by 73.4%. It is expected that this "Hispanization" of America will continue, based on median ages and fertility rates.

This growing population foreshadows economic and health crises within the Hispanic community, however. Hispanics have higher levels of unemployment and lower levels of income, educational attainment, and English proficiency than non-Hispanic whites (US Bureau of the Census, 1998). They also comprise a smaller proportion of managerial, professional, and technical positions and dominate the production, labor, and agricultural occupations. These data are consistent in Virginia too. Moreover, Hispanics living below the poverty level outnumber poor non-Hispanics by 2 to 1, a cause for great concern (US Bureau of the Census, 1990).

A report issued by the Center for Nutrition Policy and Promotion found that low income individuals across all ethnicities, in comparison to high income individuals, were less likely to be aware of diet-disease relationships, less likely to pay attention to food labels, and less likely to eat low fat and low cholesterol foods (Morton and Guthrie, 1997). In addition, access to health care among Hispanics was far more limited compared to non-Hispanic whites because of income (Trevino et al., 1991). Children are most profoundly affected by poverty for a variety of reasons – namely access to health care, sufficient and healthy food, and education.

Acculturation. In the past thirty years the demography of the U.S. has changed dramatically. By the year 2005 it is expected that non-Hispanic whites will become a "minority" group in the U.S. with Hispanics playing a "major" role in America's profile (US Bureau of the Census, 1998). Accordingly, a growing number of individuals in the U.S. are experiencing acculturation, the process of change that results when two cultures - individuals, societies - come into contact with each other (Berry, 1992). Acculturation can influence a wide range of factors including language use, self-identity, body image, religious beliefs, social relationships, and nutrition (Berry, 1992).

An early study conducted by Romero-Gwynn and co-workers (Romero-Gwynn and Gwynn, 1993; Romero-Gwynn and Gwynn, 1994) found that there were foods that were "highly sensitive," "moderately sensitive," and "stable" to change and acculturation within the Chicano culture. A study conducted with Colorado youth found that dietary variety was different between less acculturated and more acculturated children (Serrano, 2003). More recent studies have found that acculturation has impacts on macronutrient composition of diets (Bermudez et al., 2000; Guendelman and Abrams, 1995), fat and cholesterol intake (Garcia-Maas, 1999), and several vitamins, such as folic acid and vitamin C. Overall, high levels of acculturation are associated with negative impacts on overall health. Highly assimilated individuals had health profiles that resembled those of the "host" country.

It is clear why a relationship exists between acculturation and nutrition. Many native traditions and foods are no longer available. Also, peer, social, and marketing influences persuade changes in perspective and attitude towards "new" foods resulting in dietary habits that mimic those of the new country.

Objectives

The main purpose of this study was to investigate the prevalence of overweight among Latino and non-Latino limited resource Virginia youth, along with potential contributors to childhood overweight. Additional objectives included:

- Assessing diet, physical activity, body image, and acculturation level of youth and Latina mothers;
- Creating a novel body figure scale specifically for Latino children;
- Comparing the correlational accuracy of a novel scale and a scale developed and tested by Collins) to the percentile BMI-for-age ranking of individual subjects.
- Determining acculturative status among Latino women with limited resources in northern Virginia
- Examining the relationship of acculturation to various nutritional, physical, and psychological factors influencing health among Latina mothers.

Methods

Data were gathered through two mechanisms: Latina mothers and Latino and non-Latino children.

Latina mothers

Subject Recruitment. The population targeted by this study was Latino women, between the ages of 21 and 50 years old, living in northern Virginia. Northern Virginia has a diverse Latino population. Participants in the Arlington County Expanded Food Nutrition Education Program (EFNEP), Arlington County Women, Infants and Children (WIC) program, and women attending classes at the Fairfax County Parklawn Family Center were recruited for the study. All women who were enrolled as study subjects were classified as limited resource and qualified for at least one food assistance program. Limited resource was defined by USDA guidelines.

Survey Instrument. Each study subject completed a confidential and anonymous questionnaire that provided information regarding socio-demographic data, acculturative status, and selected health habits. Participants filled out two different forms, the Expanded Food and Nutrition Education Program's Family Record and a Health Habits Questionnaire (HHQ). Socio-demographic data such as age, income, and the number of children were collected using the EFNEP Family Record. The subjects' acculturative status was determined using the Short Acculturation Scale for Hispanics (Marin and colleagues, 1987), which was included in the Health Habits Questionnaire. The HHQ was a multipurpose instrument, assembled by the researchers, combining components of different, previously tested instruments. It also requested information about children's weight and height information in order to be able to assess underweight or overweight for their children.

The HHQ provided information about fruit and vegetable intake, saturated fat avoidance, physical activity and body image. In addition, information regarding administration date, location and a researcher-assigned subject ID number was recorded in the Family Record and HHQ to identify subjects while maintaining confidentiality.

A trained translator from the Department of Foreign Languages and Foreign Literatures at Virginia Polytechnic Institute and State University translated the entire survey instrument into Spanish. The translation was then reviewed by three other translators, including a native Spanish-speaking Program Assistant familiar with the target population, a native Spanish-speaking faculty member and a non-Native faculty member of the Department of Foreign Languages and Literatures. Program Assistants (PAs) are paraprofessionals employed to teach nutrition education classes. Program Assistants are usually indigenous to their target audience.

The language was kept as simple as possible to maintain a low reading level. The number of polysyllabic words was held to a minimum and directions for answering questions kept brief. The questionnaire was determined to be at the eighth grade reading level by the SMOG test (McLaughlin, 1969). The length of the questionnaire was restricted so that the time required to complete the survey instrument was no more than 30 minutes to minimize respondent burden. The Family Record included 22 items, the acculturation scale included 12 items and the HHQ

included 17 items. The survey instruments were pilot tested by the investigators with six limited resource Latino women, between the ages of 21 and 50, living in Roanoke, Virginia and Blacksburg, Virginia.

Testing Protocol. The instruments were administered on the first day of class for subjects recruited through the EFNEP program and at the Parklwan Family Center, where English classes were taught. The survey instruments were administered to subjects by the researchers at the Arlington County WIC clinic. Instrument administration occurred only during check distribution hours, which occurred Mondays from 1-6 pm, Wednesdays 1-5 pm, and Thursdays 8-12 am. Check distribution days were chosen to minimize the chance of double sampling of the same woman during the study time-span, since participants were only eligible to receive checks once every three months. All subjects were compensated with a $10 gift certificate upon completion of the questionnaires.

Latino and non-Latino children

Development of Body Figure Scales. One boy and one girl, between the ages of 8 and 12, were recruited to be "models" for the body figure scales. Informed consent was obtained from the children and parents. To allow for maximum body shape definition, the female subject was photographed in a plain black dance-style leotard and the male was photographed wearing soccer shorts and a t-shirt. To create the male and female scales and format them pleasingly on single pages, a number of steps were required. The original slides were scanned into a computer. They were then "cleaned up", digitally altered to remove background effects and identifying facial, body, and clothing characteristics, in Adobe Photoshop.

The photographs were used to create three additional format versions: a line drawing, a silhouette, and a colored line drawing. To create the initial line-drawing versions, vellum tracing paper was laid over large-scale printouts atop a light box. The drawings were then scanned again, into Photoshop, and then run through Adobe Streamline to turn them into vector line art. The vector versions were then opened in Macromedia Freehand and manually manipulated. The silhouette version was blackened completely; the colored line version had pigments added.

Two novel body figure scales, male and female, were created based on the Latino subject photographs. To create the novel scales, the initial vellum tracings were used as templates. The differently-sized pictures of the subjects were created by doing further hand tracings (again on vellum, using a light box), making the subject slightly thinner or thicker as needed. The Collins figure scale (1991) was used as a reference.

The female subject, very average in size and appearance, became the center figure for the female scale. From the original form, three figures were drawn as increasingly heavy, and three figures were drawn as increasingly light. The male figure, somewhat smaller than average, became the third thinnest figure (rather than the middle figure). From his form, two smaller and four larger figures were drawn.

The final presentation, showing the four scales (one for format, one for stance, the novel body figure scale, and the Collins figure scale), was created by bringing the various scales together

with labeling text in the page layout program, QuarkXpress. In each scale, the ordering of the figures was randomized using an online random-number service (True Random Number Service, 2003). Each item of a scale was assigned a number, the generator created a randomized sequence of the numbers, and the items were placed according to the scheme created.

Survey Instrument. In order to gather further demographic data and information on the acculturation status and body image of the target population, it was necessary to create and administer a short survey instrument. To ensure validity and reliability, as many questions as possible were extracted from tested instruments. The complete survey instrument consisted of 35 multiple-choice questions and was created to fulfill goals beyond the scope of the study discussed in this paper. The questionnaire was formatted to allow the use of scantron answer cards (Mark Reflex by NCS EM-207132-3:654).

Demographic questions, including those for age, gender, ethnicity, and year in school, were based on the 2003 Youth Risk Behavioral Surveillance Survey (YRBSS) (CDC, 2003). These questions provided baseline descriptive data regarding the testing group.

Acculturation, the population and individual-level changes that occur when two cultures co-exist, was assessed using four of the twelve questions comprising the Short Acculturation Scale for Hispanic Youth (SASH-Y) (Barona & Miller, 1994). Serrano and Anderson (2003) recently evaluated Barona and Miller's acculturation scale using factor analysis and found that language preference and usage by the preteen subjects accounted for 82.6% of the variance. Due to this finding, and concerns about using the rather lengthy 12-question original SASH-Y scale with a largely non-Hispanic audience of children, the researchers opted to use only the language questions in the survey instrument. Additionally, one of the original five SASH-Y language questions was eliminated after independent reviewers argued that the question: "What language(s) do you read and speak?" might elicit too many multi-lingual responses. They reasoned that some children are very proud of their knowledge of a few foreign words or phrases, and may confuse this for true bi-lingualism. Children speaking neither English nor Spanish as their dominant language were asked to omit the entire suite of questions.

Questions assessing body image were based on those used by the McKnight Risk Factor Survey-III (MRFS-III) (Shisslak, et al., 1999). The MRFS-III was designed to assess disordered eating risk factors in adolescent girls; it consisted of 103 questions on topics such as body image, eating disorders, sexual activity, and physical activity. From the original 103 questions, eight were culled which focused on two areas, "over-concern with weight and shape" and "body appearance/appraisal". These two topics were selected as they best assessed the core qualities which define body image, and because the corresponding questions had the highest levels of test-retest reliability and internal consistency (Cronback Alpha). The test-retest reliability for the combined five questions on over-concern with weight and shape was 0.79 among elementary school children; the Cronbach Alpha for the same questions and group was 0.82. The test-retest reliability for the combined three questions on body appearance/appraisal was 0.63 among elementary school children; the Cronbach Alpha for the same questions and group was 0.68 (Shisslak and colleagues, 1999).

It was necessary to develop novel questions regarding the body figure scales. The survey questions were based on the standard queries asked to participants in the card-sorting versions

of the body figure scales. Subjects were asked to choose which figure they liked best, and which figure they thought "looks most like you."

The survey instrument was examined for form and content by several independent reviewers before being presented to subjects. The entire questionnaire was also translated into Spanish by two bilingual individuals, and then reviewed for accuracy and appropriateness by a native Spanish speaker. Children were given the option of choosing English or Spanish-language surveys at each testing session. It was estimated that the survey would require 15-20 minutes to be completed.

Recruitment of Schools. Initial subject selection criteria attempted to locate the populations most vulnerable to overweight and obesity, limited-resource and multi-ethnic or Latino audiences. In order to officially delineate our target population, the search criteria were set to: Virginia school districts with 5% or more of the population under the age of 18 being Latino (NCES); public elementary schools in which 50% or more of the children qualifying for the free or reduced price lunch program (F&RPLP Eligibility Report, 2001-2002). There were 36 elementary schools, found in six Virginia school districts, which possessed both the percent-Latino and percent-free and reduced lunch criteria.

State-level permission was for this study was gained through a cooperative venture with the Virginia Departments of Health and Education. Each of the Virginia school districts and/or counties had its own research evaluation protocol, and review board or specialist. Each county required individual applications, letters of reference, proposals, and protocol changes.

Once a county agreed to participate in the project, individual schools were solicited for interest. Within the major participating county, individual schools were contacted via email to gauge their interest in participating in this study. Follow-up messages and phone calls completed the screening methods. Any schools expressing interest, and a few which did not reply, were visited in person by the researchers.

Testing Sessions. Testing sessions were conducted during regularly scheduled physical education classes so as not to interfere with classroom instruction. Testing occurred on one or two days during a specified week, allowing (1) the maximum number of classes to be tested, (2) any children who forgot to bring signed consent forms the first day a second chance to participate.

Testing of subjects was guided by a strict protocol, with only small deviations required for convenience by each school. Researchers were trained for accuracy and sensitivity in collection prior to participation. Training was refreshed prior to each testing instance, and brief measurement protocols were posted on the measurement equipment as a reminder. The protocol, and accompanying test information, is described below. Testing of all five schools occurred between April and October 2003.

One week prior to testing, parent consent forms and child assent forms were sent to schools, along with letters to teachers and a poster for teachers to hang in the classrooms to remind students to return their consent forms. Letters from the schools to parents asked that parents review the materials with their children to determine interest in participation. Families wishing

to have their children participate were to return signed parental and child consent forms to the schools a few days prior to testing. Due to administrator concern over whether or not children should or would be told their anthropometric data (height, weight, waist circumference), an active consent, or "check the box", form was created to identify families interested in having the assessed anthropometric data shared with the child. If a child returned a "checked" form, they were told their measurements; if they did not, the data was not released.

To protect the identities of the participating children, a system of identification numbering was created for this study. Unique nine-digit numbers, with columns identifying county, school, teacher, and child, were used. To allow for easy identification of clerical errors, the first two digits consisted only of 0 or 1, the second two digits consisted only of 2, 3, 4, or 5, the third two digits were even numbers, and the last three digits were odd numbers. To ensure that neither researchers nor subjects misnumbered the identifying instruments, pre-printed labels were affixed to the subjects' check-in sheet, subject data form, and scantron answer sheet. Only the lead researchers had access to the coding key or the raw data.

Testing Protocol. Testing occurred synchronously with regularly scheduled physical education classes. An introductory speech was given by the lead researcher to the entire class, explaining what research is, why this project was being conducted, and what would take place.

Children with signed permission forms were invited to join the researchers in an adjoining section of the gymnasium. Researchers then helped children to register for the study, double-checking that every child had two signed permission forms (parent and child) and confirming whether or not the parents wished that their child be told their weight and height information. Subjects were seated in rows, equally and as distantly spaced as was possible within the testing area.

Subjects were provided with a #2 pencil, a scantron answer form, a copy of the questionnaire (English or Spanish), and a gender-appropriate copy of the picture page (male or female). Every child was given the choice of an English- or Spanish-language questionnaire, and a male or female picture page. No prompting was given with either choice. Once supplies were dispersed, subjects were asked to complete the questionnaires to the best of their abilities, not to share answers, and to give one, but only one, answer to every question. Subjects were encouraged to let a researcher know if they had any questions or did not understand what a specific question was asking. Responses to subjects' questions were kept as neutral as possible, and often included repeating the question verbally to the subject, assuring the subject that there is "no right or wrong answer", or substituting approved synonyms (such as "picture" for "scale").

Subjects were given as much time as was available to complete their questionnaires. On average it took subjects 20-25 minutes to complete the questionnaire. Few subjects had difficulty completing the survey within the time allotted. Subjects were asked to return their testing supplies to the researchers. At that time, researchers briefly reviewed the scantrons for obvious errors (too many or too few questions answered, more than one response given for a single question), and often double-checked a few of the students' responses via verbal query. For example, the researcher might ask the subject "Which of the figures did you like best?" and the subject would point to a figure. The researcher would compare the subject's verbal choice to

the one indicated on the scantron. This allowed greater confidence that a single skipped or mis-numbered answer would not corrupt the rest of the answers on the scantron sheet.

While the group of subjects completed the survey, individuals were assessed anthropometrically. Subjects either volunteered or were asked to accompany the researcher to a semi-private area for assessment. Upon returning their completed surveys to the researchers and being measured, subjects rejoined their regularly scheduled classes. All participants were given a beaded jump rope, worth approximately $2.25, as an incentive either immediately following testing or at the end of the day (by the classroom teacher), depending on the school's preference.

At the conclusion of testing, the school's designated on-site observer was asked to complete the On-Site Observer form, a legal formality protecting all parties. Participating administrators and teachers were thanked for their assistance and given small gift bags of apples. All equipment and supplies were dismantled and returned to Virginia Tech.

Collection of Anthropometric Data. At every location, privacy of the subjects was of an utmost concern. Opaque, portable privacy screens were set up around each testing area. The privacy screens, measuring approximately 60 inches tall and 54 inches wide, were free-standing tri-paneled folding structures consisting of wood and heavy cloth. Where possible, the screened testing areas were located in adjacent rooms to the main gymnasium. To further ensure privacy, researchers were careful to locate the testing areas as far apart as possible, to obscure all completed data forms, and to speak in a soft voice that could not be heard outside of the screened area.

With each subject, the researchers explained the assessments prior to testing. The pre-labeled subject data form was collected from the subject. Subjects were then asked to remove their shoes, had they not already done so, and remove any loose or bulky clothing they wished. All anthropometric measures were recorded on the subject data form.
Height was assessed using the standing method described by Ikeda and Crawford (2000) and a factory-calibrated stadiometer, which was affixed to a portable beam balance. Subjects were asked to stand tall with their feet flat against the back of the scale, hands at their sides, facing away from the scale. Subjects' heads were adjusted, as needed, to align in the Frankfort Plane (imaginary line from the lower margin of the eye socket to the notch above the flap of skin that extends over the opening of the ear) (Ikeda & Crawford, 2000). Children were then asked to draw a deep breath and hold it while the researcher gently moved the swinging bar of the stadiometer into measurement position. Height was assessed, to the nearest one-quarter inch. Where complicated hairstyles possibly interfered with accurate measurement, appropriate notations were made on the subject data forms.

Mass (hereafter termed "weight") was assessed using a Health-o-Meter or seca Corporation scientific-quality balance beam scale, re-calibrated at each testing location. Subjects were asked to stand quietly in the center of the weighing pad, with their arms at their sides, facing away from the scale. Weight was measured to the nearest one-quarter pound. Weights were noted and the scale re-zeroed before the subject was asked to step off the scale. If a subject did not wish to remove articles of clothing that may have interfered with testing (for example, light jackets, heavy sweaters, or other articles beyond regular street clothes), the subject was assured

that this was fine. Notations of such irregularities were recorded on the subject data forms, with testing continued regularly.

Waist circumference was assessed using a modified version of the National Heart, Lung, and Blood Institute standards (NHLBI, 2000) and a seca Corporation anthropometric tape. Clothed subjects were asked to identify their navel or "belly button". The tape was then placed snugly around the body, perpendicular to the floor. Circumference was measured to the nearest one-quarter inch. Subjects who preferred not to remove excess clothing were noted, but not omitted from testing.

Subjects were then thanked and asked to replace any clothing or footwear removed for testing. Subject data forms were not returned to the subjects. Only those students with parental permission to be told their personal measurements were given this data. As instructed, researchers never made any comments, approving or otherwise, regarding the assessed measurements. Once anthropometric testing was complete, subjects were asked to rejoin the other subject participants and complete their questionnaires.

Data Analysis

Descriptive data were generated to describe frequency and central tendency of dependent and independent variables. The independent variables that were to be used were tested for correlation using Pearson's Product-Moment Correlation. Univariate analysis of covariance (ANCOVA) and multivariate analysis of covariance (MANCOVA) were conducted to test the different research hypotheses. One–way analysis of variance (ANOVA) was also conducted to detect differences in the dependent variables between recruitment groups.

Results

Latina Mothers

Demographic Information. A total of 85 subjects participated in this study. Sixty-three were recruited from Arlington County Women Infants and Children (WIC) (74.1%), fourteen from the Arlington County Expanded Food and Nutrition Education Program (EFNEP) (16.5%) and eight from Fairfax County's Parklawn Family Center (PFC) (9.4%). (See Table 1.1) All of the subjects signed consent forms prior to completing the survey instruments. Based on the EFNEP Family Record, all subjects reported living in a suburb of a city with a population over 50,000.

Table 1.1: Survey Location

Survey location	Number (%)
Arlington WIC	63 (74.1)
Arlington EFNEP	14 (16.5)
Parklawn Family Center	8 (9.4)
Total	85 (100.0)

The most common countries of origin were El Salvador, Bolivia, and Peru, comprising 37.6%, 28.2% and 9.4%, of the sample population, respectively. The remaining countries of origin included the United States, Mexico and other Central and South American countries (see Table 1.2). When asked to identify their ethnicity, 97.6% (83 out of 85) respondents identified themselves as Latino or Hispanic. Only two subjects identified themselves as Caucasian. In addition, 95.3% (81 out of 85) respondents chose the Spanish language instrument over the English language instrument.

Table 1.2: Country of Origin

Country	Number (%)
El Salvador	32 (37.7)
Bolivia	23 (28.2)
Peru	8 (9.4)
Venezuela	6 (7.1)
Mexico	5 (5.9)
Guatemala	3 (3.5)
Honduras	2 (2.4)
Other	5 (6.0)
Total	85 (100.0)

All respondents were categorized as "limited resource," since they qualified for at least one type of food assistance program. Two women did not respond whether they worked outside of the home or not. Of the 83 that did respond, 56 women, or 67%, reported not working outside of the home. The age, income, the number of children, the number of adults in the household (not including the homemaker) and the mean acculturation scores are summarized in Table 1.3. The range for acculturation scores was from one to five. A score of one described respondents who spoke only Spanish and identified with Latino culture, whereas a score of five identified a subject as preferring only English and identifying with American culture.

Table 1.3: Demographic Information

Recruitment Group	Age (years ± S.D.)	Income ($/last month ± S.D.)	Number of children (± S.D.)	Adults in household (± S.D.)	Mean Acculturation score (± S.D.)
Arlington EFNEP (n = 14)	33 ± 4.2[b]	$1392 ± 284[b]	2.1 ± 1	1.6 ± 1.2	1.6 ± 0.3
Arlington WIC (n = 63)[a]	28 ± 6.2[b,c]	$1064 ± 569[b,c]	1.5 ± 1	1.4 ± 1.0	1.9 ± 0.5
Parklawn Family Center (n = 8)	34 ± 6.0[c]	$2010 ± 265[c]	1.5 ± 1	2.0 ± 0.5	2.1 ± 0.6

a. n = 60 for income; three subjects did not respond
b. EFNEP > WIC; $p < 0.01$
c. Parklawn > WIC; $p < 0.01$

Pregnancy and Body Mass Index. Within all three recruitment groups, 14 of the 85 women who participated, or about 16.5%, stated that they were pregnant. Of all pregnant women, 12 were recruited from the WIC program and only one each from EFNEP and the Parklawn Family Center PFC). Pregnant women were excluded from body mass index and weight calculations because their gestational stage was unknown. The remaining 71 non-gravid women were as follows: 51 women from the WIC program; 13 women from the EFNEP program and seven from the PFC. Pregnant women were excluded for all remaining data analyses except the principal components analysis of acculturation, because their non-gravid body mass index could not be accurately calculated. In addition, body mass index was an important independent variable used in analyses of covariance to determine the relationship between acculturation and dietary patterns, physical activity and body image.

Only 58 non-gravid women provided both weight and height to calculate their body mass index. According to body mass index (BMI), only two of the non-gravid respondents were underweight. The remaining women were categorized as normal weight, overweight, and obese. See Table 1.4. The data provided on children's weight and height was invaluable and therefore not reported here.

Table 1.4: Body Weight of Participants

BMI category (kg/m^2)	Number (%)
Underweight (BMI < 18.5)	2 (3.4)
Normal weight (BMI 18.5 – 24.9)	26 (44.8)
Overweight (BMI 25 – 29.9)	21 (36.2)
Obese (BMI >30)	10 (17.2)
Total	58 (100.0)

Acculturation. Acculturation was measured using a 12-item Likert scale. Based on this acculturation scale, average acculturation scores ranged from one to five. A score of one described respondents who spoke only Spanish and identified with Latino culture, whereas a score of five identified a subject as preferring only English and identifying with American culture. When the scale was divided into three intervals, scores between 1.0 and 2.3 were considered to reflect low acculturative status or Latino-oriented. Scores between 2.31 and 3.60 were considered moderately acculturated. Scores between 3.61 and 5.0 were considered high acculturation status or American-oriented. None of the study subjects scored above 3.3 on the acculturation scale, indicating that none of the women who participated in this study were of high acculturative status.

Responses to the individual items in the acculturation scale were analyzed using principle components analysis (PCA). Principle components analysis was used to determine the appropriate contribution to variability in acculturation scores of each question and develop a weighted acculturation score. As a result, those questions that had the greatest influence over the overall acculturation score could be weighted accordingly. The first principle component of the acculturation score accounted for the most variability in acculturation scores. The first eigenvalue for the first principal component was 4.5488 and described 37.9% of the variability in acculturation. Below, in Table 1.5, is a list of the first eigenvectors for the twelve items of the acculturation scale. Eigenvectors represented the amount that each question contributed to the overall variability in the first principal component of the acculturation scores. The larger the eigenvector, the larger the contribution of the question to the overall acculturation score.

Table 1.5: Eigenvector Scores for Acculturation Scale

Item	Eigenvector
Language of TV programs watched	0.36
Language spoken	0.35
Language subjects thought in	0.33
Language of radio programs	0.32
Language spoken with friends	0.30
Language spoken at home	0.30
Language preference for media	0.29
Ethnicity of visitors	0.27
Ethnicity of guests at parties attended	0.27
Language spoken as a child	0.24
Ethnicity of close friends	0.21
Preferred ethnicity of children's friends	0.17

Correlations. Age and income were significantly correlated with each other ($r = 0.259$; $p = 0.02$). Age and the number of children were also significantly correlated with each other ($r = 0.282$; $p = 0.02$). Different expressions of the acculturation score, the square term of acculturation, the ranked score of acculturation and the squared term of the ranked score, were also significantly correlated with each other. However, this was expected since they were simply different expressions of the same variable.

Fruit Intake. All of the 61 women providing dietary information reported information about fruits consumed in the previous 24 hours. Fifty-one of those women (83.6%) provided sufficient information about the amounts of fruits that they ate to calculate a serving size. The range, means, standard deviations of the number of different fruits consumed and the number of servings of fruits consumed are summarized in Table 1.6

Table 1.6: Fruit Intake of Participants

Measure of fruit intake	Range	Mean	SD
Number of different fruits	0 – 7	2.6	1.3
Number of servings of fruits	0.2 - 10.75	3.3	2.4

Thirty-seven (60.7%) of the 61 subjects reported consuming two to three different types of fruits in the previous 24 hours. Details are shown in Table 1.7.

Table 1.7: Variety of Fruits Consumed

Number of different Fruits consumed	Number (%)
0 – 1	13 (21.3)
2 – 3	37 (60.7)
4 – 5	8 (13.1)
6 – 7	3 (4.9)
Total	61 (100.0)

Of 51 participants for whom serving sizes were calculated, 22 (43.1%) had consumed between two and four servings of fruits in the previous 24 hours. In addition, 14 out of 51 (27.4%) reported having consumed four or more servings of fruits. Overall, 36 out of 51 (60.5%) respondents met or exceeded the USDA Food Guide Pyramid recommendation to consume two to three servings of fruit each day (USDA, 1996).

Table 1.8: Servings of Fruit Consumed

Number of fruit servings	Number (%)
0 – 1.9	15 (29.4)
2.0 – 3.9	22 (43.1)
4.0 – 5.9	5 (9.8)
6 – 7.9	5 (9.8)
≥8	4 (7.8)
Total	51 (100.0)

The fruit most commonly reported by the 61 women was the banana. Bananas were reported 64.0% of the time. Oranges, apples, grapes, and strawberries were reported 50.8%, 42.6%, 19.7%, and 14.8% of the time, respectively. These five fruits (bananas, oranges, apples, grapes, and strawberries) were the most commonly consumed.

Based on analysis of variance, there was no significant difference in the number of different fruits consumed between recruitment groups (p = 0.082). There was also no significant difference in the number of servings of fruits consumed between recruitment group (p = 0.182).

The relationship between fruit intake and acculturation was determined by analysis of covariance. A total of 45 observations were used in the analysis of covariance of factors related to the number of different fruits consumed. Only 35 observations were used to analyze the number of servings of fruit because, as mentioned previously, ten of the women did not report enough information to calculate serving sizes of fruits. The overall model for the analysis of covariance (ANCOVA) for the number of different fruits was not significant (p = 0.538). The model for the ANCOVA for the number of servings of fruits was significant (p = 0.034). There was also a positive and significant relationship between the number of servings of fruits consumed and acculturation (p = 0.026). The results of the analyses of covariance for fruit intake measures are summarized in Table 1.9.

Table 1.9: Effect of Socio-demographic Factors on Fruit Intake

Measures of Fruit Intake	Number of Different Fruits[a] (p-value)	Servings of Fruits[b] (p-value)
Age	0.748	0.395
Income	0.806	0.230
Acculturation	0.607	0.026*
Acculturation squared	0.157	0.084
Body Mass Index	0.482	0.182
Breastfeeding status	0.351	0.922
Number of children	0.774	0.373
Recruitment group	0.573	0.937
Model	0.538	0.034*

* $p < 0.05$
a. n = 45, b. n = 35

Vegetable Intake. All of the 61 women who provided dietary information reported information about vegetables consumed in the previous 24 hours. Thirty-six of those women (59.1%) provided sufficient information about the amounts of vegetables that they ate to calculate a serving size. The range, means, standard deviations of the number of different vegetables consumed and the number of servings of vegetables consumed is summarized in Table 1.10.

Table 1.10: Vegetable Intake of Participants

Measure of fruit intake	Range	Mean	SD
Number of different vegetables	0 - 8	2.6	2.0
Number of servings of vegetables	0 - 6.25	1.6	1.6

Twenty-eight (45.9%) of the 61 participants who completed the 24–hour recall reported consuming two to three different types of vegetables in the previous 24 hours. Over all, almost 75% of non - gravid women consumed at least two different types of vegetables (44 of 61). See following table.

Table 1.11: Variety of Vegetables Consumed

Number of different vegetables	Number (%)
0 – 1	17 (27.9)
2 – 3	28 (45.9)
4 – 5	9 (14.8)
6 – 7	6 (9.8)
8	1 (1.6)
Total	61 (100.0)

Of the 36 participants for whom serving sizes were calculated, 14 (38.9%) had consumed less than one serving of vegetables in the previous 24 hours. In addition, only 7 out of 36 (19.4%) reported having consumed three or more servings of vegetables. The minimum number of servings of vegetables recommended by the USDA Food Guide Pyramid is three servings of vegetables each day (USDA, 1996). Therefore, 80.6% of the non – gravid women in this study did not consume the minimum number of vegetable servings recommended. Details are shown in Table 1.12.

Table 1.12: Servings of Vegetables Consumed

Number of vegetable servings	Number (%)
< 1.0	14 (38.9)
1.0 – 1.9	7 (19.4)
2.0 – 2.9	8 (22.2)
3.0 – 3.9	2 (9.8)
4.0 – 4.9	4 (7.8)
5.0 – 5.9	0 (0.0)
6.0 +	1 (2.8)
Total	36 (100.0)

The vegetable most commonly reported by the 61 women was the potato. Potatoes were reported 44.3% of the time. Tomatoes, carrots, lettuce and broccoli were reported 42.6%, 34.4%, 32.8% and 19.7% of the time, respectively. These five (potatoes, tomatoes, carrots, lettuce and broccoli) represented the five most commonly reported vegetables.

Based on analysis of variance, there was no significant difference in the number of different vegetables consumed between recruitment groups ($p = 0.168$). In addition, there was no significant difference in the number of servings of vegetables consumed between recruitment groups ($p = 0.247$).

The relationship between vegetable intake and acculturation was determined by analysis of covariance. A total of 45 observations were used in the analysis of covariance of factors related to the number of different vegetables consumed. Only 27 observations of those 45 could be used to analyze the number of servings of vegetabes because, as mentioned previously, 18 of the women did not report enough information to calculate serving sizes of vegetables. The overall model for the analysis of covariance (ANCOVA) for the number of different vegetables consumed was statistically significant ($p = 0.048$). Age was positively and significantly related to the number of different vegetables consumed ($p = 0.029$). None of the other independent variables, including acculturation, were significantly related to the number of different vegetables consumed. In contrast, the overall ANCOVA model for the number of servings of vegetables consumed was statistically significant ($p = 0.005$). Age and breastfeeding were both positively and significantly related to the number of servings of vegetables consumed, ($p = 0.047$ and $p = 0.01$, respectively). Again, acculturation was not significantly related to vegetable intake. The results of the analyses of covariance for vegetable intake measures are summarized in the Table 1.13.

Table 1.13: Effect of Socio-demographic Factors on Vegetable Intake

Measures of Vegetable Intake	**Number of Different Vegetables**[a] (p-value)	**Servings of Vegetables**[b] (p-value)
Age	0.029*	0.047*
Income	0.699	0.053
Acculturation	0.219	0.590
Acculturation squared	0.580	0.181
Body mass index	0.559	0.103
Breastfeeding status	0.056	0.010*
Number of children	0.955	0.875
Recruitment group	0.073	0.055
Model	0.048*	0.005**

* $p < 0.05$, ** $p < 0.01$
a. n = 45, b. n = 27

Saturated Fat Avoidance. Saturated fat avoidance was measured using two items, to determine the type of milk consumed and the type of fat or oil used for cooking. The two most common types of milk reported were whole milk (43.4% of all responses) and 2% milk (46.4% of all responses). A few women reported consuming more than one type of milk. Vegetable oil was the most commonly used type of fat or oil (91.4%). No subjects reported using lard, meat fat or shortening for cooking. A few women reported using more than one type of fat or oil for cooking

Physical Activity. Rates of physical activity were reported on a Likert scale based on how many days per week individuals engaged in either leisure time physical activity or habitual physical activity for at least 30 minutes. Possible scores ranged from one to five, and corresponded to the number of days each week that an individual engaged in at least 30 minutes of physical activity. For example, an individual who did not engage in at least 30 minutes of leisure time physical activity any day of the week scored a one on the Likert scale. An individual who engaged in at least 30 minutes of physical activity three to four days of the week scored a three.

Fourteen pregnant participants were excluded from analyses of physical activity. There was no significant difference between recruitment groups in the number of days each week that women engaged in at least 30 minutes of leisure time physical activity (p = 0.76) or habitual physical activity (p = 0.90).

Table 1.14: Number of Latina Women Engaging in Physical Activity

Days per week	Leisure-time Physical Activity n (%)	Habitual Physical Activity n (%)
0	36 (51.6)	19 (27.3)
1 - 2	23 (32.8)	23 (31.8)
3 - 4	9 (12.5)	17 (24.2)
5 - 6	2 (3.1)	5 (7.6)
7	0 (0.0)	6 (9.1)
Total	70 (100.0)	0 (100.0)

The vast majority of women, 84.9%, reported that they strongly agreed that physical activity was important. No subjects disagreed that physical activity was important and there was no difference between recruitment groups (p = 0.41). Only about 4.5% (3 women) of the subjects reported watching more than four hours of television each day. There were no significant differences in the number of hours of television watched in women between the three different recruitment groups (p = 0.122).

Based on Wilks' Lambda, the MANCOVA showed a significant relationship between age and physical activity variables (p = 0.020), though there was no significant relationship between physical activity and other independent variables.

Body Image. About half of the 71 non-gravid women who responded to questions regarding their body image, strongly agreed that they were concerned about either being or becoming fat. In comparison, only 26 of the 71 of respondents (37.1%) strongly agreed that they were on a weight loss diet. See Table 15. There was no significant difference between women in the different recruitment groups in their reported concern of being or becoming fat (p = 0.28) or being on a weight loss diet (p = 0.50).

Table 1.15: Participants' Body Image

	Concerned about being or becoming fat (%)	On a weight loss diet (%)
Strongly agree	36 (50.7)	26 (37.1)
Mostly agree	17 (23.9)	16 (22.9)
Neither agree nor disagree	11 (15.5)	7 (10.0)
Mostly disagree	3 (4.2)	8 (11.4)
Strongly disagree	4 (5.6)	13 (18.6)
Total	71 (100.0)	71 (100.0)

Discussion and Conclusions

The results indicated that the Latinas recruited in this study at local community agencies were mainly from Bolivia and El Salvador, were not highly acculturated, and spoke primarily Spanish. Almost half of the participants reported being overweight or obese (based on height and weight), nearly 50% reached the 5-A-Day goal for fruits and vegetables, and only 15% met the recommendations for physical activity.

One of the primary goals of this investigation was to determine the effect of acculturation on fruit and vegetable intake patterns in limited resource Latinas in northern Virginia. The role of acculturation in fruit and vegetable intake patterns was assessed by the number of different fruits and vegetables consumed and the number of servings of fruits and vegetables consumed. Response rates to the 24-hour recall of fruits and vegetables were lower than anticipated. Only 61 out of the 71 non-gravid recruited subjects provided information in the 24-hour recall. Of these 61 subjects, only 26 provided sufficient information to calculate serving sizes for both fruits and vegetables. The number of different fruits and vegetables consumed ranged from one to twelve, with about half of the subjects consuming between four and six different fruits and vegetables. Though the number of servings of fruits and vegetables ranged from one to twelve and a half, only half of the study subjects consumed five or more servings, the recommended intake for chronic disease prevention.

The vast majority of subjects exhibited some form of saturated fat avoidance. This was mostly due to the consumption of vegetable oil and 2% milk, as opposed to options that were higher in saturated fats, such as whole milk, butter, and lard. However, when socio-demographic variables were controlled for, there was no significant relationship between saturated fat avoidance behavior and acculturation.

Physical activity factors were reported by all but one non-gravid woman. Only 3%of the women reported engaging in at least 30 minutes of leisure time physical activity five days each week as recommended. Half of the women reported not engaging in any leisure time physical activity. This was consistent with analyses of the Third National Health and Nutrition Examination Survey (NHANES III), in which one half of Latinos reported no form of leisure time physical activity, such as jogging, swimming, or weight lifting (Crespo, et al., 2000). Rates of habitual physical were higher, though only about one fifth of subjects reported at least 30 minutes of habitual physical activity at least five days of the week. Job type was not reported frequently by subjects, but could have served as a proxy measure for the amount of habitual physical activity. For example, individuals employed as manual laborers would likely have higher energy expenditures during the day than those who worked at a desk. In addition, the majority of women also reported not working outside of the home, so the amount of habitual physical activity would have been difficult to determine. When socio-demographic variables were controlled for, there was no significant relationship found between leisure time or habitual physical activity and acculturation.

Concern about being or becoming fat and dieting for weight loss were the two measures of body image used in this study. While half of the 71 non-gravid women strongly agreed that were concerned about being or becoming fat, only 37% strongly agreed that they were on a weight loss diet. An additional 24% of women somewhat agreed that they were concerned

about being or becoming fat which corresponded to 23% somewhat agreeing that they were on a weight loss diet. Neither of the two measures of body image was significantly related to acculturation, or any other independent variable, including age, income, body mass index, and the number of children. Dieting behavior and the fear of being or becoming fat was not higher among more acculturated women. These results are contrary to results from previous research. Several studies have found a relationship between acculturation and body image factors. For example, Chamorro and associates (2000) found a significant and positive correlation between acculturation and Factor III score on the Eating Attitudes Test-26 (2000). Factor III of the EAT-26 describes control of eating and perceived pressure from others to gain weight. Other studies have shown that rates of weight-related body image distortion were as high in Latino females as they were for non-Hispanic white females (Altabe, 1998) if not higher than non-Hispanic whites (Robinson, et al., 1996). The discrepancy could have been due to the fact that study participants did not represent a wide range of individuals at different acculturation levels, not providing a huge opportunity (or statistical power) for comparisons between less and more acculturated women.

There are several limitations to this study. The participants represented a self-selected study group, a relatively small sample size, and did not reflect the variability in acculturative status that was expected. The results, however, provide interesting baseline data on recent female immigrants from Central and South America.

Results

Latino and non-Latino Children – Prevalence of Overweight

Demographic Information. A total of 217 fourth and fifth grade children were recruited from five schools representing rural and urban areas of Virginia. Fifty-percent of subjects were female, 41.7% white, 25.0% black, and 20.7% Latino, and nearly 60% from rural areas, as shown in Table 2.1.

Table 2.1: Demographic Information of Children

Variable	White n (%)	Black n (%)	Latino n (%)	Other n (%)	Total n (%)
Demographic Information					
Female	51 (47.2)	28 (25.9)	22 (20.7)	7 (6.5)	108 (50.2)
9 – 10 years old	69 (43.1)	39 (24.4)	31 (19.4)	21 (13.1)	160 (73.7)
11 – 12 years old	20 (37.7)	13 (24.5)	13 (24.5)	7 (13.2)	53 (24.4)
Urban	17 (18.9)	27 (30.0)	27 (30.0)	19 (21.1)	90 (41.5)
Rural	73 (57.5)	27 (21.3)	18 (14.2)	9 (7.1)	127 (58.5)
Total	90 (41.5)	54 (24.9)	45 (20.7)	28 (12.9)	217 (100.0)

[a,b] Spearman correlations
Percentages are for that row.

Weight. BMI percentiles, based on age and sex, ranged from 3.6 to 99.9, with the mean percentile being 64.9 and the median 68.5. Less than five percent (4.5%) of subjects were considered underweight, one-sixth (16.6%) at-risk of overweight, and almost one-quarter (22.6%) overweight, based on CDC cut-offs. See Tables 2.2 and 2.3. Girls had significantly higher BMI percentiles than boys, with means of 67.4 and 64.5. (See Figure 2.1.) Rural children generally had a higher rate of overweight, but the differences were not significant. (See Figure 2.2.) A significant correlation ($p<.05$) was found between BMI percentile and waist circumference. Based on multivariate regression, an interaction was found between rural/urban and ethnicity. White children were significantly heavier and had larger waist circumferences than those living in urban areas. Conversely, Latino and black children living in urban areas were significantly heavier than those living in rural areas. (See Figure 2.3.) There were no significant differences based on age, gender, or school.

Table 2.2: Weight Factors for Children

Variable	White n (%)	Black n (%)	Latino n (%)	Other n (%)	Total n (%)
Weight Status					
Underweight	5 (50.0)	2 (20.0)	1 (10.0)	2 (20.0)	10 (4.6)
At-risk of Overweight	8 (27.3)	12 (38.4)	10 (30.1)	2 (6.1)	32 (14.7)
Overweight	25 (51.0)	11 (22.4)	9 (18.4)	4 (8.1)	49 (22.6)
Weight Factors					
Waist Circumference (in)	28	27	28	27	28
BMI Percentile (mean)	68.1	64.4	66.4	53.1	64.9

Percentages are for that row.

Table 2.3: Weight Status by Ethnic Group

Variable	White n (%)	Black n (%)	Latino n (%)	Other n (%)	Total n (%)
Weight Status					
Underweight	5 (5.6)	2 (3.70)	1 (2.2)	2 (7.1)	10 (4.6)
At-risk of Overweight	8 (8.9)	12 (22.2)	10 (22.2)	2 (7.1)	32 (14.7)
Overweight	25 (27.8)	11 (20.4)	9 (20.0)	4 (14.3)	49 (22.6)
Total	90	54	45	28	217

Percentages are for that column.

Figure 2.1: BMI Percentile by Gender

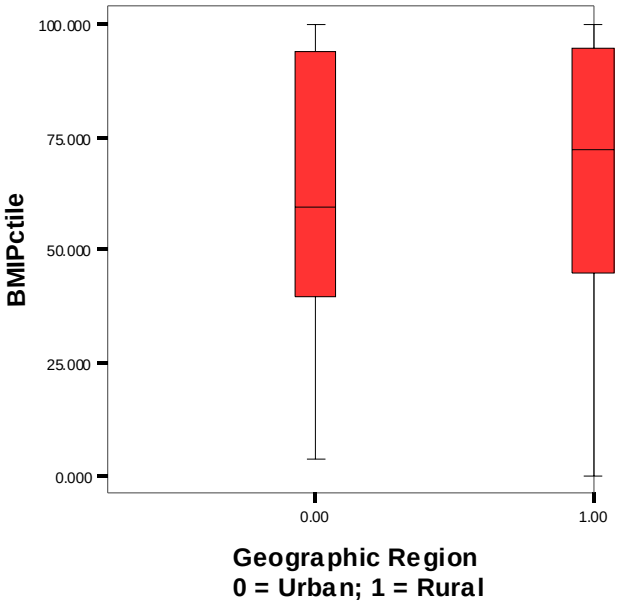


Figure 2.2: BMI Percentile by Ethnicity

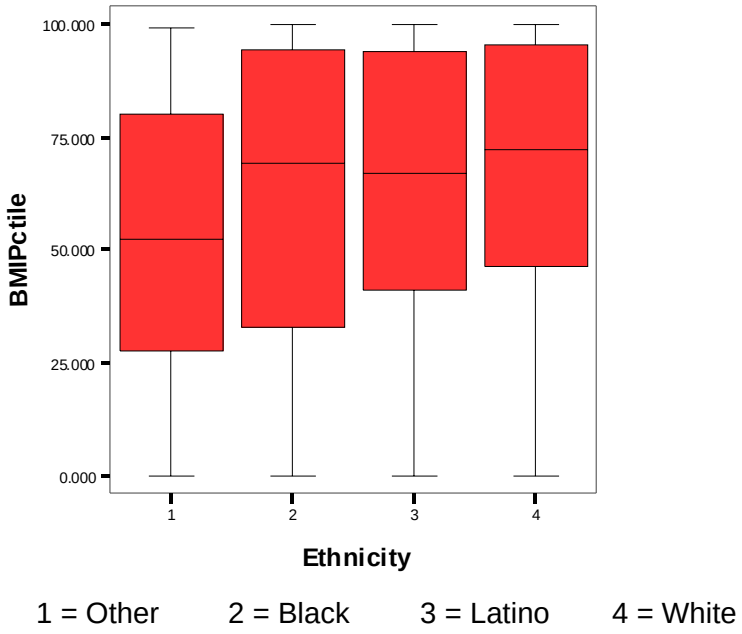


Figure 2.3: BMI Percentile and Waist Circumference

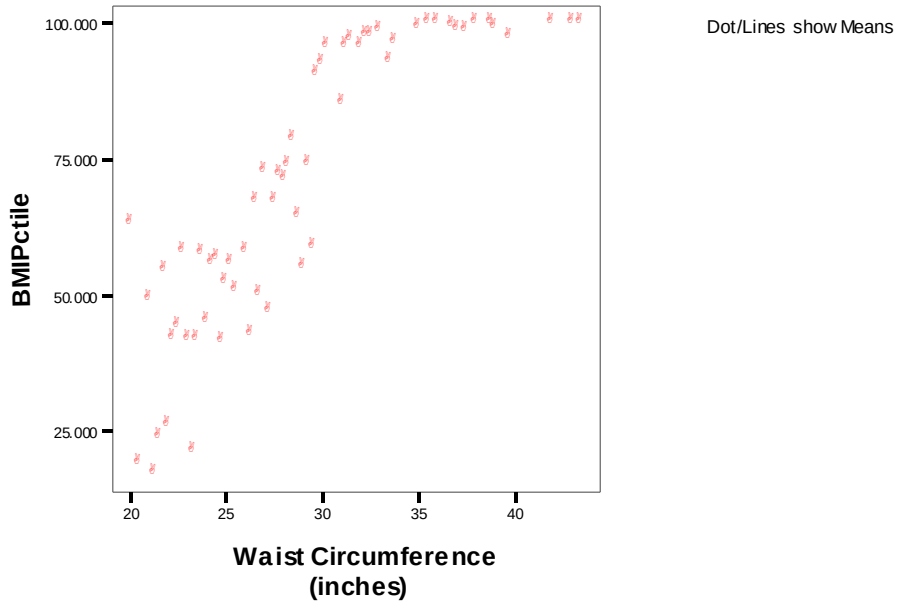
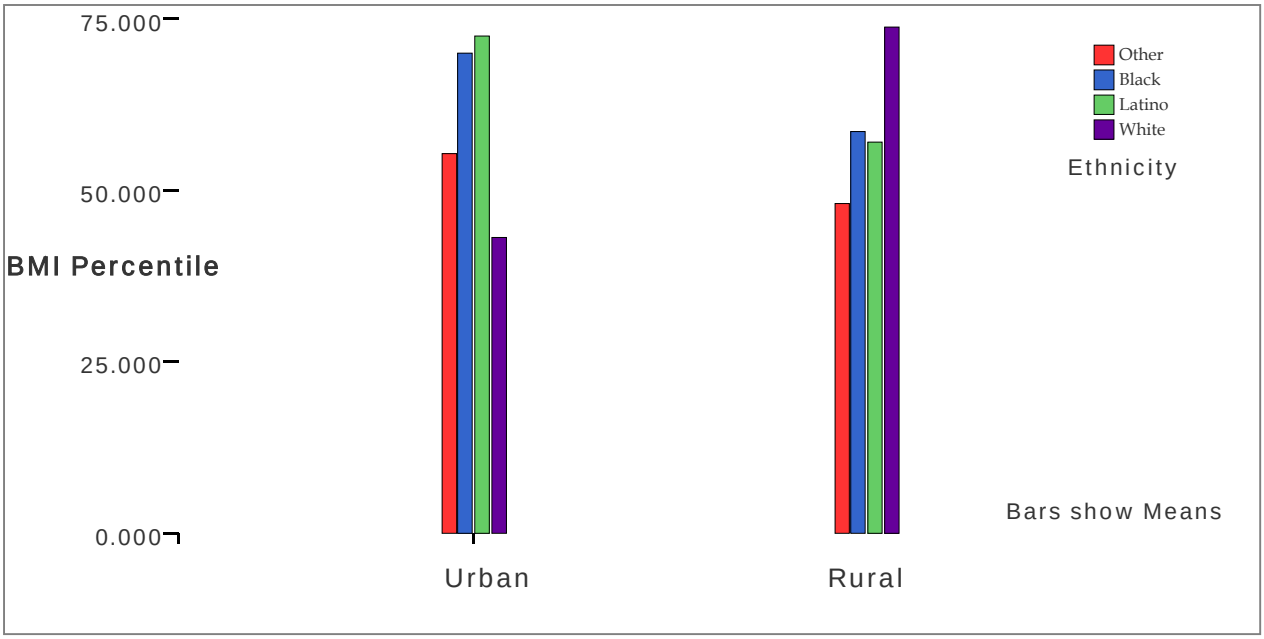


Figure 2.4: BMI Percentile by Ethnicity and Region



Health Behaviors. The findings suggest similar results to other studies. Nearly one-quarter of students never ate breakfast or fruit, as illustrated in Table 2.4. Approximately ten percent of children drank more than 3 servings of milk or soda per day or exercised fewer than three times per week. This study population reported watching less television than other studies, with only six percent watching more than 3 hours/day. There were several interesting correlations. Eating breakfast was associated ($p<.05$) with higher intake of fruit, increased physical activity, more participation in recess, decreased hours playing video games, and higher grades. There was also a significant relationship between breakfast and ethnicity/culture. White children reported eating breakfast more frequently than other ethnic/cultural groups. Finally, students who reported higher grades were more likely to eat breakfast more frequently, eat more fruit, spend less time playing video games, and not "feel fat."

Table 2.4: Dietary and Physical Activity Variables of Children

Variable	White n (%)	Black n (%)	Latino n (%)	Other n (%)	Total n (%)
Dietary and Physical Activity Factors					
Never ate breakfast*	37 (59.7)	13 (21.0)	10 (16.1)	2 (3.2)	62 (28.6)
Never ate fruit	19 (40.4)	18 (38.3)	6 (12.8)	4 (8.5)	47 (21.7)
Consumed milk > 3 servings/day	5 (18.5)	3 (11.1)	3 (11.1)	2 (7.4)	27 (12.4)
Drank > 3 glasses soda/day	8 (40.0)	10 (50.0)	1 (5.0)	1 (5.0)	20 (9.2)
Exercised fewer than 3 times/week	5 (20.0)	4 (16.0)	11 (44.0)	5 (20.0)	25 (11.5)
Watched t.v. more than 3 hrs/day	4 (30.7)	5 (38.5)	0	4 (30.7)	13 (5.9)

Contributing Factors to Weight. There were several significant factors ($p<.05$), based on multivariate regression related to BMI percentile (age-sex): milk consumption (Figure 2.5); feeling of being fat; wanting to be thinner (Figure 2.6); concern about gaining weight; unhappiness with body; and waist circumference. BMI percentile (age-sex) was not associated with television or video watching (sedentary activity) (Figure 2.7), physical activity (Figure 2.8), or soda consumption (Figure 2.9).

Figure 2.5: BMI Percentile and Milk Consumption

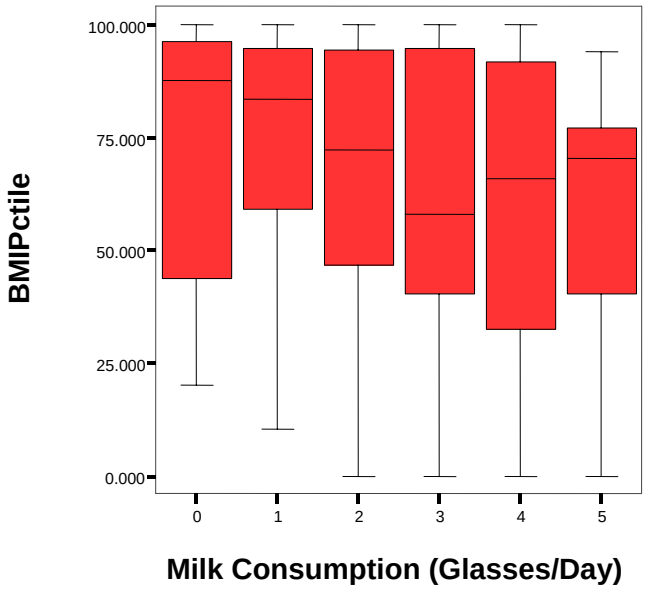


Figure 2.6: BMI Percentile and Desire to be Thinner

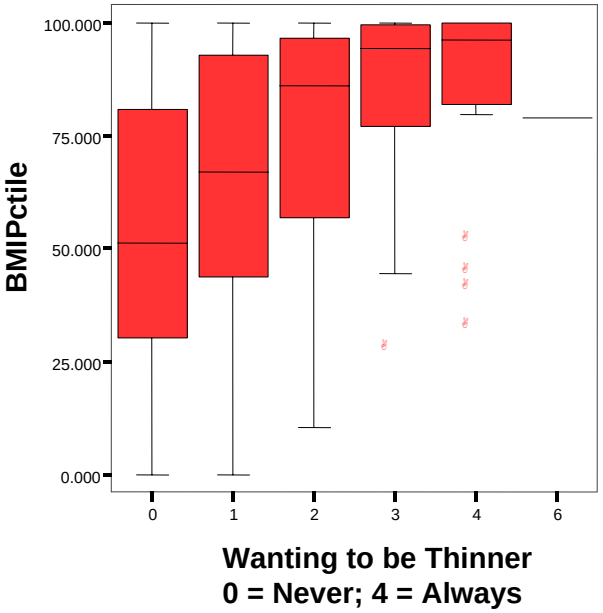


Figure 2.7: BMI Percentile and Television Watching

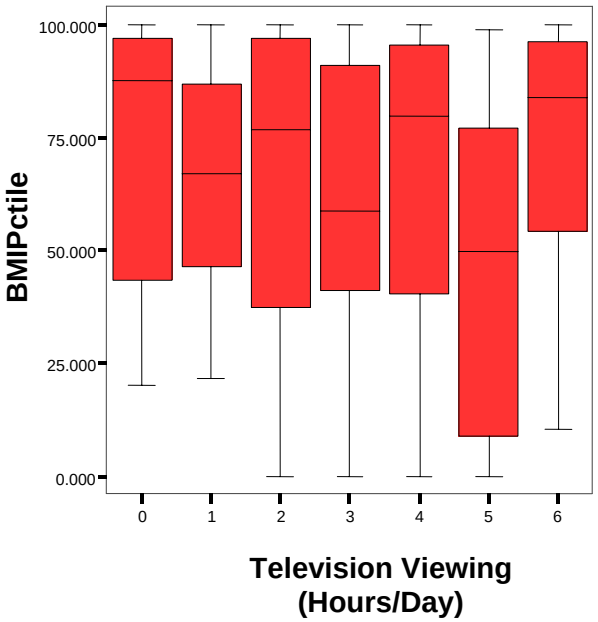


Figure 2.8: BMI Percentile and Physical Activity

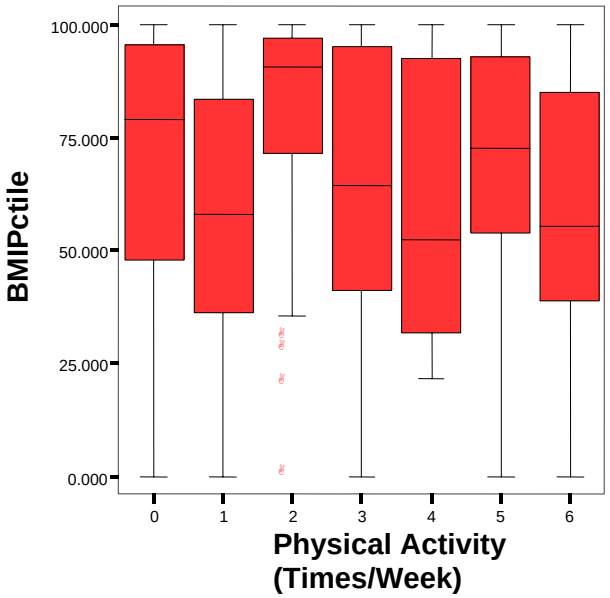
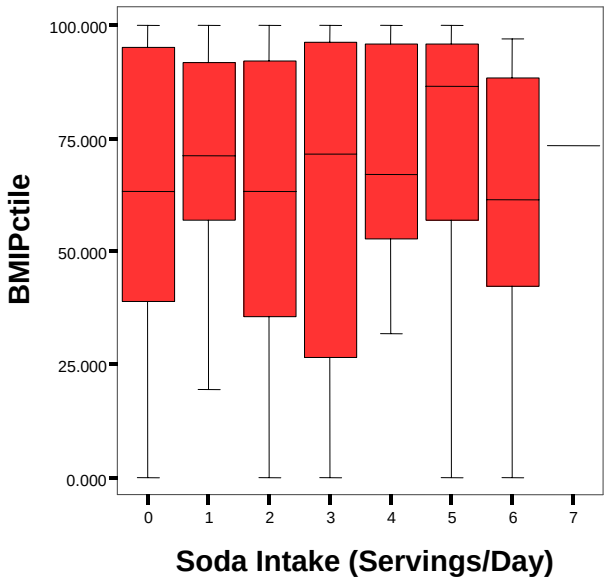


Figure 2.9: BMI Percentile and Soda Consumption



Discussion

The total rate of overweight in this study exceeded national rates, however paralleled trends in the south. In this study, Latinos did not have a significantly higher rate of overweight than blacks or white. They also did not have significantly different eating, physical activity, or body image patterns, suggesting higher acculturation than Latinos in other parts of the country.

An interesting finding in this study was the relationship between breakfast and grades with several healthy behaviors. These results should be disseminated to principals and other school officials in order to encourage them to offer school breakfasts and healthier options in vending machines. Many schools offer competitive foods with minimal nutritional value, at the expense of potential health.

While the results of this study suggest alarming trends among Latino and non-Latino limited resource youth, the subjects of his study comprised a non-representative, convenience sample, so may not be representative of other regions and/or populations. Furthermore, even though statistical differences were exhibited between various factors, the sample sizes were small. Additionally, outside of the anthropometric data, all questions were based on self-reports of the children, which has several limitations (Baranowski and colleagues, 1986, 1991).

Results

Latino and non-Latino Children – Body Figure Scales

A total of 89 boys and girls were assessed for this component of the study, comprised of subjects drawn from the urban, northern Virginia area. The subject pool consisted of 41 females and 49 males. These students identified themselves as 39 fourth-graders and 48 fifth-graders (two unreported). Most children (96.6%) were nine, ten, or eleven years of age at the time of testing. Equal numbers of Black/African-American and Latino/Hispanic students participated (30.3% each). Whites or Caucasians represented the third largest group (18%). The other three ethnic categories, American Indian/Alaskan, Asian, and Other, accounted for 21.3% of the tested subjects. Because these groups were so under-represented, their data was grouped under a category known as "All Others" for the rest of the analyses.

Table 3.1: Demographic Characteristics of Children in Body Figure Assessment

Variable	Response	n	%
Gender			
	Male	48	53.9%
	Female	41	46.1%
Age			
	9 Years	19	21.3%
	10 Years	35	39.3%
	11 Years	32	36.0%
	12 Years	3	3.4%
Grade			
	4th Grade	39	43.8%
	5th Grade	48	53.9%
Ethnicity			
	Amer. Indian/Alaskan	2	2.2%
	Asian	6	6.7%
	Black/African-Amer.	27	30.3%
	Latino/Hispanic	27	30.3%
	White/Caucasian	16	18.0%
	Other	11	12.4%

Anthropometric Data. The mean waist circumference for this portion of the study was 27.7 inches, with an overall range of 22 to 42 inches. The mean BMI was 19.8 with a range from 14.0 to 33.7. The mean BMI-for-age percentile was 62.9, with a range from 3.6 to 100.0 percentiles. When asked to select their favorite format, subjects were more likely to choose the colored line-drawing format (33.7%).

Preference Format. Preference for a particular format was related to both gender (X2 (3, N=87) = 10.676, p=0.014) and ethnic group (X2 (9, N=87) = 17.788, p = 0.038). Please see Table 3.2. Visual inspection of the data showed that, among male subjects, preferences leaned towards the uncolored line drawing and photograph formats (with approximately 35% and 33% of the males choosing each respectively). Among females, the colored line drawing was strongly preferred, with 49% of respondents choosing it as their favorite.

Among African-American or Black subjects, the photograph and colored line drawing formats were best preferred, with 37% and 33% of subjects choosing each, respectively. Among Latino or Hispanic respondents, the colored line drawing was, by far (56%), the favorite. The least favorite format among the Black and Latino subjects was the silhouette. Conversely, the silhouette was the most favored format of the White or Caucasian subjects (37.5% of subjects choose this). Among the Other group, no one format stood out as a definitive greatest or least favorite.

When asked to select the formatted figure that looks most like them, subjects were more likely to choose the photograph (39.3%). Self-identified format was also related to both gender (X^2 (3, N=89) = 12.711, p = 0.005) and ethnic group (X2 (9, N=89) = 20.264, p = 0.016). Please see Table 4.5. Visual inspection of the data revealed that the male subjects felt they could identify best with the colored line drawing format (33.3% of respondents chose this format). The majority of females (56%) felt they could identify best with the photograph format.

Among the ethnic groups, more than half (59%) of Black students felt they could best relate to the photograph format; results were similar among the Latino subjects (44% choose the photograph). As with preference, the Caucasians had very different results. The colored line drawing was chosen most often (37.5%) as the format with which students felt they could identify; the photographic format was the least popular. Only one white respondent felt she could identify best with this format. Among the Others group, nearly half (47%) felt they could identify best with the colored line drawing format.

Table 3.2: Format Selections by Ethnic Group and Gender

	Black/African-American		Latino/Hispanic		White/Caucasian		All Others	
Question and Responses	Male	Female	Male	Female	Male	Female	Male	Female
Scale which you like best.								
Silhouette	0	2	0	1	3	3	2	1
Line drawing	5	1	5	1	2	2	4	1
Photograph	7	3	2	3	4	1	2	2
Colored line drawing	2	7	3	11	0	1	5	1
Scale that looks most like you.								
Silhouette	2	0	1	0	2	3	3	0
Line drawing	3	0	5	1	3	1	1	0
Photograph	6	10	3	9	0	1	3	3
Colored line drawing	3	3	2	6	4	2	7	2

Figure Stance. For stance of figure, the results were not as definitive. Three-quarters stance with arms at sides and front view with arms at sides were the favorites, with 25.8% and 24.7% of respondents choosing each, respectively. When asked which stance-figure looked most like them, 30.3% of subjects favored the three-quarters stance with arms at sides. Difference in stance preference existed based on gender (X^2 (4, N=88) = 11.125, p = 0.025). Ability to identify with a stance was unrelated to any of the demographic factors. Please see Table 3.3.

Table 3.3: Stance Selections by Ethnic Group and Gender

	Black/African-American		Latino/ Hispanic		White/ Caucasian		All Others	
Question and Responses	Male	Female	Male	Female	Male	Female	Male	Female
Scale which you like best.								
3/4 stance; arms out	3	2	2	1	1	2	1	0
3/4 stance; arms at side	3	4	3	6	1	4	2	0
profile	3	1	4	1	1	1	3	2
front view; arms at side	5	1	1	4	4	0	6	1
front view; arms out	0	5	1	4	2	0	1	2
Scale that looks most like you.								
3/4 stance; arms out	0	0	0	1	1	3	1	0
3/4 stance; arms at side	3	2	4	3	1	3	2	1
profile	5	2	3	1	1	1	3	3
front view; arms at side	4	5	3	6	4	0	5	0
front view; arms out	2	4	1	5	1	0	3	1

As was predicted, grade level, the proxy for age, had no significant relationship to any of the figure choices (preference for or identification with format or stance, or with preference for a figure in either the novel or Collins scales). Please see Tables 3.4 and 3.5 for the Novel and Collins scale selections.

Table 3.4: Novel Scale Selections by Ethnic Group and Gender

	Black/ African-American		Latino/ Hispanic		White/ Caucasian		All Others	
Question and Responses	Male	Female	Male	Female	Male	Female	Male	Female
Figure which you like best.								
Thinnest	1	0	0	1	1	2	1	2
2nd Thinnest	0	1	2	4	2	2	1	1
Thin-Normal	2	5	2	7	4	2	6	2
Normal	3	6	4	2	1	1	3	0
Heavy-Normal	6	1	1	1	0	0	2	0
2nd Heaviest	2	0	0	0	1	0	1	0
Heaviest	0	0	2	1	0	0	0	0
Figure that looks most like you.								
Thin-Normal	2	1	1	5	4	1	6	1
Normal	1	6	1	3	0	1	2	1
Heavy-Normal	7	1	6	1	3	0	3	0
2nd Heaviest	2	2	3	2	0	0	1	1
Heaviest	0	1	0	1	0	0	1	0

Using multiple regression analysis with the "self" figure choices from the novel scale as the dependent variable and BMI-for-age percentile and the Body Image Factor as the covariates, the corrected model shows significance ($p<0.001$). BMI-for-age percentile ($p = 0.005$) was a better predictor of "self" figure choice within the novel scale than the Body Image Factor ($p = 0.065$). Similar findings were demonstrated with the Collins figure scale ($p=0.001$). BMI-for-age percentile ($p=0.020$) was the better predictor of "self" figure than the Body Image Factor ($p = 0.055$).

Colllins Scale. When asked to choose an "ideal" figure from both the novel scale and the Collins scale, the subject's choice was unrelated to gender, age, or ethnic group. Figure preference selections were heavily concentrated to just a few choices on the Collins scale, especially among males. Using the Collins scale, more than 60% of male subjects chose a single figure (the "normal", or middle, selection) as their ideal. Four of the seven figures had one or fewer males select them as their ideal body shape. By contrast, using the novel scale, no category was chosen by fewer than two males as their favorite. The figure chosen most often as the "ideal" was selected by only 30% of the subjects. This greater variety of choice was also seen in the female selections, but was not as pronounced.

Table 3.5: Collins Scale Selections by Ethnic Group and Gender

	Black/African-American		Latino/ Hispanic		White/ Caucasian		All Others	
Question and Responses	Male	Female	Male	Female	Male	Female	Male	Female
Figure which you like best.								
Thinnest	1	0	0	0	0	0	0	1
2nd Thinnest	0	2	0	0	1	0	0	0
Thin-Normal	1	4	2	6	2	3	1	2
Normal	5	2	7	7	5	4	10	1
Heavy-Normal	6	4	1	3	1	0	0	1
2nd Heaviest	1	1	0	0	0	0	0	0
Heaviest	0	0	0	0	0	0	0	0
Figure that looks most like you.								
Thinnest	0	2	0	0	0	0	0	1
2nd Thinnest	0	1	0	1	1	0	0	0
Thin-Normal	2	2	1	1	2	4	0	0
Normal	6	4	3	7	3	3	10	2
Heavy-Normal	5	2	5	5	3	0	4	2
2nd Heaviest	1	2	0	2	0	0	0	0
Heaviest	0	0	1	0	0	0	0	0

Choice of a figure that "looks most like you" provided different results. General linear model analysis showed that both gender and ethnic group had a significant impact on the "self" identified figure choice using the novel scale, $p = 0.008$. This was not the case with the Collins scale ($p=.172$). In other words, using the novel scale we came to a consistent conclusion that mean self-identified figure choice was not equal between ethnic groups. However, the mean self-identified figure choice for the Collins scale was not shown to be dissimilar between the ethnic groups. Please see following tables.

Table 3.6: Impact of Gender and Ethnic Group on "Self" Figure Choice, Novel Scale

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	44.470(a)	7	6.353	2.959	.008
Intercept	1075.741	1	1075.741	501.029	.000
ETHGROUP	31.038	3	10.346	4.819	.004
SEX	12.273	1	12.273	5.716	.019
ETHGROUP * SEX	5.612	3	1.871	0.871	.460
Error	173.912	81	2.147		
Total	1548.000	89			
Corrected Total	218.382	88			

a R Squared = .204 (Adjusted R Squared = .135)

Table 3.7: Impact of Gender and Ethnic Group on "Self" Figure Choice, Collins Scale

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	12.270(a)	7	1.753	1.523	.172
Intercept	1265.230	1	1265.230	1099.079	.000
ETHGROUP	7.968	3	2.656	2.307	.083
SEX	4.481	1	4.481	3.893	.052
ETHGROUP * SEX	0.377	3	0.126	.109	.955
Error	92.094	80	1.151		
Total	1610.000	88			
Corrected Total	104.364	87			

a R Squared = .118 (Adjusted R Squared = .040)

Discussion

This study was able to implement a few of the suggestions made by Gardner et al. (1998) in their critical review of the methodologies of body figure scale testing. Rather than lining the figures up across the page from heaviest to thinnest, the figures were placed in a random order. The figures of the Collins and novel scales were also deliberately placed in different orders, forcing the subjects to consider the figures themselves rather than simply noting their place within the line-up.

Care was also taken in constructing the figures to answer Gardner and colleagues' (1998) concerns of figure "coarseness". In two of the reviewed studies, Gardner and colleagues found that only a few (~3) of the figures accounted for the vast bulk of the selections (85% in one

study). They purported that this narrow range of typical choices might inflate the reported test-retest reliability. The 85% estimate of figure choices grouping in the center three figures does hold true for both scales when the subjects were asked to select a "self" figure, but the novel scale had a smaller clustering of answers (68.5%) when subjects were asked to identify an "ideal" figure. Perhaps the finer granulation of the figures will indeed lead for more accurate findings of "self" and "ideal" figure selections.

The strongest conclusion that can be drawn from the results of this study is that further research is warranted. A number of small and large protocol changes, and new research directions, have been suggested by this study's findings, including administering the same protocol with different, larger, and more varied populations, testing an extended protocol with figure scales targeting different sub-populations, and creating a more research- and evidence-based figure scale. The subject pool of this study was ethnically diverse, but from a small geographical location in an urban area. It was also too small. Follow-up studies with larger and more diverse populations, including subjects from rural and disparate areas, would greatly increase the relevance of the findings. Studies examining different age groups of subjects, ranging from children to teenagers and young adults, would also be important.

This study followed the examples of Stunkard et al. (1983) and Collins (1991) in constructing a seven figure scale. Others have attempted to produce the fine granularity called for by Gardner and colleagues (1998) by adding additional figures. McElhone et al. (1999) and Sanchez-Villegas et al. (2001) each developed scales with nine figures. Williamson et al. (2000) developed an 18 figure scale. These large-number figures scales also beg a follow-up study as to the optimum number of figures a scale should have.

Even more important would be a research study that builds and tests a figure scale that assesses body fatness using a solid scientific foundation. There are a number of methodological strategies, used singularly or in concert, which could add a more rigorous basis to the scale figures. One, the scale could be based upon photographs of subjects of known and ranked BMIs. Two, the photographic subjects could be assigned to a place in the scale based on body fatness (obtained via DXA scanning or underwater weighing of the subjects). Three, more than one subject of a certain BMI or body fatness could be used as the basis for a figure on the scale. For this option, the photographs of several subjects of a given BMI/body fatness category might be digitally summed, or "morphed" into a single figure that represents that category. This morphing of a number of similarly ranked subjects would eliminate the concerns that the inter-figure variations along the length of the scale were not realistic, or that the unique characteristics of one person might not be relevant to others. If a mix of persons with high BMIs due both high-fat and high-muscle were used in the morphing process, it might address the valid concerns of where athletic figures fit into these scales.

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Acknowledgements

A special thank you to Kathryn Branstad, Margarethe Goetz, Ana Moran, and Jennifer Spangler, for their assistance in conducting this study.