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The Relationship Between Social Desirability and Reported Dietary Intake in Healthy and Overweight Children

Nicolle Clemente
University of Tennessee - Knoxville

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To the Graduate Council:

I am submitting herewith a thesis written by Nicolle Clemente entitled "The Relationship Between Social Desirability and Reported Dietary Intake in Healthy and Overweight Children." I have examined the final electronic copy of this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Science, with a major in Nutrition.

Sonya Jones, Major Professor

We have read this thesis and recommend its acceptance:

Betsy Haughton, Diane A. Klein

Accepted for the Council:

Carolyn R. Hodges

Vice Provost and Dean of the Graduate School

(Original signatures are on file with official student records.)

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Major Professor

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and recommend its acceptance:

Betsy Haughton

Diane A. Klein

Accepted for the Council:

Anne Mayhew
Vice Chancellor and
Dean of Graduate Students

(Original signatures are on file with official student records.)

The Relationship between Social Desirability and Reported Dietary Intake in Healthy and Overweight Children

A Thesis
Presented for the
Master of Science
Degree
The University of Tennessee, Knoxville

Nicolle Clemente
August 2005

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ABSTRACT

Objective: The purpose of this study was to determine if social desirability bias existed in dietary recall data of fourth graders and if bias was related to child's weight status and gender. It was hypothesized that children concerned with social desirability would report decreased total energy intake, percent calories from fat, and servings per day of sugar-sweetened beverages, candies, desserts, and meats, while showing an increase in reported servings per day of vegetables.

Subjects: The sample was a baseline evaluation of 255 fourth graders from rural, East Tennessee. The evaluation took place at the beginning of an intervention called, "Youth Can! Improve Their Diets for a Healthy Heart" at The University of Tennessee-Knoxville.

Methods: Multiple-pass, computer-assisted 24-hour dietary recalls were administered to each child by trained staff. Social desirability bias was assessed using the 5 question Hays social desirability scale. Height and weight data were measured by trained school nurses according to CDC protocol.

Statistical Analyses: Data were analyzed using ordinary least square regression with the general linear models procedure for kilocalories, percent calories from fat, sugar-sweetened beverages, and vegetables. Multinomial regressions were used for dessert and candy intakes. All analyses were analyzed in SPSS 13.0 (Chicago, IL).

Results: Girls who were concerned with social desirability showed a significant ($p \leq 0.05$) association with a decreased calorie intake. Overweight participants concerned

with social desirability were three to five times more likely to report consuming some servings of candy than no candy. There were no significant differences in the percent calories from fat, and intakes of sugar-sweetened beverages, desserts, meats and vegetables between children concerned with social desirability and those not concerned with social desirability.

Conclusion: It is important to account for social desirability bias when analyzing 24-hour diet recalls, especially among girls who under-report their total kilocalorie intake. With further testing, the Hays short-form may be a valid and reliable measure for social desirability in children.

PREFACE

To assist the reader, the research study is divided into two parts. Part I includes an extensive literature review. Part II includes a manuscript containing introduction, methods, results, and discussion sections related to the research.

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PART I:
INTRODUCTION AND LITERATURE REVIEW

INTRODUCTION

The recent rise in overweight and obesity in this country has led to the development of many nutrition-related programs (1). Because many of these programs rely on current diet patterns and trends, knowledge about food and nutrient intakes of the population becomes increasingly important. Researchers use various methods of collecting information on these intakes (2), yet the most convenient and inexpensive are typically used, such as a 24-hour dietary recall (2-3).

Administration of a 24-hour dietary recall is a common method of assessing the dietary patterns and nutrient intakes of a population (3). This method is used widely among children and adults because of its ease of administration, use of short-term memory, and ability to estimate total nutrient intake (2-3). Individuals are asked to give self-reported dietary data using this tool, thus social desirability bias, a human tendency to give answers that are consistent with what is socially acceptable (4), may affect the results. Analysis of social desirability bias is extremely important in assessing actual nutrient intakes in diet recalls. Measurement error must be accounted for to yield valid results. If it is known by how much certain groups of children may under- or over-report nutrient intakes, actual intakes can be more accurately assessed. It is known that overweight women, or those concerned with their weight, typically under-report energy intake and total grams of fat (5-6). Because children demonstrate a concern about their weight in young childhood (7-8), and gender differences present themselves around this same time (7-8), further research into social desirability bias in children's dietary recall

data is needed. If energy intake is being under- or over-reported due to social desirability bias, understanding this phenomenon and its effects on current dietary patterns will help researchers plan more effective nutrition programs. The purpose of this research was to assess the phenomenon of social desirability bias among fourth grade children in rural East Tennessee.

LITERATURE REVIEW

Obesity

In the early part of the twentieth century, researchers and health professionals in the United States began to realize that many of the leading causes of death of the time were preventable. As they learned about the transmission of disease through microorganisms, the rate of infectious diseases declined. In more recent years, researchers and health professionals have shifted their focus to chronic diseases, because these have become the leading causes of death. Chronic diseases such as heart disease, cancer, and stroke have been linked to a multitude of risk factors, including overweight and obesity (1).

Among the adult population aged 20-74 years in the United States, 64.5% were classified as overweight with a body mass index (BMI) greater than 25 kg/m² in 1999-2000. Of this overweight population, 31% were classified as obese with a BMI greater than or equal to 30 kg/m² (9). The prevalence of overweight among adults has increased from 44.8% in 1960-1962, showing a drastic increase of 19.7% over the last forty years.

With more than half of the population overweight and nearly a third obese, a number of programs and research studies have emerged to investigate the cause of this epidemic and what can be done to keep it from escalating.

Obesity among Children

Obesity among children in the United States has followed a pattern similar to adults, with 15% of children aged 6 to 19 years defined as overweight (BMI at or above the 95th percentile for age and sex) in 1999-2000 (10). This prevalence has nearly tripled for adolescents in the past two decades (10). In addition to the 15% of children ages 6 to 19 years who are overweight, another 15% are considered at risk of becoming overweight (BMI of 85th to less than 95th percentiles) (11). Understanding overweight among children is essential because of the immediate and long-term consequences. Overweight children are at higher risk of adult obesity, increasing their susceptibility to chronic diseases associated with overweight and obesity (12). The immediate consequences of overweight in childhood include abnormal glucose tolerance, high serum cholesterol, hypertension, and psychosocial effects (13).

Weight concerns and body dissatisfaction are two psychosocial effects of child overweight that appear at very young ages, especially among girls. One study reports that gender differences in weight concern are apparent with children as young as third grade (7). A second study supports the belief that girls as young as ages 5 and 7 years exhibit weight concerns and body dissatisfaction (8). The same researchers conclude that by age 9, these girls are more likely to report dietary restraint, maladaptive eating

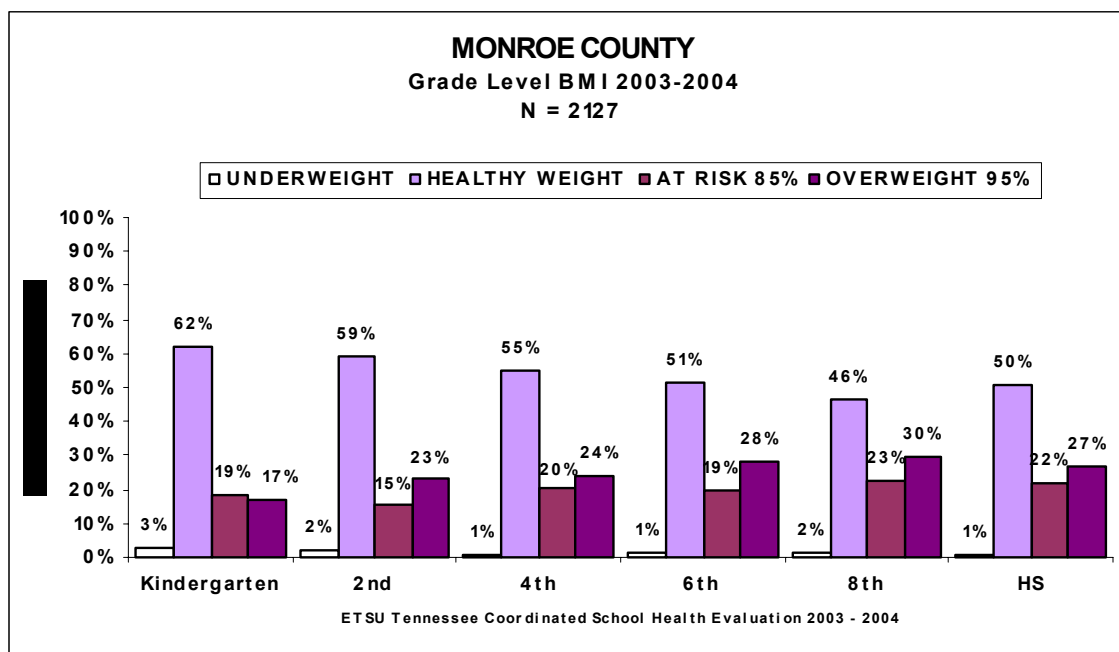
attitudes, and a greater likelihood to engage in dieting regardless of their weight status (8). These studies suggest that the negative stigma associated with being overweight begins as early as young childhood, particularly for girls. The stigma related to being overweight has harmful consequences for children themselves and may increase the sensitivity of assessment and public health interventions.

Obesity in East Tennessee

The recent rise in overweight and obesity has occurred in most regions of the United States, yet certain areas have experienced sharper increases compared with others. In one East Tennessee county, the prevalence of overweight among children is alarming, with 50.7% of children classified as overweight or at risk of overweight (14). Figure 1 demonstrates the population of school-aged children in this community who are underweight, of a healthy weight, at risk for overweight (at the 85th percentile to less than the 95th percentile), and overweight (at or above the 95th percentile). Among children in elementary school, the prevalence of overweight is particularly high with 17% of kindergarteners, 23% of 2nd graders, 24% of 4th graders and 28% of 6th graders above the 95th percentile for BMI (14).

Obesity and Energy Balance

Children and adults are becoming overweight and obese because of positive energy balance. Positive energy balance is caloric intake in excess of energy expenditure. Excess calorie intake may be the result of several factors including



Source: Coordinated School Health Program Evaluation 2003-2004. Courtesy of an electronic communication with Sonia Hardin, Coordinated School Health Coordinator for Monroe County Schools, December 1, 2004.

Figure 1.

The Prevalence of Underweight, Healthy Weight, At Risk of and Overweight among Children in Monroe County Schools.

increased energy-dense food consumption (15) and increased portion sizes (16). Large prospective studies of children's diets have been used to evaluate the food sources and caloric composition of children's diets that are associated with obesity. In the Bogalusa Heart Study, researchers found that children's reported consumption of snacks and low-quality foods were positively associated with overweight status, as were sweets, sweetened beverages, and meat (17). Specifically, the results from this study indicated that for each eight ounce serving of a sweetened beverage that a child consumed, the risk of overweight (at 85th percentile to <95th percentile) increased 33% (95% CI=1.12-1.57). Dividing foods into broad food group categories, consumption of meats and sweets

increased the risk of child overweight by 21% (CI =1.00-1.46) and 38% (CI=1.12-1.71), respectively. Meats included mixed meats, poultry, seafood, eggs, pork, and beef, while sweets included desserts, candy, and sweetened beverages. “Low-quality foods,” which included foods that were consumed at least once from salty snacks, candy, desserts, fats/oils, and sweetened beverage groups, were also analyzed. Consumption of these low-quality foods showed a 35% increase in the risk of overweight (CI=1.08-1.68). A third component of the Bogalusa Heart Study included the amount of food eaten by children to indicate portion sizes. The researchers found that the total gram amount of food/beverage consumed resulted in a 77% increase in the risk for overweight status (CI=1.02-3.08), while the gram amount of snacks consumed resulted in a 24% increase (17).

A cross-sectional study, the Growing Up Today Study (GUTS), was also performed to assess the nutrient intake of adolescents in 1996 (18). This study found that 18% of the energy intake of boys and girls came from snack foods, which provided protein (6%), fat (39%), and carbohydrate (57%). Among the snack foods, cookies, ice cream, and potato chips were the top three choices for both boys and girls. The researchers of this study also analyzed overweight status with diet. They found overweight youths consumed fewer calories and lower levels of both macro- and micronutrients compared with non-overweight youths; however, nutrient intakes remained similar when energy intake was adjusted. Overweight youths reported a lower consumption of snacks, baked goods/cereals, fruits/vegetables, meat/main dishes, and dairy foods than non-overweight youths, and reported a higher consumption of

beverages. Three interpretations of the GUTS results seem equally credible. Overweight adolescents may have under-reported their energy intake (social desirability bias); they may be eating less to lose or maintain weight; or they may be heavier because they are less physically active (18).

In both of these studies it is difficult to determine if food is the direct cause of overweight among children and adolescents. In the Bogalusa Heart Study the odds ratios, which were below 2.5, do not provide sufficient evidence of a causal association (17). However, Bogalusa was a prospective cohort study and therefore provides evidence that the dietary patterns preceded overweight status. The Growing Up Today Study (GUTS) showed that overweight children consumed lower levels of both macro- and micronutrients and fewer calories as compared with their non-overweight peers, while consuming a similar nutrient balance (18). Diet can be an important cause of child overweight, but it is not the only risk factor. It is known that the causes of child overweight are multifactorial, with physical activity and psychosocial factors also playing important roles (18).

Sources of Dietary Measurement Error

A second factor that influences the ability of researchers to link overweight to diet directly is the validity and reliability of tools that are available to assess diet. These tools are subject to measurement error and likely cause the systematic underestimation of the effect of diet on weight.

High quality dietary intake data are of great importance to studies of child overweight and nutrition. There are many methods to assess children's diets including food frequency questionnaires, diet histories, and dietary recalls (2). Each method can be used with or without adult proxy reports. Researchers found that 24-hour dietary recalls assisted by food records were valid among third-grade children (19). It is known that children may have a more difficult time remembering what they ate and knowing how food was prepared (19). In a study performed by Lytle et al. (19), third grade children were trained in how to complete a food record, which was used as a memory prompt during the 24-hour dietary recall. No significant differences were found in percentage of energy from total fat, saturated fat, monounsaturated fat, and polyunsaturated fat, and total sodium consumption between observed and recalled food intakes. The researchers found a 77.8% agreement of foods reported and observed across all meals (19), which is consistent with the findings of other researchers who tested agreement with children of the same age (20-21). This study determined that a 24-hour dietary recall assisted by a food record was a valuable tool to assess nutrient intake among children eight years and older (19). However, food records are not often collected in conjunction with 24-hour recalls due to the expense and amount of time involved in dietary data collection.

Twenty-four hour dietary recalls are widely used to assess recent dietary intake among population groups, such as American children and adults. While a single 24-hour recall cannot assess usual intake in an individual (3), it is the best method available for assessing the distribution intake in large groups of people (3). Therefore, 24-hour dietary recalls are often used to evaluate the effects of public health interventions on dietary

intake of groups. Other advantages of the 24-hour dietary recall include the speed and ease of administration, the short term memory required, and the ability to estimate total nutrient intake (2-3). Twenty-four hour dietary recalls are useful in measuring current dietary patterns in groups of subjects, because people typically remember what they ate the previous day better than what they typically ate over a longer period of time (2-3). It is not recommended that this tool be used to assess a deficiency state among an individual or an individual's usual intake (2).

Self-reported dietary data collection methods are based on human recollection, which can result in several types of measurement error (3). Error may be a result of interviewer or interviewee bias. Interviewee errors may result due to portion size, daily variation, memory, and observer bias (3). Margetts and Nelson (3) discussed the tendency of overweight individuals to under-report the amount they eat and to under-report intake of sweets and alcohol. These issues may relate to a phenomenon called social desirability bias, which is the tendency of individuals to respond or supply answers consistent with what is socially acceptable (4). It is believed this type of bias may cause dietary data to systematically under- or over-report nutrient intake based upon other characteristics, such as respondents' weight status or gender (5). Accounting for the systematic under- or over-report of nutrient intakes allows the relationship between diet and overweight to be more accurately assessed.

Social Desirability Bias

The theory of social desirability (SD) developed from psychology to recognize that different personalities can distort the responses given by individuals. Marlowe and Crowne (4) created one of the first tools developed to measure this phenomenon in 1960. The scale uses a 33-item true-false questionnaire that asks questions about behaviors that are culturally acceptable or unacceptable, but highly unlikely to occur. One example is, “I never hesitate to go out of my way to help someone in trouble,” and “I like to gossip at times.” This scale, called the Marlowe-Crowne Social Desirability scale (MCSD), has been widely used in many studies evaluating social desirability bias, and takes approximately five minutes to complete (4). From this original research on social desirability, several abbreviated measures have since been developed and validated (22-24).

Among these short forms of the social desirability scale (22-24), a five-item questionnaire was developed by Hays and colleagues (22). This scale uses five of the questions from the MCSD scale and provides five responses – definitely true, mostly true, don’t know, mostly false, and definitely false. Of these responses, only the two extremes (definitely true and definitely false) are scored. Compared to the MCSD this scale reduces the time it takes to complete from 5 minutes to 1 minute or less, making it very practical to be used among children, although it has never been validated in children (22).

Recently, Baxter et al (25) investigated the reliability of telephone administration of a 46-question Children’s Social Desirability (CSD) scale. The researchers then

adapted the CSD scale and tested its reliability. They also tested the reliability of a second scale called the Social Desirability for Foods (SDF) scale, which is a social desirability scale developed for food items. Among the adapted versions of social desirability scales, the shortened form (14 questions) of the CSD showed an adequate test-retest reliability ($\alpha=0.83$), while the adapted food social desirability scale did not fare as well (25). Although the shortened version of the CSD is the first short form social desirability scale discussed in the literature and was published in the spring of 2004, it requires further investigation into its validity and reliability. Two of the 14 questions used in this scale are similar to the questions Hays and colleagues (22) used in their shortened SD scale.

Analysis of social desirability bias is extremely important in assessing actual nutrient intakes in diet recalls. Measurement error must be accounted for to yield valid results. If it is known by how much certain groups of children may under- or over-report nutrient intakes, actual intakes can be more accurately assessed. Because children demonstrate a concern about their weight in young childhood (7-8), and gender differences present themselves around the same time (7-8), further research into social desirability bias in children's dietary recall data is needed. In adults, many studies show that women typically under-report energy intake (19-21 kcal/d) and total grams of fat (0.8g/d) (5-6), especially when they are overweight or are dissatisfied with their weight (5-6, 26-27). Not having 20 kilocalories accounted for per day would be equivalent to 7300 kilocalories per year or approximately 2.1 pounds of weight on average. It is unknown if overweight children under-report nutrient intake similar to adult women and

if girls and boys respond to concerns about social desirability differently. Children who provide dietary recall information may be subject to social desirability bias, based on the weight concern exhibited by children as young as 5 and 7 years (8). Similar to their adult counterparts, these children may report lower total calories and total fat than were actually consumed. If it is known by how much children may under-report, a more accurate representation of their intake can be determined.

Weight Status

Weight status is an important determinant of under-reporting energy intake in diet recalls. Previous studies on social desirability have simultaneously examined gender and weight status in adults (5-6, 26-28). Among adults, women typically under-report their total caloric intake (5-6, 27-28) and total intake of fat (in grams) per day (6, 26-27). Body fat and body dissatisfaction have been shown to be associated with social desirability bias (5-6, 26-27). Greater body dissatisfaction and a higher percent body fat correlated with under-reporting of total caloric intake (19-21 kcal/d) among women (5-6) and less reporting accuracy (27). One study found that lean and obese men and women under-reported total caloric intake, with obese individuals under-reporting to a greater degree than lean individuals (26). Overweight women, especially those who have tried dieting or with a high percent body fat, are at greatest risk for providing dietary recall information lower in total calories and total fat than were actually consumed, but men and lean individuals also have been found to under-report (5-6, 26-27). Unfortunately,

there is limited information on social desirability bias relating to weight status in diet recalls of boys or girls.

A recent study performed in Sweden (29) assessed energy intake using a seven-day diet record and validated the results using the doubly labeled water method among 15 year olds. It was found that dietary reports were underestimated and significant inverse correlations were found between actual percent body fat and self-reported energy intake as well as between body mass index and self-reported energy intake (29). Unfortunately, this study did not further assess the reasons why adolescents may have under-reported energy intakes and more specifically why those with a higher body fat percentage and body mass index more significantly under-reported this information.

In another recent investigation of social desirability bias, several researchers studied how it was related to self-reported dietary measures in 8-to 10-year old African American girls. Controlling for age and BMI, the researchers found a positive association between social desirability and underestimated sweetened beverage preferences ($p = 0.02$) (30). The researchers used a sample of 95 participants and one limitation to the study was the small population size. In addition, only African American girls were studied, limiting the ability to generalize findings to the entire population.

Research Questions

The only study to date that has examined the effect of social desirability bias on the dietary reports of children was performed with 8-to 10-year old African American girls (30). It was found that these girls underestimated sweetened beverage preferences.

Understanding if children in East Tennessee are subject to social desirability bias is important because of the high rate of children who suffer from overweight and at risk of overweight (14). The population in East Tennessee is very different from the sample chosen in the study on social desirability among African American girls. According to census data from Monroe County (TN), 18% of the population lives below the poverty line, 96% of the population identify themselves as white, and the area is rural with a population density of 53 people living per square mile (31).

A unique opportunity existed to evaluate the extent to which social desirability affected the dietary recalls of healthy and overweight children in rural, East Tennessee. Baseline dietary data from an intervention study, “Youth Can! Improve their Diets for a Healthy Heart” were collected in the fall of 2003. With evidence available to support the fact that children are dieting at young ages and are concerned about their weight status (7-8), the following thesis study was proposed. The aims of this study were to:

1. Describe the prevalence of social desirability in a convenience sample of fourth grade boys and girls participating in Youth Can! from Monroe County, TN.
2. Estimate the relationship between social desirability and intakes of total daily energy and percent energy from fat.
3. Determine if weight status was a modifier for social desirability and diet.
4. Determine if reported caloric intake and percent calories from fat and servings of sugar-sweetened beverages, candies, desserts, meats and vegetables were altered due to social desirability and child weight status after controlling for confounders.

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Part II:

The Effect of Social Desirability on the Dietary Reports of Children in Monroe County, TN

INTRODUCTION

Obesity has reached epidemic proportions, affecting many of the nation's children (1). Recent studies suggest the negative stigma associated with being overweight may emerge as early as young childhood (2-3). If children understand this stigma and believe certain foods contribute to weight gain, their reports of dietary intake may be altered. These altered intakes may result in a bias in dietary reporting referred to as social desirability, or the tendency to respond in a manner that is socially acceptable (4).

Several studies (5-7) have suggested that increased weight status among children is due to increased energy-dense food consumption (5), increased portion sizes (6), and consumption of specific foods (7). The researchers of the Bogalusa Heart Study (7) found that overweight status was positively associated with sweets, sweetened beverages and meat. Low quality foods, including salty snacks, candy, desserts, fats/oils, and sweetened beverage groups, were also found to be positively associated with overweight status. Groups of foods included in the current study were chosen based on the results of the Bogalusa Heart Study and based on the experience collecting data in Monroe County. The current literature on social desirability doesn't look at specific foods in depth, but the researchers experience collecting data in Monroe County suggests that foods like salad and steamed broccoli might be reported with a greater frequency among children concerned with social desirability, thus vegetable intake was assessed among the children and included in the analyses. Because causes of child overweight are multifactorial, with physical activity and psychosocial factors also playing important roles it is difficult to

determine what source plays the most critical role (8). It is important, however, for researchers to understand the foods that children associate with overweight, which may be under-reported in dietary recalls.

Because nutrition researchers rely mainly on self-reported dietary recalls, social desirability bias could easily result in inaccurate reporting of food intake. However, much of the scientific literature on social desirability has examined adult subjects. In particular, it has been seen that overweight women, or women dissatisfied with their weight, tend to under-report energy and total fat intake (9-13). With little data available on social desirability in children, it is not clear if children would under- or over-report dietary intake due to social desirability bias, or which foods children perceive as socially desirable. Because children demonstrate a concern about their weight in young childhood (2-3), and gender differences present themselves around this same time (2-3), further research into social desirability bias in children's dietary recall data is needed. If energy intake is being under- or over-reported due to social desirability bias, insight into this phenomenon will help researchers understand current dietary patterns to plan more effective nutrition programs.

The purpose of this study was to determine if social desirability bias exists in dietary recall reports of fourth graders and to determine if bias is related to weight status and gender. The conceptual framework for the study is depicted in Figure 2. Specifically, total energy intakes, percent calories from fat and servings of sugar-sweetened beverages, candies, desserts, and vegetables were the reported intake variables assessed after controlling for age. The interaction of weight and social desirability and

Conceptual Framework

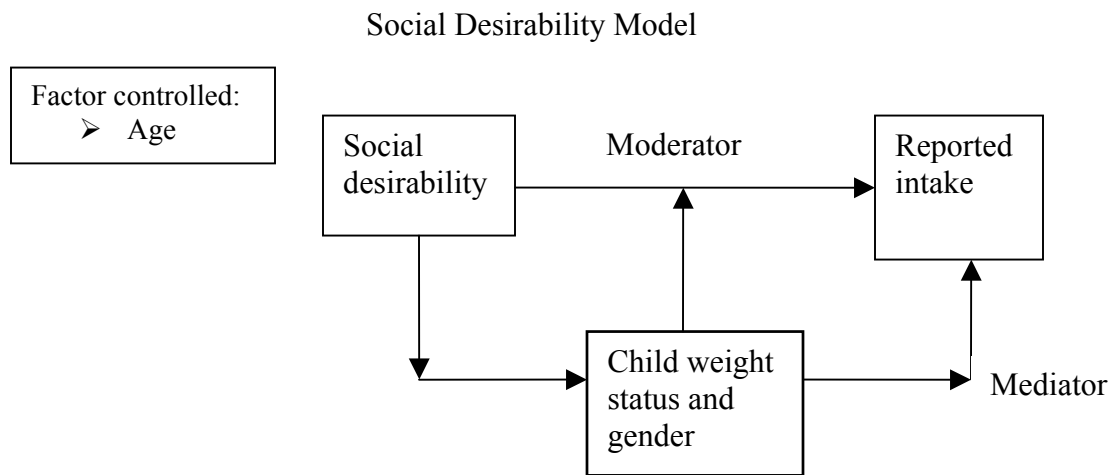


Figure 2.
Hypothesized Relationship between Child Reported Dietary Intake and Social Desirability

the interaction of gender and social desirability were variables created to assess if weight and gender moderated the effect between social desirability and reported intake. Because the Youth Can! study was not designed to test mediating effects, the sample was not adequate for available statistical methods. The aims of this study were to:

1. Describe the prevalence of social desirability in a convenience sample of fourth grade boys and girls participating in Youth Can! from Monroe County, TN.
2. Estimate the relationship between social desirability and intakes of total daily energy and percent energy from fat.
3. Determine if weight status was a modifier for social desirability and diet.
4. Determine if reported caloric intake and percent calories from fat and servings of sugar-sweetened beverages, candies, desserts, meats and vegetables were altered due to social desirability and child weight status after controlling for confounders.

EXPERIMENTAL DESIGN AND METHODOLOGY

Setting

This study was performed in Monroe County, a Coordinated School Health Program (CSHP) pilot site in rural East Tennessee. CSHP is a Centers for Disease Control and Prevention model that contains eight components including: health education; physical education; health services; nutrition services; counseling, psychological and social services; healthy school environment; healthy promotion for staff; and family/community involvement (14). The eight components interact within the school setting to address serious health and social needs.

Sample

The sample included 255 fourth graders who participated in the baseline assessment from an intervention called “Youth Can! Improve Their Diets for a Healthy Heart.” Youth Can! is a research study of The University of Tennessee, Knoxville Department of Nutrition and the CSHP in Monroe County. This intervention research study develops youth resources to reduce the prevalence of overweight among children (15) and received human subject approval from The University of Tennessee, Knoxville Institutional Review Board (IRB). The sample used for this study was a convenience sample of all fourth grade children who provided consent and assent to participate in a 24-hour dietary recall, interview survey, and height and weight screening at baseline in October and November of 2003.

Outcomes

The dependent, or outcome, variables of this study included energy intake, measured as kilocalories per day, percent of kilocalories from fat, and servings of each of the following: sugar-sweetened beverages, candies, desserts, meats and vegetables.

Diet Measures of Macronutrients

Multiple-pass, computer-assisted 24-hour dietary recalls were administered to each child by trained Youth Can! staff. Food models were used to aid in portion estimation. Nutrient calculations on total daily intake were performed using the Nutrient Data System for Research (NDS-R) software version 4.06, developed by the Nutrition Coordinating Center, University of Minnesota, Minneapolis, MN, Food and Nutrient Database 34, released May 2003 (16). Energy intake was recorded as total energy from all foods eaten in a single day, as reported by each child. The percent of kilocalories from fat were calculated from the single day dietary recall. Percent of energy from fat was calculated through NDS-R by taking the calories from fat and dividing this number by the total caloric intake and then multiplying this quotient by 100.

Diet Measures of Sugar-Sweetened Beverages, Candies, Desserts, Meats and Vegetables

The servings per day of sugar-sweetened beverages, candies, desserts, meat and vegetables were calculated from the single day dietary recall. These foods are grouped through the dietary analysis program NDS-R using USDA food groupings. Sugar-sweetened beverages include flavored milk, carbonated soft drinks, fruitades and drinks,

non-fruit beverages, and tea. Use of artificial sweeteners was not included in the sweetened beverage group. Candy included candies, ices and popsicles, gelatin desserts, jams, jellies, preserves, syrups, and added sugar. Desserts included frozen milk desserts, puddings and custards, cake, cookies, pies, cobblers, éclairs, turnovers, other pastries, Danishes, breakfast pastries, doughnuts, granola bars, and pop tarts. Meats included beef, pork (with the exception of bacon), lamb, poultry, lunchmeats, organ meats, shellfish, and frozen and shelf-stable plate meals. Vegetables included raw and cooked vegetables, dried beans and peas, and vegetarian meat substitutes. Ketchup and French fries were not included in the vegetable group.

Exposures

The independent, or exposure, variables in this study included social desirability, child weight status, and gender.

Social Desirability

A five-item measure of socially desirable responses was administered in the form of a questionnaire. The questionnaire was adapted from that of Hays and colleagues (17), which takes approximately one minute to complete (Table 1). The five questions developed are provided in Table 1.

These questions were pilot tested with 11 children in Knox County and Blount County, TN. The results of the pilot test caused the researchers to reword questions one, three and four, but the new questions were not retested. Through the process of

Table 1.
Hays Social Desirability Scale

Question	Socially desirable answer
1. I'm always courteous even to people who are disagreeable. (I am always polite even to people who are disagreeable)*.	definitely or mostly true
2. There have been occasions when I took advantage of someone.	definitely or mostly false
3. I sometimes try to get even rather than forgive and forget. (I sometimes try to get back at someone rather than forgive and forget)*	definitely or mostly false
4. I sometimes feel resentful when I don't get my way. (I sometimes hold a grudge when I don't get my way)*	definitely or mostly false
5. No matter who I'm talking to, I'm always a good listener.	definitely or mostly true

*Adapted items

interviewing children in Monroe County with the new social desirability questions, prompts had to be developed by the researchers for times when children still were unsure about the meaning of some of the words. Because prompts were developed over the course of data collection, a test was performed to see if the date of survey completion influenced social desirability responses. The test found no significant difference in social desirability by date. Unfortunately, the Hays scale has never been validated with children, thus the rewording and prompts had to be developed by the researchers.

Social desirability was scored 0 to 5 by counting the two most extreme answers – definitely true or mostly true and definitely false or mostly false. Definitely false or mostly false were coded as 1 in questions #2, #3, and #4, while definitely true or mostly true was coded as 1 in questions #1 and #5 to provide the social desirability score. The score was then recalculated for each child by recoding 5 item scales into dichotomous variables with 0 being “not concerned with social desirability” and 1 being “concerned

with social desirability¹.” Students who were not concerned with social desirability answered at least one question in a manner that is not socially desirable. Hays used only the most extreme response for each question and assigned a score based on the proportion of socially desirable responses. In a cross validation study, Hays describes using a cut point similar to the method used in this study however, the cut point was not defined. For the purposes of this study the most conservative cut point, 5 socially desirable responses, was used to categorize children as “concerned with social desirability.”

Weight Status

BMI was calculated based on each child’s height and weight data. Each child had his or her height and weight measured by trained school nurses according to CDC protocol. Weight measurements were calibrated to the nearest 100th pound. The height and weight measures allowed the researcher to calculate BMI percentile according to CDC/NCHS revised growth charts (18) for each child. Children with a BMI at or above the sex- and age-specific 85th percentile and less than the 95th percentile cutoff points were classified as at risk for overweight, while children at or above the 95th percentile were classified as overweight. Both overweight and at risk for overweight (BMI \geq 85th percentile) children were assigned to a group called “overweight.” A dichotomous variable that indicated the presence or absence of overweight status was generated.

¹ Hays uses terminology “higher degree of SDRS [socially desirable response set] tendencies.” For readability the terminology “concerned with social desirability” is used in this study.

Gender

Gender was noted by the interviewer on both the paper survey and the computer assisted dietary recall. The gender variable recorded in both instruments was compared and verified with the child's name to be sure it was recorded correctly. Gender was coded as 0 for male and 1 for female in the study.

Analysis

All statistical analyses were conducted using SPSS-13.0 (Chicago, IL).

Aim #1

To address specific aim #1, the proportion of children that were concerned with social desirability were reported alone and stratified by child gender and weight status. In addition, descriptive statistics of these sample characteristics were reported, as were age statistics. A birth date was required in the program NDS-R for each child to proceed with the dietary recall. Race/ethnicity was not reported because the sample was predominantly white, with no black and only three Latino children. Parent's education level was eliminated from analyses because this information was deemed unreliable, as most children did not know the highest completed level of education of their parents.

Aim #2 and #4

To determine if reported caloric intake and percent calories from fat and servings of sugar-sweetened beverages, candies, desserts, meat and vegetables were altered due to

social desirability and child weight status, differences among groups were tested using ordinary least squares regression and multinomial logistic regression. In adjusted analyses, weight status, gender, age and interactions between both social desirability and weight, and social desirability and gender were controlled for using the same regressions to meet specific aim #4.

Aim #3

To determine if weight status modifies the effects of social desirability on reported energy and fat intake, test effect modification was run based on the following regression model: $Y_{\text{dietary outcome}} = \text{constant} + X_{\text{overweight}} * X_{\text{social desirability}} + \text{error}$.

Model

The multiple regression equation was $F = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + e$, where F indicated the final outcome factors. These included energy (kcal), fat intake (percent of total kcal), and intake of sugar-sweetened beverages, desserts, candy, meat and vegetables (servings per day). Other variables included in this equation were: regression weight as indicated by b_i (where $i=1$ to 3), X_1 as the social desirability factor, X_2 as the overweight factor, X_3 as the gender factor, and e as the unexplained error.

RESULTS

Sample Description

There were slightly more girls (n=129) than boys (n=125) in the study, as depicted in Table 2. There were slightly fewer overweight participants (n=103) than not overweight participants (n=123) for an overall overweight prevalence of 40.4% in the analytical sample. Most of the children were between nine and ten years old (76.1%) and only 2 participants were older than 11 years (0.8%). One participant did not have a code for gender or BMI, while an additional 28 did not have BMI data. No results were missing for social desirability responses.

Of the results included in the study, outliers in each analysis were eliminated to improve the estimations of ordinary least squares regression. A box and whiskers plot was used to eliminate the outliers. All of the valid intakes were based on the outliers defined in a box and whiskers plot analysis. Briefly, outliers are those values that are 1.5 to 3 times the interquartile range (length of the box).

The distribution of energy, percent calories from fat, servings of all sugar-sweetened beverages, meats and vegetables were distributed normally after eliminating outliers. Valid energy intakes were identified as greater than 500 kilocalories per day and less than 4000 kilocalories per day (n=244), and valid percent fat intakes were greater than or equal to 17.5% and less than or equal to 50% (n=246). Valid sugar-sweetened beverage intakes were less than or equal to 9.4 servings (n=248) and valid meat intakes

Table 2.
Description of the Baseline Sample of 4th Grade Youth Can! Participants, 2004*

Gender^a	#	%
Male	125	49.0
Female	129	50.6
Weight Status^b		
Not overweight	123	48.2
Overweight	103	40.4
Age^c		
9 years, 1 month - 10 years, 0 months	194	76.1
10 years, 1 month – 11 years, 0 months	31	12.2
11 years, 1 month – 11 years, 4 months	2	0.8

^a Missing gender for 1 participant

^b Missing BMI for 29 participants

^c Missing age for 28 participants

were less than or equal to 5.4 servings (n=249). Valid vegetable intakes were less than or equal to 2.35 servings (n=241).

To account for non-normal distribution of candy and dessert intakes, tertiles were created and all intakes were included. A sensitivity analysis was performed with jams, jelly and preserves to determine if these foods were subject to the same level of social desirability bias as other candies. Analyses were run with and without these variables. Because no change in direction of the effect was found, jams, jellies and preserves were eliminated from candy analysis.

The nutrient and food group intake data for the sample are shown in Table 3. Mean intakes were similar whether outliers were included or removed from the data set. Exclusion of outliers resulted in a decrease of mean total energy intake by 122 kcal, mean total calories from fat by 0.4%, and mean servings of sugar-sweetened beverages, meat, and vegetables by 0.1.

Table 3.
*Nutrient and Food Group Mean Daily Intake of the Baseline Sample of 4th Grade Youth Can! Participants, 2004**

Nutrients	Mean intake
Kilocalories	2110 kcal
Percent calories from fat	33.8%
Food Groups	Mean # of servings
All sugar-sweetened beverages	3.4
Candy	0.8
Desserts	1.3
Meat	1.5
Vegetables	0.4

*Table does not include outliers

Social Desirability

Results of the social desirability response set are shown in Table 4. The first part of the table provides information on the number and percentage of participants who answered each question in a socially desirable manner. In each of the five questions, the two most socially desirable responses (definitely true and mostly true, or definitely false and mostly false) were recoded in the data set. Questions number one and five were the two socially desirable answers (definitely true or mostly true) most students chose, while questions number two, three, and four had about 50% of the students responding in a socially desirable manner (definitely false or mostly false). The socially desirable scores were then tallied for each participant to provide a total “social desirability score” and the results are presented in the second half of Table 4. Most participants gave two (25.1%), three (25.5%), or four (23.1%) socially desirable answers. There were 32 participants (12.5%) who responded to all five questions in a socially desirable manner. When the dichotomous variable was formed, these 32 participants were given a score of 1 to

Table 4.
Social Desirability Responses and Scores of the Baseline Sample of 4th Grade Youth Can! Participants, 2004

Frequency of Socially Desirable Responses	#	%
Q1: I am always polite even to people who are disagreeable	174	68.2
Q2: There have been occasions when I took advantage of someone	117	45.9
Q3: I sometimes try to get even rather than forgive and forget.	112	43.9
Q4: I sometimes feel resentful when I don't get my way	128	50.2
Q5: No matter who I'm talking to, I'm always a good listener.	211	82.7
Social Desirability Score		
0 Socially Desirable responses	12	4.7
1 Socially Desirable response	23	9.0
2 Socially Desirable responses	64	25.1
3 Socially Desirable responses	65	25.5
4 Socially Desirable responses	59	23.1
5 Socially Desirable responses	32	12.5
Social desirability Dichotomous Score		
0 – Not at all concerned with social desirability	223	87.5
1 – Concerned with social desirability* (variable used in the subsequent analysis)	32	12.5

*Participants concerned with social desirability responded to all 5 questions in a socially desirable manner.

indicate they were concerned with social desirability. All other students were given a score of 0 to indicate an absence in concern for social desirability. One child concerned with social desirability was eliminated from the percent calories from fat analysis and one was eliminated from the vegetable analysis.

Table 5 provides a summary of the gender and weight status of the participants who responded in a socially desirable manner. Of the 32 children who provided one of the two most socially desirable responses for every question, 10 were boys (8% of the total sample of boys) and 22 were girls (17.1% of the total sample of girls). The BMI of two children concerned with social desirability is unknown, but 15 of the rest of the 30 participants (or 50%) were overweight (defined in this study as a BMI greater than or

Table 5.
Prevalence of Social Desirability Trait among Boys and Girls and Overweight Status in the Baseline Sample of 4th Grade Youth Can! Participants, 2004

	Social Desirability	
	#	%
All	32	12.6
Boys	10	8.0
Girls	22	17.1
Overweight	15	14.6
Boys	5	7.8
Girls	10	16.9

equal to the 85th percentile). Five of the 15 overweight participants who responded with the social desirability trait were boys, while the other 10 were girls.

Outcomes

Table 6 describes the results of calories, percent calories from fat, servings of all sugar-sweetened beverages, servings of meat, and servings of vegetables in the multivariate regression. Beginning with the macronutrients, there was not a crude or adjusted effect of social desirability on energy intake in the whole sample. However, the interaction between social desirability and gender indicates that girls who were concerned with social desirability showed a significant ($p \leq 0.05$) association with a decreased calorie intake. The overweight participants with the social desirability trait did not report significantly more or less total kilocalorie intakes than other participants. There were no significant differences in the percent of kilocalories from fat by social desirability trait alone or by the interaction of social desirability with gender or overweight status.

Table 6.

Results of the Regression Models to Assess the Effect of Social Desirability Bias in Nutrient and Food Estimates for Females (n=129)

Social Desirability												
	Crude		Adjusted no interaction		Adjusted SD*Weight		Beta (SD*Weight)		Adjusted (SD*Gender)		Beta (SD*Gender)	
	β	<i>P</i>	β	<i>P</i>	β	<i>P</i>	β	<i>P</i>	β	<i>P</i>	β	<i>P</i>
Kcal	-37.18	0.78	64.48	0.63	95.89	0.61	-63.49	0.81	421.27	0.06	-557.87	0.05
% Fat kcal	0.01	0.61	0.01	0.51	0.01	0.63	<0.00	0.98	0.02	0.35	-0.02	0.51
Sugar-sweet beverages	0.45	0.25	0.38	0.34	-0.19	0.74	1.15	0.15	-0.15	0.82	0.84	0.32
Meat	0.02	0.94	0.12	0.59	0.09	0.78	0.08	0.87	-0.09	0.82	0.33	0.49
Vegetables	-0.02	0.87	-0.02	0.89	-0.11	0.51	0.21	0.41	-0.26	0.24	0.37	0.17

Among the food groups, consumption of sugar-sweetened beverages did not appear to be affected by social desirability bias. It is interesting to note that overweight participants concerned with social desirability consumed slightly more servings of sugar-sweetened beverages than their non-overweight counterparts who were concerned with social desirability. Concern for social desirability did not significantly impact reported consumption of meat or vegetable servings in this study.

Results of the outcome variables candy and dessert servings are presented in Table 7. Participants concerned with social desirability were three times more likely to report consuming 0.02 to 0.59 servings (zero to one-half of a serving) of candy than no candy (CI: 1.15-8.18) as compared with participants not concerned with social desirability. When controlling for the interaction between weight and the social desirability trait, it appears that participants concerned with social desirability were five and a half times more likely to report consuming 0.02 to 0.59 servings of candy than no candy (CI: 1.49-21.90). The results were not significant when the interaction between gender and social desirability was included. Being concerned with social desirability was not associated with dessert reports in the adjusted analysis.

DISCUSSION

In a recent publication Livingstone and Robson (19) discussed several factors, including age, which influence dietary intake in children. They state that children who are 7-10 years old may fully comply with the reporting process (of dietary reports)

Table 7.

Results of the Multinomial Regression Models to Assess the Effect of Social Desirability Bias in Food Estimates of Candy and Desserts for Females (n=129)

Social Desirability												
	Crude		Adjusted no interaction		Adjusted SD*Weight		OR (SD*Weight)		Adjusted (SD*Gender)		OR (SD*Gender)	
Candy	OR	CI	OR	CI	OR	CI	OR	CI	OR	CI	OR	CI
No candy	Reference		Reference		Reference		Reference		Reference		Reference	
0.02-0.59	3.08	1.21-7.81	3.07	1.15-8.18	5.70	1.49-21.90	3.75	0.50-28.09	4.02	0.79-20.39	1.51	0.20-11.52
0.66-9.02	0.55	0.21-1.44	0.66	0.24-1.80	0.51	0.10-2.60	0.66	0.08-5.36	0.45	0.08-2.44	0.53	0.06-4.32
Dessert												
No dessert	Reference		Reference		Reference		Reference		Reference		Reference	
0.10-1.40	0.87	0.35-2.13	1.04	0.41-2.64	0.71	0.18-2.81	2.03	0.31-12.14	1.74	0.49-6.18	0.31	0.05-2.13
1.45-10.95	0.83	0.34-2.05	0.84	0.32-2.19	0.76	0.21-2.79	1.21	0.18-8.28	1.53	0.45-5.22	0.15	0.01-1.80

because it is a new venture for them. By adolescence, these teens may lose interest in reporting what they eat, their schedules may vary causing them to eat away from home frequently, they may inadequately estimate portion sizes, and they may have an exaggerated concern for body image (19). These statements provide twofold implications. The age group assessed in this study may be eager and willing to try and report to the best of their ability (because this is a new adventure), but if some of these children are already concerned with their body image, they may change the way they report their intake. Livingstone and Robson (19) did not discuss that this concern may begin as young as 9 or 10 years old in girls, as was found in research studies by Davison (3). It is unknown if the girls in the current study were concerned with their weight, but results showed that girls who were concerned with social desirability demonstrated a significant ($p < 0.05$) association with decreased calorie intake. Using the multiple regression model, it was found that all girls, whether they were concerned with social desirability or not, reported less calories than all boys. When comparing the girls to boys, girls not concerned with social desirability reported 136 kcal less than boys not concerned with social desirability, and girls who were concerned with social desirability reported 149 kcal less than boys concerned with social desirability. Comparing social desirability within each gender, boys concerned with social desirability actually reported 421 kcal more than the boys not concerned with social desirability, while the girls concerned with social desirability reported 137 kcal less than the girls not concerned with social desirability. Understanding the differences in the effect of concern with social desirability between boys and girls would be an avenue for future research.

Comparing this study to the studies that have assessed social desirability among adults, these girls under-reported an additional 100 calories per day than adult women. Women typically under-reported energy intake by 19-21 kcal per day and total grams of fat by 0.8g/d, especially when they were overweight or dissatisfied with their weight (9-10). Among the adult women, this translates into 7300 kcal per year, or 2.1 pounds of weight. The 9 to 11 year old girls in the current study who were concerned with social desirability reported 50,000 kcal less per year, which translates into 14.3 pounds of weight. These results did not find that this was accentuated if the girls were overweight, and did not assess if these girls were also concerned or dissatisfied with their weight. Unlike the studies performed with adult women, this study did not find any significant relationships between social desirability and weight or gender and social desirability on the reporting of percent calories from fat.

The results of this study may also be compared to the findings of Champagne, et al (20) who assessed energy intake under-reporting by doubly labeled water among children ages 9-12. These researchers found that there were no reported differences in energy intakes with respect to age and body fat. They did find that girls reported a lower energy intake than boys and the result was significant. More specifically, African-American girls reported a significantly lower energy intake than both Caucasian and African American boys, while Caucasian girls only reported a significantly lower energy intake than Caucasian boys. These researchers also presented information that all children under-reported their energy intakes by about 20% (20). This statement is important to the current study because if girls concerned with social desirability reported

137 kcal less per day than their boy counterparts, and all of the children under-reported nearly 20% of their energy intakes (440 kcal), further investigation into a possible compounding effect is necessary.

This study did not find significant differences between reports of sugar-sweetened beverages, desserts, meats or vegetables. In the Bogalusa Heart Study (7) researchers found that the consumption of sweets, meats and sugar-sweetened beverages was positively associated with being overweight; thus these food groups were included in this study. Sweets included desserts and candy in the Bogalusa study. In the current study, however, overweight children were not subject to social desirability bias in reports of sugar-sweetened beverage, meat and dessert intakes. They did demonstrate this type of bias in reported candy intakes, and the results of the data are interesting. It was expected that the overweight children concerned with social desirability would under-report their intake of candy. The data indicated that these children were three times more likely to report eating 0.02 to 0.59 servings than eating no candy. When the interaction between weight and social desirability bias was controlled for, these children were five and a half times more likely to report eating 0.02 to 0.59 servings of candy. It appears that these children were reporting eating candy, but they were more likely to report only eating up to half a serving.

There were no significant differences among intakes of sugar-sweetened beverages or meats. It was interesting that overweight participants concerned with social desirability appeared to report a higher intake of sugar sweetened beverages than their non-overweight, concerned with social desirability counterparts. Recent studies such as

the Bogalusa Heart Study (7) have found that sugar sweetened beverage and meat consumption increase the risk for overweight. In the case of sugar sweetened beverages, controlling for social desirability may be important for estimating the true effect of these beverages on weight.

Vegetable consumption was analyzed because the researchers thought there were children who were overweight that reported higher intakes of this food group than other children. It was unknown if these children were subject to social desirability bias. The results were not significant, but across the board it appeared that children in this study reported low intakes of vegetables. The average intake was half of a serving, which is consistent with national data of low youth vegetable intakes (21).

Strengths

The current status of overweight is drastic in southern states and is alarming in certain areas of East Tennessee. Children at risk of overweight or overweight make up 50.7% of all children in one East Tennessee county (22). Unfortunately, there is limited research investigating the reasons why the rates of overweight are so high in these areas, although diet likely plays a critical role. This study provides insight into one form of bias used in dietary reports among children in this area, but there is a need for more research to fully understand why these children are overweight.

A second major strength of this study is the use of the dietary assessment program, The Nutrition Data System for Research (NDS-R). This program is a state of the art instrument for investigating diet relationships (16). The program was able to

provide data for total kilocalorie and percent calories from fat from 24-hour dietary recalls as well as data for sugar-sweetened beverage, dessert, candy, and vegetable food groups. All of the interviewers were trained in the program and had some practice sessions before asking the children participating in the study for their 24-hour food recalls. Each interviewer had the same prompts, which is inherent in NDS-R, to maintain consistency.

Other strengths to this study include the use of a Coordinated School Health Program (CSHP) pilot site, use of height and weight data as measured by school nurses according to CDC protocol and the use of food models. Using a CSHP site allowed the researchers to build a relationship with the schools to investigate the eating habits of 4th graders. Having the school nurses measure height and weight allowed for accurate BMI data and allowed the researchers to focus on diet recalls. Food models were used when children needed assistance estimating the portion size of the food they consumed.

Limitations

The use of the Hays Social Desirability short-form scale may prove to be valid and reliable in children; however, it was not tested for validity and reliability prior to data collection. The Hays scale has been tested over the years and found to be a valid and reliable measure of social desirability, but no research indicates that it has ever been used with children (17). Since the collection of social desirability data in this study, a new short form of a social desirability scale for children was tested for its reliability (23).

This new scale used 14 questions from the Children's Social Desirability (CSD) scale and

was found to have adequate test-retest reliability by researchers in the spring of 2004. Because the scale is still new, it would benefit from more testing for its validity and reliability. Future research should compare the relative advantages of the 5 and 14 item questionnaires in identifying socially desirable response patterns.

As the data were analyzed, it was also noted that all recalls were provided in the months of October and November. Near the end of October and beginning of November, candy reports were high and this is likely due to the celebration of Halloween. The children may have consumed more candy than usual, and the candy may or may not have displaced other foods.

A final limitation to the study includes the missing BMI data for 29 participants. There were two children who did demonstrate a concern for social desirability whose overweight status is unknown. These two participants could have influenced the results of the study.

Suggestions for Future Research

This research does support the belief that girls differ from boys in their dietary reports and this may be due to social desirability bias. The overweight factor, which was expected to influence social desirability bias, did not show that result. This type of research is important because the question of social desirability bias in children has not been investigated to a great extent. The findings in this study support the research performed with adults and will only be strengthened through repeated trials. Now that a new children's social desirability questionnaire has become available, it would be

beneficial to replicate this study to see if results can be duplicated with the tool that has been developed for this age group.

It would also be interesting to see if candy intakes were higher because of the time frame (Halloween) and if candy was displacing certain food groups, such as vegetables. Vegetable intake was very low in this sample, which is consistent with literature available from the Youth Risk Behavior Surveillance System (YRBSS) (21), but it may have been even lower if candy displaced these healthier food options around the time of year when these data were collected.

Future intervention studies should consider measuring social desirability bias to better assess the effects of their interventions on dietary intake, particularly among girls.

Implications for Research

Understanding how certain groups estimate dietary intakes of specific foods and nutrients is essential in the study of nutrition. If systematic under- or over-reporting of select foods and nutrients occurs and can be measured, this information can provide researchers and those who provide interventions with a more valid understanding of dietary intake. This research strengthens the belief that girls are subject to social desirability bias to a greater extent than boys, even at young ages. Research studies (19-20) suggest that children typically under-report and adolescents under-report to a higher degree than younger children, making this information even more important.

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VITA

Nicolle Marie Clemente was born in Cumberland, RI on March 16, 1981. She was raised in the same town and went to Garvin Memorial Elementary School and Cumberland Middle School. She graduated from Cumberland High School in 1999. From there, she went to the University of Vermont in Burlington, Vermont and received a B.S. in Dietetics and Nutritional Food Sciences in 2003.

Nicolle is currently pursuing a dual master's degree in nutrition (M.S.) and public health (M.P.H.) at the University of Tennessee, Knoxville.