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To the Graduate Council:

I am submitting herewith a dissertation written by Marsha Lynn Spence entitled "Teachers' Classroom Food-Related Practices and Perceptions of the School Nutrition Environment." I have examined the final electronic copy of this dissertation for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy, with a major in Human Ecology.

Michael Zemel, Major Professor

We have read this dissertation and recommend its acceptance:

Sonya Jones, Carol Costello, Gary Truett, Tara Wass

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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Accepted for the Council:

Vice Chancellor and Dean of Graduate Studies

Thesis
2006b
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TEACHERS' CLASSROOM FOOD-RELATED PRACTICES AND PERCEPTIONS OF THE SCHOOL NUTRITION ENVIRONMENT

A Dissertation
Presented for the
Doctor of Philosophy
Degree
The University of Tennessee, Knoxville

Marsha Lynn Spence
December 2006

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DEDICATION

This paper is dedicated to my mother, Betty Jean Spence, whose love and faith in my abilities inspired me to reach for my dreams. Also, it is dedicated to the memory of my father, Mervin Eugene Spence, who left me with a legacy of love, humor, and enduring spirit. Lastly, it is dedicated to the memory of my aunt, Elsie Nicola Rouse, who was my first student in a make-believe classroom in 1964. She taught me to believe in things that seemed impossible.

ACKNOWLEDGEMENTS

I would like to express my sincere gratitude to everyone who supported my efforts and helped me complete this dissertation and my degree. First, I would like to thank Dr. Betsy Haughton, my mentor for the past 11 years, who first fostered my interest in community nutrition and helped me develop the skills and knowledge base necessary to succeed. Also, I would like to thank Dr. Jean Skinner, and Dr. Dileep Sachan, both of whom encouraged me to pursue a doctorate degree and had unwavering faith in my ability to succeed. Next, I would like to thank Dr. Sonya Jones who guided my research throughout the past three years and gave me the opportunity to make a real difference with my research. In addition, I would like to thank Dr. Michael Zemel who graciously chaired my committee and facilitated the completion of my dissertation. Also, I would like to thank my committee members, Dr. Carol Costello, Dr. Gary Truett, and Dr. Tara Wass for providing valuable input and excellent advice. I would like to thank Dr. Jay Whelan, the chair of my department, who gave me numerous opportunities to learn, grow, and succeed professionally. Also, I would like to thank Sonia Hardin and Kathy Davis, my community partners, who generously gave their time and provided support and friendship throughout this process. I would like to thank Ashlee Schoch who worked diligently coding transcripts and checking dietary data. Additionally, I would like to thank my husband, Pete Garza, and son, Nick Green, whose love, humor, and support helped me reach my goals. Finally, I would like to thank my other family members and friends who cheered me on throughout the years.

ABSTRACT

Objective: This research project consisted of three studies designed to investigate intermediate school teachers' classroom food-related practices and perceptions of the school nutrition environment.

Setting: The setting for this project was a rural county in the southern region of East Tennessee.

Design: This project used a mixed-methods approach to investigate teachers' food-related practices and perceptions of the school nutrition environment, including grounded theory methodology, secondary data analysis, and a cross-sectional survey.

Analyses: For the first study, the transcribed data were coded using open, axial, and selective coding and constant comparison of data. For the second study, descriptive and inferential statistics were used to compare teachers' themes to student BMI and 24-hour recall data. For the final study, a factor analysis and regression analysis was used to determine what factors were predictive of teacher food-related classroom practices.

Results: Rich details were obtained and a logic model was developed from the in-depth interviews in the first study. The second study yielded numerous significant results, including those which demonstrated that lunches students brought from home had significantly greater mean ranks of percent calories from carbohydrate and grams of total sugar and significantly less mean ranks of percent calories from protein and grams of fiber than lunches purchased at school. The factor analysis and descriptive statistics from the final study showed that many teachers used candy, pizza, and soft drinks as rewards, while fewer used more healthy food alternatives. Additionally, the regression analysis showed that years teaching at current school was predictive of less frequently reported

use of teacher food-related practices that supported healthful eating among students, while a less supportive attitude regarding the school environment was predictive of more frequent reported use of less healthful classroom food-related practices.

Conclusions: Teachers were able to identify key areas in the school environment that may have influenced students' diet quality and weight status. However, there were mixed results when comparing teacher-identified themes about the school nutrition environment with student BMI and 24-hour recall data. In addition, many teachers used classroom food-related practices that were not supportive of healthful eating behaviors among students.

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PART 1

OVERVIEW

Introduction

In 2001, David Satcher, the former US Surgeon General, declared that obesity and overweight have reached epidemic proportions in the United States (1). Thirty-four percent of US adults, ages 20 to 74 years, are overweight (Body Mass Index (BMI) = 25 to 29.9 kg/m^2) and another 27% are obese (BMI greater than or equal to 30 kg/m^2) according to the National Health and Nutrition Examination Survey (NHANES), 1999-2000 (2). According to NHANES, 1999-2000 data (3) 15.5% of adolescents ages 12 to 19 years are overweight (age- and gender-specific BMI $\geq$ 95th percentile) and 15.3% of children ages 6 to 11 years are overweight (age- and gender-specific BMI $\geq$ 95th percentile). Other studies have found similar or even higher overweight prevalence rates among children and adolescents (4-6). Therefore, more than half of U.S. adults and nearly a third of U.S. children are at increased risk of the health and social consequences of overweight and obesity.

Children and adolescents who are overweight or at risk of overweight (age- and gender-specific BMI $\geq$ 85th percentile) suffer both negative psychosocial (7-9) and physiological long-term consequences (7-14). Overweight children and adolescents may encounter social isolation and discrimination from both adults and their peers and may develop a distorted body image and preoccupation with weight (7-9). Overweight adolescents are at risk for low self-esteem (7-9), which for female adolescents can persist into adulthood, adversely affecting their college completion rates and economic earning potential (7-8). In addition to the negative psychosocial factors associated with childhood and adolescent overweight, increased morbidity and mortality risks threaten the long-term health of overweight youths (7-14). Overweight children and adolescents

are significantly more likely to become overweight or obese adults, with the accompanying risks of dyslipidemia, hypertension, cardiovascular disease, certain types of cancer, glucose intolerance, type II diabetes mellitus, cholecystitis, sleep apnea, gout, and hip fractures (7-14).

In response to this national epidemic, Tommy Thompson, the US Secretary of the Department of Health and Human Services (DHHS), and former Surgeon General David Satcher have called upon individuals, families, communities, schools, organizations, worksites, health care providers, public health professionals, researchers, and the media to work collectively and collaboratively to help find solutions to this public health problem (1). Additionally, Health People 2010 (15), the nation's most comprehensive health promotion and disease prevention initiative, includes overweight and obesity as one of the leading health indicators and has set an objective to reduce the proportion of children and adolescents who are overweight or obese. Indeed, numerous other national, state, and local initiatives, training guides and program plans have been developed to help lower the prevalence of childhood overweight and at risk of overweight (1). Yet, in the midst of these promising strategies, the prevalence rate of childhood and adolescent overweight and at risk of overweight continues to rise (3).

Multiple genetic and environmental factors and their complex interactions are contributing factors to childhood and adolescent overweight (16). Although the genetic link to childhood and adolescent overweight is well documented and may account for 25 to 40% of the variance in BMI in the population (16-18), genetic factors cannot explain the dramatic rise in the rate of childhood and adolescent overweight during the past four decades, as significant genetic changes within any given population cannot occur this

rapidly (16,18). Thus environmental factors, such as familial and psychosocial factors, physical activity patterns, dietary factors, mass media, and societal changes, are generally thought to be the multi-factorial causes of the dramatic increase in childhood and adolescent overweight during recent decades (16,18-21).

In recent years there has been growing concern regarding the effect of food commercialism, both at home and at school, on the prevalence of childhood and adolescent overweight (22). This commercialism, which has gained access into public and private schools through "pouring rights" soft drink and commercial fast food contracts, along with increased vending machine access, may be undermining national efforts to improve the overweight and at risk of overweight rates and dietary intake of children and adolescents (22-23). Further, even though national guidelines recommend that food should not be used as a reward and students should not have access to low-nutritive quality foods (24-25), the use of candy and other non-nutritious foods and beverages as rewards and to raise funds is well established in the nation's schools (23).

Numerous social marketing campaigns and school-based nutrition interventions have been conducted to help improve children's overall health and diet quality and to reduce the overweight/at risk of overweight epidemic in school children (21, 26-48). Additionally, many national studies to evaluate the quality of school meals have been performed (49-52). However, only a few studies have addressed classroom food-related teacher practices (53-56). Therefore, limited data exist regarding the type of snack foods and beverages available to students in the classroom, the use of food as incentives or rewards in the school setting, or the impact these foods and beverages have on children's dietary intake of simple sugars, total dietary fat, saturated fat, fiber, and cholesterol.

The Centers for Disease Control and Prevention (CDC) and the United States Department of Agriculture (USDA) suggest that schools have written nutrition policies to limit access and availability of low-nutritive quality foods and beverages (24-25). The guidelines, issued by both agencies, assert that development and implementation of such policies are fundamental in improving the school nutrition environment and are the framework necessary in implementing all other guidelines.

In June 2004, the Child Nutrition and WIC Reauthorization Act of 2004 became law (Public Law 108-265) (57). This law mandated that all local education agencies that participate in the National School Lunch Program (NSLP) must establish local "school wellness policies" by the beginning of the 2006-07 school year. Among the key components of this directive were setting minimum standards for nutrition education, physical activity, and other wellness activities; implementing guidelines for all foods available on the school campus during the school day with set objectives for promoting health and reducing obesity; establishing a plan for measuring implementation of the policy; and including parents, students, representatives of school food service, the school board, school administrators, and the public in the development of the wellness policies. In addition, the Tennessee State Legislature passed a bill to amend state code (TCA. 49-6-2307) (58), which directed the State Board of Education to develop rules and guidelines on minimal nutritional standards of foods and beverages sold outside the National School Lunch Program for schools that house students from pre-kindergarten to the eighth-grade. The State Board of Education set forth these rules (Chapter 05201-6.04) to be implemented by all schools that house students from pre-kindergarten to fifth-grade by

the beginning of the 2006-07 school year and by the beginning of the 2007-08 school year for all other schools that house sixth- through eighth-grade students (59).

Research Goal and Specific Aims

Originally, the overall goal of the proposed project was to delineate the school nutrition policy making process and test the feasibility of improving classroom food-related teacher practices by involving teachers in the development of formal school nutrition policy. However, major developments in state and federal regulations regarding school food policies prompted changes at the local level. Although principals in the intervention schools agreed to use the formal nutrition policies developed by the school nutrition policy committee, which included teachers, as the foundation for the wellness policies, they decided to wait to implement the policies until the beginning of the 2006-07 school year, so that nutrition policy committee chairs and administrators could attend county-wide wellness policy development meetings in the spring of 2006. Both thought this was important to ensure that the new policies would satisfy all new mandates and could be implemented at the same time as all other schools in the district. In addition, many of the control schools began implementing changes in the school nutrition environment to begin the transition to meet the new mandates. Therefore, the policy making process, as originally planned was altered. Thus, the overall goal and last objective of the original proposal were changed to adapt to these community changes. The amended goals of this study were to gain insight about teachers' classroom food-related practices and their perceptions of the school nutrition environment and to provide baseline evaluation of intermediate grade (grades 3 to 5) teachers' classroom food-related practices. The specific aims were:

1) Using in-depth interviews, the researcher ascertained intermediate school (grades 3-5) teachers' perceptions about how the school environment, including classroom food-related teacher practices, influences students' overall dietary quality, weight status, and health.
2) Using secondary analysis of students' BMI and 24-hour dietary recall data, the researcher validated teacher-developed themes about how the school environment impacts students' overall dietary quality and weight status.
3) Using a cross-sectional survey of intermediate school teachers in Monroe County schools, the researcher collected baseline data on teachers' food-related classroom practices and determined significant predictors of these practices.

After the dissertation study is completed, a follow-up survey will be administered to all intermediate grade teachers in Monroe County during the 2006-07 school year to evaluate the effectiveness of the wellness policies and state mandate in improving reported classroom food-related practices.

Review of the Literature

Dietary Factors and Childhood Overweight

Much research has been devoted to examining the role of dietary factors in the etiology of childhood overweight and at-risk of overweight. Most of the research has focused on children's total caloric intake. However, although one longitudinal study (60) showed that an increase in reported total caloric intake among children ages 9 to 14 years predicted greater BMI increases ($.0059 \pm .0027$ kg/m^2 per increase of 100 kcal/day and $.0082 \pm .0030$ kg/m^2 per increase of 100 kcal/day for girls and boys, respectively), most

short-term studies have found little evidence to suggest a clear link between total caloric intake and childhood overweight (20,61). Generally, two major problems occur in studies designed to test the relationship between caloric intake and childhood overweight. First, children may not be able to conceptualize portion sizes, which may lead to underreporting of foods consumed. Secondly, typical dietary data collection methods are not accurate enough to detect the differences in caloric intake necessary to show a significant effect on weight (61). Given these limitations, many researchers have begun to examine other dietary factors, including dietary fat intake, fruit and vegetable intake, snacking, soft drink consumption, and fiber intake, as potential contributors to the epidemic of childhood overweight (19-20,62-73).

Dietary Fat Intake

Dietary fat intake and its potential contribution to childhood and adolescent overweight has been the focus of numerous studies. Troiano and colleagues (64), using National Health and Nutrition Examination Survey (NHANES) III data, found that there was little variation by age or gender groups for the mean percentage of total daily caloric intake from dietary fat or saturated fat, with aggregate means of 33.5% dietary fat and 12.2% from saturated fat for children and adolescents ages 2 to 19 years. Using NHANES I, II, and III data sets, the researchers found that there was a slight decline in the mean percentage of daily energy from both dietary fat and saturated fat, but percentages remained above national recommendations. The age-adjusted mean percentage of calories from total fat decreased from 36-37% to 33-34% and the mean percentage of calories from saturated fat decreased from 14% to 12% across age and gender groups, using NHANES I and NHANES III data. Further findings from

NHANES III data, conducted by Anand and associates (65), showed that the mean percentage of total caloric intake from dietary fat was positively and significantly associated with age and gender specific BMI ≥85th percentile in a subsample of 7- to 16-year-old children and adolescents.

Obarzanek and associates (66) analyzed data from 3-day food and physical activity records, activity-patterns questionnaires, and an assessment of hours spent viewing television for 2,379 black and white females ages 9 to 10 years, who were enrolled in the National Heart, Lung, and Blood Institute Growth and Health Study. Using multivariate-regression analyses, the results showed that the best model to explain the variation in BMI and skin-fold measurements for black females in the study included age, hours of television/video viewing, the percentage of energy from saturated fat, and the activity-patterns score. For white females in the study, the best model included age, hours of television/video viewing, and the percentage of energy from total fat.

In another study of 9- to 10-year-old children (100 males and 162 females), Tucker and associates (67) grouped children into three categories based on their body fat percentages, which were calculated by the average of three skin-fold measurements of the triceps, calf, subscapular, and abdomen. The results showed that the average percentage of calories from dietary fat was positively associated with body fat percent, even after controlling for confounding variables (gender, total energy intake, fitness level, and parental BMI). For each percentage point increase in calories from dietary fat, percent body fat tended to increase about 1/5 of a percentage point. In addition, the results showed that children in the group with the highest percent body fat consumed a significantly higher percentage of calories from dietary fat compared to children in the

group with the lowest percent body fat, after controlling for confounding variables (36.6%) of calories from dietary fat for those in the group with the highest percent body fat compared to 34% of calories from dietary fat for those in the group with the lowest percent body fat; $p=0.0226$).

Another study, which investigated the link between dietary fat intake and childhood overweight, found several significant associations. McGloin and associates (68) used a cross-sectional study of 114 children (66 males and 48 females) ages 5 to 8 years and classified the children as obese (OB) if their BMI was >95th percentile, as high-risk (HR) if at least one parent had a BMI >29.5 kg/m^2, and as low-risk (LR) if neither of their parents had a BMI $\geq$25 kg/m^2. Dietary intake was measured using 7-day records that required parents to weigh all foods consumed by the children. In addition, children's body fatness was measured using deuterium isotope dilution during total energy expenditure measurements by a doubly labeled water method. The results showed that the percentage of calories from dietary fat in this sample was 27 to 47%. Children in the OB group consumed significantly more dietary fat (+12g/day; $p<0.05$), a greater percentage of calories from dietary fat (+3%; $p<0.05$), and a lesser percentage of calories from carbohydrate (-4%; $p<0.05$) than children in the LR group, but no other significant differences were observed between the groups in macronutrient consumption or the proportion of calories from macronutrients. After analyzing the relationship between body fatness and each macronutrient as separate independent variables, a stepwise regression analysis showed that the percentage of calories from dietary fat was the only significant predictor of body fatness ($r^2=0.05$; $p<0.05$). Since this was the only significant association with body fatness, the researchers analyzed the data using quartiles

of the percentage of calories from dietary fat. These results showed that children in the highest quartile of fat intake had a significantly higher mean body fat percentage than those in the lowest quartile of fat intake (24.9% body fat in children in the highest quarter of fat intake compared to 19.5% body fat in children in the lowest quarter of fat intake; $p<0.05$). The trend for increasing body fatness with increasing percentages of calories from dietary fat was significant as well ($p<0.05$).

Although the effect of dietary fat intake on the development of childhood obesity is still tentative, these studies, along with other studies with younger children and adolescents (62,69-70), have demonstrated a significant relationship. It is biologically plausible that diets high in dietary fats may be more obesigenic than diets lower in dietary fats, because high-fat diets are usually energy dense and very palatable, which may lead to passive over-consumption of energy (74-75). In addition, it is theorized that dietary fats may promote obesity through the metabolic efficiency in which they are stored in adipocytes (74-75).

Fruit and Vegetable Intake

Some studies have reported significant associations between childhood overweight and low fruit and vegetable intakes (20,63-65). It is theorized that daily intakes of adequate fruits and vegetables lower overall daily energy density and increase fiber intake, which may lead to greater satiety (71). According to NHANES III data (72), children do not consume the recommended five or more daily servings of fruits and vegetables. These data indicated that less than 15% of elementary school students consumed the recommended servings, with average intakes of approximately 2.4 servings per day. The 1999 California Children's Healthy Eating and Exercise Practice Survey

(CalCHEEPS) (89) used mailed questionnaires to survey 814 children ages 9 to 11 years, and found that compared to children who were not at risk for overweight, children who were overweight (BMI ≥95th percentile for age and gender) or at risk for overweight (BMI ≥85th and <95th percentile for age and gender) reported consuming significantly less servings of fruits and vegetables (2.8 servings vs. 3.1 servings; p=.05).

Similar findings have been reported in adolescents and in younger children (73,76). In a study of 36,284 students in grades 7 through 12, Neumark-Sztainer and associates (73) reported that a greater percentage of overweight adolescents (BMI > 23.8 kg/m^2) consumed inadequate intakes of fruits and vegetables (<5 servings of fruits and vegetables) compared to adolescents who were not overweight (BMI < 23.8 kg/m^2) (31.9 % vs. 27.3% inadequate fruit intake; p<0.00001 and 38.2% vs. 35.6% inadequate vegetable intake; p<0.00001, respectively). Further, in a cross-sectional study of 1,468 children ages 5 to 7 years, Muller and associates (76) found that overweight and obese children (BMI ≥85th and <95th percentile for age and gender and BMI ≥95th percentile for age and gender, respectively) consumed significantly fewer servings of fruits and vegetables than did children with BMI <85th percentile for age and gender. Although these studies do not show a cause and effect relationship between low fruit and vegetable intake and childhood and adolescent overweight, the associations may be indicative of displacement of fruits and vegetables with more energy-dense or high-fat foods.

Soft Drink Consumption

Over the past three decades, there has been a shift in the types of foods U.S. children and adolescents consumed (77-80) and where they consumed them (78-79). More foods were consumed away from home (20,77-79), with an increase in the

consumption of soft drinks, high-sodium snacks, and pizza (20,77-80). Several recent studies suggested that there may be a relationship between soft drink consumption and childhood and adolescent overweight (20,63-64,81-82). In a prospective study of 548 school children ages 11 to 17 years, living in Massachusetts, Ludwig and colleagues (81) examined baseline and follow-up data from a student questionnaire assessing dietary intake, physical activity, and television viewing. The results showed that for each additional sugar-sweetened beverage serving consumed, BMI significantly increased (mean 0.24 kg/m^2; 95% CI: 0.10-0.39; p=0.03), and there was a 60% increase in the risk of obesity (odds ratio 1.60; 95% CI: 1.14-2.24; p=0·02), after controlling for confounding variables. Additionally, consumption of sugar-sweetened beverages at baseline was independently related with changes in BMI (mean 0.18 kg/m^2 for each daily serving; 95% CI: 0.09-0.27; p=0.02), which demonstrated that for each 12 fluid ounce serving consumed per day, there was an associated increase in BMI of 0.18 point . In another prospective study of 196 normal weight pre-menarche females ages 8 to 12 years, who were followed until four years after menarche, Phillips and colleagues (82) found that soda consumption was significantly associated with BMI z scores over the 10-year study period.

Two larger studies demonstrated similar findings. In the Bogalusa Heart Study (19), 24-hour recall data from a cross-sectional sample of 1,562 10-year old children showed that consumption of sweetened beverages (soft drinks, fruit flavored beverages, and sweetened tea and coffee) was positively associated with at risk of overweight status (BMI $\geq$85th percentile; p<0.001). Further, in an examination of energy and fat intakes of U.S. children and adolescents from the NHANES, 1988-1994, Troiano and associates

(64) found that when the contributions of all beverage (soft drinks, dairy beverages, juices) intakes to energy were stratified by weight status, each age and gender group of overweight children and adolescents had greater proportions of energy from beverages than did normal weight children in corresponding age and gender groups, with the exception of females ages 12 to 19 years. Further, soft drink intake contributed a greater proportion of energy for overweight children and adolescents in all age and gender groups than for normal weight children in corresponding age and gender groups.

A recent report from the World Health Organization (WHO) considered the aggregate evidence from available studies on the link between added sugar consumption and obesity to be strong enough to recommend that individuals restrict added sugars to less than 10% of total calories per day (83). Further, in 2004, the American Academy of Pediatricians (AAP) issued a policy statement regarding soft drinks and other sweetened beverages in schools (84). This policy statement recommended that pediatricians should advocate for removal of soft drinks from schools, both as items for sale through vending and school stores and through consumption in the classroom. It has been hypothesized that soft drinks and other sugar-sweetened beverages may cause excess energy intake and promote weight gain due to their high glycemic index or because individuals are less likely to compensate for calories consumed in liquids than for calories consumed in solid foods (85-86).

Snack Food Consumption

Fewer studies have examined the relationship between energy-dense or low-nutritive-quality snacks and children's weight status. Therefore, this relationship is still uncertain (87). However, it is clear that there has been an increase in snack consumption

over the past several decades. Neilson and associates (77), using the 1977 to 1998 Nationwide Food Consumption Survey (NFCS77) and the 1989 to 1991 and 1994 to 1996 (and 1998 for children age 2 to 9) Continuing Survey of Food Intake by Individuals (CSFII) data, found that there was a significant increase in calories consumed as snacks for all age and gender groups in the U.S. (from 11.3% in 1977 to 17.3% in 1996; $p<0.01$) and that snack foods represented a greater portion of the diets of children and adolescents ages 2 to 18 years than for any other age group (13% in 1977 and >20% in 1996). Another study by Jahns and colleagues (78), using the NFCS77 and 1989 to 1991 and 1994 to 1996 CSFII data sets, found similar results. In addition, they found that although the mean snack size and calories per snack were relatively stable among children ages 6 to 11 years and adolescents ages 12 to 18 years, the mean number of snacking occasions significantly increased among both groups (from 1.56 in 1977 to 1.99 in 1996; $p=0.01$ and 1.60 in 1977 to 1.97 in 1996; $p=0.01$, respectively), with a subsequent significant increase in the mean total daily calories from snacks (from 347 calories/day in 1977 to 462 calories/day in 1996; $p=0.01$ and 460 calories/day in 1977 to 612 calories/day in 1996; $p=0.01$, respectively).

A few studies have found a relationship between snack food consumption and childhood overweight. The Bogalusa Heart Study (19) results showed that the total gram amount of snack foods consumed was positively related to childhood overweight status (odds ratio 1.24; 95% CI: 1.02-1.50; $p<0.01$). However, the percentage of variance explained by the total gram amount of snacks was only 1%. Also, the CalCHEEPS study (63) found that in a sample of 9- to 11-year-old children, a larger percentage of children who were overweight or at risk of overweight consumed high-fat snacks on the survey

date compared to children who were not overweight or at risk of overweight (87% of children who were overweight or at risk of overweight children compared to 79% of children who were not overweight or at risk of overweight; p=0.05). However, this was not adjusted for socioeconomic status or race and ethnicity. In a study of 88 children ages 9 to 12 years in Ohio, Ricketts (88) found that in children who preferred and consumed high-fat snack foods, triceps skinfold measurements and BMI were positively correlated with high fat food preferences ($r = 0.51$ and $r = 0.46$; $p < 0.05$, respectively). Although further studies are needed to fully investigate the link between snack food consumption and childhood overweight, there was enough evidence to suggest that increased consumption of snack foods, especially energy-dense and high-fat snacks, may be a potential contributor to the national epidemic of childhood overweight (78).

Fiber Intake

Although only a few studies have shown a significant relationship between childhood overweight and low dietary fiber intake, the growing body of evidence in adult populations warrants examination (89). In general, foods that are high in fiber tend to be less energy-dense, are lower in dietary fat, and have greater bulk than foods low in fiber. Because of the increased bulk, high-fiber foods may induce satiety and slow the rate of gastric emptying, prolonging satiation (61). A few epidemiological studies demonstrated that in adult males and females, dietary fiber intake was lower in obese individuals than in non-obese individuals (90) and BMI was lower in both male and female adults who consume a high-fiber diet (91).

Limited data have shown a significant association between childhood overweight and low dietary fiber intakes (92-93), but it was clear that children's dietary fiber intakes

fell well below the new Dietary Reference Intakes of 26 grams and 31 grams per day for girls and boys ages 9 to 18 years, respectively (94). NHANES III results (95) showed that the mean total dietary intakes per day for females and males ages 6 to 11 years were 13 grams and 14 grams per day, respectively, and for females and males ages 12 to 15 years were 13 grams and 16 grams per day, respectively. Over the past several decades, national survey results have shown consistently that children's intakes of dietary fiber have not met national recommendations (96).

There was some empirical evidence that low dietary fiber intake may be involved in the development of childhood overweight. In a study of 878 children and adolescents ages 11 to 15 years, Patrick and colleagues (92) found that that girls and boys in the at-risk and overweight group (BMI $\geq$85th percentile for age and gender) consumed fewer total grams of dietary fiber per day than those girls and boys in the normal weight group (BMI<85th percentile for age and gender) ($p = .01$ for girls; $p < .001$ for boys). The researchers examined the proportion of children and adolescents who met the "age + 5 grams" fiber recommendation and found that only a small proportion of children in any group met the recommendation, but a larger percentage of boys in the normal weight group met the fiber intake guideline than boys in the at-risk and overweight group (25% vs. 14%; X^2=8.3; p=.004). Similar results were demonstrated in another study of 242 Native Canadian children and adolescents ages 10 to 19 years from a community with high rates of adult obesity and type 2 diabetes. Hanley and associates (93) found that fiber consumption, calculated from 24-hour recall data, was significantly associated with a decreased risk of overweight (OR = 0.69; 95% CI: 0.47, 0.99 for each 0.77 g/MJ increase in fiber intake).

Even though two longitudinal studies found no significant association between dietary fiber intake and childhood overweight (61-62), the potential role of dietary fiber in the prevention and treatment of childhood overweight cannot be dismissed, because both studies had methodological limitations. In the National Heart, Lung, and Blood Institute Growth and Health Study (61), there was a suggestion that 9 and 10 year-old females in the upper quartile of adiposity consumed fewer total grams of dietary fiber per day than did females in the lowest quartile, but further multivariate analysis showed no significant effect. However, the major weakness of this study was that fiber may have been subsumed under carbohydrate intake, which limited full investigation of dietary fiber as a potential predictor of weight status.

The other longitudinal study that found no significant association had major weaknesses as well. This study, by Berkey and associates (60), followed 10,769 children ages 9 to 14 years for one year. The first major weakness was the use of self-reported heights and weights to calculate BMI, because several studies have found that there were significant differences between children's self-reported weight measurements, especially among females and overweight children, and actual measurements collected by trained professionals (97-100). The other major weakness was the use of a self-administered one-year semi-quantitative food frequency questionnaire to estimate energy-adjusted fiber intake. Although the researchers report that the food frequency questionnaire was shown to be valid and reproducible, the use of a food frequency questionnaire is generally thought to be more suitable for ranking and grouping subjects according to nutrient intake levels than for calculating absolute energy and nutrient amounts of individuals, because actual serving sizes of foods may be substantially greater or less than

the estimated amount on a food frequency questionnaire (101). Given the limitations of these studies, the current fiber intake of children, the significant associations found in some studies with children, and the significant inverse relationship between fiber intake and obesity demonstrated in studies with adults, it is plausible that low dietary fiber intake may be a potential contributor to the high prevalence of childhood overweight (61).

Summary

Although few published reports showed a significant link between childhood overweight and energy intake, significant associations between other dietary factors and childhood weight status were well documented. Low intakes of fruits and vegetables, high intakes of added sugar, specifically from soft-drink consumption, and high intakes of dietary fat may all be factors in the etiology of childhood overweight. Additionally, snack food consumption and low intake of dietary fiber may be potential contributors as well. It is unlikely that a single dietary factor is responsible for the current epidemic of childhood overweight, but these findings provide researchers with potential intervention targets and dietary factors to examine for the prevention and treatment of the disease.

School Nutrition Environment

Introduction

As childhood and adolescent overweight continues to rise, researchers have become increasingly interested in determining significant contributing factors to this epidemic. Because a healthy diet is important in maintaining a healthy weight (15), logically, many researchers have focused on the dietary and nutrient intakes of children and adolescents. Traditionally most studies regarding the dietary and nutrient intakes of

school children have consisted of baseline and outcome data from nutrition education interventions or dietary and/or nutrient intake data for the National School Breakfast and Lunch Programs (49-52,102-103). However, more recently, several research studies and national initiatives have focused on the school nutrition environment and its potential contribution to the steady increase in the prevalence rate of overweight in children and adolescents (24-25,104-109). Additionally, some researchers have begun to examine detailed aspects of the school nutrition environment that may be contributing factors also, including food commercialism, vending machine and concession access, a la carte food items, and teacher classroom food practices (22,53-56,110-116).

Assessments of School Nutrition Environment

The School Health Policies and Programs Study (SHPPS), a comprehensive national survey to assess school health policies and programs at the state, district, local, and classroom levels, was first conducted in 1994 (SHPPS-I) and repeated in 2000 (SHPPS-II) (104). A portion of this study focused on specific aspects of the school nutrition environment, including vending machine access, the types of foods and beverages available through vending machines and canteens as well as school lunchrooms, and school food service policies to lower the dietary fat content of school meals. In 2001, the SHPPS-II results revealed that students could purchase food and beverages via vending machines, school stores, canteens, or snack bars in 43.0% of elementary schools, 73.9% of middle/junior high schools, and 98.2% of high schools, while only 20.8% of the schools surveyed had policies that required either fruits or vegetables to be offered in school stores, canteens, and snack bars or at student celebrations or after-school programs. An even smaller percentage of schools (12.4%)

prohibited snack foods and beverages of low-nutritive quality. Table 1.1 describes the percentage of surveyed schools that sold specific types of snack foods and beverages outside the school meals programs in 2000. In addition, Table 1.2 delineates the percentage of surveyed schools that allowed students to buy selected specific food or beverage items from vending machines, school stores, snack bars, or canteens at specific times during the school day.

Other pertinent findings from the SHPPS II study revealed that in 82.4% of schools surveyed, school-based organizations, including the PTA/PTSA, student clubs, or athletic teams, sold food, candy, or beverages at school or in the surrounding community to raise funds for the school or organizations during the 12 months prior to the study. Of these schools, 38.7% allowed students to purchase these items throughout the school lunch period. Additionally, the study showed that 23.3% of the schools surveyed allowed the promotion of candy, soft drinks, or fast food restaurant meal or food items through free or reduced price coupon distribution. About 14% allowed promotion of these products through school event sponsorship and 7.7% through school publications, such as a newsletter or newspaper.

The SHPPS-II survey revealed other important information among school districts and individual schools regarding "pouring rights" contracts. In 49.9% of the school districts, contracts had been established, which gave exclusive rights to an individual soft drink company to sell beverages at schools within the district. Among these school districts, 79.2% received a designated percentage of the beverage sales totals, while 62.5% received added cash or product incentives tied to increased sales. Further, 35.3%

Table 1.1. School Health Policies and Programs Study 2000: Percentage of surveyed schools* selling specific snack food and beverages outside the school meal program in 2000.

Type of food or beverage	All schools	Elementary schools	Middle/ junior high schools	Senior high schools
Soft drinks, sports drinks, fruit drinks	76.3	58.1	83.5	93.6
100% fruit or vegetable juice	55.6	49.7	54.1	66.5
2% or whole milk	44.8	49.6	39.8	44.5
1% or skim milk	24.1	28.8	19.5	23.1
Salty snacks not low in fat	63.5	51.0	62.4	83.0
Baked goods not low in fat	63.0	52.6	61.2	80.7
Low-fat salty snacks	53.4	44.5	54.5	65.0
Low-fat baked goods	36.4	26.4	37.7	49.6
Fruits or vegetables	17.6	20.0	11.8	22.0
* Surveyed schools with either vending machines, concessions, school stores, or canteens				

Source: Kolbe, LJ, Kann L, Brener ND. Overview and summary of findings: School Health Policies and Programs Study 2000. *J Sch Health.* 2001;71:253-259.

Table 1.2. School Health Policies and Program Study 2000: Percentage of schools allowing students to buy specific foods or beverages from vending machines or a school store, canteen, or snack bar at specific times

Type of food or beverage	Purchases allowed before classes start in the morning	Purchases allowed during lunch periods	Purchases allowed during school hours when meals are not being served
Food items high in fat, sodium, or added sugars*	40.7	70.7	35.5
Soft drinks, sports drinks, or fruit drinks**	48.2	68.4	43.0

* Among the 79.5% of schools where students can purchase these items in these settings.
** Among the 76.3% of schools where students can purchase these items in these settings.

Source: Kolbe, LJ, Kann L, Brener ND. Overview and summary of findings: School Health Policies and Programs Study 2000. *J Sch Health.* 2001;71:253-259.

of the school districts surveyed allowed the companies to advertise their products inside the school buildings, while 43.0% of the districts surveyed allow the soft-drink companies to advertise their products on school grounds. In addition, 47.1% of individual schools surveyed in districts without "pouring rights" contracts had similar contracts that gave specific soft-drink companies the right to sell their products at the schools. Over 91% of these schools received a designated percentage of the beverage sales totals, while 37.0% received added cash or product incentives tied to increased sales. At the school-level, 37.6% of schools surveyed allowed the beverage companies to advertise within the school buildings, while 27.7% of the individual schools allowed the companies to advertise on school grounds.

Several smaller studies have confirmed the availability of low-nutritive quality foods and beverages in schools, including a study by French and associates (114), conducted in 20 secondary schools in Minnesota. Researchers found that a la carte items were sold in all 20 schools and grouped these foods into 27 different categories. The greatest proportion of a la carte foods were categorized as chips/crackers (11.5%), with an average of 9.7 such items available per school, followed by entrees (10%), ice cream/frozen desserts (9.9%), packaged cookies/bars (8.7%), and school-prepared pastries (5.5%), with an average of 11.6, 8.0, 7.8, and 5.6 items available per school, respectively. Of all a la carte items available in the schools, lower-fat foods ($\leq$ 5.5 grams of dietary fat/100 gram serving) constituted a median percentage of only 35.4%. Items in the chips/crackers category were the most energy-dense foods, had the greatest average percentage of total calories/serving from dietary fat, and contributed little other key nutrients. Additionally, the median number of snack and beverage vending machines in

the schools was 12. Eighty-eight percent of snack machines and 37% of beverage machines were reported to be turned on throughout the day, except during the lunch periods, while 26% of beverage vending machines were reported to be turned on only before or after school hours. Of all snacks and candies available via vending, a median percentage of 35% were lower-fat items, due to the large amounts of hard-candy items available.

This study was unique in that it included an evaluation of school food policies and practices. The researchers found that only 5.9% of principals and 27.8% of food service directors surveyed reported the existence of any nutrition and/or food policies. Interestingly, 61.1% of principals reported that food service directors were involved in food policy setting, while only 21.1% of the directors reported that they were actually involved in food policy setting. Further, only about 11.0% of principals reported the existence of policies against the use of teachers using food as rewards for students, while 55.6% reported that teachers used food as rewards for students. All of the principals surveyed said that students were allowed to sell food items for fundraising. Also, the survey found that 50.0% of principals and 68.4% of foods service directors agreed that "schools should provide both healthy and less healthy foods and let the students choose" (114, p.1166), while the majority of both principals and food service directors agreed that school food service should be completely self-supported.

School Nutrition Environment Influences on Children's Dietary Intake

Other researchers have begun to investigate the impact of the school nutrition environment on children's dietary intakes. One such study, conducted by Cullen and associates (113) in a south Texas school district, compared the fruit, juice, and vegetable

(FJV) intake of fourth-graders who had no access to a la carte food items with the FJV intake of fifth-graders who had access to a la carte food items via a school snack bar. The results showed that those without access to a la carte foods had a significantly higher FJV intake than did those with access (0.80 serving vs. 0.60 serving; $p<0.001$), after controlling for FJV preferences. Further, the results showed that among students with a la carte food access, those who ate school lunch meals had significantly higher FJV intakes than those who consumed only snack bar meals (0.82 serving vs. 0.40 serving; $p<0.001$).

Another study, conducted by Kubik and colleagues (115), evaluated how elements of the school nutrition environment affected children's dietary intake. The researchers used a cross-sectional design with 16 middle schools in the St. Paul-Minneapolis area to assess the influence of a la carte sales, the availability of vending machine and school stores, and the amounts of fried potatoes served during lunch on seventh-grade students' eating behaviors. Similar to national studies, the results showed that the majority of schools (13 of 16 schools) had a la carte programs. Of the a la carte foods, 84% of foods offered and 93% of foods sold through these programs were considered "foods to limit," such as snacks with 5 grams of dietary fat or greater per serving, 2% and whole milk, prepared foods with greater than 7 grams of fat per serving, and other sweetened snacks and drinks. Additionally, 7 of the 16 schools had a range of 1 to 5 snack vending machines, 15 of 16 schools had a range of 1 to 11 beverage vending machines, and 1 school had a school store. About 80% of snacks and 84% of beverages offered were considered "foods to limit." A la carte food program availability was significantly and inversely related with students' total daily consumption of fruits and of fruits and

vegetables. Students in schools without access to a la carte food items had significantly greater total daily intakes of fruits and of fruits and vegetables than students in schools with access to these programs (1.95 vs. 1.30 servings of fruit; p=0.005 and 4.23 vs. 3.39 servings of fruits and vegetables; p=0.02).

Further, availability of a la carte foods was positively related to students' average percentage of total daily calories from total dietary and saturated fat. Students in schools without a la carte food availability had an average percentage of total daily calories from dietary fat of 28.49% and from saturated fat of 10.46%, while students with a la carte food availability had an average percentage of total calories from dietary fat of 31.08% and from saturated fat of 11.47% (p=0.02 and p=0.03, respectively). Also, access to snack vending machines was significantly inversely related to mean total daily fruit intake of students. For each increase of one snack machine present in schools, the average daily intake of fruit servings decreased by approximately 11% (p=0.03).

A study by Marlette and colleagues (117) demonstrated that sixth-grade students who purchased competitive foods via a la carte items at lunch (n=250) had significantly greater plate waste of foods supplying essential nutrients in school lunches. The authors found significantly greater waste of grain products (p=.009), meats (p=.015), fruits (p=.0001), and mixed dishes (p=.0001) when plate waste was compared between students who did and did not purchase competitive foods items.

Another study by Templeton and associates (118) showed that one-third of sixth-grade student in 3 Kentucky middle schools purchased competitive food items for lunch. Of these students, nearly a quarter purchased more than one competitive food item. Approximately 44% of the 250 students who purchased competitive foods chose fruit or

sports drinks, soft drinks, or iced tea. About 46% chose high-fat snacks such as corn chips, potato chips, beef jerky, nuts, or popcorn and around 38% chose high-fat pastry products, ice cream, yogurt, or granola. Students that purchased competitive foods consumed 20% greater total energy than students who did not ($p<0.05$). This accounted for almost 37% of total daily caloric intake, while providing only a small amount of protein. While students who consumed school lunch with no competitive foods had fat and saturated fat percentages close to the recommended percents of calories. However, those students who consumed competitive foods had fat intakes about 32% higher than those students who did not consume competitive foods ($p<0.05$).

These data on the availability of competitive foods and the resulting negative impact of these foods on children's dietary intake have prompted some researchers to investigate ways to improve the school nutrition environment and subsequently, students' dietary intakes. From 1996 through 2000, as part of a larger study, Zive and colleagues (111) conducted one of the first environmental interventions to improve the dietary quality of a la carte foods. The goal of this intervention, conducted in 24 middle schools in California, was to decrease the amount of high-fat a la carte items available for sale. At baseline, they found that 23 of the 24 schools sold a la carte items, the average student in these schools purchased 2.4 a la carte food items per week, and the most popular types of foods sold were all high in fat, including desserts, fast food, chips/crackers, and frozen desserts, with 9 to 16 grams of dietary fat per average item. The intervention focused on improving the types of a la carte items available to students by providing in-service training for the school food service staff, consultation with a dietitian, and a food fair assembled to allow staff the opportunity to sample new lower-fat products, gather

marketing materials and food cost information, and make affiliations with venders of these products. Further, students from several schools were asked to evaluate the new products and the findings were reported back to the food service staff (116). Although some successful environmental changes were reported, such as providing more healthful a la carte food options at prices competitive with high-fat options, the final analysis revealed that the intervention was not successful in reducing the total number of fat and saturated fat grams sold via a la carte sales.

In 2003, French and Stables (119) reviewed the literature for effective interventions to improve children's dietary intakes, including fruit and vegetable intakes, by modifying the school food environment and found 16 well-designed interventions. Five of the 16 studies described were part of larger comprehensive school-based interventions with several components, including environmental interventions that focused on increasing the availability of fruits and vegetables in the school cafeteria (120-124). Three of the 16 studies were school environmental interventions, which focused on increasing the availability of low-cost fruits and vegetables (125-127). Additionally, the researchers reviewed 4 studies that were comprehensive school-based interventions that had several targeted outcomes, including increased fruit and vegetable intake (39,128-130). The final 4 studies investigated the effects of increasing the availability of low-fat food options or decreasing the price of low-fat food options while increasing the price of high-fat food options (131-134). The comprehensive school-based interventions were effective in increasing fruit intakes, with increases ranging from 0.2 to 0.6 servings per day, but less effective in increasing vegetable intake, with increases ranging from 0 to 0.3 servings per day. However, in these multicomponent interventions,

there were no outcome measures for the environmental intervention components. Notably, results from all of the environmental interventions reviewed showed significant positive outcomes on students' targeted food choices.

Food-Related Classroom Teacher Practices

Few researchers have investigated less traditional aspects of the school nutrition environment, such as teachers' classroom food policies and practices and the use of food as incentives or rewards for students. Only four such studies were found (53-56). The first study, conducted by Kubik and colleagues (53), surveyed a convenience sample of 490 middle school teachers in 16 schools in the Minneapolis-St. Paul area, to assess how demographic characteristics, personal health and eating behaviors, nutrition knowledge, perceptions about how students' food choice and behaviors influenced their overall health and behavior, and beliefs regarding the overall school nutrition environment influenced teachers' eating behaviors during school and their food practices within their classrooms. The researchers created two dependent variables from the survey, classroom food practices-to-promote and classroom food practices-to-limit. High scores for classroom food practices-to-promote indicated that teachers engaged in classroom food practices that promoted healthy food choices or behaviors in students. High scores for classroom food practices-to-limit indicated that teachers engaged in classroom food practices that promoted unhealthy food choices or behaviors in students. Independent dichotomous variables for personal health, eating behaviors at school, nutrition knowledge, perceptions regarding students' food choices and health, and school nutrition environment beliefs were created using the median score as the cutpoint for each variable.

The results showed that several independent variables and demographic factors significantly predicted higher classroom food practices-to-limit scores. Women had a significantly higher mean score compared to men (4.33 and 3.14, respectively; p=0.0002). Teachers of all subjects other than health and/or physical education and family and consumer science had a higher mean score compared to health and/or physical education and family and consumer science teachers (4.18 and 2.63, respectively; p= 0.0003). Compared to both seventh- and eighth-grade teachers, sixth-grade teachers had a higher mean score (3.4, 3.3, and 4.60, respectively; p=0.009 for 6th vs. 7th; p=0.0024 for 6th vs. 8th). Teachers with less teaching experience (<10 years) had a significantly higher mean score than teachers with more teaching experience (>10 years) (4.25 and 3.58, respectively; p=0.03). Teachers who were less supportive of the school food environment had a higher mean score compared to teachers who were more supportive (4.77 and 3.34; p=0.0001). In addition, teachers perceptions about whether or not students' food choices influenced their health and behavior was marginally significant (p=0.06) in predicting teacher classroom food practices-to-limit scores.

The researchers concluded that the use of food as student rewards was a common teacher practice in middle schools and most of the foods used as rewards did not help establish a foundation for healthy dietary habits for school children. Additionally, the researchers concluded that middle school teachers in this study did not provide healthful eating behavior role modeling at school.

In a study by Burnett (54), preschool and primary school teachers were surveyed to determine how often sweets were used as rewards and the perceived merit of these rewards as educational motivation. This study showed a clear division of opinions

regarding the use of sweets as rewards. Fifty-six percent of the teachers surveyed thought that sweets were the least effective educational incentive and 44% of those surveyed used sweets as rewards. Younger children and special education children were more likely to receive sweets than were older and mainstream students. Furthermore, the use of sweets for special occasions and on sports days was quite common in this sample.

Another study by Kubik and colleagues (55) in the Minneapolis-St. Paul area, surveyed both teachers and parents regarding their perceptions of the school nutrition environment and beliefs about middle school students' eating habits. The surveys revealed that parents and teachers were concerned about several aspects of the school nutrition environment. Nearly all teachers believed that it was important to have a healthful school food environment. About 85% believed that the school environment influenced middle school students' food choices, but only 31% agreed that schools adequately support students' nutrition. Only about 15% of teachers surveyed thought that fast-food should be sold at school lunch, while only 12% thought that students should be allowed to purchase soft drinks and/or candy. Almost 75% of teachers believed that vending machines should contain only healthful foods and beverages. Only about 25% of teachers thought that it was acceptable to sell low-nutritive foods for fundraising. However, almost half believed that most teachers used foods as student rewards. About two-thirds of teachers thought schools should be free of commercialism, with no advertising allowed. Most agreed also that it was important to have written policies that addressed the use of foods in the classroom and the types of beverages and foods allowed in vending.

Teachers and parents concurred on many opinions regarding the school environment. However, parents were not as concerned about commercial advertising as teachers. Although this study did not assess the school food environment directly, it is unique in that it demonstrated that both teachers and parents, who are key stakeholders in school communities, may be unrecognized advocates to improve the nutrition integrity of schools.

A final study by Kubik and associates (56), also unique in its approach, surveyed 16 middle school administrators regarding schoolwide food practices, such as using food as rewards and selling food for fundraising. In addition, they collected self-reported heights and weights from 3088 eighth-grade students from these schools. BMI was calculated from the student data and a 7-item food practices scale was created. These practices and the percentages of schools allowing such practices are as follows: use of food items as rewards (69%), use of food for classroom fundraising (56%), students allowed to have beverages in the classroom (38%), students allowed to eat in classrooms (31%), students allowed to have snacks in the hallway (31%), use of food for school-wide fundraising (31%), and students allowed to have beverages in the hallway (19%). The results showed that there was a significant association between school-wide practices and students BMI ($p=0.06$) and that BMI increased by 10% ($p=0.03$) for every additional food practice allowed by a school.

This study confirmed that the use of food items as rewards or fundraising were common school practices. In addition, it revealed some previously unreported school practices, such as allowing students to eat and/or drink in school hallways. Further, it is the first study to show a positive association between the number of food-related school

practices and students' BMI. The authors concluded that these school-wide food practices encourage consumption of foods and beverages that are high-calorie, with low nutritional value, and adversely affect student BMI.

School Nutrition Policies

Effective school nutrition policies are essential in creating and sustaining school environments that are conducive to the development of healthy dietary behaviors in children (24). Although only a few studies have examined the process of developing such policies (135-139), one study, by Kubik and colleagues (135), offered a practical approach to establishing school nutrition advisory councils (SNAC), which were identified by the CDC's Guidelines for School Health Programs to Promote Lifelong Healthy Eating (24) as the most effective and appropriate vehicle for developing school nutrition policies. This approach was used in eight intervention schools participating in the TEENS study, a school-based trial conducted in 16 middle schools in Minnesota.

First, the researchers conducted an assessment of the school food environment, which included interviews of key informants, direct observation of food and drink items available through vending, and a school production record review. After the assessment was conducted, the researchers created a document that summarized the nutrition needs of each school and served as the foundation for SNAC discussion and policy-making. Then the researchers met with school principals, provided them with information regarding the nutrition needs assessment, and asked them to serve on the council and to recommend teachers and students to serve on it. Potential council members were contacted by phone and interested individuals were mailed letters to confirm participation. All of the established councils included a school administrator, a teacher,

and a foodservice employee. Parents and students were included in 6 councils, a school nurse was included in 4 councils, an athletic coach was included in 2 councils, and a school social worker was included in 1 council. Seven of the 8 schools convened SNACs during the intervention period. The researchers provided technical and advisory support at each meeting and assisted in operational development of each school's action plans.

The SNACs were able to develop nutrition action plans and implement "mini-interventions" to address some of the identified nutrition needs of their school, but they were unable to fully develop formal nutrition policies, because, as the authors state, "the practical process of policymaking at the local school level is both complex and time-intensive (135, p.227)." Although the SNACs did not establish formal school nutrition policies, one notable outcome was achieved. At one school, in response to the common teacher practice of using high-fat, high-sugar foods to reward students, the SNAC developed "healthy food coupons" that could be purchased by teachers and given to students as rewards. Students could redeem these coupons in the school cafeteria for specific items, including fruit, low-fat desserts, and baked chips.

A recent study by Davee and associates (139) was important and timely given recent state and federal mandates requiring nutrition policy development and implementation (57-58). This study documented the process of making changes to a la carte and vended items to meet policy guidelines at 4 public high schools in Maine. Also, it detailed barriers to change, reactions, and recommendations. The researcher team implemented the project after initially meeting with school administrators and liaisons, developing committees to promote the vending and a la carte changes, conducting baseline assessments of a la carte and vended items, and developing nutrition guidelines

that prohibited the sale of items with more than 30% dietary fat, more than 35% sugar by weight, or exceeded set portion sizes. Other activities completed prior to implementation included meeting with food service staff and food and beverage purveyors to discuss the policy and identify items that met all criteria. Additionally, presentations were made to faculty and staff, letters were sent home to inform parents and students of changes, promotional banners were posted, and taste-tests and demonstrations about fat and added sugar were held. Changes were made at the beginning of the school year. For the first 6 months after implementation of the changes, members of the research team made biweekly visits to the schools for technical assistance and continued communication. Follow-up assessments at each school were made during the spring semester after implementation.

Some barriers were encountered in implementation, including obtaining nutritional information of vended items and sales figures from suppliers. Little resistance to change was demonstrated by students, faculty, and staff at two schools, which both had full support from administrators and liaisons. However, at the other two schools negative reactions, specifically about a la carte items, were conveyed by faculty, staff, and students. They complained that too many items were removed, limiting food and beverage choices and that portion sizes had been reduced, but prices had not. Food service staff at one school were concerned that the changes in the a la carte program would adversely affect their job security. After the intervention, each school developed a model policy for vending and a la carte items to ensure sustainability of the changes.

The authors concluded that although these changes were achievable, frequent school visits from the research team, ongoing technical assistance, and open

communication were essential for success. They found that students, faculty, and staff were less likely to accept changes to a la carte items than to vended items and that key stakeholder support was essential. They recommended that others attempting to make such changes should have early organized communication with all key stakeholders to increase awareness of the importance of healthful food choices and to enhance support for changes. Further, they recommended that food service staff be provided with nutrition education and training to help implement food preparation changes to enhance the nutritional quality of a la carte food choices. Finally, they suggested that written food policies should be developed and implemented to sustain healthful changes in schools.

Another recent study by Greves and colleagues (140) looked at competitive food policies in the largest school districts from each state and Washington, DC. First, the researchers gathered information regarding the competitive food policies via the Internet. Then representatives, usually Food/Nutrition Services directors, from each district were interviewed to ascertain student demographics, district policies on competitive foods and beverages, and current environment pertaining to competitive foods, including "pouring rights" and other vending contracts.

Findings showed that 39% of school districts had instituted policies that went beyond state and federal regulations. Most had implemented these since 2002. About 50% of schools with policies set different criteria by grade level, with less restrictive policies for high schools. Sixty-three percent of schools had policies that prohibited soft drink sales at all grade levels. The policies regarding competitive food focused mainly on restricting fat, sugar, and sodium content and limiting portion sizes. Most district policies applied only to vended food and beverage items, with less than half addressing

other issues, such as items sold for fundraising. Some of the school districts had more comprehensive "wellness" policies that addressed nutrition education (26%), food commercialism at school (26%), and physical activity (11%). None of the districts had set guidelines for objective measurement of students' nutrition status or health. Although 32% of districts surveyed referred to monitoring and compliance issues, only 10% had directives for non-compliance.

Also, the study surveyed the districts regarding the school nutrition environment. These findings showed that 86% prohibited soft drink sales at elementary schools, but at middle and high schools only 29% and 25%, respectively, prohibited theses sales. Six percent of districts surveyed allowed fast food companies to provide a la carte food items without requiring the vendors to make changes to products to meet the USDA guidelines, while another 41% sold branded fast foods that were reformulated to meet the guidelines. About 30% of districts surveyed had exclusive "pouring rights" contracts with a beverage purveyor. This study demonstrated that although improvements have been made in the past several years regarding school nutrition policies, there is much work to be done still, especially in connection with school fundraising, portion size limitations, and non-compliance issues.

School Nutrition Environment Guidelines

The CDC developed guidelines to help local schools develop school environments that foster the development of healthy eating behaviors in children. The CDC Guidelines for School Health Programs to Promote Lifelong Healthy Eating (24) were developed in collaboration with experts from across the country and were based on scientific research, behavioral theory, public health nutrition policies, and current practice in the field. The

guidelines, which provide seven recommendations to improve all aspects of the school nutrition environment, asserted that development and implementation of a coordinated school nutrition policy are paramount in improving and sustaining a supportive school nutrition environment, as policy is the framework for the implementation of the other six recommendations. In addition, the guidelines recommended that schools perform nutrition assessments and identify the nutrition needs specific to their communities, before developing and implementing the policies. Further, these guidelines suggested that key stakeholders in the school and community should be involved in these endeavors to ensure that policies developed would be effective, relevant, and sustainable. Also, strategies to improve the school nutrition environment were included in this document, as follows:

- *Make healthy foods (e.g., fruits, vegetables, and whole grains) widely available at school, and discourage the availability of foods high in fat, sodium, and added sugars.*
- *Involve parents in nutrition education through homework.*
- *Provide role models (e.g., teachers, parents, other adults, older children, and celebrities or fictional characters) for healthy eating.*
- *Provide cues, through posters and marketing-style incentives, that encourage students to make healthy choices about eating and physical activity.*
- *Use incentives, such as verbal praise or token gifts, to reinforce healthy eating and physical activity. Do not use food for reward or punishment of any behavior* (24,p.40).

Additional guidelines were set forth by the USDA, which, in collaboration with five medical associations, produced a document entitled, Call to Action: Ten Keys to Promote Healthy Eating in Schools (141). This document was designed to assist local

schools in developing a "prescription for change" to improve their school nutrition environments. The ten recommendations were as follows:

- *Students, parents, educators and community leaders will be involved in assessing the school's eating environment, developing a shared vision and an action plan to achieve it.*

- *Adequate funds will be provided by local, state and federal sources to ensure that the total school environment supports the development of healthy eating patterns.*

- *Behavior-focused nutrition education will be integrated into the curriculum from pre-K through grade 12. Staff who provide nutrition education will have appropriate training.*

- *School meals will meet the USDA nutrition standards as well as provide sufficient choices, including new foods and foods prepared in new ways, to meet the taste preferences of diverse student populations.*

- *All students will have designated lunch periods of sufficient length to enjoy eating healthy foods with friends. These lunch periods will be scheduled as near the middle of the school day as possible.*

- *Schools will provide enough serving areas to ensure student access to school meals with a minimum of wait time.*

- *Space that is adequate to accommodate all students and pleasant surroundings that reflect the value of social aspects of eating will be provided.*

- *Students, teachers and community volunteers who practice healthy eating will be encouraged to serve as role models in the school dining areas.*

- *If foods are sold in addition to National School Lunch Program meals, they will be from the five major food groups of the Food Guide Pyramid. This practice will foster healthy eating patterns.*

- *Decisions regarding the sale of foods in addition to the National School Lunch Program meals will be based on nutrition goals, not on profit making* (141, p.1).

In addition to these guidelines, both the CDC and USDA have developed assessment and planning guides to further assist local schools in improving school

environments. The CDC's School Health Index (142), which focused on four health-related areas including physical activity, healthy eating, a tobacco-free environment, and safety-related issues, had eight modules for self-assessment and a planning section for making recommendations and prioritizing them. The index stated that one of the central items for assessment is whether or not a school has a representative school health committee. In this context, representative meant that the committee should made up of key stakeholders in the community, such as teachers, school nurses and administrators, students, parents, and representatives from the local health department, community organizations, and law enforcement agencies. Another key item for assessment should be whether or not a school has written policies to address health issues. Some of the notable nutrition-related assessment questions included the following:

- *Does the school or district have written policies that govern all of the following areas related to student health and safety?*
    - *food and beverages available on campus beyond school food service.*
- *Does the school prohibit giving students food as a reward and withholding food as punishment? Is this prohibition consistently followed?*
- *Do school fundraising efforts support healthy eating by selling non-food items or foods that are low in fat, sodium, and added sugars (e.g., fruits, vegetables, pretzels, air-popped popcorn) instead of by selling foods that are high in fat, sodium, or added sugars (e.g., candy)?*
- *Does the school prohibit the sale and distribution to students of foods of minimal nutritional value throughout the school grounds during the entire school day?*
- *Does the school prohibit the sale and distribution to students of other foods of low nutritive value throughout the school grounds during the entire school day* (142,Module 5,pp.5-7)*?*

The USDA, in collaboration with 16 organizations, developed an action kit, entitled Changing the Scene: Improving the School Nutrition Environment (25), that can

be used at the state or local level to assist schools in developing a healthful school nutrition environment. This action kit expanded on the school food environment portions of the CDC's School Health Index. It outlined steps to improving the school food environment by 1) creating a team, 2) conducting a needs assessment, 3) developing an action plan, 4) putting the plan into action, 5) evaluating the progress, and 6) communicating activities to the community and media. Furthermore, the kit suggested that the teams should consist of all interested individuals, including students, parents, teachers, administrators, school nurses, and community leaders. A supporting document (143) for the kit contained a self-assessment form for six areas in the school nutrition environment. Some notable assessment questions in relation to this proposal were as follows:

- *School staff, students, and parents are part of the policy making process and support a healthy school nutrition environment.*
- *The school has a health council to address nutrition and physical activity issues.*
- *All foods and beverages that are available at school contribute to meeting the dietary needs of students; that is, they are from the five major food groups of the Food Guide Pyramid.*
- *School policies include nutrition standards for foods and beverages offered at parties, celebrations, and social events.*
- *If foods are sold in competition with school meals, they include healthy food choices offered at prices children can afford.*
- *There are appropriate restrictions on students' access to vending machines, school stores, snack bars, and other outlets that sell foods and beverages, if these options are available. For example: no access in elementary schools, no access until after the end of the school day for middle and junior high schools, and no access until after the end of the last lunch period in senior high schools.*

- *School staff does not use food as a reward or punishment for students. For example, they don't give coupons for fast food meals as a reward for an "A" on a class project or withhold snacks as punishment for misbehaving.*

- *The school encourages organizations to raise funds by selling non-food items* (143,pp.4-8).

In September 2004, the Institute of Medicine (IOM) released a report, Preventing Childhood Obesity (144), which contained recommendations on the roles of industry, communities, families, and schools in confronting the epidemic of childhood overweight. The recommendation stated, *Schools should provide a consistent environment that is conducive to healthful eating behaviors and regular physical activity* (144,p.324). Further, the recommendation stated, *To implement the recommendation, USDA, state and local officials, and schools should develop and implement nutritional standards for all competitive foods and beverages sold or served in schools. . .* (144,p.325).

Although none of these guidelines are mandated by federal law, an increasing number of state and local legislative bodies have begun issuing directives to limit the availability of low-nutritive quality foods and beverages in schools, as shown in the study by Greves and colleagues (140). They investigated state level competitive food policies and found that 20 states had enacted legislation that was more restrictive than federal mandates prior to 2002. Seven states, including Tennessee, had passed new legislation more restrictive than federal mandates since 2002, while 4 states had legislation that recommended changes to competitive foods policies. In addition, 16 states, including Tennessee, had legislation that addressed childhood overweight through nutrition and/or physical activity. On May 18, 2004, in Tennessee, the Governor signed a bill into law (TCA: Section 49-6-2307) that provided the Tennessee Board of Education, in

collaboration with the Tennessee Department of Education and the Tennessee Department of Health, with the legal authority to set nutrition standards for foods and beverages sold through vending machines and other sources, including the cafeteria, to students in grades pre-kindergarten to eighth grade (58). The regulations set forth by the Tennessee Board of Education addressed all foods sold on campus during the school day regarding portion size, percentage of calories from fat, saturated fat, and added sugar, and gram amount of sodium, with provisions for nuts and nut butters, including foods for fundraising, vending, and a la carte (59). However, the rules did not include any directives pertaining to classroom food-related teacher practices or the use of fast food coupons as rewards for students, as the law does not provide for such authority.

Summary

In 2001, the USDA issued a report to Congress entitled Foods Sold in Competition with USDA School Meal Programs (145), which outlined the negative effects of competitive foods on the school meal programs and the limited regulatory ability of the USDA to restrict these foods. The report emphasized that most competitive foods are usually high in fat, sugar, and calories, while providing little or no other essential nutrients. The report stated that students consuming competitive foods instead of school meals may suffer from inadequate daily dietary intakes of key nutrients, while students who consume competitive foods in addition to school meals may be at increased risk of weight gain. Furthermore, the report suggested that when children are surrounded by competitive foods via a la carte sales, vending machines, snack bars, and school stores, the message conveyed within the school environment clashes with classroom

instruction regarding healthful food choices, which may lead children to believe that good nutrition is not really important to their overall health.

The literature provided clear evidence that competitive foods are readily available to school children via a la carte, concession, and vending sales and as rewards or motivational incentives. Additionally, the research showed that competitive foods can have a negative effect on school children's dietary intake. Some success in improving students' dietary intake has been demonstrated by intervention studies aimed at improving the school nutrition environment. Nonetheless, few studies have documented the availability of snack foods in the classroom and food-related classroom teacher practices.

The CDC and USDA have issued guidelines to improve the school nutrition environment. Even though these guidelines suggested that schools have written nutrition policies, the literature showed that few schools had such policies. Also, with the exception of a very few studies, there was limited information available regarding the policymaking process in schools.

Conclusions

Childhood and adolescent overweight rates have reached epidemic proportions in the United States. Although numerous initiatives and research studies have been implemented, prevalence rates continue to rise. Genetic factors may account for some of the variance in weight status, but environmental factors, which are amenable to prevention and treatment efforts, play an important role in the etiology of childhood overweight.

Studies showed that low-nutritive-quality foods were readily available to children in schools throughout the nation via a la carte, concession, and vending sales and as rewards or motivational incentives. Further, there was evidence that consumption of these foods may have negative effects on school children's dietary intake and may place them at greater risk of overweight. The limited success of numerous nutrition education and physical activity interventions has led many researchers to investigate the impact of improving school nutrition environments on school children's dietary intake. Indeed, many interventions to improve school nutrition environments have been successful. However, very few studies have examined the types of foods and beverages that are available to school children in the classroom or teachers' use of these foods and beverages for rewards or motivational incentives.

In 2004, federal legislation mandated that all schools that participate in the NSLP must develop and implement school wellness policies by the beginning of the 2006-07 school year. Further, more states, including Tennessee have instituted legislation that goes beyond the new federal mandate, which required schools to implement sweeping changes in competitive food policies. However, neither the state nor federal directives specifically restricted the use of foods and beverages as rewards or prohibited low-nutritive quality foods as classroom snacks.

After a thorough review of the literature, the study was designed to examine teachers' classroom food-related practices, using both qualitative and quantitative methods, and to investigate predictors of these practices. Chapter 3 outlines the research questions and methodology for the study. Chapters 4 through 6 are papers relating to this research.

Expanded Methodology

This section outlines the methodology designed for the research project. It includes the theoretical foundations and setting for the project as well as descriptions of the study designs, sample populations, and data collection and analyses methods of the three study components of the project. The strengths and weaknesses are included, also.

Research Goals and Questions

The purpose of this project was to gain insight about teachers' classroom food-related practices and their perceptions of the school nutrition environment. Additionally, this research will be used to help inform and evaluate the school wellness policy making process at the district level in Monroe County. The research questions included:

1) What are intermediate school (grades 3 to 5) teachers' perceptions of the influence of the school food environment, including classroom food-related teacher practices, on students' overall dietary quality, weight status, and health?
2) Are teacher-developed theories regarding the influence of the school nutrition environment on students' overall dietary quality and weight status validated by secondary analysis of student BMI and 24-hour dietary recall data from the Youth Can! Improve their Diet for Heart Health intervention study?
3) At the intermediate grade level, what are teachers' normative classroom food-related practices and their perceptions of the school food environment? What, if any, teacher characteristics are predictors of these practices?

Theoretical Foundation

This project was based on the socioecological model (SEM) (146) and social cognitive theory (SCT) (147), which provides theoretical frameworks for understanding and improving aspects of environmental factors and social interactions that may influence health beliefs and behaviors. A 2003 review of health behavioral change models by Baranowski and associates (148) concluded that use of the socioecological approach offers one of the most promising means of understanding, and in turn, preventing obesity-related diet and activity practices, especially among children. Proponents contend that socioecological approaches are necessary to effectively promote and sustain positive health behavioral changes (149-150). SCT provides a practical, comprehensive means of examining and understanding the reciprocal interplay among personal factors, the environment, and health behavior (147-148,151). It has been used extensively in designing nutrition interventions because it addresses a broad range of motivational and environmental factors (148).

The SEM has three central tenets. First, a transactional relationship exists between humans and the environment, meaning that human behavior is influenced by the environment, but at the same time, human behavior can influence and modify the environment. Secondly, the environment is comprised of nested spheres of overlapping levels that influence health beliefs and behaviors: 1) individual, 2) interpersonal, 3) organizational, 4) community, and 5) public policy. Finally, the model suggests that to successfully modify health behaviors and subsequently improve health and well-being, interventions must target a broad range of environmental factors that influence the targeted behaviors (152). Although this model provides a clear depiction of how multiple

levels of the environment may shape behavior, it does not contain a clear delineation of cognitive or motivational factors necessary for behavioral change (148). Given this limitation, this project utilized SCT concepts as well.

The SCT has six central tenets that can be used to explain health behavior, which include transactional interactions of behavior, cognitive factors, and the environment (152). Like the SEM, this theory is based on the premise that human behavior and the environment are transactional systems that have a reciprocal relationship. This concept, called reciprocal determinism, maintains that although the environment can shape, sustain, or constrain behavior, human behavior can influence and shape the environment, also. The second concept defined by this theory is behavioral capability, which asserts that an individual must have the knowledge and skills necessary to make behavioral changes. The third concept holds that an individual will have certain expectations of what will occur, given a particular action or behavior. The fourth tenet, self-efficacy, may be the most important personal factor that determines whether or not an individual will attempt to change behavior. An individual must believe that they can successfully perform a specific action or behavioral change or it is unlikely that they will attempt any action towards change. Observational learning, the fifth tenet of SCT, is commonly referred to as modeling, meaning that an individual develops certain behaviors by observing others' actions and behaviors and the subsequent consequences. The final concept of SCT is reinforcement, which is the response to an individual's behavior or action that either increases or decreases the likelihood of repeating the action or behavior.

For purposes of this project, the school was viewed as a microenvironment and the socioecological model was applied as depicted in Figure 1.1 In the classroom,

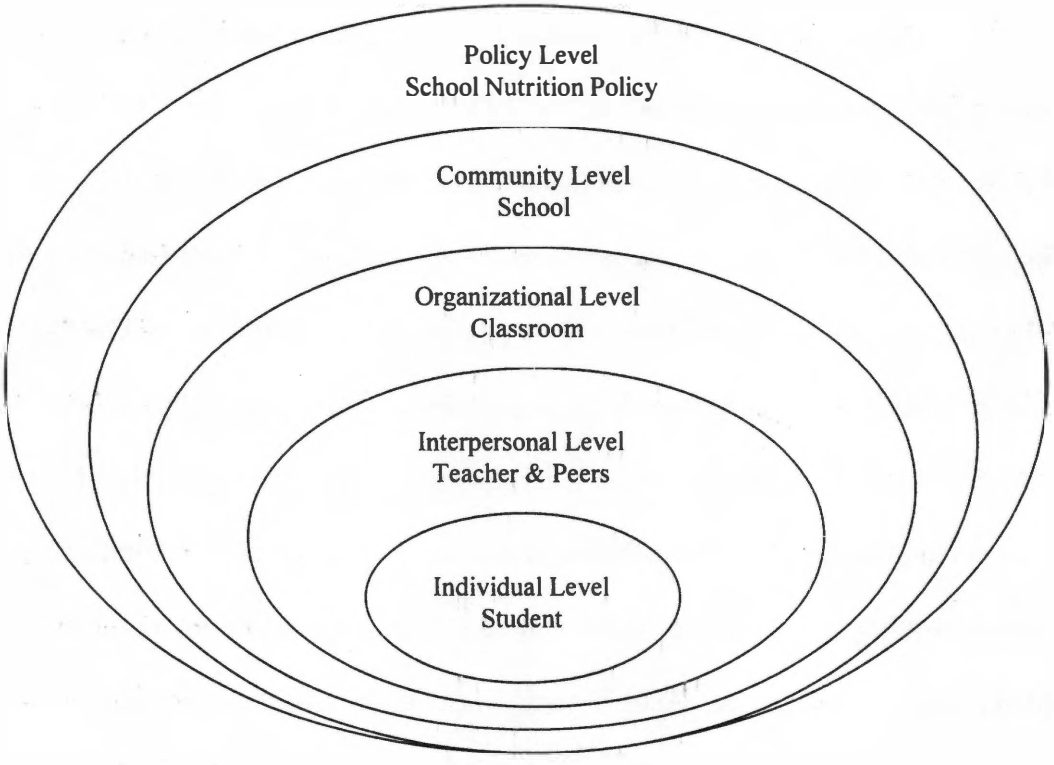

Figure 1.1. Proposed Socioecological Model of the School Environment

Source: Adapted from McLeroy KR, Bibeau D, Steckler A, Glanz K. An ecological perspective on health promotion programs. *Health Educ Q.* 1988; 15:351-377.

students' food intake is influenced by multiple levels of the school environment. At the individual level, personal preferences, attitudes, knowledge, and cultural norms may influence intake (153). However, availability and accessibility of foods in the classroom impact students' intake as well. To some degree, all of these factors are influenced by other levels of the environment, but the availability and accessibility of foods in the classroom can be directly linked to the interpersonal level, where teachers may act as role models and gatekeepers (53,154). If there is no formal nutrition policy in the school, each classroom food environment may differ, depending upon individual teacher's classroom food-related practices. In turn classroom food-related teacher practices may be influenced by the types of snacks available in the school via vending machines, snack bars, and concession stands, which is influenced by either formal or informal nutrition policy at the school.

Although older students may be able to influence school nutrition policy through advocacy, at the elementary school level, communication channels, such as student councils (155), usually do not address these issues. However, teachers may be able to influence school nutrition policy by serving on committees or making their opinions known at faculty meetings or with school administrators. Thus, the adapted model suggests that multiple levels of the contextual environment influence classroom food-related teacher practices, which ultimately affects the types of foods that are available to students in the classroom. This research project investigated the interpersonal and organizational levels of the SEM, by examining teachers' classroom food-related practices, role modeling behaviors, and perceptions of the school environment.

Within the classroom, teachers interact with students daily and have numerous opportunities to affect students' dietary patterns (53). The SCT provides the foundation to understand that teachers may act as role models and gatekeepers. Teachers may model behaviors that may or may not promote healthy food choices based on the school food environment and their knowledge of how modeling behaviors influence the development of childhood eating behaviors. As gatekeepers, teachers may establish what foods are appropriate for classroom snacks, rewards, and classroom parties based on the school food environment, their nutrition knowledge, and their perceptions of how snack foods may affect students' dietary quality, weight status, and overall health. In addition, using the tenets of the SCT, teachers should have adequate knowledge of how the school nutrition environment can affect student's dietary quality, weight status, and overall health and the self-efficacy to believe that they can make positive nutrition-related changes within the school environment. The project used these tenets in the development of questions for in-depth interviews and the teachers surveys and with the information derived from teacher-developed themes about how the school food environment affects students' overall diet quality, weight status, and overall health.

Setting

This project was conducted with intermediate grade teachers from 7 schools in Monroe County, Tennessee. Monroe County is a rural, Southern Appalachian county, located approximately 30 miles southeast of Knoxville, Tennessee. According to 2000 Census Bureau demographic data (156), approximately 94% of the population in Monroe County is white (not Hispanic or Latino), 2.3% of the population is black or African American, 1.8% of the population is Hispanic or Latino, and less than 2% of the

population is of another race. Additionally, the data show that the county has a lower per capita income ($14,951) compared to the per capita income of $19,393 for the state of Tennessee. Also, the county has a higher percentage of families below the poverty level (12.0%) when compared to Tennessee (10.3%). According to 2000-2001 data from the State of Tennessee Department of Education, 48.3% of students in the Monroe County School System (MCSS) were eligible for free or reduced-price school meals, which is higher than the state eligibility rate of 42.9% (157).

The MCSS was selected as one of ten pilot Coordinated School Health Program (CSHP) sites in 2002 (183). In fall 2003, the CSHP nurses conducted height and weight measurements and calculated BMI at all schools in the MCSS for students in grades 2, 4, 6, and 8. Data from the CSHP Final Report 2003 (158) showed that the overall prevalence rates of overweight for all male and female fourth grade students in MCSS schools were 32.72% and 37.5%, respectively. Of the five CSHP sites in Tennessee that provided valid BMI data for students above the 95th percentile, Monroe County reported the highest prevalence rate for both male and female students.

Research Design

This project consisted of three studies to answer the research questions. The first component of the project, which used grounded theory methodology, built on the preliminary study and addressed the first and second research questions. The second component of the project used secondary data analysis from an ongoing intervention study, Youth Can! Improve Their Diet for Heart Health, for triangulation and validation of teacher-developed theories obtained from the in-depth interviews and preliminary study. The third component of the project collected cross-sectional baseline survey data

about teachers' classroom food-related practices and their perceptions of the school nutrition environment and investigated the predictors of these practices. Complete methodologies of each study follow.

Study One

Research Question

1) What are intermediate school (grades 3 to 5) teachers' perceptions of the influence of the school food environment, including classroom food-related teacher practices, on students' overall dietary quality, weight status, and health?

Study Design

The first study of the research project used grounded theory methodology (159-160) to understand emergent themes related to teacher perceptions of how the school food environment, including classroom food-related teacher practices, influences students' overall dietary quality, weight status, and health, during individual, in-depth, semi-structured interviews. This qualitative research method allowed for the development of theory through thorough and methodical repeated overlapping data collection and analyses (161). As depicted in Figure 1.2, in a grounded theory research design, the study sample (Figure 1.2-A) is selected because the participants may provide insight about a particular social phenomenon. For example, a convenience sample of fifth-grade teachers was selected for the preliminary study (described in Part III) because their students would be participating in the Youth Can! intervention during the 2004-2005 school year. Additionally, the researchers believed that these teachers could provide insight about how the school environment may impact students' dietary quality,

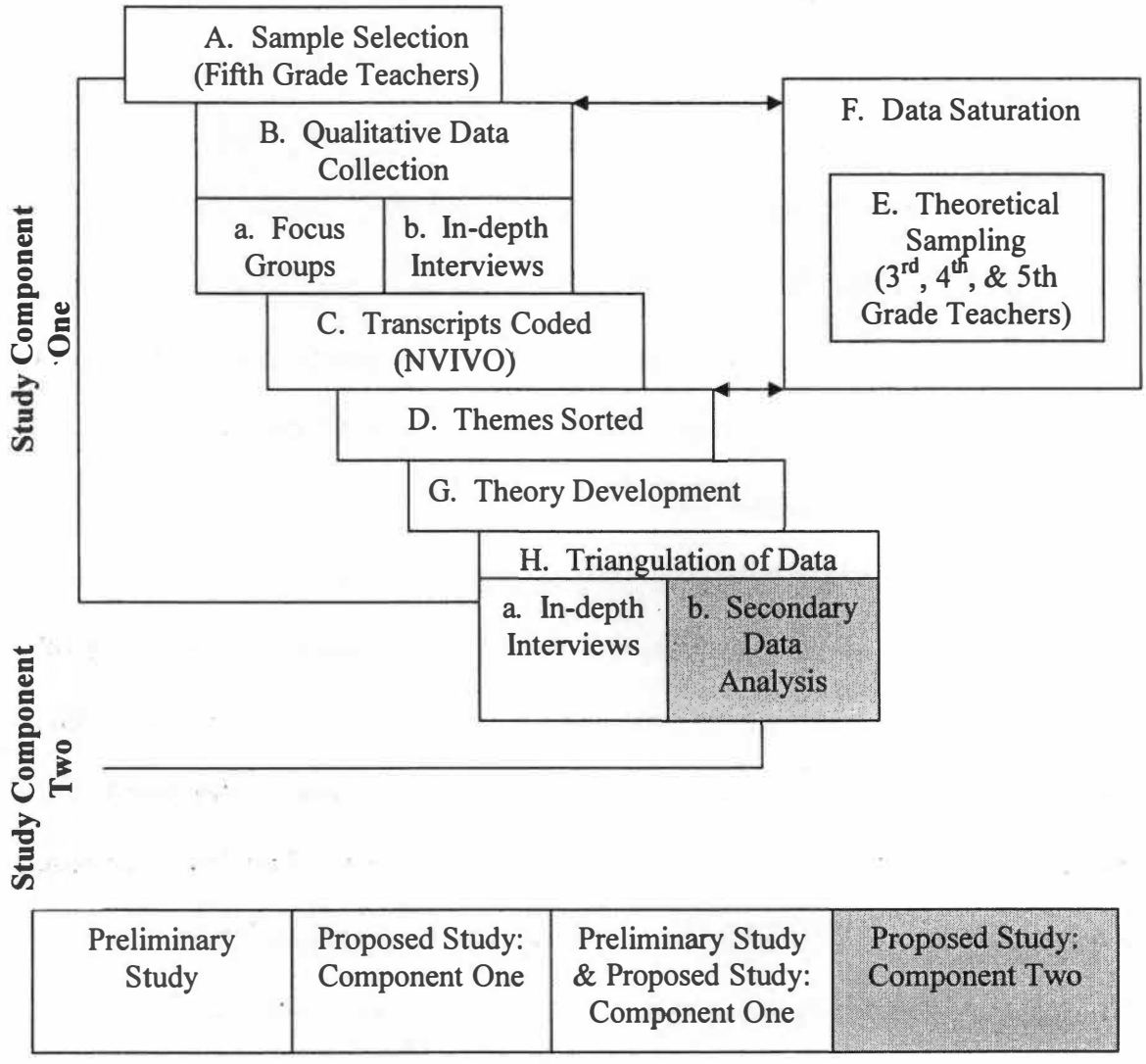

Figure 1.2. Grounded theory research design of the project

Source: Charmaz K. Grounded theory: objectivist and constructivist methods. In: Denzin NK, Lincoln YS. *Handbook of Qualitative Research.* 2nd ed. Thousand Oaks, CA: Sage Publications; 2000.

weight status, and overall health. In a grounded theory research design, data collection is performed using qualitative methods (Figure 1.2-B). In this case, focus group interviews were conducted. After each focus group, the transcribed data were coded (Figure 1.2-C) and sorted (Figure 1.2-D), as suggested by grounded theory methodology (159). Although some theories were developed (Figure 1.2-G), further information was needed for saturation of the data (Figure 1.2-F). Grounded theory suggests that when further data are needed, theoretical sampling should be used, meaning that one should recruit more participants who may give additional insight about the social phenomenon under investigation (160). In addition, the theory suggests that to increase validity of the study, triangulation of the data should occur (160). Triangulation, which is a method to establish validity in qualitative studies, can be achieved in several ways, by information source (e.g. students and teachers), by methodology (e.g. interviews and focus groups), or by data type (e.g. qualitative and qualitative data) (161). Therefore, the project used theoretical sampling (Figure 1.2-E) of third-, fourth-, and fifth-grade teachers to provide further data (Figure 1.2-B), which was combined with the preliminary study data, using in-depth, semi-structured interviews (Figure 1.2-Ha). Again, the transcribed data were coded (Figure 1.2-C) and sorted (Figure 1.2-D), and additional themes developed (Figure 1.2-G). After no additional themes developed, data saturation (Figure 1.2-F) was reached, as postulated by grounded theory research design (160).

Sample Population

The sample population for the first study consisted of a theoretical sample of third-, fourth-, and fifth-grade teachers from Monroe County. Although the preliminary study provided great insight about teacher classroom food-related practices and teacher

perceptions about how the school environment and teachers' classroom food-related practices may influence students' overall dietary quality, weight status, and health, only fifth-grade teachers were included and the depth of interviews was limited. To ensure data saturation, which for this study was determined to be the point at which no new themes developed after 3 consecutive interviews, the qualitative portion of the project included a theoretical sample of third-, fourth-, and fifth-grade teachers for individual, semi-structured, in-depth interviews. Due to the limited depth of interviews in the preliminary study, fifth-grade teachers were recruited for participation in this study as well.

Using school mailboxes, a recruitment letter was distributed to all third-, fourth-, and fifth-grade teachers. The letter provided a brief description of the study and a contact number to call if they were interested in participating in the study. After one-week, thank-you/follow-up postcards were distributed via school mailboxes to all potential participants to improve the response rate. All teachers who wished to participate signed consent forms, signifying their willingness to participate in the qualitative portion of the study. Each study participant received a $20.00 gift card purchased from a local retailer.

Data Collection

The in-depth interviews were conducted at each school during April and May of 2005, after human subject approval from the University of Tennessee (UT) Institutional Review Board (IRB). The researcher consulted with principals at all schools to find convenient times and secure locations to interview teachers. Each interview was audio-recorded and then transcribed verbatim by the researcher.

The interviews focused on teachers' classroom food-related practices and their perceptions about how food available to students at school, including the classroom, may influence their overall dietary quality, weight status, and health. The interview guide can be found in Appendix A. Photographs from the preliminary study were used as the catalyst for the interviews, which were guided using an interview protocol modified from the Popular Education process (162), SHOWeD (163). This technique uses a series of questions about photographs to generate discussion. The questions include:

1) What do you **S**ee here?
2) What is really **H**appening here?
3) How does this relate to **O**ur lives?
4) **W**hy does this problem or strength exist?
5) What can we **D**o about it?

Data Analysis

In grounded theory methodology, there are three overlapping coding processes, open coding, axial coding, and selective coding (159-160,164). First, open coding is used to delineate broad groupings of interrelated entries. After open coding is completed, axial coding, using relevant categories, is performed. Finally, selective coding is used for theory development, linking relevant categories to one central theme or theory. For this study, the transcripts were entered into NVivo computer software (165) to sort teachers' perceptions, first by broad categories that developed. Next, the broad groupings were coded using themes and categories that emerged from the data (Figure 2). Memoing, which is a technique in which the researcher writes notes to him/herself to help identify relationships among open- and axial-coded data to develop clusters and common themes

(161), was used to begin theory development. Common themes within the model and clusters of similar data were used for selective coding to develop theories. Core categories, central ideas, and events were established. Then, these categories were linked to other related categories, such as causal conditions, intervening conditions, consequences, or interactions. The relationships and clustering of these categories and themes were used to develop emergent themes from the informant data and a logic model integrating all of the relevant categories and themes.

Common themes developed from in-depth interviews were compared to themes from the preliminary study to ascertain if saturation of the data was achieved. No new themes developed after the first 17 interviews. However, 3 more interviews were conducted and coded to insure data saturation.

The results, discussion, and conclusions for this study are described in Part II, which is a manuscript entitled, A qualitative study on intermediate grade teachers' perceptions of the school nutrition environment.

Study Two

Research Question

2) Are teacher-developed theories regarding the influence of the school nutrition environment on students' overall dietary quality and weight status validated by secondary analysis of student BMI and 24-hour dietary recall data from the Youth Can! Improve their Diet for Heart Health intervention study?

Sample Population

The second study component of the project used secondary data analyses from an intervention project, Youth Can! Improve their Diet for Heart Health, for triangulation

and validation of teacher theories generated from the first study component and the preliminary study (Figure 2-Hb). The sample population for the first component of the study was described on page 57 of this document. The sample population for the preliminary study was a convenience sample of all fifth-grade teachers at 2 schools within the county, because students in these teachers' classes, during the 2004-05 school year, would be implementing the Youth Can! intervention. In addition to this circumstance, the researchers believed that these teachers could provide valuable insight about how the school environment may impact students' dietary quality, weight status, and overall health.

The sample population for the Youth Can! study was a convenience sample of 256 fourth-grade students from all schools in the MCSS. Students were recruited from all fourth grade classrooms by a letter to students' parents. Human subject approval was granted by UT IRB. Signed consent and assent forms were returned and verified prior to beginning any component of this research.

Study Design

Triangulation has been recognized as a means to provide cross-validation (166) and convergent corroboration of theory development for grounded theory research designs (161) (Figure 2-H). As previously stated, triangulation can be achieved in several ways, by information source (e.g. students and teachers), by methodology (e.g. interviews and focus groups), or by data type (e.g. qualitative and qualitative data) (161). This component of the project used secondary data analyses (quantitative data) of the Youth Can! baseline data for triangulation to provide cross-validation of teacher-developed themes (qualitative data) from the first component of the project. This

corroboration was not intended to test the accuracy of the teachers' perceptions, but was completed to help ensure that the findings reflected accurately the teachers' perceptions of the school environment and to lend credible support to the emergent themes that developed and that sufficient data were collected.

Data: Youth Can! Baseline Data

Computer-based, multiple pass, twenty-four dietary hour recalls for all fourth grade participants were conducted by trained interviewers using Nutrition Data System for Research (NDS-R) software version 5.0_35, developed by the Nutrition Coordinating Center (NCC), University of Minnesota, Minneapolis, MN, Food and Nutrient Database (167). In addition, trained interviewers asked the participants each of the questions on a student survey and circled the corresponding answer. The survey was developed to assess students' self-efficacy regarding the ability to consume components of a healthy diet as well as the use and effectiveness of rewards in the classroom.

Computer-based menu analyses of the reported daily school menus were completed by trained research assistants using NDS-R diet analysis software. School production records and interviews about serving sizes and food preparation methods were conducted with the food service managers and the MCSS Food Service Director to ensure accurate menu entries.

Data Analyses

Variable Descriptions

Eating occasions were defined as *breakfast, lunch, dinner*, and *snack*. The term used for each eating occasion was classified according to what the student called the eating occasion. *Day* was defined as the sum of all eating occasions. The locations of

eating occasions were defined as follows: 1) *at school* was defined as all foods and beverages, except fluid water, reported in student 24-hour recalls that were consumed only at school, during school hours; 2) *elsewhere* was defined as all foods and beverages, except fluid water, reported in student 24-hour recalls that were consumed before or after school hours.

Gram and nutrient information were calculated for eating occasions and locations based on the following definitions. *Total gram amount* was defined as the total weight of all foods and beverages, except fluid water, reported in student 24-hour recalls for each eating occasion and defined meal/snack location. Other studies have demonstrated that gram is an adequate measure of portion size (9-10). *Energy* was defined as the amount of kilocalories of all foods and beverages, reported in student 24-hour recalls for each eating occasion and defined meal/snack location.

Macronutrients from foods and beverages reported in students' 24-hour recalls were defined as follows: 1) *dietary fat* was defined as the gram amount of dietary fat of all foods and beverages reported in student 24-hour recalls for each eating occasion and defined meal/snack location; 2) *saturated fat* was defined as the gram amount of saturated fat of all foods and beverages reported in student 24-hour recalls for each eating occasion and defined meal/snack location; 3) *protein* was defined as the gram amount of protein of all foods and beverages reported in student 24-hour recalls for each eating occasion and defined meal/snack location; 4) *carbohydrate* was defined as the gram amount of carbohydrate of all foods and beverages reported in student 24-hour recalls for each eating occasion and defined meal/snack location; 5) *dietary fiber* was defined as the gram amount of total dietary fiber of all foods and beverages reported in student 24-hour

recalls for each eating occasion and defined meal/snack location; 6) *total sugar* was defined as the gram amount of total sugar of all foods and beverages reported in student 24-hour recalls for each eating occasion and defined meal/snack location.

Macronutrient densities were defined as follows: 1) *percent calories from fat* was defined as the kilocalories from dietary fat divided by total kilocalories (multiplied by 100) of all foods reported in student 24-hour recalls as lunch from home or lunch from school and consumed at school; 2) *percent calories from carbohydrate* was defined as the kilocalories from carbohydrate divided by total kilocalories (multiplied by 100) of all foods reported in student 24-hour recalls as lunch from home or lunch from school and consumed at school; 3) *percent calories from protein* was defined as the kilocalories from protein divided by total kilocalories (multiplied by 100) of all foods reported in student 24-hour recalls as lunch from home or lunch from school and consumed at school; and 4) *percent calories from saturated fat* was defined as the kilocalories from saturated fat divided by total kilocalories (multiplied by 100) of all foods reported in student 24-hour recalls as lunch from home or lunch from school and consumed at school.

Body mass index was calculated for each student with height and weight measurements and age and gender classifications. Heights were measured to the nearest mm using a Schorr Board without shoes and read by a trained coordinated school health nurse. Weights were triple measured to the nearest 0.1 kg on a digital, calibrated scale by trained coordinated school health nurses. All heights and weights were entered into a spreadsheet. BMI was calculated as kg/m^2 and compared the National Center for Health Statistics growth charts. Weight status was defined as follows: 1) *overweight student* was defined as a student with age- and gender-specific BMI (kg/m^2) $\geq 85^{th}$ percentile and

2) *student who was not overweight* was defined as a student with age- and gender-specific BMI (kg/m^2) <85th percentile.

Healthy food was defined according The State of Tennessee's most recent policy statement on the definition of healthy foods in schools, the Tennessee State Board of Education Rule 0520-1-6-04, Minimum Nutritional Standards for Individual Foods Items Sold or Offered for Sale to Pupils in Grades Pre-Kindergarten through Eighth Grade (59) (Table 1.3). The variable *snack that met guidelines* was defined as a snack that met all guidelines for minimum nutritional standards. The variable *snack that did not meet guidelines* was defined as a snack that did not meet one or more guideline for minimum nutritional standards.

Table 1.3. Snack criteria from Tennessee State Board of Education Rule 0520-1-6-04, Minimum Nutritional Standards for Individual Foods Items Sold or Offered for Sale to Pupils in Grades Pre-Kindergarten through 8th Grade

Food item	Regulation	Portion Size
Beverages	Beverages that can be offered for sale include: fluid milk, 100% fruit and vegetable juices, water that is non-flavored, non-sweetened, and non carbonated, and low calorie beverages	8 fl oz or less, except for non-flavored, non-caffeinated, non-carbonated water.
All individually sold food items	Total fat calories should be no more than 35% excluding nuts, seeds, and nut butters; Total saturated fat calories should be no more than 10%; Calories from sugar should be no more than 35% by weight; Snack items may not contain more than 230 mg. sodium per serving; pastas, meats, and soups many not contain more than 480 mg.; and pizza, sandwiches and main dishes may not contain more than 600 mg.	(see below)
Chips, crackers, popcorn, cereal, trail mix, nuts, seeds, dried fruit, or meat jerky	May not exceed regulations for individually sold items or portion-size limits	1.25 oz.
Cookies	May not exceed regulations for individually sold items or portion	1 oz.
Cereal bars, granola bars, pastries, muffins, doughnuts, bagels, and other bakery products	May not exceed regulations for individually sold items or portion	2 oz.
Frozen desserts	May not exceed regulations for individually sold items or portion	4 fl. oz.
Non-frozen yogurt	May not exceed regulations for individually sold items or portion	8 oz.
Fruits and non-fried vegetables	May be fresh, frozen, canned or dried; Must be found in the Food Buying Guide for Child Nutrition Programs*	Exempt from portion-size limits.
Pure cheese	Must be low-fat or fat-free, containing no more than 3.5 grams of fat	1 oz.

Source: State of Tennessee. Rules of the State Board of Education. Chapter 0520-1-6.04. *Minimal Nutritional Standards for Individual Food Items Sold or Offered for Sale to Pupils in Grades Pre-Kindergarten through Eight (Pre-K-8).* Available at: http://state.tn.us/sos/rules/0520/0520-01/0520-01-06.pdf. Accessed on July 1, 2006.

Statistical Tests

NDS-R output files and SPSS software, version 14.0 (2005) (168), were used to complete all analyses. First, 5 diet recalls were excluded because the interviewers' notes indicated that the recall data were unreliable. Secondly, descriptive statistics, including variable frequencies and means, box plots, stem and leaf plots, outliers, skewness, and kurtosis, were conducted to determine the appropriate statistical approach for testing hypotheses posed by teacher-developed themes.

Unequal variances t-tests for independent groups and independent t-tests were used to test for significant differences between the students who were overweight and students who were not overweight for mean total grams, energy, and grams of dietary fat, saturated fat, total dietary fiber, and total sugar for all eating occasions (breakfast, lunch, dinner, and snacks) and for snacks consumed at school and snacks consumed elsewhere.

Students' 24-hour recall snack data were used to identify snacks consumed at school. The snacks students consumed at school were categorized by type, i.e. sugar-sweetened beverages, chips, and cookies. The nutrient composition and portion size of each snack was compared to the state guidelines to determine the percentage of snacks consumed by students at school that did and did not meet the newly mandated criteria. Then, a Chi-square test was completed to test if there was a significant difference in the distribution of snacks that did and did not meet the guidelines.

Another Chi-square test was used to test if there was any difference in the distribution of children who did not consume a snack at school or elsewhere (n=32), children who did not consume a snack at school, but consumed one elsewhere (n=136), children who consumed a snack at school, but did not consume one elsewhere (n=11),

and children who consumed a snack at school and elsewhere (n=68). Secondly, to test if differences existed among the three groups of children who consumed a snack (at school, elsewhere only, or at school and elsewhere) for mean total grams, mean energy, and mean grams of protein, carbohydrate, dietary fat, and saturated fat, dietary fiber, and total sugar of snacks, a non-parametric test, Kruskal-Wallis, was performed because the snack recall data by location were not normally distributed. Next, an ANOVA was used to test if there were significant differences between all four groups (at school, elsewhere only, at school and elsewhere, or no snack) for the day's mean intake of energy and mean grams of protein, carbohydrate dietary fat, saturated fat, dietary fiber, and total sugar. A Tukey's b post hoc test was used to determine which group means were different from one another.

Recall data from students who consumed lunch, either from home (n= 35) or purchased at school (n=195), were used for the last statistical analysis. In addition to the 5 cases that were excluded because they were deemed unreliable, an additional 14 cases were excluded because interviewer notes indicated that although these students consumed lunches purchased at school, they consumed additional food items given to them by classmates or brought from home. Because tests for normality showed that group data for one or more variable of interest were not normally distributed, a nonparametric test, Mann-Whitney, was performed to ascertain if there were statistically significant differences in mean ranks of total gram amounts, energy, gram amounts of total dietary fat, saturated fat, total dietary fiber, and total sugar, and percent calories from fat, carbohydrate, protein, and saturated fat.

The results, discussion, and conclusions for this study are described in Part III, which is a manuscript entitled, Teacher perceptions of students' dietary intake: A comparison to students' 24-hour recall and BMI data.

Study Three

Research Question

3) At the intermediate grade level, what are teachers' normative classroom food-related practices and their perceptions of the school food environment? What, if any, teacher characteristics are predictors of these practices?

Objectives and Hypotheses

The main objectives of the study were to collect baseline data on teachers' classroom food-related practices and perceptions about the school nutrition environment and to ascertain what teacher characteristics, if any, were predictive factors in the practices. It was hypothesized that some teacher characteristics, specifically, one or more of the following: support for the school environment, nutrition knowledge scores, perceptions regarding students' diet and health, years teaching, years teaching at current school, grade level teaching, education, weight status, and/or whether or not they had completed a college level nutrition course, may be predictive of teachers' classroom practices. It was postulated further that if any of these characteristics were significant predictors of practices, there would be significant differences ($p<0.05$) between teachers grouped by quartile cut points of the predictive characteristics.

Sample Population and Study Design

This study was a cross-sectional baseline survey with a convenience sample of 59 intermediate school level teachers in Monroe County, Tennessee to determine their

normative classroom food-related practices and predictive factors associated with these practices. There were a total of 70 teachers in the sample population.

Data Collection

Informational letters, describing the survey and consent forms were distributed to all third-, fourth-, and fifth-grade teachers via their school mailboxes, after human subject approval was obtained from the UT IRB. Participants were asked to return the consent forms to the school office if they were willing to participate in the study. One week following the initial distribution of consent forms, reminder/thank you cards were distributed to all teachers, reminding them to turn in the consent forms if interested and thanking those who had already returned them. Print surveys, instructions, and a $5.00 gift card to a local retailer were distributed to all teachers who returned consent forms. Again, reminder/thank you cards were distributed, one-week after distribution of the surveys, which reminded teachers to return the surveys to the school office or mail them to the research office in the enclosed postage paid envelope. Envelopes were coded to track survey completion for follow-up on non-responders, but the surveys had no identifying codes. However, they were colored-coded for each of the 7 schools. The response rate was 84%, as 59 of the 70 teachers returned surveys.

Survey Instrument

The survey instrument used in this study was adapted from the Teens Eating for Energy and Nutrition at School (TEENS) Teaching Staff Survey (53) and a student survey developed for the Youth Can! Improve their Diet for Healthy Heart. Face validity of the TEENS Teaching Staff Survey was confirmed by independent researchers and was piloted with 65 teachers prior to implementation (53). The student survey for the Youth

Can! study was piloted independently with 256 students in the same rural East Tennessee county that the current teacher survey was conducted.

The first section of the survey consisted of 20 questions about classroom food-related practices, including "more healthful" and "less healthful" practices. This section used a 5-point, Likert-type scale for ranking how often teachers engaged in the practices, 1="always (about 1 time per day)," 2="often (about 1 time per week or more)," 3="sometimes (about 2-3 times per grading period)," 4="not often (about 1 time per grading period)," and 5="never." Thus a low score for "more healthful practices" denoted that these practices were carried out often. A high score for "less healthful practices" denoted that these practices were not carried out often. The second section of the survey consisted of 37 questions. Twenty-two of these questions related to teachers' perceptions of the overall school environment. The other 15 questions in this section related to teachers' perceptions of students' dietary intake and food choices and how theses factors may affect students' health and behavior. The perceptions about the school environment or students' dietary intake and food choices were ranked on a 5-point, Likert-type scale from "strongly disagree" to "strongly agree." The third section of the survey consisted of 25 questions to measure nutrition knowledge, adapted from the United States Department of Agriculture (USDA) Diet and Health Knowledge Survey (DHKS) (170). These questions consisted of multiple choice and short answer questions. The fourth section of the survey consists of 8 demographic questions to determine age, gender, education, years employed at current school, years employed as a teacher, grade level currently teaching, weight status, and whether or not the teacher completed a college-level nutrition course. The final section of the survey consisted of 5 questions

from the Social Desirability Scale (171), with 5 statements designed to measure social desirability, scaled on a 5-point Likert-type scale from "definitely true" to "definitely false."

As previously stated, the teacher survey for this project is based on the TEENS survey, but some changes were made to investigate teacher practices revealed by the preliminary study and preliminary data from the Youth Can! intervention study. In addition, some changes were necessary to allow for data comparison with the Youth Can! student survey. Although these changes are noteworthy, they should not have affected the validity of the survey because the changes were consistent with questions from the original survey and the constructs of SCT (147).

First, the use of terms that denoted middle school aged students was changed to reflect intermediate school aged students. Secondly, three statements were added in the section regarding teachers' perceptions of the school nutrition environment. This section asked, "How strongly do you disagree or agree with the following statements?" The following statements were added based on findings from the preliminary study: "Most teachers at my school do not purchase school meals because the food is not very tasteful," "Teachers should model healthy eating behaviors for students," "Teachers should not allow students to eat 'junk food' in their classrooms." These statements were similar to other statements found in the TEENS survey and reflected issues that the researcher thought should be investigated.

The following additional changes were made to the teacher practice section. The TEENS survey asked, "How often do you allow students to eat food items (including candy) in the classroom?" This question was deleted, but three other questions were

added that expand on the concept and correspond with questions from the Youth Can! survey, as follows, "How often do you allow students to eat yogurt or cheese or drink low-fat or skim milk in your classroom," "How often do you allow students to eat fruits or drink 100% fruit juice in the classroom," "How often do you allow students to eat vegetables in your classroom."

Two other questions were added to correspond with questions from the Youth Can! survey, as follows, "How often do you give extra time at recess as a reward, incentive or as a special treat for students" and "How often do you give special duties, like being the leader, as a reward, incentive or as a special treat for students?"

Further, three additional questions were added based on preliminary findings from the Youth Can! intervention. Specifically, Youth Can! student leaders expressed that they believed teachers should not drink soft drinks or eat candy in class, if students are not allowed. These questions target those teacher practices and address modeling behaviors as presented in SCT (147). The questions that were added included, "How often do you drink soft drinks in your classroom while students are present," "How often do you eat fruits or vegetables in your classroom while students are present," "How often do you eat candy or snack foods in your classroom while students are present, "How often do you eat yogurt or cheese or drink low-fat or skim milk while students are present."

A final change was made to the section about classroom practices. The Likert-type scale was changed from a six-point scale to a five-point scale. This change was made to correspond with the five-point scale on the Youth Can! student survey. The six-point scale in the classroom practice section of the TEENS survey included "2 or more

times per day," "1 time per day," "1-3 times per week," "2-3 times per month," 1 time or less per month," and "never." This was changed to "always (about 1 time per day)," "often (about 1 time per week or more)," "sometimes (2-3 times per 6-week grading period)," "rarely (about 1 time per 6-weeks)," and "never." This changed collapsed the highest two categories "2 or more times per day" and "1 time per day" into one category, "always (about 1 time per day)."

Prior to conducting this research, the teacher surveys and Youth Can! student surveys were piloted with 5 fourth-grade teachers and 8 randomly selected students from each teachers' classroom in another rural East Tennessee school district. This pilot allowed the researchers to check for face validity and internal consistency of the teacher survey. Additionally, data analysis from the student surveys and the pilot teacher surveys was used to test if the distribution of teacher scores and student scores regarding rewards and food availability in the classroom were different, using a Chi-square test. There were no significant differences in the distributions ($p<0.187$).

Data Analysis

Dependent Variables

To assess classroom food-related teacher practices, two dependent continuous variables were created from responses in first section of the survey. The first dependent variable, "less healthful classroom practices," was created by using responses to questions that represent classroom food-related practices that do not promote healthy eating patterns among students. The second dependent variable, "more healthful classroom practices," was created by using responses to questions that represent classroom practices that promote healthier eating or a healthy lifestyle among students.

There were 10 questions for each variable with a 5-point scale. Therefore, the possible range for each variable was 10 to 50. A score of 50 denotes that the practices were never carried out, while a score of 10 denotes that the practice were carried out about 1 time per day.

Independent Variables

Several continuous independent variables were created from the survey questions. These variables were selected because prior research (53), using the TEENS survey showed that these variables were significant predictors (or approached significance) of classroom food-related teacher practices in 16 Minnesota schools. The first two variables were created by conducting factor analyses, using principal components factors with varimax rotation, to determine which of the survey questions explained most of the variances observed. These questions were retained to develop a scale for the independent variables, "school environment" and "student diet." The "school environment" variable used responses to questions regarding teachers' perceptions about the overall school environment to reflect level of support for a healthy school environment. Ten of the 22 questions were retained, with a 5-point scale, which provided a possible range of 10 to 50. The "student diet" variable used responses to questions regarding teachers' perceptions about students' dietary intake, food choices, and how these factors may affect students' health and behavior to reflect level of understanding of these concepts. Eight of the 15 questions were retained, with a 5-point scale, which provided a possible range of 8 to 40.

The third continuous variable, "nutrition knowledge" was created using responses to the questions in third section of the survey. This section contained 25 questions, which

were scored as correct or incorrect, producing a final possible nutrition knowledge score of 0 to 25. Other independent variables included education, years employed at current school, years employed as a teacher, grade level currently teaching, age, weight status, and whether or not the teacher had completed a college nutrition course. Ethnicity was not used as a demographic variable because the vast majority of teachers in the county were Caucasian. Gender was not used as a demographic variable because the vast majority of the teachers in the sample were female. Descriptive statistical analyses were performed, as were step-wise and forward regression analyses to determine if any independent variables were significant predictors of classroom food-related teacher practices. Multivariate analysis was performed with the covariates that were deemed significant predictors. All statistical analyses were conducted using SPSS, version 14 (168).

In the original proposal, it was proposed that teachers' average scores on classroom practices questions would be validated by comparing them to students' average scores from similar questions from the Youth Can! survey questions. After the pilot, the student surveys were revised so that the descriptors for the Likert scale corresponded identically to the descriptors for the Likert scale on the teacher surveys. This revision was not made until after surveys had been completed at the three smaller schools in the district. A total of 61 revised surveys were collected from students from the final two schools. However, only 5 fifth-grade teachers from these schools returned surveys. Therefore, the sample size was too small to validate the survey questions. In addition, during administration of the surveys to students, it became apparent that the 6-week time frame may have been too long for students to comprehend. This was evident

by questions that asked how often students received pizza or food coupons as rewards. Although these items were used as rewards, in-depth interviews with teachers revealed that food coupons were given out only 1 time per grading period, with report cards, and pizza parties were given either once per grading period or once per semester due to the expense to teachers. However, about 30% of students surveyed reported that they received pizza as a reward about 2-3 times per 6-weeks or more, with about 13% reporting that they received pizza 1 time per week or more. Further, about 75% of students reported receiving food coupons at least 2-3 times per 6-weeks or more.

The results, discussion, and conclusions for this study are described in Part IV, which is a manuscript entitled, A cross-sectional survey of third-, fourth-, and fifth-grade teachers: Classroom food-related practices and perceptions of the school nutrition environment.

Project Strengths

The research project had several notable strengths. First, the project included both qualitative and quantitative methodologies to seek greater understanding of classroom food-related teacher practices and their perceptions about the school nutrition environment. In addition, two forms of triangulation were used to increase validity of the study. First, triangulation occurred by using two different types of data collection, focus groups and in-depth interviews. Secondly, triangulation of qualitative data from the preliminary study and first study component with the quantitative data from the Youth Can! quantitative data provided cross-validation and corroboration of teacher generated themes. Further, the involvement of teachers through the participatory action research portion of the preliminary study and the intervention component of this project provided

an emic perspective of the school environment and normative teacher practices that may influence students' snack intake at school. Also, this project added to the scientific literature by describing the nutrition environment of intermediate schools, teachers' classroom food-related practices, and predictive factors of those practices. It was the first such research to do so. Further, this project was quite timely given the recent policy changes at the state and federal levels, giving rise to vast changes in school environments across the country. The survey used for this study may be a useful tool for collecting baseline and follow-up data on teacher practices and the school environment in other school districts.

Project Limitations

Even though attempts were made to survey all intermediate school level teachers, the main limitation of the proposed project is the small sample size, which caused two potential problems in the statistical analyses. Although some difference were detected, the sample size may have been too small to detect differences in nutrition knowledge, student diet and health concepts, weight status, and other demographic characteristics. Teachers from other grade levels were not included in the study to increase the sample size because of additional confounding variables based on teacher practices used specifically with younger and/or older students. Another limitation of the proposed project was the lack of a random sample, given the limited number of intermediate grade teachers in the county. Further, because the Youth Can! intervention was conducted in the two largest schools, in which the researcher was the Project Coordinator, it was not possible to control for related confounding factors that may have influenced teachers' reported classroom food-related practices or perceptions of the school environment.

Finally, because of unforeseen, albeit positive changes, in regulations at the state and federal levels, the third component of the original proposed project was altered and implementation of formal nutrition policies developed by representative groups of key stakeholders, including teachers, was delayed. Thus, analysis of the effectiveness of such policies could not be completed. However, a follow-up survey of intermediate grade teachers will be conducted after implementation of the new school wellness policies and enactment of Tennessee's healthy vending legislation. Statistical tests will be completed to ascertain if differences exist in teachers' classroom food-related practices perceptions before and after these major policy changes are enacted.

Project Significance

Healthful dietary behavior is one of the key components of a healthy lifestyle and is essential in preventing and treating overweight and its sequela. Traditionally, school-based efforts to promote and sustain the development of healthful dietary behavior and prevent overweight in children have been implemented through nutrition education and improvements in the nutrition quality of school meals. However, more recently, researchers have begun to focus efforts on improving the school environment to eliminate many of the factors that conflict with nutritional health messages that students receive in the classroom and to ensure that the setting encourages the development of healthful eating behaviors.

This research project and the preliminary study were planned in accordance with the CDC's Guidelines for School Health Programs to Promote Lifelong Healthy Eating, which suggest that key school and community stakeholders should be involved in improving the school nutrition environment. The preliminary study involved teachers,

who are key stakeholders in their schools, in an assessment of the school environments, using the photovoice assignment as the catalyst for identifying the particular needs of each school and developing unique nutrition action plans that addressed these needs. The goals of this project were to gain insight regarding teachers' classroom food-related practices, their perceptions of the school environment, and to provide baseline data for evaluation of school wellness policies in Monroe County. Chapters 4 through 6 represent a body of work that indicates the goals and specific aims of this project were met.

The results from the first study were presented at a district-wide wellness policy development meeting in Monroe County in April 2006. These results were used to inform school administrators and wellness policy committee chairs about teachers' perspectives on their roles in supporting and providing a healthful school environment. One of the most noteworthy aspects that was addressed at this meeting was the finding that nearly all of the teachers interviewed said that they believed strongly that school-wide policies were needed to address the use of foods, including candy, as rewards and to delineate the types of snacks and beverages that would be acceptable for classroom snacks. This is important because the new state and federal mandates do not specifically prohibit the use of food items as student rewards nor do they specifically address the types of snacks available in the classroom. Although final versions of school wellness policies have not been released, discussions with the CSHP Coordinator indicate that at least some primary and elementary schools in the district will include policies that address these issues. Further, results from the final two studies will be released to all school principals and wellness committees in August 2006. In addition, the teacher survey data will serve as a baseline evaluation of teacher practices in the county and

intermediate grade teachers will be surveyed again in the fall of 2006 to evaluate the effectiveness of the policy changes on teachers' classroom food-related practices and their perceptions of the school environment.

In addition, this research project will add to the scientific literature, because few studies exist that described classroom food-related teacher practices or their perceptions of the school environment. Although the researcher does not purport that a causal relationship exists between teacher practices and the high prevalence of childhood overweight, these practices may influence children's normative behaviors and perceptions that may indirectly contribute to this public health crisis. Identification of teacher practices may provide other researchers with the necessary tools to develop nutrition interventions that target these behaviors. Further, these practices must be identified and documented, if healthy school nutrition environments are to be realized.

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PART 2

A QUALITATIVE STUDY OF INTERMEDIATE GRADE TEACHERS' PERCEPTIONS OF THE SCHOOL NUTRITION ENVIRONMENT

Introduction

As the prevalence of childhood overweight continues to increase (1), the federal government and many state legislatures have focused efforts on improving the school environment through development and implementation of wellness policies, legislation directed to limit students' access to unhealthy beverages and snacks, and development of coordinated school health programs. The Centers for Disease Control and Prevention (CDC) (2) and the United States Department of Agriculture (USDA) (3) have developed guidelines to help local schools develop school environments that foster the development of healthy eating behaviors in children. Both agencies recognize teachers as part of the core group of key stakeholders in schools and suggest that they should be included in the development and implementation of wellness policies to ensure that policies are effective, relevant, and sustainable.

Teachers are key stakeholders because they have a unique and critical role to play in providing and supporting a healthy environment for children in schools. Both the Social Ecological Model (4) and Social Cognitive Theory (5) suggest that they are part of the social environment, in which students' food preferences and dietary behaviors may be influenced and modified (2). The school environment can expose students to nutritious foods and beverages and provide positive role models to help support healthy eating behaviors and the development of lifelong healthful eating patterns (6). Indeed, Berensen and colleagues (7) have concluded that teachers may have a greater potential influence on elementary students' health than any other social group outside of the family. However, few studies have examined teachers' personal understanding of their role in providing and supporting a healthy school environment for students. This study was undertaken as

part of the school wellness policymaking process to ascertain teachers' perceptions of the influence of the school food environment, including classroom food-related teacher practices, on students' overall dietary quality, weight status, and health.

Methods

This study was conducted in 2 phases. The preliminary study, which consisted of focus groups and a photovoice assignment, was conducted in April 2003. The second phase of the study, which built upon the formative data from the preliminary study and consisted of in-depth interviews, was conducted in April and May 2005.

Preliminary Study

Participants

As part of the formative research, a convenience sample of 12 fifth-grade teachers and 1 school nurse was selected from 2 intervention schools for the Youth Can! Improve Their Diet for a Healthy Heart research project. These teachers were chosen because student participants in the Youth Can! research study would be in their classrooms during the 2004-2005 school year. Additionally, the researchers believed that these teachers could provide insight about the school environment and could assist in an assessment of the school nutrition environment. Each participant was given a $20.00 gift card from a local retailer.

Procedures

Human subject approval from the University of Tennessee Institutional Review Board was granted prior to all data collection. Consent forms were collected and verified. Formative research data were collected in spring 2003 from teachers at 2 Youth

Can! intervention schools as part of an assessment of the school nutrition environment. An audio-recorded, 90-minute focus group meeting was conducted with all participants from the two participating schools. The goal of this initial meeting was to discuss the high prevalence rate of childhood overweight in the county and contributing factors, how the school nutrition environment influences children's health, eating patterns, and weight status, and ways to improve the school nutrition environment.

This study used a novel investigative methodology called photovoice. Developed by Wang and Burris (8), photovoice provides participants with cameras and asks them to document their environment. After the focus group meeting, the teachers were each given a camera with 36 exposures and a photovoice assignment, in which they were asked to document the types of foods, including candies and beverages, available throughout their schools, in the cafeteria, hallways, classrooms, and any other school event, during a 1-week period in April 2003. Teachers were given basic information on photovoice documentation, including privacy issues and photovoice ethics. Following the first week of photovoice documentation, the cameras were retrieved by the researchers and the photographs were developed.

Two separate audio-recorded, 60-minute focus group meetings were convened with participants from each school to discuss the types of foods depicted in the photographs and how these foods could impact students' health, dietary intake, and weight status. At each meeting the participant that took the photographs sorted his/her photographs by common themes. After the common themes were discussed, the photographs were sorted again by the group, until consensus was achieved. The

participants discussed the implications of the themes and developed an action plan to improve their school's nutrition environment based on the themes.

Phase 2

Participants

Participants for the second phase of this study consisted of a theoretical sample of 20 third-, fourth-, and fifth-grade teachers from two school systems in a rural East Tennessee county, where the formative research was conducted. Eight fifth-grade teachers, 6 fourth-grade teachers, 5 third-grade teachers, and 1 multi-grade (grades 3-5) teacher were included in the sample. The participants were recruited by placing letters in their school mailboxes. The letters provided a brief description of the study and a contact number to call if they were interested in participating in the study. Each study participant received a $20.00 gift card purchased from a local retailer.

Procedures

This study used grounded theory methodology (9) to understand emergent themes and constructs related to teacher perceptions of how the school food environment, including classroom food-related teacher practices, influences students' overall dietary quality, weight status, and health. Individual, in-depth, semi-structured interviews were conducted at each school during and immediately after school hours. Each interview was audio-recorded and then transcribed.

The interviews focused on teacher classroom food-related practices and teachers' perceptions about how food available to students at school, including the classroom, may influence their overall dietary quality, weight status, and health. Photographs from the preliminary study were used as the catalyst for the interviews, which were guided by an

interview protocol modified from the Popular Education process (10), SHOWeD (11). This technique uses a series of questions about photographs to generate discussion. The questions include:

1) What do you **S**ee here?
2) What is really **H**appening here?
3) How does this relate to **O**ur lives?
4) **W**hy does this problem or strength exist?
5) What can we **D**o about it?

The interview guide is located in the Appendix on page 188.

Data Analysis

Two researchers coded the transcribed data independently, using open, axial, and selective coding and constant comparison of data using memoing. Open coding was completed by first using broad groupings of interrelated entries using the SHOWeD questions as topic headings. After open coding was completed, axial coding was performed by grouping similar clusters under each broad category and then categorizing them based on common themes as they emerged. Common themes were categorized further by core categories, which were used to develop an emergent logic model, using selective coding. Common themes and categories regarding teachers' perceptions of students' diet quality were compared to themes from the preliminary study.

Results

The following four major themes regarding students' diet quality developed from the formative research and were evident again in phase two of the study: 1) most of the

snack foods students eat are not healthy, 2) school breakfasts and lunches are probably much healthier for students than the breakfasts they eat at home or breakfasts and lunches they bring from home, 3) students don't make healthy choices at school meals, even though they are offered, 4) if students don't consume a snack or soft drink at school, they will just consume it after school. Several clusters from phase two of the study supported these four major themes. In addition, two new major themes developed, including: 1) candy rewards positively influence students' work habits and behavior, and 2) overweight students eat larger portions than do students who are not overweight.

Using the themes that developed regarding students' diet quality and the relevant subcategories and core categories of teachers' perceptions surrounding these themes, a conceptual model emerged (Figure 2.1). The conceptual model shows that these teachers believed that nutrition interventions should target both the home and school environments, which in turn would influence students' diet quality and subsequently students' growth and weight status, which would ultimately impact their current and long-term health status.

Although the teachers interviewed believed the school environment had an influence over students' diet quality and food choices, all teachers interviewed said that they thought the home environment had more influence over students' diet quality, food choices, and health.

> *"Even if you only let them eat healthy foods at school, when they get home, they eat the junk food that their mommas buy. You could take away all the junk at school, but if it isn't reinforced at home, it wouldn't do any good."*

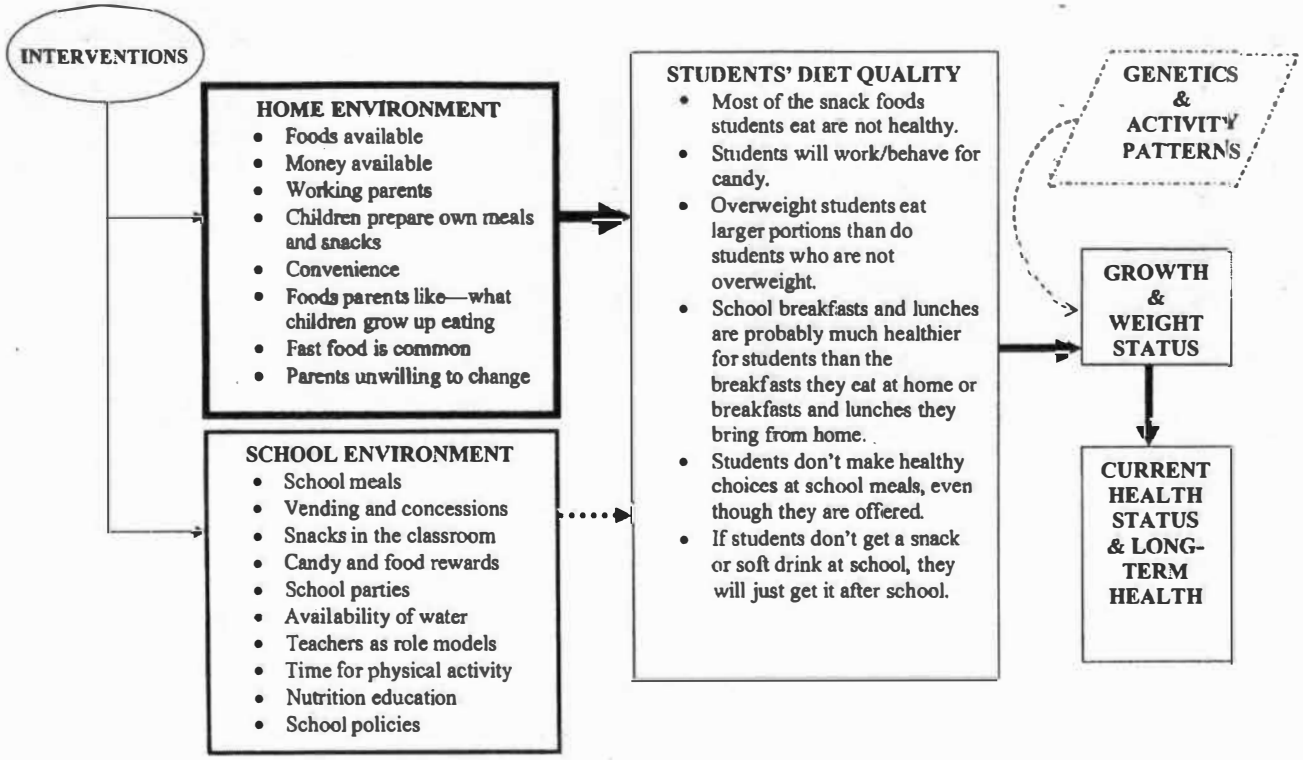

Figure 2.1. Teachers' perceptions: Determinants of students' diet quality and health

As the conceptual model shows, the teachers believed that the main areas of influence on students' diet quality within the home environment included: 1) the foods available at home, 2) convenience foods, 3) parental work schedules, 4) preparation of snacks and meals by children, 5) the money available for food, 6) readily available fast food, 7) parental food preferences, and 8) the difficulty reaching some parents for education and/or interventions.

> *". . .the parents fed them for 5 years before coming to school so many of their patterns are already set—what they like and what they don't. What is in the cabinets and refrigerators at home really influence what types of foods the kids are used to and ultimately what they want to eat."*

Within the school environment, the teachers perceived that the main areas of influence on students' diet quality included: 1) school meals, 2) school food policies, 3) snacks in the classroom, 4) availability of water, 5) candy and food rewards, 6) vending and concessions, 7) school parties and special events, 8) nutrition education, and 9) time period for physical activity (recess or physical education classes).

School Meals

With few exceptions, the teachers interviewed thought that improvements had been made in school meals, with sustained efforts to prepare healthier meal options for students and staff. Notable improvements included baking foods that had been traditionally fried, such as french fries, tater tots, and chicken nuggets as well as the addition of salads with low-fat or fat-free dressings. Teachers reported few complaints from students regarding lower fat options, with the exception of canned vegetables prepared without seasoning or added fat. However, teachers did report concern about the

number of high-carbohydrate foods offered at both breakfast and lunch and the amount of sandwich items served each month.

"We have something on a bun 3 to 4 times a week. I know kids like that, but it isn't healthy with all that white bread. . ."

". . . it seems like everything in there is served on a bun. We counted 12 or 14 days that they served something on a bun—now remember there are only 20 school days in a month not 30!"

School Food Policies

Most teachers did not think that schools had moved forward with developing healthful school nutrition policies or improving the school environment because vending and concessions have become such an important source of income.

"It all comes down to money. They won't make these [nutrition policy] changes unless it is a law."

"It doesn't matter if the schools got more money. If they got enough to make all the copies we could ever need, they would just come up with another reason to sell the junk, like more computers or computer programs."

Of the teachers interviewed, most believed that "healthy classroom snack policies" should be included in the school wellness policies and must be school or system-wide.

"[The classroom snack policy] has to be school wide. It would not be fair if one brother or sister had a teacher that let them bring in doughnuts and the other could only bring in fruits and vegetables."

"It [classroom snack policy] has to be school wide, because if you have one [a healthy snack policy], then you become the bad teacher. 'Mean old lady! She makes you eat vegetables!'"

"I don't want to be the bad guy. No teacher wants to be the one that students don't want to have as a teacher.

"... it [the classroom snack policy] needs to be school wide. If this teacher says no you can't eat [junk food] in my classroom, but [the students] are walking down the hall and others are eating cupcakes and drinking cokes. If it was a school wide thing, it wouldn't be a problem."

Of the teachers interviewed, only one had classroom policies that placed stipulations on the type of snack foods students could bring to class. A second teacher had established policies in the past, but because of an early lunch schedule, no longer had a snack time. These teachers did not allow any high-fat, high-sugar foods or beverages for classroom snacks.

". . . we are having snacks, but only healthy snacks are allowed. Here is a list. If it is not on the list they won't be able to eat it during snack time. I have that in my classroom and when they bring the junk in, I say that's good, but you can't eat that during healthy snack time, you can eat it at lunch or recess. And they miss out on eating snack, so they tell their parents, 'I can't bring that, I have to bring something healthy. That will make the parents change what they send."

"I had another teacher and we were on the same team so we just stuck together and made the restrictions. If they brought something in we would let them have one warning, they could eat it once, but that was it. We put together a list and sent it home."

Although other teachers agreed that some students brought in unhealthy snacks, which were sources of extra calories, dietary fat, and sugar, most were reluctant to set such policies on their own.

Snacks in the Classroom

Many teachers believed that classroom snacks were important for students' readiness to learn, especially for those with late lunches or for those who skipped breakfast.

[Students] do need a snack because most of them ride the bus and if they don't eat breakfast here at school, then they will go a long period of time without eating. That is if they eat breakfast at all. Some of them don't have time. Then when they are waiting on lunch they are hungry and can't work.

Availability of Water

At one school, students were not allowed to drink water from water bottles in their classrooms because of a school policy. This policy was enacted after a trial period of allowing students to drink water in classrooms. Because of spills and excess lavatory breaks, the faculty and administration decided to no longer allow water bottles in the classrooms. Most other teachers interviewed allowed students to drink water throughout the day from water bottles. Many of the teachers had heard that proper hydration was vital to students' brain function and overall health. To prevent spills, most teachers

required that students bring in water bottles with sealable "sport-caps." Although many teachers did acknowledge that some students needed extra lavatory breaks, especially when water bottles were first introduced, most had practical measures in place to deal with any abuse of privileges.

Candy and Food Rewards

Although nearly all of the teachers agreed that there should be school policies prohibiting or discouraging the use of food and candy as rewards and incentives, almost all admitted to using the practice. Most teachers said that candy was one of the best rewards, because large bags are available for low costs and students will work and/or behave for candy. Another common practice among the teachers interviewed was the use of "coke and pizza" parties. Teachers said that these parties, which were usually held about once per six weeks or at least once per semester, were given as a general reward for the entire class. A final alternate practice regarding the use of food and candy should be noted. Several teachers discussed restricting students' access to concessions and soft drink machines as a form of discipline. Students with excessive disciplinary "marks" for the week were not allowed to participate in concessions or were restricted from getting soft drinks during recess.

> *"Candy is an inexpensive reward that directs behavior. Students respond and it doesn't cost much. We all like a little reward now and then."*

> *"Students will work for candy."*

Vending and Concessions

Almost all of the teachers interviewed thought that changes should be made in vending and at concessions by providing healthy choices, but most did not think it would have a great impact on students' overall diet quality. They believed that if students didn't purchase soft drinks or "junk food" at school, they would purchase it after school. Many were concerned that if healthy snack policies were not implemented, the students would bring in soft drinks and unhealthy snacks instead of buying them from concessions or vending.

> *They'll just bring in the junk food from home, or some of them will. I know that when we did healthy snacks for concessions, the younger kids didn't complain, hardly at all, but the fifth-graders complained. One reason was we had run out of the fruit and yogurt and just had those [cereal] bars. They don't like them—I think they get them in the lunchroom.*

However, some teachers did not think that healthy choices in vending and concessions would decrease revenues for schools.

> *"If they have a dollar, they will spend a dollar."*

> *"The kids just like plugging the money in the machine. I know because when our coke machines are out of everything except water then they will buy the water.*

Parties and Special Events

Most teachers viewed classroom parties as an acceptable time to have high-fat, high-sugar treats. They thought that because the parties were held infrequently, usually only once or twice a semester, that they would not negatively impact students' weight

status, diet quality, or health. However, a few teachers did believe that parties were held too frequently and were often times tied into schools' reward systems.

> *"We have pizza parties, popcorn parties, ice cream parties for students with gold or purple cards [for honor roll]."*

Time Period for Physical Activity

A few teachers discussed the timing of physical education class. These teachers believed that students had a better appetite at lunch time if the students went to physical education class before lunch. Although most of the recess periods were scheduled in the afternoons, these teachers thought that scheduling recess before lunch might have similar benefits.

Nutrition Education

Many of the teachers interviewed taught at schools where a nutrition education intervention for fifth-grade students was conducted. Thus, several of these teachers discussed nutrition education as a means to improve students' diet quality, weight status, and overall health. Most were complimentary of the curriculum and thought it should be included for at least one 6-week grading period. However, scheduling nutrition education during regular class time seemed problematic because of rigorous teaching schedules due to annual achievement testing. Suggestions for improvement in the curriculum included a greater focus on reducing soft drink consumption among students and increasing family awareness of the nutrition education messages.

Teachers as Role Models

One notable concept emerged regarding how teachers perceived themselves as role models. Although the majority of teachers recognized that they were role models for

their students, few acknowledged that they had thought about being positive role models for healthy eating.

> *"I think teachers should be made aware that kids get upset when [teachers] drink cokes or eat candy in front of them. I'm not sure they even realize that they shouldn't do that."*

> *"I know my kids look up to me, but I hadn't really even thought about being a role model when it comes to food. What's next?"*

Discussion

This study used grounded theory methodology (9) to develop a conceptual understanding of how teachers perceive the school food environment, its impact on students' overall dietary quality, weight status, and health, and their roles in providing and supporting a healthy school environment for students. To our knowledge, this is the first study to examine these issues at the intermediate grade levels (grades 3-5). This study addressed a gap in the existing literature about teachers who are key constituents in their school communities with the potential to influence, promote, and help sustain recently mandated school wellness policies.

Teachers interviewed in this study believed that the home environment had a greater influence on child health, diet quality, and weight status than did the school environment. However, all concurred that the school environment had a strong influence or the potential to have a strong influence as well. Nine key areas of influence within the

school environment and 6 recurrent themes regarding the impact of the school environment on students' diet quality emerged throughout the data.

Many of the themes and concepts that emerged in this study were consistent with the Socio-Ecological Model (4) and findings from other studies that examined middle school (grades 6-8) environments and teachers' beliefs and opinions concerning the school food environment (12-15). One such theme, *students won't choose healthy options even when they are offered*, emerged in findings among teachers and parents in 2004 by Bauer and associates (15).

As this study revealed, teachers perceived that the use of candy and food rewards was a widespread classroom practice. Several other studies revealed (12-16) that this practice was routine at other elementary and middle schools. Teachers in this study perceived candy and food rewards as an effective means to control students' behavior and as an incentive for outstanding academic achievement. Most believed that an occasional hard candy for a reward would not negatively impact students' health, diet quality, or weight status. However, many teachers believed that the use of high-fat and/or high-sugar "treats," such as pizza, ice-cream, nachos, cookies, and cakes, as rewards could negatively influence students' diet quality, weight status, and eventually their health. A few teachers did not use candy or food as rewards or incentives, but used other innovative methods to reward students, such as "homework coupons," which students earned by reaching goals or excelling academically. The coupons could be used by students to be excused from certain homework assignments. Other rewards and incentives included the use of trinkets, pencils, stickers, and allowing students to be teacher assistants for a day,

Very few teachers believed that candy and food items sold for fundraising had a negative impact on students' health, weight status, or diet quality. Reasons for this lack of concern included infrequent fundraising activities in the schools and limited amounts of treats sold at any given time. This may provide some insight into why greater than 50% of teachers surveyed in a study by Kubik and colleagues (12) were either uncertain or supportive of using candy and low-nutritive quality foods for fundraising.

In contrast to the studies by Bauer (15) and Kubik (12-13), few teachers in this study perceived peer influence as a strong modulator of students' diet. This may be because most of the teachers in this study did not eat breakfast or lunch with their students in the cafeteria and did not have occasion to witness how students interact during meal times or peer influence may not be as great in the intermediate grades as in the middle grades. However, one notable discussion of peer interaction among students did emerge. Several teachers recognized overweight students were often stigmatized by other students. Further these teachers discussed what they viewed as a recent phenomenon, overweight students teasing other overweight students about weight status. These teachers thought that this was a problem that should be targeted by school counselors and guidance teachers.

Conclusions

Teachers were aware of the connection between the school nutrition environment and child health. They provided an emic, or insider's, perspective on how the school environment may impact child health and discussed their roles in providing and supporting a healthy school environment. Their opinions are important in developing,

implementing, and evaluating sustainable nutrition policy changes in schools. Further studies with larger and more diverse populations are needed to validate and verify the model and general themes that emerged from this study.

School Health Implications

This study was developed as part of the policymaking process, in which teachers were involved in several aspects, including assessing school environments and developing and implementing school nutrition action plans. In addition, the results of this study were presented to school wellness policy committees at the school and system levels during formulation of federally mandated school wellness policies. If effective, this model may be used by other schools to develop sustainable school wellness policies that address the unique underlying problems within individual school environments. In addition, pubic health professionals should use emic details, gained by research, to effectively target salient aspects of the school environment.

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PART 3

TEACHER PERCEPTIONS OF STUDENTS' DIETARY INTAKE: A COMPARISON TO STUDENTS' 24-HOUR RECALL AND BMI DATA

Introduction

In response to the high prevalence of childhood overweight in the United States, greater emphasis has been placed on school-based nutrition interventions and improving the school nutrition environment. In the mid-1990s, the Centers for Disease Control and Prevention (CDC) (1) and the United States Department of Agriculture (USDA) (2) published guidance to assist local schools and school districts in developing school policies and practices that foster healthy environments, which provide nutrition education, availability of healthy food choices, and the support necessary to develop and sustain healthy dietary behaviors. Both agencies recognize that teachers can play a pivotal role in promoting and providing a healthy environment in which students can become empowered to develop and sustain these behaviors. Although teachers have been clearly identified as key stakeholders in improving the school nutrition environment, little research has been conducted to determine teachers' perceptions of their role in promoting and providing a healthy atmosphere or how the school environment can influence students' dietary behaviors.

In conjunction with the Coordinated School Health Program (CSHP) and as part of the school wellness policy-making process, formative research, which consisted of focus group interviews with fifth-grade teachers and in-depth semi-structured interviews with intermediate grade level teachers (grades 3-5) in a rural East Tennessee community, was conducted to ascertain teachers' perceptions about the school nutrition environment, their roles in providing and promoting a healthy environment, and how the school food environment may influence students' dietary behaviors. Transcribed and coded data from the qualitative research revealed several recurrent themes regarding students' dietary

quality and intake. The objective of this study was to compare themes from teacher interviews with student age- and gender-specific BMI and self-reported 24-hour dietary recall data. Comparison of multiple data types within an ethnographic study setting improves the credibility and reliability of the qualitative data and helps assess the sufficiency of data collected (3).

Methods

Formative Research

All research was conducted after human subject approval from the University of Tennessee Institutional Review Board was granted. Informed consent and assent forms were collected and verified. The study was conducted in phases, including formative research, which consisted of two phases of qualitative interviews, and a final phase, which consisted of validation of the teacher interviews with secondary analysis of student 24-hour recall and BMI data. Both phases of the formative research were conducted in a rural East Tennessee county. In the first phase, a convenience sample of 12 fifth-grade teachers and 1 school nurse was selected from 2 intervention schools for the Youth Can! Improve Their Diet for a Healthy Heart research project. First, an audio-recorded, 90-minute focus group interview was conducted with all participants from the intervention schools. The goal of this meeting was to discuss the high prevalence rate of childhood overweight in the county and contributing factors, how the school nutrition environment influences children's health, eating patterns, and weight status, and ways to improve the school nutrition environment.

After the focus group meeting concluded, teachers were given a photovoice assignment (4), which is a novel investigative technique that provides participants with cameras to document their environment. The participants were asked to use cameras to document the types of foods available throughout their schools during a one-week period. Information on photovoice documentation was provided, including ethics and privacy issues. After one week, the cameras were retrieved by the researchers and the photographs were developed. Additional 60-minute focus group meetings were convened with participants from each school to discuss the photographs and how the foods depicted could impact students' health, dietary intake, and weight status. The pictures were sorted by common themes until consensus was achieved. All recordings were transcribed verbatim and coded. The analyses revealed several preliminary teacher-identified themes based on their perceptions about how the school nutrition environment contributes to students' dietary intake and weight status.

During the second phase of the formative research, a theoretical sample of 20 intermediate grade (grades 3-5) teachers was interviewed using a semi-structured interview format based on the poplar education method (5) SHOWeD (6). Grounded theory methodology (7) was used to understand emergent themes and constructs of teacher perceptions regarding how the school food environment, including classroom food-related teacher practices, influences students' overall dietary quality, weight status, and health. Each interview was audio-recorded, transcribed verbatim, and coded. Common themes and categories regarding teachers' perceptions of students' diet quality were compared to themes from the preliminary study.

Secondary Data

Baseline dietary and anthropometric data from a concurrent intervention study, Youth Can! Improve Their Diet for a Healthy Heart, were compared to teacher identified themes, a process known as data triangulation. The baseline sample consisted of 252 24-hour recalls from fourth-grade students in the same rural community in East Tennessee, along with height, weight, age, and gender data on 228 of these students, from which age- and gender-specific body mass index (BMI) percentile data were calculated. The multiple-pass, 24-hour dietary intake data were collected using Nutrition Data System for Research (NDS-R) software version 5.0_35 (2004), developed by the Nutrition Coordinating Center, University of Minnesota, Minneapolis, MN (8). Height and weight data were collected by trained school nurses and nutrition personnel.

Data Analysis

Variable Descriptions

Eating occasions were defined as *breakfast, lunch, dinner*, and *snack*. The term used for each eating occasion was classified according to what the student called the eating occasion. *Day* was defined as the sum of all eating occasions. The locations of eating occasions were defined as follows: 1) *at school* was defined as all foods and beverages, except fluid water, reported in student 24-hour recalls that were consumed only at school, during school hours; 2) *elsewhere* was defined as all foods and beverages, except fluid water, reported in student 24-hour recalls that were consumed before or after school hours.

Gram and nutrient information were calculated for eating occasions and locations based on the following definitions. *Total gram amount* was defined as the total weight of

all foods and beverages, except fluid water, reported in student 24-hour recalls for each eating occasion and defined meal/snack location. Other studies have demonstrated that gram is an adequate measure of portion size (9-10). *Energy* was defined as the amount of kilocalories of all foods and beverages, reported in student 24-hour recalls for each eating occasion and defined meal/snack location.

Macronutrients from foods and beverages reported in students' 24-hour recalls were defined as follows: 1) *dietary fat* was defined as the gram amount of dietary fat of all foods and beverages reported in student 24-hour recalls for each eating occasion and defined meal/snack location; 2) *saturated fat* was defined as the gram amount of saturated fat of all foods and beverages reported in student 24-hour recalls for each eating occasion and defined meal/snack location; 3) *protein* was defined as the gram amount of protein of all foods and beverages reported in student 24-hour recalls for each eating occasion and defined meal/snack location; 4) *carbohydrate* was defined as the gram amount of carbohydrate of all foods and beverages reported in student 24-hour recalls for each eating occasion and defined meal/snack location; 5) *dietary fiber* was defined as the gram amount of total dietary fiber of all foods and beverages reported in student 24-hour recalls for each eating occasion and defined meal/snack location; 6) *total sugar* was defined as the gram amount of total sugar of all foods and beverages reported in student 24-hour recalls for each eating occasion and defined meal/snack location.

Macronutrient densities were defined as follows: 1) *percent calories from fat* was defined as the kilocalories from dietary fat divided by total kilocalories (multiplied by 100) of all foods reported in student 24-hour recalls as lunch from home or lunch from school and consumed at school; 2) *percent calories from carbohydrate* was defined as the

kilocalories from carbohydrate divided by total kilocalories (multiplied by 100) of all foods reported in student 24-hour recalls as lunch from home or lunch from school and consumed at school; 3) *percent calories from protein* was defined as the kilocalories from protein divided by total kilocalories (multiplied by 100) of all foods reported in student 24-hour recalls as lunch from home or lunch from school and consumed at school; and 4) *percent calories from saturated fat* was defined as the kilocalories from saturated fat divided by total kilocalories (multiplied by 100) of all foods reported in student 24-hour recalls as lunch from home or lunch from school and consumed at school.

Body mass index was calculated for each student with height and weight measurements and age and gender classifications. Heights were measured to the nearest mm using a Schorr Board without shoes and read by a trained coordinated school health nurse. Weights were triple measured to the nearest 0.1 kg on a digital, calibrated scale by trained coordinated school health nurses. All heights and weights were entered into a spreadsheet, BMI was calculated as kg/m^2 and compared the National Center for Health Statistics growth charts (11). Weight status was defined as follows: 1) *overweight student* was defined as a student with age- and gender-specific BMI (kg/m^2) $\geq 85^{th}$ percentile and 2) *student who was not overweight* was defined as a student with age- and gender-specific BMI (kg/m^2) $<85^{th}$ percentile.

Healthy food was defined according The State of Tennessee's most recent policy statement on the definition of healthy foods in schools, the Tennessee State Board of Education Rule 0520-1-6-04, Minimum Nutritional Standards for Individual Foods Items Sold or Offered for Sale to Pupils in Grades Pre-Kindergarten through Eighth Grade (12). The variable *snack that met guidelines* was defined as a snack that met all guidelines for

minimum nutritional standards. The variable *snack that did not meet guidelines* was defined as a snack that did not meet one or more guideline for minimum nutritional standards.

Statistical Tests

NDS-R output files and SPSS software, version 14.0 (2005) (13), were used to complete all analyses. First, 5 diet recalls were excluded because the interviewers' notes indicated that the recall data were unreliable. Secondly, descriptive statistics, including variable frequencies and means, box plots, stem and leaf plots, outliers, skewness, and kurtosis, were conducted to determine the appropriate statistical approach for testing hypotheses posed by teacher-developed themes.

Unequal variances t-tests for independent groups and independent t-tests were used to test for significant differences between the students who were overweight and students who were not overweight for mean total grams, energy, and grams of dietary fat, saturated fat, total dietary fiber, and total sugar for all eating occasions (breakfast, lunch, dinner, and snacks) and for snacks consumed at school and snacks consumed elsewhere.

Students' 24-hour recall snack data were used to identify snacks consumed at school. The snacks students consumed at school were categorized by type, i.e. sugar-sweetened beverages, chips, and cookies. The nutrient composition and portion size of each snack was compared to the state guidelines to determine the percentage of snacks consumed by students at school that did and did not meet the newly mandated criteria. Then, a Chi-square test was completed to test if there was a significant difference in the distribution of snacks that did and did not meet the guidelines.

Another Chi-square test was used to test if there was any difference in the distribution of children who did not consume a snack at school or elsewhere (n=32), children who did not consume a snack at school, but consumed one elsewhere (n=136), children who consumed a snack at school, but did not consume one elsewhere (n=11), and children who consumed a snack at school and elsewhere (n=68). Secondly, to test if differences existed among the three groups of children who consumed a snack (at school, elsewhere only, or at school and elsewhere) for mean total grams, mean energy, and mean grams of protein, carbohydrate, dietary fat, and saturated fat, dietary fiber, and total sugar of snacks, a non-parametric test, Kruskal-Wallis, was performed because the snack recall data by location were not normally distributed. Next, an ANOVA was used to test if there were significant differences between all four groups (at school, elsewhere only, at school and elsewhere, or no snack) for the day's mean intake of energy and mean grams of protein, carbohydrate dietary fat, saturated fat, dietary fiber, and total sugar. A Tukey's b post hoc test was used to determine which group means were different from one another.

Recall data from students who consumed lunch, either from home (n= 35) or purchased at school (n=195), were used for the last statistical analysis. In addition to the 5 cases that were excluded because they were deemed unreliable, an additional 14 cases were excluded because interviewer notes indicated that although these students consumed lunches purchased at school, they consumed additional food items given to them by classmates or brought from home. Because tests for normality showed that group data for one or more variable of interest were not normally distributed, a nonparametric test, Mann-Whitney, was performed to ascertain if there were statistically significant

differences in mean ranks of total gram amounts, energy, gram amounts of total dietary fat, saturated fat, total dietary fiber, and total sugar, and percent calories from fat, carbohydrate, protein, and saturated fat.

Results

From the formative research, the following themes emerged from the teacher focus group and individual in-depth interviews:

1) *overweight students eat larger portions than do students who are not overweight,*

2) *most of the snack foods students eat at school are not healthy,*

3) *if students don't consume a snack or soft drink at school, they will just consume it after school,*

4) *school breakfasts and lunches are probably much healthier for students than the breakfasts they eat at home or breakfasts and lunches they bring from home,*

5) *students don't eat healthy choices even when they are offered,*

6) *students will work/behave for a candy reward.*

Because of the experimental nature of the last two themes, only the first four themes could be operationalized for secondary data analyses.

Table 3.1 shows the demographic characteristics of the 223 students for which there were matched BMI and 24-hour recall data. Data from these students were used to examine the first teacher-identified theme; *overweight students eat larger portions than do students who are not overweight.* Statistical comparisons were made for each group (overweight and not overweight) for mean total grams, energy, and gram amounts of total

Table 3.1. Youth Can! baseline data: Demographic characteristics of students with matched BMI and recall data (n=223)

Age			
Mean age (y)	9.67		
Gender			
	n	**Percentage**	
Males	117	52.5%	
Females	106	47.5%	
Weight status[a]			
	Percentage	**Mean**	**Standard Deviation**
Overweight	44.8%	95.05	3.80
Not overweight	55.2%	53.34	22.31

[a] Overweight defined as age- and gender-specific BMI $\geq 85^{th}$ percentile

dietary fat, saturated fat, total sugar, and dietary fiber for each meal and for snacks consumed at school and snacks consumed elsewhere. Table 3.2 delineates the distribution of mean total grams, energy, and gram amounts of total dietary fat, saturated fat, total sugar, and total dietary fiber from snacks eaten at school by overweight and non-overweight students. The mean total gram amount (270,86 g) of snacks consumed at school by overweight students (n=32) was significantly greater than the mean total gram amount (174.06 g) of snacks consumed at school by students who were not overweight (n=41) (p-value= 0.03). There were no significant differences in energy or mean gram amounts of total fat, saturated fat, total sugar, or total fiber.

Table 3.3 delineates the distribution of mean total grams, energy, and gram amounts of total dietary fat, saturated fat, total sugar, and total dietary fiber from dinner by overweight and non-overweight students. For dinner, the mean total gram amount (678.10 g) of snacks consumed at school by overweight students (n=95) was significantly greater than the mean total gram amount (582.12 g) of snacks consumed at school by students who were not overweight (n=118) (p-value= 0.03). Also, overweight students' mean intake of energy (812.37 kcal), total fat grams (35.86 g), and saturated fat grams (14.11 g) was significantly greater than the mean intake of energy (675.85 kcal), total fat grams (28.79 g), and saturated fat grams (10.82 g) (p-values=0.01, 0.02, and 0.01, respectively). There were no significant differences between groups in mean total gram amount, energy, or grams of fat, saturated fat, dietary fiber, or total sugar for breakfast, lunch, or snacks consumed elsewhere.

The second teacher-identified theme, *most of the snack foods students eat at school are not healthy*, was examined using 24-hour dietary recall snack data, which

Table 3.2. Youth Can! baseline data: Mean amounts of total grams and selected nutrient intakes of snacks consumed at school

Intake	Overweight (n=32) Mean ± SD	Not Overweight (n=41) Mean ± SD	p-value
Total Amount* (g)	**270.86 ± 204.24**	**174.06 ± 181.91**	**0.036**
Kilocalories	207.12 ± 106.47	181.76 ± 114.58	0.337
Total Fat (g)	7.13 ± 6.16	5.83 ± 6.37	0.390
Saturated Fat (g)	2.72 ± 3.5	1.78 ± 3.1	0.230
Total sugar (g)	23.99 ± 18.54	21.47 ± 22.11	0.607
Total fiber (g)	1.14 ± 1.16	1.05 ± 1.00	0.737
*significant at 0.05			

Table 3.3. Youth Can! baseline data: Mean amounts of total grams and selected nutrient intakes from dinner

Intake	Overweight (n =95) Mean ± SD	Not Overweight (n=118) Mean ± SD	p-value
Total Amount* (g)	**678.10 ± 356.86**	**582.12 ± 282.65**	**0.03**
Energy* (kcal)	**812.37 ± 419.49**	**675.85 ± 350.79**	**0.01**
Total Fat* (g)	**35.86 ± 22.73**	**28.79 ± 19.79**	**0.02**
Saturated Fat* (g)	**14.11 ± 10.22**	**10.82 ± 8.36**	**0.01**
Total sugar (g)	39.48 ± 27.85	34.32 ± 21.44	0.29
Total fiber (g)	4.84 ± 3.78	4.31 ± 3.42	0.13
*significant at 0.05			

revealed that 79 students ate a total of 115 either snack foods or beverage items at school. The types of foods consumed are categorized in Table 3.4. Salty snacks, such as chips, crackers, and pretzels, were consumed with the greatest frequency, accounting for 23.5% of the snacks consumed, closely followed by sweetened beverages at 21.7%. Milk was consumed with the least frequency, accounting for only 3.5% of snacks consumed. Dessert foods, candy, fruit and 100% fruit juice, cereal and cereal bars, and ice cream were consumed as well. Table 3.5 shows that only 20 of the 115 foods (17.4%) met the state guidelines for a healthy snack, while 95 foods (82.6%) did not. The frequency with which snacks did not meet the guidelines was significantly greater than expected, while the frequency of snacks that did meet the guidelines was significantly less than expected (X^2=48.91; p-value<0.001).

Analysis of 24-hour recall snack and day's intake data were used to investigate the third teacher-identified theme, *if students don't consume a snack or soft drink at school, they will just consume it after school.* Fewer students than expected consumed a snack at school only or did not have a snack, while more students than expected consumed a snack at school and elsewhere, or only elsewhere (Table 3.6) (X^2=145.96; p-value<0.001). The expected frequency was 61.8 compared to the observed frequency of 32 students who consumed no snack at school or elsewhere, 11 who consumed a snack at school only, 68 who consumed a snack at school and elsewhere, and 136 who consumed a snack elsewhere only. Further analysis was done to ascertain if significant differences existed among the three groups of children who consumed a snack (at school, elsewhere only, and at school and elsewhere) for mean total grams, energy, and grams of protein, carbohydrate, dietary fat, and saturated fat, dietary fiber, and total sugar of snacks.

Table 3.4. Youth Can! baseline data: Types of snacks consumed at school

Type of Food	Frequency (items mentioned)	Percent
Salty snacks (chips, crackers, pretzels, etc.)	27	23.5
Sweetened beverages	26	21.7
Dessert foods (cookies, snack cakes, etc.)	15	13.0
Candy	13	11.3
Fruit & 100% fruit juice	12	10.4
Cereal & cereal bars	10	8.7
Ice cream	9	7.8
Milk	4	3.5

Table 3.5. Youth Can! baseline data: Percentages and Chi-square test of snacks consumed at school that did and did not meet the Tennessee healthy vending legislation

	Observed Frequency	Expected Frequency	Percent
Did meet guidelines	20	57.5	17.4
Did not meet guidelines	95	57.5	82.6
Total	115		
Test Statistics			
	Chi-square	Degrees of Freedom	p-value
	48.91	1	<.001

Table 3.6. Youth Can! baseline data: Chi-square test for differences in distribution of students by snack group

Location	Observed N	Expected N	Residual
No Snack	32	61.8	-29.8
Snacked at School Only	11	61.8	-50.8
Snacked at School & Elsewhere	68	61.8	6.3
Snacked Elsewhere Only	136	61.8	74.3
Test Statistics			
	Chi-square	Degrees of Freedom	p-value
	145.955	3	<0.001

Table 3.7 summarizes the findings from the Kruskal-Wallis test, showing that for total gram amount of snacks, students who consumed a snack both at school and elsewhere had a significantly higher mean rank (127.58) than did students who consumed a snack elsewhere only (103.38) and at school only (44.14) (p-value <0.05). The mean rank for total gram amount of snacks was significantly higher for students who consumed a snack elsewhere only compared to students who consumed a snack at school only.

The same pattern was seen for the mean rank of all other nutrients except total fat grams. Those students who consumed a snack both at school and elsewhere had significantly greater mean ranks of energy (138.04), carbohydrate grams (136.50), protein grams (128.90) saturated fat grams (130.86), dietary fiber grams (135.18), and sugar grams (131.32) compared to students who consumed a snack elsewhere only. In turn, this group had greater mean ranks of energy (98.35), carbohydrate grams (98.75), protein grams (102.06), saturated fat grams (100.78), dietary fiber grams (98.08), and sugar grams (101.52) than did those students who consumed a snack only at school. For total fat grams, students who consumed a snack elsewhere and at school had a greater mean rank (134.13) than did students who consumed a snack elsewhere only (98.81) and those who consumed a snack only at school (60.05).

An ANOVA with Tukey's b post hoc test was used to test if there were significant differences among the four groups (school only, elsewhere only, at school and elsewhere, or no snack) for the day's total intake of mean grams of energy and grams of carbohydrate, protein, total fat, saturated fat, dietary fiber, and sugar. As shown in Table 3.8, the results indicated that students who consume snacks at school only or consumed no snack had significantly (p-value=0.05) lower mean intakes of grams of carbohydrate

Table 3.7. Youth Can! baseline data: Mean ranks of snack nutrients and snack total gram amounts by snack consumption location*

	Snack Location		
	School Only n=11	Elsewhere Only n=136	Elsewhere & School n=68
Intake	Mean Rank	Mean Rank	Mean Rank
Snack Total Gram	44.14[a]	103.38[b]	127.58[c]
Snack Energy	41.64[a]	98.35[b]	138.04[c]
Snack Dietary fat	60.05[a]	98.81[a]	134.13[b]
Snack Carbohydrate	46.05[a]	98.75[b]	136.50[c]
Snack Protein	52.23[a]	102.06[b]	128.90[c]
Snack Saturated Fat	56.00[a]	100.78[b]	130.86[c]
Snack Dietary Fiber	62.59[a]	98.08[b]	135.18[c]
Snack Total Sugar	43.9[a]	101.52[b]	131.32[c]

*Mean ranks with different letters are significantly different from one another at p-value of 0.05.

Table 3.8. Youth Can! baseline data: Day's total intake by snack grouping*

	Snack Group			
Nutrient	Elsewhere Only n=136 Mean ± SD	Elsewhere & School n=68 Mean ± SD	School Only n=11 Mean ± SD	No Snack n=32 Mean ± SD
Day's Energy (kcal)	2283.90 ± 875.12[B]	2333.67 ± 953.69[B]	1679.96 ± 441.10[A]	1806.02 ± 574.39[AB]
Day's Total Dietary Fat (g)	87.12 ± 40.03[A]	89.81 ± 43.27[A]	67.37 ± 19.47[A]	71.76 ± 33.40[A]
Day's Total Carbohydrate (g)	302.18 ± 120.97[B]	310.26 ± 128.25[B]	206.10 ± 75.10[A]	227.80 ± 67.99[A]
Day's Total Protein (g)	79.52 ± 35.23[A]	78.75 ± 36.98[A]	65.87 ± 32.37[A]	67.75 ± 29.10[A]
Day's Total Saturated Fat (g)	32.54 ± 15.98[A]	35.52 ± 17.73[A]	25.80 ± 11.09[A]	28.45 ± 16.31[A]
Day's Dietary Fiber (g)	14.34 ± 6.70[A]	15.82 ± 8.16[A]	11.08 ± 6.21[A]	12.01 ± 4.20[A]
Day's Total Sugar (g)	169.96 ± 73.93[B]	177.91 ± 75.79[B]	105.37 ± 35.50[A]	121.83 ± 47.77[A]

* Means with different letters are significantly different from one another at p-value of 0.05.

(206.10 g and 227.80 g, respectively) for the day than those students who consumed a snack both at school and elsewhere (310.26 g) and those students who consumed a snack elsewhere only (302.18 g). Similar results are shown for mean intakes of grams of sugar. Students who consumed snacks only at school or who consumed no snack had significantly (p-value=0.05) lower mean intakes of grams of sugar (105.37 g and 121.83 g, respectively) for the day than those students who consumed a snack both at school and elsewhere (177.91 g) and those students who consumed a snack elsewhere only (169.96 g). There were no significant differences in the day's mean energy intake or mean grams of dietary fat, protein, saturated fat, or dietary fiber.

Two-hundred thirty students' 24-hour recall lunch meal data were used to analyze the final theme, *school breakfasts and lunches are probably much healthier for students than the breakfasts they eat at home or breakfasts and lunches they bring from home.* Because the breakfast data were analyzed in a previous study (14), only lunch data were used to complete this analysis. Table 3.9 summarizes the findings, which shows that when recall data from students who consumed lunch from home (n= 35) was compared to recall data from students who purchased lunch at school (n=195), using an alpha of 0.05, there were significant differences in mean ranks of percent calories from protein and carbohydrate and grams of total sugar and dietary fiber. The mean rank of percent calories from carbohydrate in lunches brought from home was significantly greater than for lunches purchased at school (139.69 vs. 111.16; p-value =0.020). Similarly, the rank of total sugar grams in lunches brought from home was significantly higher compared to lunches purchased at school (147.04 vs. 109.84; p-value=0.002). Also, the mean rank of percent calories from protein and grams of dietary fiber were lower for lunches brought

Table 3.9. Youth Can! baseline data: Mean ranks of total grams, energy, fat grams, saturated fat grams, fiber grams, and total sugar grams for lunches brought from home and lunches purchased at school

Intake/Nutrient	Home lunches	School Lunches	p-value
Total gram	108.66	116.73	0.510
Energy	134.94	112.01	0.060
Dietary fat	126.90	113.45	0.271
Saturated fat	121.63	114.40	0.554
Dietary fiber	**94.16**	**119.84**	**0.039**
Total sugar	**147.04**	**109.84**	**0.002**
% kcal from fat	112.63	116.02	0.782
% kcal from carbohydrate	**139.69**	**111.16**	**0.020**
% kcal from protein	**63.64**	**124.81**	**<0.001**
% kcal from saturated fat	110.23	116.45	0.611

*significant at p-value of 0.05

from home compared to lunches purchased at school (63.64 vs. 124.81; p-value <0.001 and 94.16 vs. 119.84; p-value=0.039, respectively). Further, the difference in the mean rank for energy approached significance at p=0.060, with the mean rank for energy from lunches brought from home exceeding the mean rank for energy from lunches purchased from school (134.94 vs. 112.01).

Discussion

Overall, comparison of teacher-identified themes with secondary data analysis provided valuable insight regarding students' dietary intake and the school nutrition environment. Some of the themes were supported by secondary data analyses of student 24-hour recall data, while others were not. The first teacher-identified theme, *overweight students eat larger portions than do students who are not overweight*, was compared to matched BMI and student recall data for each meal and for snacks consumed at school and snacks consumed elsewhere. The results for these analyses were mixed, but total gram amounts of dinner and snacks consumed at school were significantly greater for overweight students than for students who were not overweight. Similar results regarding the association of weight status of children and total gram amount of snacks consumed was demonstrated by the Bogalusa Heart Study (15), where they found a significant association between total gram amount of snacks consumed and overweight status (BMI>85th percentile) ($p<0.05$). Further, Huang and colleagues (9), using Continuing Surveys of Food Intakes by Individuals (CSFII) 1994 to 1996 and 1998 data, demonstrated that meal portion size, measured by total gram amount of foods and beverages, except tap and bottled water, consumed at meals, but not snacks (measured by

total gram amounts of foods and beverages, except tap and bottled water), was positively associated with BMI percentile in male children ages 6 to 11 (p-value=0.01) and in male and female children ages 12 to 19 (p-value<0.001). From their review of the literature, Ello-Martin (16) and associates, concluded that although a casual relationship between larger portion sizes and overweight may be difficult to establish, the research suggests that as children grow older, they are more likely to ignore satiety cues, which may prompt them to overeat when large portions of palatable foods are readily available in the environment.

Although there were no significant differences in any other intake variable for snacks consumed at school, the analysis showed that for the dinner meal, mean energy and mean grams of dietary and saturated fat were significantly higher for overweight students than for non-overweight students. Although few studies have found a significant difference in energy between overweight and non-overweight children, these findings are important because positive energy imbalance is the most scientifically plausible explanation for weight gain (17). Further, several studies have shown an association between intake of dietary and saturated fat intake with childhood overweight (18-19).

Analysis of the second teacher-identified theme, *most of the snack foods students eat at school are not healthy*, was supported by the secondary data analysis and showed that the majority of snacks consumed at school were salty snacks and sweetened beverages. These findings are consistent with trend research conducted by Nielsen and associates (20) using data from the Nationwide Food Consumption Survey (NFCS) and CSFII. These data showed that among 2- to 18-years-olds, there was a significant increase in the total energy percentages of snacks consisting of salty snacks (from 7.6%

to 14.2%; p-value $\leq$0.01) and sweetened beverages (from 11.1% to 12.4%; p-value $\leq$0.001) from 1977 to 1996. Although no research could be found that documented the types of snacks intermediate grade students consumed at school, the types of snack foods consumed by students at school in this study were consistent with findings from a study by Zive and colleagues (21) of a la carte foods available in 24 middle schools. The most popular types of foods sold consisted of desserts, fast food, chips/crackers, and frozen desserts. Also, it is consistent with data from the School Health Policies and Programs Study 2000 (22), which showed that at the elementary school level, 58.1 % sold sweetened beverages, 51% sold salty snacks not low in fat or sodium, and 52.6% sold baked goods not low in fat or sodium. Further, it is consistent with the types of snack foods consumed throughout the day in two studies, one with a sample of third-grade students and the other with a sample of fifth- and sixth-grade students (23-24).

The third teacher-identified theme, *if students don't consume a snack or soft drink at school, they will just consume it after school,* which too was validated by secondary data analysis, is consistent with other studies that have looked at consumption patterns of children. Using 1977-78 NFCS, 1989-91 CSFII, and 1994-96 CSFII data, Jahns and associates (25) demonstrated that snacking increased among all age groups of children from 77% to 91%, with a significant increase in the number of snacking occasions per day (an increase of approximately 0.4 snacking occasions per day between the 1977-78 data and the 1994-196 data; p-value =0.01). Additionally, a study by Cross and colleagues (24), showed that 82.7% of fifth- and sixth-grade students (n=289) snacked at least one time per day, with 98.7% of students reporting that they snacked in the afternoon at least once a week or more. In addition, the study showed that students who

consumed one or more snacks after school consumed significantly higher total grams, energy, total sugar, and fiber than did students who did not consume any snacks. However, there was no significant difference in weight status between the two groups. This may warrant further investigation to determine if more frequent snacking occasions in this study may be associated with overweight status.

Analyses of the final teacher-identified theme, *school breakfasts and lunches are probably much healthier for students than the breakfasts they eat at home or breakfasts and lunches they bring from home,* yielded mixed results. There were no significant differences in mean ranks of total grams, energy, grams of total fat, and saturated fat, or percent calories from total dietary fat or saturated fat. However, the data indicated that lunches brought from home had less protein and fiber than school lunches, while being higher in total grams of carbohydrate and sugar.

No recent study that specifically compared school lunch intake of elementary or intermediate students who purchased lunch at school with those who brought lunch from home could be found in a review of the literature. However, one study from Gleason and colleagues (26), using 1994-1996 CSFII data for children ages 6 to 18-years old, found mixed results as well. Similar to the present study, the CSFII data revealed that that students who did not participate in the National School Lunch Program (NSLP), i.e., those students who did not consume at least 3 or the 5 food components of the school lunch offered, had significantly lower mean percent of calories from protein and mean grams of fiber and had significantly higher mean grams of added sugar and percent of calories from carbohydrate when compared to NSLP participants. Unlike the present study, the CSFII data revealed that there were significant differences in mean energy

intake as a percent of recommended intake and mean percents of calories from total dietary fat and saturated fat, with NSLP participants consuming significantly larger amounts of each.

In an earlier secondary analysis of the Youth Can! baseline data, using 244 recalls of students who ate breakfast at school, at home, or both, the researchers found that students who ate breakfast at school had significantly higher mean intakes of percent calories from total dietary fat and saturated fat and grams of protein compared to students who ate breakfast at home, with no significant difference in the mean gram amounts of fiber (14). Other studies of the School Breakfast Program (SBP) found that students who participated in the SBP had greater intakes of protein, total dietary fat, and saturated fat than non-participants (26-27), which may be due to the consumption of meat products consumed in school breakfasts (28).

Therefore, there were mixed results when trying to corroborate the final teacher-identified theme with secondary data analysis. Secondary analysis of Youth Can! breakfast data in a prior study, showed that breakfasts purchased at school may not be as healthy as breakfasts eaten at home, especially when looking at percentage of calories from fat and saturated fat. However, this portion of the theme was purely speculative, as the teachers could not see what students ate at breakfast outside of school. Lunch data showed mixed results, with no real differences in lunches from home in regard to calories or percents of calories from fat and saturated fat. However, it may have been reasonable for teachers to believe that lunches from school were healthier than lunches brought from home. Many of the lunches from home contained soft drinks or other sweetened beverages, which may account for the greater mean ranks of percent calories from

carbohydrate and total sugar grams as well as teachers' perceptions that these lunches were not as healthy as school lunch. Further, lunches from home had lower mean ranks of percent calories from protein and grams of dietary fiber.

To our knowledge, this study was the first to attempt to compare teacher-identified themes with students' recall and BMI data. The empirical data were mixed when compared to the teachers' themes. However, the study provided great insight into intermediate students' dietary intakes at school and elsewhere in relationship to teachers' perceptions regarding student intake. The major strength of this study was the use of mixed-methods in an attempt to validate teachers' perceptions. Indeed, teachers' perceptions are important, but to make substantial and sustainable improvements in the school environment, it is equally important to understand whether or not teachers' perceptions accurately reflect the school environment.

The findings of this study must be interpreted in light of the limitations associated with qualitative and secondary analysis. First, qualitative data may not be generalizable to other populations due to the bias inherent in recruiting participants. Although a theoretical sample of third-, fourth-, and fifth-grade teachers was used to obtain a variety of perspectives, the sample size was relatively small, with 13 participants for the initial focus group interviews and 20 participants for the in-depth interviews. Additionally, the groups were quite homogenous, as most participants were education professionals and female. Further, these participants may have had perspectives that differed from other individuals who did not choose to participate in the study. Similarly, the sample for the secondary data analysis was not randomly selected and there were no details describing those students who elected not to participate in the study. Also, although the student data

used for secondary analysis was collected shortly after the initial focus group with teachers, the in-depth interviews were completed over a year after the student data were collected. Additionally, during this time the Youth Can! intervention began at two of the schools and several of the teachers interviewed had direct contact with nutrition educators and researchers, which might have influenced their perceptions.

Conclusions

This study provided further insight about teachers' perspectives of students' dietary intake at school and the school nutrition environment. Although the results were mixed, these research findings support the CDC's and USDA's guidance, which suggests that teachers are key stakeholders in school communities and should be involved in the development and promotion of policies and programs that provide a healthy school environment for students. Additionally, health professionals and researchers should look to teachers as key informants, as they have intimate knowledge of the day to day activities and normative values within their schools and can provide an emic, or insider's, perspective. Although the teacher-identified themes were on target with some aspects of students' dietary intake, the teachers did not elaborate on methods to improve students' dietary behaviors. Information collected from teachers regarding the school environment and students' dietary behaviors may be useful for nutrition and other health professionals in targeting specific behaviors and/or aspects of the school environment for intervention. Further, comparisons of teacher-identified themes to empirical data may be useful in developing meaningful and sustainable wellness policies and evaluating policies once implemented.

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PART 4

A CROSS-SECTIONAL SURVEY OF THIRD-, FOURTH-, AND FIFTH-GRADE TEACHERS: CLASSROOM FOOD-RELATED PRACTICES AND PERCEPTIONS OF THE SCHOOL NUTRITION ENVIRONMENT

Introduction

In recent years, as the prevalence of childhood overweight has reached epidemic rates, many researchers have begun to study the school nutrition environment as a potential target to help improve children's dietary intake and weight status. Traditionally, most researchers investigating the school nutrition environment have looked at the foods available to students in the cafeteria, vending, school stores, and concessions. Few researchers have investigated less traditional aspects of the school nutrition environment, such as teachers' classroom food-related policies and practices, their use of food as incentives or rewards for students and their perceptions regarding the school food environment.

After an extensive review of the literature, only a few studies that investigated the less traditional aspects of the school nutrition environment were found (1-4). Three of these studies were conducted in middle-school settings by Kubik and colleagues. In the first study (1), the researchers surveyed a convenience sample of teachers to assess how demographic characteristics, personal health and eating behaviors, nutrition knowledge, perceptions about how students' food choice and behaviors influenced their overall health and behavior, and beliefs regarding the overall school nutrition environment influenced teachers' eating behaviors during school and their food practices within their classrooms. They found that several teacher characteristics, including low support for a healthful school environment, were predictive of classroom practices that should be limited. From the findings, they concluded that the use of food as student rewards was a common teacher practice in middle schools and most of the foods used as rewards do not help establish a foundation for healthy dietary habits for school children. Additionally, the

researchers concluded that middle school teachers do not provide healthful eating behavior role modeling at school.

In the second study (2), the researchers surveyed both teachers and parents regarding their perceptions of the school nutrition environment and beliefs about middle school students' eating habits. They found that teachers and parents concurred on many opinions regarding the school environment. Nearly all agreed that it was important to have a healthful school environment. However, parents were not as concerned about commercial advertising in schools as teachers were. Although this study did not assess the school food environment directly, it was unique in that it demonstrated that both teachers and parents, who are key stakeholders in school communities, may be unrecognized advocates to improve the nutrition integrity of schools.

A final study by Kubik and associates (3) surveyed school administrators about schoolwide food-related practices and collected self-reported heights and weights from 3088 eighth-grade students from these schools. BMI was calculated from the student data and a 7-item food practices scale was created. The results showed that there was a significant association between school-wide practices and students BMI ($p=0.06$) and that BMI increased by 10% ($p=0.03$) for every additional food practice allowed by a school.

This study confirmed that the use of food items as rewards or fundraising were common school practices. In addition, it revealed some previously unreported school practices, such as allowing students to eat and/or drink in school hallways. It is the first study to show an association between the number of food-related school practices and students' BMI. The authors conclude that these schoolwide food practices encourage

consumption of foods and beverages that are high-calorie, with low-nutritional value, and adversely affect student BMI.

Burnett (4) surveyed preschool and primary school teachers to determine how often sweets were used as rewards and the perceived merit of these rewards as educational motivation. This study showed a clear division of opinions regarding the use of sweets as rewards. About 56% of teachers surveyed thought that sweets were the least effective educational incentive, while about 44% of those surveyed reported using sweets as rewards. Younger children and special education children were more likely to receive sweets than were older and mainstream students. Furthermore, the use of sweets for special occasions and on sports days was quite common in this sample.

No studies could be found that looked at teacher-related aspects of nutrition environments of intermediate schools (grades 3 to 5). It is important to understand these aspects of the school nutrition environment at every level because teachers have a key role in developing and supporting policies and programs to improve the school environment and can have a powerful influence on students' health (5). This study surveyed a convenience sample of 59 intermediate school level (grades 3 to 5) teachers to determine their normative classroom food-related practices and predictive factors associated with these practices.

Methods

Study Setting

In conjunction with the Coordinated School Health Program (CSHP) and as part of the school wellness policy evaluation process, this study was conducted with intermediate grade teachers from 7 schools in a rural East Tennessee community.

Survey Instrument

The survey instrument used in this study (Appendix B) was adapted from the Teens Eating for Energy and Nutrition at School (TEENS) Teaching Staff Survey (1) and a student survey developed for the Youth Can! Improve their Diet for Healthy Heart intervention study. Face validity of the TEENS Teaching Staff Survey was confirmed by independent researchers and was piloted with 65 teachers prior to implementation. The student survey for the Youth Can! study was piloted independently with 256 students in the same rural East Tennessee county that the current teacher survey was conducted.

Further, prior to conducting this research, the teacher surveys and Youth Can! student surveys were piloted with 5 fourth-grade teachers and 8 randomly selected students from each teacher's classroom in another rural East Tennessee school district. This pilot allowed the researchers to check for face validity and internal consistency of the teacher survey. Additionally, data analysis from the student surveys and the pilot teacher surveys was used to test if the distribution of teacher scores and student scores regarding rewards and food availability in the classroom were different, using a Chi-square test. There were no significant differences in the expected distributions ($p<0.187$).

The first section of the teacher survey consisted of 20 questions about classroom food-related practices, including "more healthful" and "less healthful" practices. This

section used a 5-point, Likert-type scale for ranking how often teachers engaged in the practices, 1="always (about 1 time per day)," 2="often (about 1 time per week or more)," 3="sometimes (about 2-3 times per grading period)," 4="not often (about 1 time per grading period)," and 5="never." Thus, a low score for "more healthful practices" denoted that these practices were carried often. A high score for "less healthful practices denoted that these practices were not carried out often. The second section of the survey consisted of 37 questions. Twenty-two of these questions related to teachers' perceptions of the overall school environment. The other 15 questions in this section related to teachers' perceptions of students' dietary intake and food choices and how these factors may affect students' health and behavior. The perceptions about the school environment or students' dietary intake and food choices were ranked on a 5-point, Likert-type scale from "strongly disagree" to "strongly agree." The third section of the survey consisted of 25 questions to measure nutrition knowledge, adapted from the United States Department of Agriculture (USDA) Diet and Health Knowledge Survey (DHKS) (6) . These questions consisted of multiple choice and short answer questions. The fourth section of the survey consisted of 8 demographic questions to determine age, gender, education, years employed at current school, years employed as a teacher, grade level currently teaching, weight status, and whether or not the teacher completed a college-level nutrition course. The final section of the survey consisted of 5 questions from the Social Desirability Scale (7), with 5 statements designed to measure social desirability, scaled on a 5-point Likert-type scale from "definitely true" to "definitely false."

Data Collection

Informational letters, describing the survey and consent forms were distributed to all third-, fourth-, and fifth-grade teachers via their school mailboxes, after human subject approval was obtained from The University of Tennessee Institutional Review Board. Participants were asked to return the consent forms to the school office if they were willing to participate in the study. One week following the initial distribution of consent forms, reminder/thank you cards were distributed to all teachers, reminding them to turn in the consent forms if interested and thanking those who had already returned them. Print surveys, instructions, and a $5.00 gift card to a local retailer were distributed to all teachers who returned consent forms. Again, reminder/thank you cards were distributed one week following the distribution of surveys to remind teachers to return surveys to the school office or mail them to the research office in the postage paid envelopes. Envelopes were coded to track survey completion for follow-up on non-responders, but the surveys had no identifying codes. However, they were colored-coded for each of the 7 schools. The response rate was 84%, as 59 of the 70 teachers returned surveys.

Data Analysis

Dependent Variables

To assess classroom food-related teacher practices, two dependent continuous variables were created from responses in the first section of the survey. The first dependent variable, "less healthful classroom practices," was created by using responses to questions that represent classroom food-related practices that do not promote healthy eating patterns among students. The second dependent variable, "more healthful classroom practices," was created by using responses to questions that represent

classroom practices that promote healthier eating or a healthy lifestyle among students. There were 10 questions for each variable with a 5-point scale. Therefore, the possible range for each variable was 10 to 50. A score of 50 denotes that the practices were never carried out, while a score of 10 denotes that the practice were carried out about 1 time per day.

Independent Variables

Several continuous independent variables were created from the survey questions. These variables were selected because prior research (1), using the TEENS survey showed that these variables were significant predictors (or approached significance) of classroom food-related teacher practices in 16 Minnesota schools. The first two variables were created by conducting factor analyses, using principal components factors with varimax rotation, to determine which of the survey questions explained most of the variances observed. These questions were retained to develop a scale for the independent variables, "school environment" and "student diet." The "school environment" variable used responses to questions regarding teachers' perceptions about the overall school environment. Ten of the twenty-two questions were retained, with a 5-point scale, which provided a possible range of 10 to 50. The "student diet" variable used responses to questions regarding teachers' perceptions about students' dietary intake, food choices, and how these factors may affect students' health and behavior. Eight of the fifteen questions were retained, with a 5-point scale, which provided a possible range of 8 to 40.

The third continuous variable, "nutrition knowledge" was created using responses to the questions in third section of the survey. This section contained 25 questions, which were scored as correct or incorrect, producing a potential nutrition knowledge score of 0

to 25. Other independent variables include education, years employed at current school, years employed as a teacher, grade level currently teaching, age, weight status, and whether or not the teacher had completed a college nutrition course. Ethnicity was not used as a demographic variable because the vast majority of teachers in the county were Caucasian. Gender was not used as a demographic variable because the vast majority of the teachers in the sample were female (96%). Descriptive statistical analyses were performed, as were step-wise and forward regression analyses to determine if any independent variables were significant predictors of classroom food-related teacher practices. Multivariate analysis was performed with the covariates that were deemed significant predictors. All statistical analyses were conducted using SPSS, version 14 (2005) (8).

Results

Table 4.1 shows the demographic characteristics of the teachers surveyed. The mean age of the teachers was 44 years. The mean number of years teaching was 13.83 years, while the mean number of years teaching at the current school was 9.05 years. The mean score for the nutrition knowledge section of the survey was 15.76 points. The total score possible was 25 points. The percent of teachers surveyed with a Bachelors degree was 40.7%, with a Masters degree was 40.7%, and with an Education Specialist certification (a certification beyond a master's degree) was 18.6%. Approximately 58% of teachers classified themselves as overweight, while 42% classified themselves as healthy weight. About 50% of teachers had taken a college level nutrition course.

Table 4.1. Demographic characteristics of teachers surveyed (n=59)

	Mean	Standard Deviation	
Age (y)	43.98	±10.19	
Total years teaching (y)	13.83	±8.08	
Years teaching at current school (y)	9.05	±6.66	
Nutrition Knowledge Score (points)	15.76	±3.14	
	BA/BS	**MS**	**EdS**
Highest academic degree (%)	40.7	40.7	18.6
	Overweight	**Healthy weight**	
Weight status (%)	57.6	42.4	
	Yes	**No**	
College-level nutrition course (%)	50.8	49.2	

Table 4.2 provides a summary of findings regarding teachers' classroom practices that do not support and/or promote healthful behaviors and eating patterns. As shown in this table, the vast majority of teachers used candy (93.2%), high-fat pastries and cookies (71.2%), pizza (64.4%), sweetened beverages (59.4%), and fast-food coupons (74.6%) as rewards, incentives, or special treats at least one time per grading period. In addition, most teachers allowed students to drink sweetened beverages (96.6%) and eat high-fat, high-sugar snack foods (94.9%) in the classroom at least one time per grading period, while about 30% of teachers allowed these practices once per week or more. Additionally, the survey data showed that most teachers drank soft drinks (69.5%) and ate candy or snack food (71.2%) in front of students in their classrooms. However, fewer teachers indicated that they had withheld a food or beverage item from a student as punishment (28.8%).

Table 4.3, which summarizes findings about teachers' classroom practices that support and/or promote more healthful behaviors and eating patterns among students, shows that fewer teachers used lower-fat baked goods (28.8%), like bagels or pretzels, fruits or vegetables (37.3%), bottled water, fruit juice, or low-fat milk (32.2%) as a reward, incentive, or special treat. Although most teachers did allow students to eat more nutritious foods in their classrooms, like yogurt, cheese, or drink low-fat milk (74.5%), fruit or drink 100% fruit juice (94.6%), and vegetables (79.9%). In addition, most teachers used extra time at recess (84.4%) or special duties, like being the leader, (88.8%) as a reward, incentive, or special treat. Also, the majority of teachers surveyed had eaten fruits or vegetables in their classrooms while students were present (76.3%). Finally,

Table 4.2. Teachers' classroom practices that do not support/promote healthful behaviors and eating patterns among students

Practice	Always n(%)	Often n(%)	Sometimes n(%)	Not Often n(%)	Never n(%)
Used candy as reward, incentive or as a special treat for students	5(8.5)	16(27.1)	13(22.0)	21(35.6)	3(5.1)
Used doughnuts, cookies, or snack foods such as chips as rewards, incentives or as a special treat for students	0	1(1.7)	6(10.2)	35(59.3)	17(28.8)
Used pizza as reward, incentive or as a special treat for students	0	0	6(10.2)	32(54.2)	20(33.9)
Used sweetened drinks, like soft drinks or fruit drinks, as reward, incentive or as a special treat for students	0	6(10.2)	6(10.2)	23(39.0)	24(40.7)
Given out food coupons, like Hardees food coupons, as rewards or incentives to students	0	2(3.4)	9(15.3)	33(55.9)	15(25.4)
Allowed students to drink soft drinks in the classroom, at recess, or at a classroom party	5(8.5)	13(22.0)	10(16.9)	29(49.2)	2(3.4)
Allowed students to eat cookies or snack foods, like chips, in your classroom, at recess, or at a classroom party	12(20.3)	7(11.9)	10(16.9)	27(45.8)	3(5.1)
Drank soft drinks in your classroom while students are present	9(15.3)	10(16.9)	8(13.6)	14(23.7)	18(30.5)
Eaten candy or snack foods in your classroom while students are present	2(3.4)	6(10.2)	18(30.5)	16(27.1)	17(28.8)
Withheld a food or beverage item from a student as punishment	1(1.7)	2(3.4)	4(6.8)	10(16.9)	42(71.2)

Table 4.3. Teachers' classroom practices that support/promote more healthful behaviors and eating patterns among students

Practice	Always n(%)	Often n(%)	Sometimes n(%)	Not Often n(%)	Never n(%)
Used bagels or pretzels, as reward, incentive or as a special treat for students	0	1(1.7)	2(3.4)	14(23.7)	42(71.2)
Used fruits or vegetables as reward, incentive or as a special treat for students	0	1(1.7)	4(6.8)	17(28.8)	37(62.7)
Used bottled water, 100% fruit juice or low-fat milk as reward, incentive or as a special treat for students	0	0	4(6.8)	15(25.4)	40(67.8)
Given extra time at recess as a reward, incentive or as a special treat for students	1(1.7)	12(20.3)	22(37.3)	16(27.1)	7(11.9)
Given special duties, like being the leader, as a reward, incentive or as a special treat for students	10(16.9)	14(23.7)	15(25.4)	11(18.6)	9(15.3)
Allowed students to eat yogurt or cheese or drink low-fat milk in the classroom, at recess, or at a class party	9(15.3)	5(8.5)	14(23.7)	16(27.1)	15(25.4)
Allowed students to eat fruits or drink 100% fruit juice in the classroom, at recess, or at a class party	16(27.1)	6(10.2)	14(23.7)	20(33.9)	3(5.1)
Allowed students to eat vegetables in your classroom, at recess, or at a class party	15(25.4)	5(8.5)	7(11.9)	19(32.2)	12(20.3)
Eaten fruits or vegetables in your classroom while students are present	6(10.2)	11(18.6)	16(27.1)	12(20.3)	12(20.3)
Praised students when you see them eating healthier foods, such as fruit, fruit juice or low fat snack items	7(11.9)	12(20.3)	17(28.8)	14(23.7)	8(13.6)

most teachers had praised students when they saw them eating healthier foods, such as fruits, fruit juice, or low-fat snack items (84.7%).

Principal components factor analysis showed that 10 of the 22 school environment questions accounted for 43.01% of the variance for the school environment score, while 8 of the 15 students' diet questions accounted for 38.9% of the variance for the students' diet score. The component matrices can be found in the Table 4.4. These questions were retained for further analysis, as shown in Tables 4.5 and 4.6. Also, these tables indicate the frequency (by number and percentage) of teachers who strongly disagreed or disagreed, were uncertain, and agreed or strongly agreed with each question retained for analysis.

The descriptive statistics for these variables show that most teachers were in agreement with all of the statements regarding students' diet, food choices, health, and behavior. Approximately 92% of teachers surveyed believed that the foods students eat during the school day affect their readiness to learn. Seventy-eight percent believed that students' eating behaviors are influenced by social pressures. About 88% believed that students eating behaviors are a priority issue that should be addressed during childhood. Greater than 96% of teachers surveyed believed that nutrition education should give students the skills to make healthy food choices (98.3%), a school breakfast can help students be ready to learn (96.6%), and children's food habits affect their health as adults (98.4%). Although still a majority, fewer teachers believed that if more healthy foods were available in vending machines, concessions, or on the a la carte or snack line, students would purchase them (61.0%) or that a school breakfast program can help reduce tardiness and absenteeism (66.1%).

Table 4.4 Rotated component matrix[a]

	Component			
	1	2	3	4
B2	.667			
B3	-.325		.504	
B4				.764
B5	-.397			.329
B6	.373		-.342	
B7	.631			
B8			-.470	.341
B9				.762
B10			-.360	
B11	.521			.407
B12	.727			
B13				.586
B14	.544	.333		
B15	.532	.326		
B16			.357	
B17		.345	.472	
B18				
B19		.336	-.513	
B20	.589			
B21	.371		.522	
B22				.363
B25	.323		.592	
B26	.386			
B27	-.437		-.356	
B28	-.565			
B29	.548			-.522
B30		.797		
B31		.570		
B32		.717		
B33		.429		
B34			-.429	
B35	-.369			
B36	.706	.408		
B37	.655			

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
[a]Rotation converged in 9 iterations.

Table 4.5. Teachers' perceptions about students' diets, food choices, and health and behavior

Students' Diet	Strongly Disagree n(%)	Disagree n(%)	Uncertain n(%)	Agree n(%)	Strongly Agree n(%)
The foods students eat during the school day affect their readiness to learn.	1(1.7)	0	4(6.8)	31(52.5)	23(39.0)
Students' eating behaviors are influenced by social pressures.	0	4(6.8)	9(15/3)	31(52.5)	15(25.4)
If more healthy food and beverage items were available in vending machines, concessions, or on the school a la carte or snack line, students would purchase them.	1(1.7)	7(11.9)	15(25.4)	34(57.6)	2(3.4)
Students eating behaviors are a priority issue to address during childhood.	1(1.7)	0	6(10.2)	37(62.7)	15(25.4)
Nutrition education should give students the skills to make healthy food choices.	0	1(1.7)	0	46(78.0)	12(20.3)
A school breakfast program can help students be ready to learn.	1(1.7)	0	1(1.7)	35(59.3)	22(37.3)
A school breakfast program can help reduce tardiness and absenteeism.	1(1.7)	8(13.6)	11(18.6)	24(40.7)	15(25.4)
Children's food habits affect their health as adults.	1(1.7)	0	0	29(49.2)	29(49.2)

Table 4.6. Teachers' perceptions about the school environment

School Environment	Strongly Disagree n(%)	Disagree n(%)	Uncertain n(%)	Agree n(%)	Strongly Agree n(%)
Vending machines and concessions at school should offer only healthy food and beverage items.	1(1.7)	8(13.6)	8(13.6)	27(45.8)	15(25.4)
It is important to have a healthy school food environment.	0	1(1.7)	0	41(69.5)	16(27.1)
More healthy food and beverage items should be offered in the vending machines, concessions, and on the a la carte or snack line.	0	1(1.7)	2(3.4)	36(61.0)	20(33.9)
The nutritional health of students should be a school priority.	0	2(3.4)	6(10.2)	43(72.9)	8(13.6)
The school environment (i.e. vending machines, classroom food rules, foods students see school staff eat) affects students' food choices.	0	7(11.9)	5(8.5)	36(61.0)	11(18.6)
Teachers should model healthy eating behaviors for students.	0	4(6.8)	6(10.2)	36(61.0)	13(22.0)
Teachers should not allow students to eat "junk food" in their classrooms.	0	25(42.4)	16(27.1)	14(23.7)	4(6.8)
Selling high fat, high sugar foods, such as candy and cookies, as part of school fundraising is okay because it helps provide revenue for school programs and school activities.*	5(8.5)	24(40.7)	16(27.1)	13(22.0)	1(1.7)
Students in intermediate grade levels should be provided the foods they want at school.*	3(5.1)	31(52.5)	16(27.1)	8(13.6)	0
Students should be able to buy soft drinks and candy at school.*	10(16.9)	19(32.2)	16(27.1)	12(20.3)	1(1.7)

* Coded in reverse order for analysis.

Less agreement was seen among teachers regarding their perceptions of the school nutrition environment. Most teachers believed that it was important to have a healthy school food environment (96.6%) and that more healthy food and beverage items should be offered in school vending, concessions, and a la carte and snack lines (94.9%).

Many teachers agreed that the nutritional health of students should be a school priority (86.5%) and that teachers should model healthy eating behaviors for students (83.0%). Only slightly fewer thought that vending machines and concessions at school should offer only healthy food and beverage items (71.2%) and that the school environment affects students' food choices (79.6%). Additionally, greater than half of teachers disagreed that students in intermediate grade levels should be provided the foods they want at school (57.6%). However, less than half of the teachers surveyed disagreed that selling high fat, high sugar foods is okay because it helps provide revenue for school programs and activities (49.2%) and that students should be able to buy soft drinks and candy at school (49.2%). Even fewer teachers believed that teachers should not allow students to eat "junk food" in their classrooms (30.5%).

Step-wise and forward regression analyses were used to determine which independent variables were predictive of the dependent variables, "more healthful" and "less healthful" classroom practices (Tables 4.7 and 4.8). Both step-wise and forward regression showed that "years teaching at the school" was predictive of "more healthful" classroom teacher practices" ($p=0.048$). The regression equation showed that for each 1 year increase at current school, the score for "more healthful classroom teacher practices" increased by 0.26 points. Descriptive statistics showed that the 25th, 50th, and 75th percentiles for years taught at current school were 4.0 years, 7.88 years, and 12.0 years,

Table 4.7. Regression coefficients for "years at school" as a predictor of "healthful classroom practices"

Model[a]		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	32.817	1.429		22.973	.000
	Year at School	.256	.126	.271	2.028	.048

[a]Dependent Variable: "healthful classroom practices"

Table 4.8. Regression coefficients for "healthy environment score" as a predictor of "less healthful classroom practices"

Model[a]		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	25.264	4.951		5.102	.000
	Environment Score	.325	.132	.323	2.463	.017

[a]Dependent Variable: "less healthful classroom practices"

respectively. Univariate analyses were conducted to ascertain if there were statistical differences at each percentile cutpoint. These analyses revealed no significant differences at 4.0 or 7.88 years. However, there was a significant difference in the "more healthful practices" classroom teacher practices at 12.0 years. Teachers with 12 or more years at their current school had a mean "more healthful" score of 38.31, while teachers with less than 12 years, had a mean "more healthful practices" score of 34.07 (p= 0.022). This shows that if a teacher taught at a school 12 years or longer, the less often he/she engaged in classroom practices that were supportive of healthful eating patterns among students.

Additionally, "perceptions of the school environment" was predictive of "less healthful" classroom teacher practices (p=0.017). The regression equation showed that for each 1 point increase in the "school environment" score, the "less healthful classroom practices" score increased by 0.33. Because a higher "less healthful classroom practice" score denoted that teachers carried out these practices less often, the data suggest that as support for the school environment increased, the less frequently teachers reported engaging in classroom practices that were not supportive of healthful eating behaviors among students. Descriptive statistics showed that the percentile cut points for this variable were 33.79, 37.5, and 40.0. Univariate analyses showed no significant difference at the 25th percentile cut point of 33.79, but showed a significant difference at the 50th percentile of 37.5. Teachers with mean environment scores of less than 37.5 had lower mean "less healthful practices" scores than did teachers with mean environment scores of 37.5 or greater (35.28 compared to 39.24; p=0.003). Because a lower "less healthful practices" score denoted that the teachers carried out the practices more often

than those with higher "less healthful practices," these data suggest that teachers with lower scores, or less supportive attitudes, for the school nutrition environment engaged more frequently in classroom practices that were not supportive of healthful behaviors and eating patterns among students. No other variables, including teachers' nutrition knowledge score or weight status, were significant predictors in the model.

Discussion

This study assessed normative classroom food-related practices of intermediate grade teachers in a rural East Tennessee county. This study showed that nearly all or about 95% of teachers allowed students to eat snack foods in the classroom or at recess and about 97% allowed students to drink soft drinks in the classroom or at recess at least once per 6-week grading period, which was substantially higher than the percentages reported by Kubik and associates (1) in their study of middle school teachers. They found that about half of teachers allowed students to eat in the classroom and only about one-fourth allowed students to drink soft drinks in the classroom. Like the findings of Kubik and associates, these data suggested that the use of food as a reward, incentive, or special treat was a pervasive practice. Also, consistent with the results from Kubik and associates' study, the most commonly used reward/treat was candy, with approximately 95% of teachers indicating they had used candy as a reward or treat at least once per 6-week grading period and about 36% reporting that they had used candy as a reward or treat at least once or more per week. The use of soft drinks, high-sugar, high-fat snacks foods, and pizza were used slightly less often than candy, with about two-thirds of teachers reporting that they used one of these foods as a reward or treat at least once per

6-week grading period. Previous qualitative research with teachers from this sample population indicated that pizza and coke parties were used commonly as student rewards (9).

Other findings consistent with the study by Kubik and associates were those about classroom practices that provide more healthful options for students in the classroom. For example, their findings revealed that fewer middle school teachers used more nutritious items for treats or rewards, which was similar to the findings of this study, which indicated that only about one-third of intermediate grade teachers used bagels or pretzels, fruits or vegetables, and bottle water, 100% fruit juice, or low-fat milk as a reward or special treat. Most of these teachers, between 60 and 70%, revealed that they have never offered such foods or beverages as rewards or special treats.

This study was unique in that it included a question regarding the use of fast-food coupons as rewards for students. Approximately 75% of teachers used food coupons for rewards or treats at least once per grading period. Another study by Kubik and associates (3) investigated the use of food coupons as incentives, but did not separate it from the use of food as incentives. However, the current finding may be of importance because the 2005 study by Kubik and colleagues found that for every additional food practice allowed by schools, including the use of food or food coupons as incentives, student BMI increased by 10% ($p=0.03$). Further, the use of fast-food coupons as incentives in schools is part of the growing trend of commercialism in schools. This trend has been sharply criticized by many because it allows corporations to gain name recognition (10) and brand loyalty (11) among an important market segment, namely children.

Also unique to this study was the inclusion of survey questions about positive and negative role modeling behaviors of teachers in the classroom setting. Although Kubik and associates (1) investigated some teacher role modeling behaviors, such as purchasing soft drinks and high-fat or high-sugar snacks from vending machines and a la carte lines, this was the first study to investigate teachers' role modeling behaviors in the classroom. For example, the data showed that about 70% of teachers modeled unhealthy eating behaviors in the classroom while students were present by drinking soft drinks or eating candy and/or snack foods. However, the study revealed some encouraging results as well. About 76% of teachers reported positive role modeling behaviors by eating either fruits or vegetables in the classroom with students present.

Study data showed that teachers exhibited other behaviors that supported the development of healthful eating behaviors among students as well. About 85% of teachers reported giving students extra time at recess or special duties as a reward and praising students when they saw them eating healthier foods, such as fruit, fruit juice, or low-fat snack items. Further, greater than 71% of teachers reported that they had never withheld a food or beverage as punishment for students. Qualitative data from earlier research indicated that restricting students access to concessions or vending as a form of discipline for misbehavior was a common practice among some teachers in the sample population (9).

The study of middle school teachers by Kubik and associates (1) showed several significant and marginally significant predictors of teacher classroom food-related practices, including courses taught, grade level taught, years teaching, perceptions about the school food environment, and perceptions regarding students' diet. However, this

study found only two predictive factors, years teaching at current school and perceptions of the school environment. The number of years teaching at the current school was not significantly related to teacher practices in the study by Kubik and colleagues, but findings from this study indicate that teachers who were at their current school for 12 years or more engaged in classroom practices that support healthful eating patterns less often than did teachers who were at their current school for less than 12 years. This finding may be an artifact of the data because one school in the study is less than 5 years old. However, it may reflect that teachers that have been teaching at their current school for a longer period of time do not favor less traditional types of rewards such as extra recess, special duties, or more healthful snacks and beverages. Also, since years taught at current school was not associated with less healthful classroom practices, these teachers may be less likely to use any novel rewards or incentives in general.

Finally, the data suggested that teachers with less supportive attitudes for the school nutrition environment were more likely to frequently engage in classroom practices that were not supportive of healthful behaviors and eating patterns among students. This was quite similar to findings by Kubik and associates (1), who found that teachers that showed less support for the school nutrition environment engaged in classroom practices that should be limited, such as using candy, high-fat, high sugar snacks, and soft drinks as rewards, more often than did teachers who showed more support for the school environment.

Although this study provided insight into normative classroom food-related practices of intermediate grade teachers, it did have several limitations. First, the study used a convenience sample instead of a random sample. Although most teachers in the

county did respond, there could be significant differences between responders and non-responders. Thus, the results may not be representative of the entire population within the county or other similar populations. Secondly, this study was a cross-sectional study, which cannot establish causation, reflect temporal events, or trend development. Thirdly, the sample size was relatively small with little diversity in gender or ethnicity. Therefore, generalizations to other more diverse populations cannot be made.

The findings in this study are important and timely in light of recent policy changes that occurred due to the Child Nutrition and WIC Reauthorization Act of 2004 (Public Law 108-265) (12), which required that all local education agencies that participate in the National School Lunch Program establish local "school wellness policies" by the beginning of the 2006-07 school year. In addition, many states have passed legislation regulating the sale of competitive foods, which were more restrictive than the federal mandate (13). However, state and federal legislation did not address specifically foods and beverages available in the classroom, such as those available through student rewards, classroom snacks, or classroom parties. Clearly, the findings of this study and the studies by Kubik and associates indicated that these food and beverage items were available readily in the classroom and warrant serious consideration when developing comprehensive "wellness policies" so that all aspects of the school nutrition environment will be consistent and conducive to the development of healthful eating patterns by our nation's youth.

Conclusions

The school environment and school wellness policies play pivotal roles in the development of healthful eating behaviors among students. However, to make sustainable changes in the school environment, health professionals, administrators, and advocates for nutrition integrity in schools must understand that teachers are a critical link between the school nutrition environment, school policies, and students via their normative classroom food-related practices and modeling behaviors. A greater understanding of teachers' perceptions about the school environment and their classroom food-related practices can lead to better targeted school-based interventions and the knowledge necessary to support teachers as we request that they become more involved in shaping students' eating behaviors and subsequent dietary health.

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APPENDIX

This is an interview guide and will not be read as if it were a survey. Additional questions may be asked to probe for further insight. The bracketed questions are examples of the types of questions that may be asked in response to a specific answer given by a teacher. These specific questions are only a guide, based on focus group comments. The researcher will use the SHOWeD technique for each picture or group of pictures.

Good morning (afternoon). My name is _____, and as you might already know, I am from _____. First, I'd like to thank you for agreeing to participate in our study. Do you have your signed consent form? (If yes, make sure it is signed and then the researcher should sign in the space provided. If not, provide another consent form and ask: *Did you get a chance to read the original consent form?* If yes, have the participant sign the consent form. Then, the researcher should sign in the space provided. If not, say: *Let me give you a few minutes to read over this one before you sign it.* Allow enough time for participant to read the consent form and then have him/her sign consent form. Then, the researcher should sign in the space provided.) I just wanted to remind you that I am taping this interview so it can be transcribed later, but I wanted to let you know that after it is transcribed, the tape will be erased and all of your comments will be grouped with other teachers comments so that they will be anonymous. Do you have any questions before we begin?

I am going to show you some pictures that were taken at your school and at another school in the county and ask you some questions so that we can get a better understanding of what teachers think about the kinds of foods students eat at school and how these foods might influence students' health. Here is the first picture.

1) What do you see in this picture?
2) What is really happening here?
3) How does this relate to students' health?
   [How do you think this will impact a student's diet quality?]
   [How do you think this will impact a student's weight?]
   [How do you think this will impact a student's overall health?]

May probe here regarding "healthy," "snack," "after-school, if appropriate.

   [What is your definition of a "healthy food"?]
   [When you say snack, what exactly do you mean?]
   [How do you distinguish a snack from a meal?]
   [When you say after school, what exactly do you mean. . . at home, at the Boys and Girls club, at sporting events?]
4) Why do you think this problem [or strength] exists?
   [Why do you think children bring these kinds of food to school?]
   [Why do you think children choose these kinds of food?]
   [Why do you think vending machines are in schools?]
   [Why do you think teachers have candy in their classrooms?]
   [Why do you think teachers should be role models?]
   [Why do you think students are given candy and junk food as rewards?]
5) What can we do about it?
   [What can we do to encourage more students to eat healthy snacks?]
   [What can we do to encourage students to choose better kinds of foods?]
   [What can we do about vending machines in schools?]
   [What can we do about teachers having candy in their classrooms?]
   [What can we do to help teachers be better role models when it comes to food and nutrition?]
   [What can we do to provide other types of rewards for student?]

Figure A.1. Interview Guide

Thank you for agreeing to participate in our study. The estimated time to complete the survey is 15-30 minutes. Please read the instructions for each section carefully.

SECTION A:

Please think back over the current and past six week grading periods and the type of snack foods available to your students during the school day, in the classroom, at recess, and at class parties. Circle your response to the first question.

i. Do your students have a regular daily snack time? **Yes** **No**

Place an X on the circle of these questions to indicate HOW OFTEN YOU:

	Always (about 1 time per day)	**Often** (about 1 time per week or more)	**Sometimes** (about 2-3 times per 6-weeks)	**Not often** (about 1 time per 6-weeks)	**Never**
1. Use candy as reward, incentive or as a special treat for students?	o	o	o	o	o
2. Use bagels or pretzels, as reward, incentive or as a special treat for students?	o	o	o	o	o
3. Use doughnuts, cookies, or snack foods such as chips as rewards, incentives or as a special treat for students?	o	o	o	o	o
4. Use pizza as reward, incentive or as a special treat for students?	o	o	o	o	o
5. Use fruits or vegetables as reward, incentive or as a special treat for students?	o	o	o	o	o
6. Use sweetened drinks, like soft drinks or fruit drinks, as reward, incentive or as a special treat for students?	o	o	o	o	o
7. Use bottled water, 100% fruit juice or low-fat milk as reward, incentive or as a special treat for students?	o	o	o	o	o
8. Give out food coupons, like Hardees food coupons, as rewards or incentives to students?	o	o	o	o	o
9. Give extra time at recess as a reward, incentive or as a special treat for students?	o	o	o	o	o
10. Give special duties, like being the leader, as a reward, incentive or as a special treat for students?	o	o	o	o	o
11. Have allowed students to eat yogurt or drink low-fat milk in the classroom, at recess, or at a class party?	o	o	o	o	o
12. Have allowed students to drink soft drinks in the classroom, at recess, or at a class party?	o	o	o	o	o

PLEASE CONTINUE TO PAGE 2

Figure A.2. Teacher Survey

HOW OFTEN YOU:	Always (about 1 time per day)	Often (about 1 time per week or more)	Sometimes (about 2-3 times per 6-weeks)	Not often (about 1 time per 6-weeks)	Never
13. Have allowed students to eat fruits or drink 100% fruit juice in the classroom, at recess, or at a class party?	O	O	O	O	O
14. Have allowed students to eat vegetables in the classroom, at recess, or at a class party?	O	O	O	O	O
15. Have allowed students to eat cookies or snack foods, like chips, in the classroom, at recess, or at a class party?	O	O	O	O	O
16. Drink soft drinks in your classroom while students are present?	O	O	O	O	O
17. Eat fruits or vegetables in your classroom while students are present?	O	O	O	O	O
18. Eat candy or snack foods in your classroom while students are present?	O	O	O	O	O
19. Withhold a food or beverage item from a student as punishment?	O	O	O	O	O
20. Praise students when you see them eating healthier foods, such as fruit, fruit juice or low fat snack items?	O	O	O	O	O

SECTION B:

Place an X on the circle of the following statements to indicate how strongly you agree or disagree with each statement.

	Strongly *Disagree*	Disagree	Uncertain	Agree	Strongly *Agree*
1. The foods students eat during the school day affect their readiness to learn.	O	O	O	O	O
2. Vending machines and or concessions at school should offer only healthy food and beverage items.	O	O	O	O	O
3. School prepared meals at my school are healthy	O	O	O	O	O
4. Food items from "fast food chains," such as Pizza Hut, should be offered as school lunch alternatives in elementary and intermediate schools.	O	O	O	O	O
5. Selling high fat, high sugar foods, such as candy and cookies, as part of school fundraising is okay because it helps provide revenue for school programs and school activities.	O	O	O	O	O
6. Students' eating behaviors are influenced by social pressures.	O	O	O	O	O

PLEASE CONTINUE TO PAGE 3

Figure A.2. Continued

	Strongly *Disagree*	Disagree	Uncertain	Agree	Strongly *Agree*
7. It is important for schools to have a written "school nutrition policy" which addresses food related issues, such as food in the classroom or food selections in vending machines.	o	o	o	o	o
8. High fat and high sugar foods are used as reward and incentive in the classroom because students prefer these kinds of foods.	o	o	o	o	o
9. Students in my school seem to eat fairly healthy diets.	o	o	o	o	o
10. If more healthy food and beverage items were available in vending machines, concessions, or on the school a la carte or snack line, students would purchase them.	o	o	o	o	o
11. It is important to have a healthy school food environment.	o	o	o	o	o
12. More healthy food and beverage items should be offered in the vending machines, concessions, and on the a la carte or snack line.	o	o	o	o	o
13. Students' parents or guardians are concerned about the nutritional health of their children.	o	o	o	o	o
14. The eating behaviors of teachers influence the eating behaviors of students.	o	o	o	o	o
15. Food and beverage items available at school and school sponsored functions influence students' eating behaviors.	o	o	o	o	o
16. As a teacher, I can influence school food policy.	o	o	o	o	o
17. School prepared meals are required to meet government nutritional standards.	o	o	o	o	o
18. Most teachers at my school use food (including candy) as a reward or incentive for students.	o	o	o	o	o
19. Food habits are determined before students reach the intermediate grade levels (grades 3, 4, and 5).	o	o	o	o	o
20. The nutritional health of students should be a school priority.	o	o	o	o	o
21. School decisions about selling food items from fast food chains, like Pizza Hut, should be made at the district level.	o	o	o	o	o
22. Students in intermediate grade levels should be provided the foods they want at school.	o	o	o	o	o
23. Students eating behaviors are a priority issue to address during childhood.	o	o	o	o	o
24. The school environment (i.e. vending machines, classroom food rules, foods students see school staff eat) affects students' food choices.	o	o	o	o	o

PLEASE CONTINUE TO PAGE 4

Figure A.2. Continued

	Strongly *Disagree*	Disagree	Uncertain	Agree	Strongly *Agree*
25. School decisions about vending machines or concessions and the food and beverage selections offered should be made at the district level.	o	o	o	o	o
26. Nutrition education should give students the skills to make healthy food choices.	o	o	o	o	o
27. It doesn't make sense to offer students only healthy foods in school when they can choose to eat whatever they want outside of school.	o	o	o	o	o
28. Students should be able to buy soft drinks and candy at school.	o	o	o	o	o
29. Fewer students eat the school prepared lunch as a result of vending machines, the a la carte or snack line, and cookies and candy sold during the school day for fundraising.	o	o	o	o	o
30. A school breakfast program can help students be ready to learn.	o	o	o	o	o
31. A school breakfast program can help reduce tardiness and absenteeism.	o	o	o	o	o
32. Children's food habits affect their health as adults.	o	o	o	o	o
33. Schools should be commercial free areas where no food or beverage advertising is allowed.	o	o	o	o	o
34. Most teachers at my school *do not* purchase breakfast or lunch at school because the food is not very tasteful.	o	o	o	o	o
35. It is okay for schools to expect students to sell candy, cookies, and/or snack foods for fundraising purposes.	o	o	o	o	o
36. Teachers should model healthy eating behaviors for students.	o	o	o	o	o
37. Teachers should not allow students to eat "junk food" in their classrooms.	o	o	o	o	o

SECTION C:
Based on your knowledge, please answer the following questions:

Write the answer in whole numbers on the space provided.

1. How many servings from the bread, cereal, rice, and pasta group would you say a person of your age and gender should eat each day for good health?

   _____ serving(s)

PLEASE CONTINUE TO PAGE 5

Figure A.2. Continued

2. How many servings from the vegetable group would you say a person of your age and gender should eat each day for good health?

_____ serving(s)

3. How many servings from the fruit group would you say a person of your age and gender should eat each day for good health?

_____ serving(s)

4. How many servings from the milk, yogurt, and cheese group would you say a person of your age and gender should eat each day for good health?

_____ serving(s)

5. How many servings from the meat, poultry, fish, dry beans, eggs, and nuts group would you say a person of your age and gender should eat each day for good health?

_____ serving(s)

Circle the letter of your answer to the following questions.

6. Which has more saturated fat:
   a. liver
   b. T-bone steak
   c. both have about the same amount of saturated fat
   d. don't know

7. Which has more saturated fat:
   a. skim milk
   b. whole milk
   c. both have about the same amount of saturated fat
   d. don't know

8. Which has more saturated fat:
   a. egg whites
   b. egg yolks
   c. both have about the same amount of saturated fat
   d. don't know

9. Which has more saturated fat:
   a. Butter
   b. Margarine
   c. both have about the same amount of saturated fat
   d. don't know

10. Which kind of fat is more likely to be a liquid rather than a solid:
   a. saturated fats
   b. polyunsaturated fats
   c. they are equally likely to be liquids
   d. don't know

PLEASE CONTINUE TO PAGE 6

Figure A.2. Continued

11. If a food has no cholesterol is it also. . .
   a. low in saturated fat
   b. high in saturated fat
   c. it could be either high or low in saturated fat
   d. don't know

12. Cholesterol is found in . . .
   a. vegetables and vegetable oils
   b. animal products like meat and dairy products
   c. all foods containing fat or oil
   d. don't know

13. If a product is labeled as containing only vegetable oil is it . . .
   a. low in saturated fat
   b. high in saturated fat
   c. it could be either high or low in saturated fat
   d. don't know

14. If a food product is labeled "light," does that mean that compared to a similar product not labeled "light" it is:
   a. lower in calories
   b. lower in fat
   c. lower in calories and/or fat
   d. it means something else

15. Which has more fat:
   a. regular hamburger
   b. ground round
   c. both have about the same amount of fat
   d. don't know

16. Which has more fat:
   a. loin pork chops
   b. pork spare ribs
   c. both have about the same amount of fat
   d. don't know

17. Which has more fat:
   a. hot dog
   b. ham
   c. both have about the same amount of fat
   d. don't know

18. Which has more fat:
   a. peanuts
   b. popcorn
   c. both have about the same amount of fat
   d. don't know

PLEASE CONTINUE TO PAGE 7

Figure A.2. Continued

19. Which has more fat:
    a. yogurt
    b. sour cream
    c. both have about the same amount of fat
    d. don't know

20. Which has more fat:
    a. porterhouse steak
    b. round steak
    c. both have about the same amount of fat
    d. don't know

Think about the section of the food label that tells the amount of calories, protein, and fat in a serving of the food.

21. If it showed that one serving of the food contained 100 milligrams of sodium, would you consider that to be a low amount or a high amount for one serving of food?
    a. low
    b. high
    c. don't know

22. If it showed that one serving of the food contained 20 grams of fat, would you consider that to be a low amount or a high amount for one serving of food?
    a. low
    b. high
    c. don't know

23. If it showed that one serving of the food contained 15 milligrams of cholesterol, would you consider that to be a low amount or a high amount for one serving of food?
    a. low
    b. high
    c. don't know

24. If it showed that one serving of the food contained 5 grams of fiber, would you consider that to be a low amount or a high amount for one serving of food?
    a. low
    b. high
    c. don't know

25. If it showed that one serving of the food contained 10 grams of saturated fat, would you consider that to be a low amount or a high amount for one serving of food?
    a. low
    b. high
    c. don't know

Please circle your answer to the following question:

ii. Have you visited the MyPyramid.gov website? YES NO

Figure A.2. Continued

SECTION D: Please complete the following demographic questions.

1. What year were you born? 19 _____ _____
2. Are you a male or a female?

   _____Male _____Female
3. What is the highest academic degree you have received?

   _____Bachelors degree _____Masters degree _____Doctoral degree _____Other, please indicate_____
4. How many years have you held your current position in this school?

   _____years _____months
5. How many years of teaching experience do you have?

   _____years _____months
6. What grades are you currently teaching? Please indicate all that apply.

   _____3rd grade _____4th grade _____5th grade _____Special subject, please describe_____
7. How would you classify your weight status?

   _____Overweight _____Healthy weight _____Underweight
8. Have you ever taken a college-level nutrition course?

   _____YES _____NO

SECTION E:

The next section includes statements about how well you get along with others. Please place an X on the circle of the following statements to indicate how strongly you agree or disagree with each statement.

	Definitely true	Mostly true	Don't know	Mostly false	Definitely false
1. I am always courteous even to people who are disagreeable.	o	o	o	o	o
2. There have been occasions when I took advantage of someone.	o	o	o	o	o
3. I sometimes try to get even rather than forgive and forget.	o	o	o	o	o
4. I sometimes feel resentful when I don't get my way.	o	o	o	o	o
5. No matter who I'm talking to, I'm always a good listener.	o	o	o	o	o

Thanks again for completing the survey!

Figure A.2. Continued

Vita

Marsha Lynn Spence was born in Lakeland, Florida on October 31, 1960. She was raised in Knoxville, Tennessee. She graduated from Holston High School in Knoxville. She received a BS in Nutrition from The University of Tennessee in 1997. She received a dual MS-MPH degree with concentrations in Public Health Nutrition and Health Planning and Administration, from The University of Tennessee in 2000. She will receive her PhD degree in Human Ecology in 2006.

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