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The Relationship between Nutrition Knowledge and School Cafeteria Purchases of Seventh Grade Students in a Rural Indiana School District

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Please note that this study was published before the SY2014-15 implementation of the Smart Snacks Nutrition Standards for Competitive Food in Schools, as required by the Healthy, Hunger-Free Kids Acts of 2010. As such, certain research relating to food in schools may not be relevant today.

Abstract

Purpose/Objectives
School cafeterias have the potential to positively contribute to the prevention and treatment of childhood obesity. The purpose of this project was to assess adolescents' nutrition knowledge and dietary choices, and to measure the relationship between students' nutrition knowledge and the type of food items purchased in their school cafeteria using Indiana's legal definition of 'better choice' food.
Methods
A 25-question nutrition knowledge survey was pilot-tested (r=0.79) and used to measure general nutrition knowledge among 287 seventh grade students in a rural Indiana junior high school. A computerized list of all foods purchased in the school cafeteria by each student over one week was obtained from the Meal Tracker program. A dietary choice score was calculated for each student based on the percentage of foods they purchased that met Indiana's legal definition of a 'better choice' food.
Results
Dietary choice scores ranged from 19 to 100%, with no difference detected by gender (t = 0.99, p = 0.32). Results indicated a low nutrition knowledge level (12.1±4.0) among these teens. Girls scored higher on the nutrition knowledge survey than boys (12.8±3.3 vs. 11.6±4.3; t=2.6; p=0.01). There was no relationship between the nutrition knowledge score and dietary choice score (r=.06, NS) among this seventh grade population.
Applications to Child Nutrition Professionals
Students in this sample scored high on healthy dietary choices without scoring high on the nutrition knowledge test. This result may indicate a need to shift toward behavior control by limiting food options, rather than focusing efforts on education alone, when trying to improve teenagers' healthy food consumption patterns. Alternately, the apparent high intake of healthy dietary choices could have been a result of the definition of Indiana's 'better choice' foods. Further research to clarify the relationship between nutrition knowledge and dietary choice among adolescents is needed.

Introduction

Unhealthy eating habits in children can lead to altered growth and development, behavioral problems, disrupted learning, obesity, and diabetes (Daniels et al., 2005). The 2009-2010 NHANES data indicated 18.4% of U.S. adolescents aged 12-19 years were obese, with the prevalence of obesity higher among boys (19.6%) than girls (17.1%) (Ogden, Carroll, Kit, & Flegal, 2012). Failure to establish healthy choices in children can lead to poor health in adulthood. Research indicates overweight or obese children are more likely to be overweight and have chronic health conditions as adults (Janssen et al., 2005).

Schools have the potential to help children establish healthy habits (Story, 1999). Health and wellness classes present opportunities to teach nutrition concepts to students (Indiana Department of Education, 2008). The lack of a state-wide, nutrition curriculum policy that standardizes nutrition education in grades K-12 results in inconsistent nutrition instruction which may hinder students from establishing positive food selection habits. In addition, health and physical education instruction is disappearing from curriculums as schools strive to meet standards in other core classes set forth by the No Child Left Behind Act of 2001 (Indiana Department of Education, 2008). Furthermore, many teachers feel they are not adequately trained to provide nutrition and health education (Lambert, Monroe, & Wolff, 2010).

Studies of the National School Lunch Program (NSLP) indicate students who participated in the program were twice as likely to consume milk and vegetables and one and one half times more likely to consume fruit and fruit juices at lunch than non-participants, while students who did not participate were almost three times as likely to consume sweetened beverages, candy, crackers, and high sodium snack foods (Gleason & Suitor, 2001).

In 2006, Indiana passed legislation amending the Indiana Code to mandate that at least 50% of the competitive foods sold in schools must meet guidelines of a 'better choice' food (Indiana Senate, 2006). To meet the better choice guidelines, a beverage must contain at least 50% fruit or vegetable juice and contain no added caloric sweeteners, and whole food items must not contain more than 30% of their total calories from fat per serving, no more than 10% of their total calories from saturated or *trans fat*, and no more than 35% of the food's weight can be from sugars that do not naturally occur in fruit, vegetables, or dairy. The law (Indiana Code 20-26-9-19) also specified portion sizes for all foods and beverages sold in school cafeterias (Indiana Senate, 2006).

Indiana was not the only state to address the problem of low-nutrient value, high-caloric competitive foods in schools (School Nutrition Association, 2008). Early policy adopters included, among others, state legislators in California (Escutia, 2001) and Texas (Combs, 2004). Yet, the inconsistency in which foods qualified as 'healthy' between states suggested that a national policy was warranted. Nutritional requirements of children do not fluctuate across state borders.

The federal government decided to act by creating a national policy that defined what food items were classified as healthy or not. The Healthy, Hunger-Free Kids Act [HHFKA] of 2010 (Healthy, Hunger-Free Kids, 2010) strengthened the nutritional quality of lunches served by the NSLP through the implementation of nutrition standards for all foods sold in schools. In addition, the interim final rule, published in the *Federal Register* on June 28, 2013 and effective August 27, 2013, amends the NSLP and School Breakfast Program regulations to establish nutrition standards for all foods sold in schools, other than food sold under the lunch and breakfast programs. Research has shown that, when given choices, children often do not select the healthier choice (Park, Sappenfield, Huang, Sherry, & Bensyl, 2010; Kakarala, Keast, & Hoerr, 2010). Because the interim final rule results in the removal of the energy-dense, nutrient poor food choices from the school environment, implementation is expected to improve the health and well-being of the nation's children, increase consumption of healthful foods during the school day, and create an environment that reinforces the development of healthy eating habits (USDA, FNS, 2013).

The consumption of fruits and vegetables among adolescents remains below recommended levels. Nationwide, the 2011 Youth Risk Behavior Surveillance System (YRBSS) (Centers for Disease Control and Prevention [CDC], 2011) indicated 37.7% of high school students (versus 42% from Indiana) ate less than one serving of vegetables, and 36% (versus 44.7% from Indiana) consumed less than one fruit or 100% juice serving per day during the seven days before the survey. Although the data focused on high school youth, research indicates that consumption habits remain constant between middle and high school unless coercion by peers is implemented (Howland, Hunger, & Mann, 2012).

A review of the literature indicates conflicting results regarding the relationship between nutrition knowledge and food selection choice. Many older studies failed to find a positive correlation between nutrition knowledge and food choice causing some health professionals to question the value of nutrition education interventions (Axelson, Federline, & Birnberg, 1985; Shepherd & Towler, 1992; Shepherd & Stockley, 1987). More recent studies have found positive associations between nutrition knowledge and food selection choice among both adults (Wardle, Parmenter, & Waller, 2000; Kolodinsky, Harvey-Berino, Berlin, Johnson, & Reynolds, 2007; Sharma, Germand, & Day, 2008; Kresic, Kendel Jovanovic, Pavicic Zezel, Cvijanovic, & Ivezic, 2009) and children (Powers, Stuempler, Guarino, & Parmer, 2005). A major problem with these studies, however, is their dependence on self-reported dietary choices. It was hypothesized that using a more precise method, such as records of specific foods purchased in a school cafeteria, would provide a more accurate estimate of food choices.

The purpose of this study was to: 1) assess nutrition knowledge of seventh grade students; 2) determine the percentage of "better choice" foods purchased by seventh grade students, as defined in Indiana P.L. 54-2006; and 3) examine the relationship between students' nutrition knowledge and their dietary choices, both overall and by gender.

METHODS

An informational letter alerting parents of the study was sent prior to collecting data. All data were collected anonymously using the students' four-digit unique school lunch PIN number to match the nutrition knowledge score with the food purchase data. At no time did the researchers receive a list that matched the PIN to a specific person. This study was approved as exempt since the data collected were determined not to meet the definition for human subjects as described by the Institutional Review Board at Ball State University. This study was determined to be exempt under the second exemption category as the educational test was anonymous and the topic did not reveal sensitive information about the participants that could place the students at risk. The food purchase data received from the school regarding students' food selections were considered not to meet the definition of "human subjects" as identifiable data was not received.

Subjects

All seventh grade students enrolled at a junior high school in a rural Indiana town were given a nutrition knowledge test at the beginning of the appointed week. Only students who completed the nutrition knowledge test and purchased any type of food in the cafeteria on all five days during the selected week were included in the analyses.

Instrument

An age-appropriate 25-question multiple choice nutrition knowledge instrument was used to quantify students' nutrition knowledge about several key nutrition concepts, including: carbohydrates (n=3), variety in the diet (n=4), vitamins and minerals (n=5), MyPyramid food groups (n=4); fats (n=5), and diet-disease relationships (n=2) (Table 1). The survey was developed by adapting previously published nutrition knowledge surveys (Parmenter & Wardle, 1999; Huang & Volpe, 2004; Whati et al., 2005; Pierce, 1998) to reflect current nutrition guidelines. The instrument was examined by a panel of nutrition experts to establish content validity and pilot-tested in a middle school classroom to determine its internal reliability (r=0.79), comprehension, and readability.

Procedures

The nutrition knowledge survey was given to seventh grade students during the homeroom class period by their classroom teachers. The students were instructed to write their school cafeteria PIN number instead of their name on the survey. A nutrition knowledge score was calculated for each student by totaling the number of questions each student answered correctly, divided by the total number of questions.

All foods sold in the cafeteria were categorized based on the criteria established in Indiana P.L. 54-2006. Specifically, to meet the "better choice" guidelines, beverages must contain at least 50 percent fruit or vegetable juice, contain no added caloric sweeteners, and, with the exception of low-fat or fat-free chocolate milk, they must not contain caffeine. Water, seltzer water, low-fat and fat-free milk, and isotonic beverages are classified as "better choice" foods. Whole food items must not contain

more than 30 percent fat or more than 10 percent saturated fat per serving and no more than 35 percent of the food's weight can be from sugars that do not naturally occur in fruit, vegetables, or dairy. To be classified as a "better choice" food, the portion size of chips, popcorn, trail mixes, cereal, nuts, seeds, dried fruit, and jerky must not exceed 1.75 ounces while cookies and cereal bars must be less than two ounces. All other bakery products must be less than three ounces. Frozen desserts must not exceed three fluid ounces. A serving of yogurt must be 8 ounces or less. To be a better choice option, entrée items and side items cannot be larger than the portion size of entrée items or side items served as part of the school lunch program. No beverage may exceed 20 ounces (Indiana Senate, 2006).

Foods sold that met the 'better choice' criteria as established by Indiana Code 20-26-9-19 included the regular school lunch menu items, an extra school lunch entrée, cereal, chicken bites, breadsticks, any fruit, any vegetable, Gushers, string cheese, water, 100% juice, Milk, chocolate flavored Yoo Hoo, Powerade, and Healthwise ice cream cups. Foods sold in the cafeteria that did not meet the criteria included breaded mozzarella sticks, Uncrustables, iced tea, pizza, fries, chips, cookies, muffins, Welch's fruit drinks, Twix, Dolphins cheese nips, Pop tarts, and all ice cream items that were not Healthwise ice cream cups.

Meal Tracker®, a computerized program developed by eTritionWare, was used to record all foods purchased in the cafeteria at the junior high school. The foodservice director provided the researchers with a point of sale (POS) report that listed all of the foods purchased by each student throughout the specified week. The students were identified only by their cafeteria PIN number. A dietary choice score for each participating student was calculated by summing the number of food items purchased that met the "better choice" definition as outlined in Indiana P.L. 54-2006 and dividing that number by the total number of foods the student purchased over the same period of time as indicated by *Meal Tracker*. The students' PIN numbers were used to match their nutrition knowledge survey responses with their food purchase records.

Data Analyses

The data were analyzed using SPSS v20.0 (IBM Corp., Armonk, NY). Descriptive statistics were calculated for all demographic variables. Student's t-test was used to measures the differences in nutrition knowledge by gender. Pearson's correlation coefficient was used to measure the relationship between the nutrition knowledge and dietary choice scores. Significance was set at a level of p=0.05.

RESULTS AND DISCUSSION

The subject pool for this study consisted of 430 seventh grade students who attended a rural Indiana junior high school during the spring of 2008. Of these, 365 students (85% response rate) completed the nutrition knowledge survey. Students who did not purchase foods in the school cafeteria on all five days (n=55), and those with incomplete surveys (n=7) or incorrect PIN numbers (n=16), were removed from the analysis. The final sample consisted of 287 seventh grade students (67% response rate). Of these, 48.4% were female (n=139) and 50.2% were male (n=144). Four subjects (1.4%) did not provide their gender.

By race and ethnicity, 83% (n=238) were White/Caucasian, 4% (n=11) were African-American, 4% (n=11) were Hispanics, 6% (n=16) were Asian/Pacific Islander, and 3% (n=9) reported their race as "other." Two of the students did not provide their race/ethnicity. The percent of students who qualified for a free or reduced lunch through the federal school lunch program is often used as a proxy for income. According to school records, 26 of the 287 seventh grade students (9.1%) who completed this study qualified for a free or a reduced lunch.

On average, MealTracker® records indicated students purchased a total of 11.4 food items throughout the week. The mean number of "better choice" items purchased was 7.8, or 73.8% of the total foods purchased, including the federally-reimbursed school lunch. Dietary choice scores ranged from 19 to 100%. There was no difference in dietary choice score by gender (t=0.99, p=0.32).
The mean nutrition knowledge score on the 25-question instrument was 12.1+4.0 (n=287), equivalent to a mean score of 48.5% correct; the median score was 13 of 25 correct (52%), with

scores ranging from a low of zero to a high of 22 (0 to 88%). Overall, the girls scored significantly higher than the boys on the nutrition knowledge survey (12.8±3.3 or 51% correct vs. 11.6±4.3 or 48% correct; t=2.6; p<0.01). By concept, more girls correctly identified the number of servings of milk needed each day for good health (64.7% correct vs. 48.6%; p<0.01), the nutrients found in large amounts in fruits and vegetables (89.2% vs. 77.1%; p<0.01), which foods belong in the breads and cereals group (89.1% vs. 78.5%; p<0.01), and sources of calcium (85.6% vs. 76.4%; p<0.05). In contrast, more boys were able to identify dietary sources of iron (28.5% vs. 18.0%; p<0.05). Each question's stem and the percent of students who correctly answered each question are found in Table 1. Cronbach's alpha for the 25-question nutrition knowledge test for the 287 subjects was 0.71.

Table 1. *Nutrition knowledge of seventh grade students: Question stems and percent correct (N=287)*

Question Stem by Construct	**% Correct**
Carbohydrate	
Which of these foods is a good source of carbohydrates?	50.2
Which of the following has the most fiber?	48.4
Which of these foods has the most sugar?	42.9
Variety	90.6
Which of these diets would be the healthiest?	75.6
Eating a lot of different foods is healthier than eating only a few kinds of foods.	56.4
How much milk do you think you should have every day for good health?	53.3
A well-balanced diet would be one that had:	
Vitamins and Minerals	
Which nutrient is found in large amounts in fruits and vegetables?	82.2
Which of these foods can give you the most calcium?	80.1
Vitamin C helps you see in the dark.	47.7
Which of these groups of foods has the most vitamin A?	45.3
Which of these foods is a good source of iron in your diet?	23.3
Protein and Meat Alternatives	
Why are dry beans, peas, and lentils a good choice to eat instead of meat?	49.5
Which of these is NOT a source of protein?	29.3
MyPyramid Groups	
Which of these foods belong in the breads and cereals food group?	83.6
In which food group does peanut butter belong?	54.4
How much spinach is equal to a "one cup serving"?	8.4
Fats	
The fat in nuts and avocados is better for you than the fat in cheese and meat.	51.6
Which of these foods is most likely to contain *trans fat*?	28.9
Which of these foods is a source of healthy Omega 3 fats?	26.8
Which of these foods contains the most cholesterol?	12.2
Which of these foods has the most saturated fat?	7.0
Diet-Disease Relationships	
Which of these may help prevent heart disease in your future?	55.1
Which of these diets may put you at risk for osteoporosis?	47.4

Question Stem by Construct	% Correct
Calories	
Which of these foods has the fewest number of calories?	61.0

No significant relationship was found between the subjects' (n=287) dietary choice scores and their nutrition knowledge scores (r=.05, NS). Because students who receive free and reduced-priced lunches most likely selected the school lunch based on their parents' financial status rather than their nutrition knowledge of "healthy foods," the relationship between nutrition knowledge and dietary choice was examined after omitting the 26 students who received free or reduced lunches. No significant relationships were found between the remaining subjects' (n=261) dietary choice scores and their nutrition knowledge scores (r=.08, NS). By gender, no correlation was found between nutrition knowledge and dietary choice among non-free and reduced lunch qualifying males (r=.08,p=.36) or females (r=.15, p=.10).

Results of this research show low levels of general nutrition knowledge among seventh graders at a rural junior high school in Indiana. The nutrition knowledge scores reported in this study are comparable to the scores reported in a 2001 study of American seventh and eighth grade students (Pirouznia, 2001). Girls in the present study scored significantly higher on the nutrition knowledge survey than did boys, substantiating the observation of other researchers (Kresic et al., 2009; Pirouznia, 2001).

In the present study, the seventh grade students selected approximately 7.8 'better choice' foods out of every 11.4 total foods they purchased over a one-week period. Although no previous research had assessed adolescents' diet based on this categorization of foods, it seems that a diet comprised of 73.8% of foods classified as 'healthy choices' is highly unusual when compared to nationwide averages (USDA-ARS, 2008). In addition to the 26 free and reduced participants, an additional 21 students selected the NSLP meal.

YRBSS data show low consumption of fruit, vegetables, and milk among this age group, both nationwide and in Indiana (CDC, 2011). The National Health and Nutrition Examination Survey reported that adolescents ages 12-19 are consuming too many calories from saturated fat, too much sodium, and too little of several key nutrients (USDA-ARS, 2008). Dietary analyses indicates the intake of calorie-dense foods (e.g., pizza, fried meats, soda, candy) is too high among this age group, while consumption of milk, fruits, and vegetables is too low (Perez, Hoelscher, Brown, & Kelder, 2007; Zapata, Bryant, McDermott, & Hefelfinger, 2008; Cavadini, 2000; Enns, Mickle, & Goldman, 2002). It is possible that this sample of students had better eating habits than the national average, but it is more likely that the scores are higher than expected due to Indiana's generous definition of qualifying 'better choice' foods. This reinforces the importance of the current national debate on setting national standards for what qualifies as 'healthy' competitive food choice sales. The 'better choice' Indiana guidelines only address percentage of calories from fat and saturated fat, the percentage of weight from added sugars, and portion sizes. Consequently, many foods could meet these guidelines (e.g., breadsticks with cheese, Gushers) without contributing essential nutrients such as calcium, iron, fiber and Vitamin A found to be lacking in the diets of adolescents.

Students' nutrition knowledge had no significant impact on the percentage of foods chosen that were categorized by current Indiana legislation as being 'better choice' foods. In contrast, other research reports a significant correlation between knowledge and food choice among adolescents (Pirouznia, 2001). Powers and colleagues (2005) reported a correlation between nutrition knowledge and eating choice among children after an education intervention, although the correlation was weak. Kresic et al. (2009) found that university students with the highest levels of nutrition knowledge were twelve times more likely to have a diet in accordance with recommendations than those with the lowest knowledge levels.

Efforts to influence other factors that contribute to food choice could be made in order to improve the nutrient profiles of students' diets. Hanks, Just, Smith, and Wansink (2012) found that a convenience line that served only healthier foods in the school cafeteria increased sales of healthier items by 18% and decreased grams of less healthy foods eaten by 28%. The widespread availability of competitive foods in schools deteriorates the nutrition status of students (Fox, Meinen, Pesik, Landis, & Remington, 2005; Gordon, Crepinsek, Nogales, & Condon, 2007); therefore, reducing the convenience and prevalence of these foods can improve students' diets regardless of their knowledge of nutrition.

CONCLUSIONS AND APPLICATION

Results of the present study indicate the students had lower levels of nutrition knowledge and better eating habits, as currently defined by the Indiana legislature, than expected. . The high percent of 'better choice' foods selected by students in this study could be an indication that Indiana's definition of a 'better choice' food needs to be reassessed to reflect the more rigorous national standard.

The low nutrition knowledge test scores suggest the need for more nutrition education and a standardized nutrition education curriculum for elementary and middle schools. The relationship between nutrition knowledge and dietary choice remains unclear as no correlation was found between the two scores, either overall or by gender. It is anticipated that implementation of the Healthy, Hunger-Free Kids Act of 2010 guidelines (Healthy, Hunger-Free Kids, 2010) and the Nutrition Standards for All Foods Sold in School guidelines (USDA-FNS, 2013) should positively impact children's food consumption behaviors while at school. However, one can only hypothesize about the potential synergistic effect on children's food consumption behaviors outside of school if, in addition to the new nutrition guidelines, a comprehensive, standardized nutrition education curriculum was developed and implemented nationwide.

Limitations to this study include a high socio-economic population indicated by only 9.1% qualified free and reduced NSLP participation. Moreover, only one school was assessed in a Midwest region. This study investigated food item selection, but composite nutrient analyses may provide a better overall picture of students' nutrient intakes, excesses in kilocalories and deficiencies in fiber and micronutrients. The greatest limitation was Indiana State's definition of which food items constituted a "healthy choice".

Although Indiana has taken steps to improve the quality of the food sold in the schools, clearly more work needs to be done. Comprehensive, standardized nutrition education is not mandated in Indiana public schools. School wellness policies, required since 2004, provide an opportunity for school districts to improve the nutrition environment during the school day; however, the assessment of student learning outcomes related to basic nutrition principles has been inconsistent. School personnel should be encouraged to include nutrition concepts in classes, in the lunch line and to reinforce the importance of the school lunch as a model for healthier eating. In addition, until the proposed USDA "*Smart Snacks in School*" proposal is fully implemented, school foodservice personnel can support better food choices by positioning nutrient dense foods within easy reach, even if students may not actually understand the nutritional benefit of these foods.

The importance of developing healthy eating habits at a young age cannot be overstated. Children who do not learn and establish good eating habits risk obesity, diabetes, high cholesterol, and high blood pressure in adulthood. Unfortunately, research reveals that the youth of the United States are not developing the eating habits needed to sustain health throughout adulthood (Larsen, Laska, Story & Neumark-Sztainer, 2012). The responsibility for helping children develop good eating habits should fall, in part, on schools.

Further studies linking specific knowledge to correlated food selection may assess nutrition education modules that link knowledge to action. Correlating food consumption patterns of students making purchasing decisions through POS systems is a potential data source for future research.

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