Effects of a Nutrition Education Program on the Dietary Behavior and Nutrition Knowledge of Second-Grade and Third-Grade Students

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ABSTRACT: This research investigated the effects of a nutrition education program on dietary behavior and nutrition knowledge among elementary school-aged children participating in a Social Cognitive Theory–based nutrition education program. Participants included 1100 second-grade and third-grade students selected by convenience-type sampling from public schools in Alabama. A preassessment and postassessment control group design assessed dietary behavior and nutrition knowledge using Pizza Please, a specially designed interactive evaluation tool. A $2 \times 2$ mixed analysis of variance was used to analyze data. Children in the treatment group exhibited significantly ($p < .001$) greater improvement in overall dietary behaviors such as consumption of dairy products, fruits, and vegetables, than children in the control group. Children in the treatment group exhibited significantly ($p < .001$) greater improvement in nutrition knowledge, including Food Guide Pyramid understanding, nutrient-food association, and nutrient-job association, than children in the control group. Results suggest that nutrition education programs that teach positive dietary messages potentially can improve dietary behavior and increase nutrition knowledge in children. (J Sch Health. 2005;75(4):129-133)

Family, peers, media, and environment influence the health habits, especially eating habits, of children. Research has shown that eating habits developed during childhood continue into adulthood. Thus, childhood influences should optimally have positive effects on the elementary school–aged child. These positive influences will help form a basis for good nutrition and physical activity habits to be followed throughout an individual’s adolescent and adult life.

Nutrition-related problems in elementary school–aged children include proper growth and development; immediate health problems such as dental caries and overweight; and long-term health problems such as heart disease, cancer, and diabetes. By increasing consumption of low-fat dairy products, fruits, and vegetables; decreasing consumption of soft drinks; and increasing participation in regular physical activity within the elementary school–aged population, prevalence of these nutrition-related problems could be reduced.

To facilitate dietary behavior changes, education is an effective beginning. Nutrition educators must consider certain factors to effectively reach children. They should carefully determine the purpose and goals of a nutrition education program. In addition, educators must determine the theory used to develop and deliver nutrition education topics.

After determining these strategic characteristics of a nutrition education program, educators should assess program effectiveness through evaluation. Literature explains the need for impact, outcome, and process evaluations to determine effectiveness and to allow for continued success of a nutrition education program.

This research determined the effects of a Social Cognitive Theory–based nutrition education program on dietary behavior and nutrition knowledge among second-grade and third-grade students. The State Cooperative Extension System and State Department of Human Resources cosponsored the study, which was conducted through the State Cooperative Extension Nutrition Education Program.

METHODS

Subjects

The study used a preassessment and postassessment control group design consisting of 1100 (550 girls and 550 boys) second-grade and third-grade students from 64 schools in two thirds of the counties of Alabama. Students were a convenience sample from schools where at least 51% of students received free or reduced-price meal plans. Children in the treatment group ($n = 702$; mean age $= 7.58 \pm 0.71$ years; 52.99% female; 60.40% Caucasian) participated in a preassessment, 6 weekly nutrition education classes, and a postassessment. Children in the control group ($n = 398$; mean age $= 7.58 \pm 0.72$ years; 44.72% female; 48.74% Caucasian) participated in a preassessment and postassessment only. Preassessments, postassessments, and nutrition education classes were conducted by nutrition educators employed by the State Cooperative Extension Nutrition Education Program.

Instruments

Pizza Please, a dynamic assessment method, was developed to collect impact data from elementary school children participating in a Social Cognitive Theory–based nutrition education program. Participants included 1100 second-grade and third-grade students selected by convenience-type sampling from public schools in Alabama.
school–aged children. Pizza Please consisted of 2 parts, an interactive game component and a developmentally appropriate questionnaire.

**Pizza Please Game.** The Pizza Please game component included an interactive game board and 12 mealtime game questions. The game board consisted of a life-size pizza with detachable toppings and 4 place mats depicting a table setting with an outline of a pizza slice on the plate. The object of the game was to answer correctly the most game questions. A pizza topping was awarded and placed on the pizza slice found on the team’s place mat for a correct response.

**Pizza Please Questionnaire.** The questionnaire included 24 dietary behavior and 16 nutrition knowledge questions based on nutrition-related problems associated with elementary school–aged children and previous questionnaires. Dietary behavior was self-reported and assessed using “yes/no” questions to determine whether a particular food was consumed at a particular meal or snack. For example, “On most school days do you drink milk at breakfast?” This frequency question was used for breakfast, lunch, dinner, and snack as well as individually for consumption of milk, cheese, yogurt, juice, fruit, and vegetable. Dietary consumption questions only detected frequency; amounts were not assessed. Nutrition knowledge was assessed using matching and item-elimination questions. Topics included food-appropriate Food Guide Pyramid food group, nutrient-food association, and nutrient-job association.

To facilitate questionnaire completion, educators received a prompt guide that included procedures for beginning the assessment process, directions to be explained to children after printed directions were read, and examples to be read as students individually answered a specific question.

A pilot study was conducted to determine content validity. Teachers in 19 classrooms presented the questionnaire to 300 participants using the prompt guide. A process evaluation was provided to teachers to enable them to detail strengths and weaknesses of the questionnaire. Careful consideration was given to suggestions teachers made when the questionnaire was revised for the final edition. University faculty, school administrators, and parents also reviewed all materials.

Readability was assessed to ensure ease of completion, validity, and reliability. A Flesch-Kincaid Readability score for the questionnaire was approximately 2.3. In addition, educators read aloud each question and answer choice on the questionnaire to help children who read below this level.

**Evaluation Process.** To begin the game, educators placed the large pizza and 4 place mats on a display board, divided students into teams of 4 to 6 players, and distributed a questionnaire to each child. Teams alternated answering game questions. A pizza topping was awarded and placed on the team’s pizza slice for a correct answer to a game question. Embedded within game questions were 2 “Go To” questions that directed students to temporarily stop playing the game as a team and to complete a specific section of the questionnaire as an individual. After the specific questionnaire section was completed, children continued answering game questions. A bonus round was played when all game and questionnaire questions had been answered. The team with the most toppings on their pizza slice at the end won the game. Approximately 1 hour was needed to complete Pizza Please.

**Intervention**

In between preassessment and postassessment, nutrition educators conducted 6 weekly nutrition classes on concepts assessed in the questionnaire, including dairy consumption, fruit and vegetable consumption, Food Guide Pyramid knowledge, nutrient-food association knowledge, and nutrient-job association knowledge. To ensure consistency, nutrition educators were provided a curricula guide with specific curricula and materials appropriate for the target audience. Materials were from a variety of sources such as the Dairy Council, Wellness Inc, and the American Heart Association.

The 6 weeks of nutrition classes were based on tenets of Social Cognitive Theory, which incorporates the interdependent relationship between personal characteristics, behavioral factors, and environmental influences. In this study, nutrition educators taught skills to select healthy foods both at school and home. Nutrition educators also served as role models by eating with students in the lunchroom. Nutrition concepts were reinforced with hands-on activities and nutrition messages on bulletin boards and in cafeterias.

**Procedures**

The study was conducted in accordance with current policies and procedures of the Cooperative Extension System efforts of a land-grant university. To promote data collection consistency, nutrition educators (n = 46) participated in a daylong training on implementation protocol in summer 2003. Nutrition educators conducted the study between August and December 2003 in second-grade and third-grade classrooms in public school systems. For both treatment and control groups, All About Me forms were completed, which provided demographic information. In addition, both groups completed a Pizza Please preassessment and postassessment. For the treatment group, 6 weekly nutrition classes were conducted between preassessment and postassessment. For the control group, no nutrition classes were conducted in the 6 weeks between assessments. Educators mailed all assessment materials to the researcher.

**Statistical Analysis**

Data were analyzed using SPSS. Descriptive statistics summarized demographic data from the All About Me form. Cronbach’s coefficient alpha was used to determine the reliability of dietary behavior and nutrition knowledge questions on preassessment and postassessment.

Responses to 24 dietary behavior questions were summed for an overall preassessment dietary behavior score and an overall postassessment dietary behavior score. Responses to behavior questions were then disaggregated into 2 clusters for further analyses. Responses to 12 questions concerning milk, cheese, and yogurt consumption at each meal were used to calculate dairy consumption preassessment and postassessment scores. Responses to 12 questions concerning juice, fruit, and
vegetable consumption at each meal were used to calculate fruit and vegetable consumption preassessment and postassessment scores.

Responses to 16 nutrition knowledge questions were summed for an overall preassessment nutrition knowledge score and an overall postassessment nutrition knowledge score. Responses to knowledge questions were then disaggregated into 3 clusters for further analyses. Overall knowledge scores at preassessment and postassessment were calculated for food-appropriate Food Guide Pyramid food group from a 6-question cluster, food-nutrient association from a 5-question aggregate, and nutrient-job association from a 5-question cluster.

To measure the overall impact of the intervention, gain scores were calculated for overall dietary behavior, dairy consumption, fruit and vegetable consumption, overall nutrition knowledge, and specific knowledge categories. For each student, a specific gain score was calculated by subtracting the student’s preassessment score for a specific category from the postassessment score for the same category (Postscore - Prescore = Gain score).

A 2 (treatment and control) × 2 (preassessment and postassessment) mixed analysis of variance determined significant differences between overall dietary behavior gains, dairy consumption gains, fruit and vegetable consumption gains, overall nutrition knowledge gains, food-appropriate Food Guide Pyramid food group knowledge gains, nutrient-food association knowledge gains, and nutrient-job association knowledge gains in treatment and control groups. To determine specific dietary behavior changes and nutrition knowledge changes within each experimental group, paired t-tests were performed on each student’s preassessment score for a specific category from the postassessment score for the same category (Postscore - Prescore = Gain score).

A 2 (treatment and control) × 2 (preassessment and postassessment) mixed analysis of variance determined significant differences between overall dietary behavior gains, dairy consumption gains, fruit and vegetable consumption gains, overall nutrition knowledge gains, food-appropriate Food Guide Pyramid food group knowledge gains, nutrient-food association knowledge gains, and nutrient-job association knowledge gains in treatment and control groups. To determine specific dietary behavior changes and nutrition knowledge changes within each experimental group, paired t-tests were performed on each student’s preassessment score for a specific category from the postassessment score for the same category (Postscore - Prescore = Gain score).

To determine specific behavior changes, 24 behavior questions were analyzed individually by comparing each question’s preassessment and postassessment answers using paired t-tests. Significant positive changes (p < .05) between preassessment and postassessment were noted for 5 questions within the treatment group: increased consumption of juice at breakfast, increased consumption of vegetables and cheese at lunch, increased consumption of fruit at supper, and increased consumption of fruit at snack. Item analysis confirmed that control students did not significantly (p > .05) improve any nutrition behavior from preassessment to postassessment.

**Nutrition Knowledge Changes**

Children in the treatment group exhibited significantly greater improvements (F = 140.82, p < .001, η² = .11) in overall nutrition knowledge than children in the control group (Table 1). The overall nutrition knowledge score was separated into 3 sections: food-appropriate Food Guide Pyramid food group, nutrient-food association, and nutrient-job association. Ability to determine which food did not belong to the appropriate Food Guide Pyramid food group improved in the treatment group significantly (F = 24.20, p < .001, η² = .02) more than in the control group. Nutrient-food association was significantly (F = 72.11, p < .001, η² = .06) greater in the treatment group than in the control group. Knowledge of a specific nutrient’s job increased in the treatment group, significantly (F = 87.45, p < .001, η² = .07) more than in the control group.

To determine specific nutrition knowledge changes, 16 nutrition knowledge questions were analyzed individually by comparing each question’s preassessment and postassessment answers using paired t-tests. Within the treatment group, significant positive changes (p < .001) were found for all 16 nutrition knowledge questions. Students in the control group demonstrated a significant (p < .001) increase in correctly answering 1 question from

**Table 1**

<table>
<thead>
<tr>
<th>Topic</th>
<th>Treatment Group Gain Scores</th>
<th>Control Group Gain Scores</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall dietary behavior</td>
<td>0.41 ± 4.56</td>
<td>-0.62 ± 4.58</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Dairy consumption</td>
<td>0.08 ± 2.77</td>
<td>-0.50 ± 2.59</td>
<td>.001</td>
</tr>
<tr>
<td>Fruit and vegetable</td>
<td>0.31 ± 2.75</td>
<td>-0.11 ± 2.80</td>
<td>.016</td>
</tr>
<tr>
<td>Overall nutrition knowledge</td>
<td>3.26 ± 3.62</td>
<td>0.76 ± 2.83</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Food-appropriate</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Food Guide Pyramid food group</td>
<td>0.71 ± 1.40</td>
<td>0.27 ± 1.47</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Nutrient-food association</td>
<td>1.27 ± 1.93</td>
<td>0.29 ± 1.69</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Nutrient-job association</td>
<td>1.27 ± 1.94</td>
<td>0.20 ± 1.63</td>
<td>&lt;.001</td>
</tr>
</tbody>
</table>

**RESULTS**

**Reliability**

Internal consistency as calculated by Cronbach’s coefficient alpha determined reliability of 24 dietary behavior questions (preassessment α = .73; postassessment α = .74) and 16 nutrition knowledge questions (preassessment α = .61; postassessment α = .77). To determine consistency of question responses over time, preassessment and postassessment alphas were reported.

**Dietary Behavior Changes**

Children in the treatment group exhibited significantly greater improvements (F = 12.91, p < .001, η² = .01) in overall dietary behavior than children in the control group, whose overall dietary behavior declined (Table 1).

The overall dietary behavior score was disaggregated into 2 clusters: dairy consumption and fruit and vegetable consumption (Table 1). Dairy consumption improved significantly (F = 11.81, p = .001, η² = .01) more in the treatment group compared to a drop in the control group. Fruit and vegetable consumption increased significantly (F = 5.82, p = .016, η² = .01) more in the treatment group compared to a decline in the control group.
preassessment to postassessment, which was choosing the food that did not belong to the grain group in the Food Guide Pyramid.

**Relationships Between Knowledge and Behavior**

The correlation between gains in overall dietary behavior and gains in overall nutrition knowledge \[ r(1098) = .097, \ p < .001 \] was weak for the overall study group. In addition, the correlation between gains in overall dietary behavior and gains in overall nutrition knowledge \[ r(702) = .098, \ p = .009 \] was weak for the treatment group.

**DISCUSSION**

This study investigated the effects of a nutrition education program on dietary behavior and nutrition knowledge among second-grade and third-grade students participating in an 8-week nutrition education program. Results indicated that the intervention effectively improved dietary behavior and increased nutrition knowledge. Similar findings were demonstrated in other studies. These studies, like the present, included children in the same age group and used the Social Cognitive Theory.

Dairy consumption has decreased in the past 20 years and begins to decrease at ages 6 to 11 years. The 1977-1978 US Department of Agriculture Continuing Survey of Food Intakes by Individuals demonstrated that 99% of children aged 6 to 8 years consumed milk or milk drinks. In contrast, the 1994-1996, 1998 Continuing Survey of Food Intakes by Individuals demonstrated that 86% of boys and 83% of girls aged 6 to 9 years consumed milk, milk drinks, or yogurt.

The present study suggests that nutrition education in schools can lessen the dairy consumption decline among elementary school-aged children. Children in the treatment group demonstrated an increase in dairy consumption, while children in the control group showed a decrease in dairy consumption. Specifically, cheese consumption at lunch increased significantly (\( p = .01 \)) from preassessment to postassessment in the treatment group. Conversely, cheese consumption at lunch and snack decreased significantly (\( p = .006 \) and \( p < .001 \), respectively) from preassessment to postassessment in the control group. Thus, the decrease in dairy consumption in children, including those in this study’s control group, may be slowed by providing school-based nutrition education.

While milk consumption has decreased in the past 20 years, fruit and vegetable consumption has remained constant. The level of fruit consumption of children in this study was consistent with findings at the national level. A national survey in 1998 indicated that 62% of children aged 6 to 11 years consumed at least 1 fruit item on any given day. In the current study, 65% and 62% of children in the treatment and control groups, respectively, consumed at least 1 fruit item. For vegetable consumption, 82% of children aged 6 to 11 years consumed at least 1 vegetable, which included fried white potatoes, on any given day in 1998. In the current study, 49% and 43% of children in the treatment and control groups, respectively, consumed at least 1 vegetable at postassessment. Although this value is lower than the national average, one explanation may be that examples for vegetables in this study that were verbally given to children during data collection consisted of green beans, tomatoes, and potatoes. It is unknown whether second-grade and third-grade students would consider “fried white potatoes” as “potatoes.” Moreover, data in this study were self-reported as opposed to rigorously collected national intake survey data.

A more detailed analysis of data helps justify school-based nutrition education. Similar to an increase in dairy consumption in the treatment group, increases also were found in fruit and vegetable consumption. Significant (\( p = .01 \)) improvements were seen in fruit and juice consumption in the treatment group, while the control group demonstrated a decrease in fruit and juice consumption. In addition, significant (\( p < .05 \)) improvements occurred in vegetable consumption in the treatment group, while the control group had a decreased vegetable consumption. Further improvements in fruit and vegetable consumption may occur with nutrition education.

Based on item analysis of behavior questions, the change in dietary behavior for dairy and vegetable consumption for the treatment group occurred during lunch. This is noteworthy because both treatment and control groups were within the same school and 75% of students participated in the National School Lunch Program. This suggests that the school-based nutrition education effort may have affected behavior change since the 2 factors were not confounding variables of the study. Perry et al demonstrated a similar trend in which fruit and vegetable consumption increased at lunch in the treatment group, which received nutrition education.

The short duration of the study may have minimized dietary behavior changes of students. The School Health Education Evaluation found that a minimum of 50 hours were needed to impact behavior. However, students in this study only participated in a minimum of 6 hours of nutrition education. Thus, changes in dietary behavior were minimal, yet significant. Ideally, more instruction hours would yield a more positive impact on behavior. In the present study, longer term education could not be provided due to educational costs and time restrictions.

In a review of numerous nutrition education study outcomes, Lytle found that 71% of studies reporting on knowledge outcomes demonstrated significant knowledge gains for the treatment group compared to the control group. Results in the present study concerning knowledge gains were consistent with these findings. Furthermore, the School Health Education Evaluation showed that 10 to 15 hours were needed to expect “large” effects in program-specific knowledge. By participating in as few as 6 hours of nutrition education in this study, the treatment group demonstrated a statistically significant (\( p < .001 \)) increase in overall nutrition knowledge and other specific nutrition knowledge categories (Table 1).

Findings from this study suggest programs similar in constructs potentially can improve dietary behavior and increase nutrition knowledge in second-grade and third-grade students. Educators or other school health officials, by implementing a similar nutrition education program, can positively influence the dietary behavior and nutrition knowledge of students.
References


