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Relationships between nutrition-related knowledge, self-efficacy, and behavior for fifth grade students attending Title I and non-Title I schools

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ABSTRACT

The Social Cognitive Theory (SCT) is a widely used theory for nutrition education programming. Better understanding the relationships between knowledge, self-efficacy, and behavior among children of various income levels can help to form and improve nutrition programs, particularly for socioeconomically disadvantaged youth. The purpose of this study was to determine the relationships between knowledge, self-efficacy, and behavior among fifth grade students attending Title I (≥40% of students receiving free or reduced school meals) and non-Title I schools (<40% of students receiving free or reduced school meals). A validated survey was completed by 55 fifth grade students from Title I and 122 from non-Title I schools. Differences in knowledge, self-efficacy, and behavior scores between groups were assessed using t test and adjusted for variations between participating schools. Regression analysis was used to determine the relationships between knowledge, self-efficacy, and behavior. In adjusted models, the Title I group had significantly lower scores on several knowledge items and summary knowledge ($P = 0.04$). The Title I group had significantly lower scores on several behavior variables including intakes of fruits ($P = 0.02$), vegetables ($P = 0.0005$), whole grains ($P = 0.0003$), and lean protein ($P = 0.047$), physical activity ($P = 0.002$) and summary behavior ($P = 0.001$). However the Title I group scored higher on self-efficacy for meal planning ($P = 0.04$) and choosing healthy snacks ($P = 0.036$). Both self-efficacy ($\beta = 0.70$, $P < 0.0001$) and knowledge ($\beta = 0.35$, $P = 0.002$) strongly predicted behavior; however, only self-efficacy remained significant in the Title I group (self-efficacy, $\beta = 0.82$, $P = 0.0003$; knowledge, $\beta = 0.11$, $P = 0.59$). Results demonstrate disparities in nutrition knowledge and behavior outcomes between students surveyed from Title I and non-Title I schools, suggesting more resources may be necessary for lower income populations. Findings suggest that future nutrition interventions should focus on facilitating the improvement of children's self-efficacy.

1. Introduction

Despite the many efforts that have been made into research and intervention, childhood and adolescent obesity remain a significant health issue for the United States (US), affecting approximately 17% of youth ages 2–19 years old (Centers for Disease Control and Prevention (CDC), 2014). There are many factors that are linked to childhood obesity, including poor eating behaviors and lack of physical activity (Popkin, 2001; Swinburn, Caterson, Seidell, & James, 2004). The 2010 Dietary Guidelines for Americans recommended children and adolescents consume more fruits, vegetables, whole grains, lean protein, and dairy food (United States Department of Agriculture (USDA) & US Department of Health and Human Services, 2010). However, research demonstrated that the majority of youth did not meet these recommendations (Kimmons, Gillespie, Seymour, Serdula, & Blanck, 2009).

Children and adolescents of low socioeconomic status (SES; a measure of income, education, and employment) are particularly at risk. In a national sample of more than 40,000 US children aged 10–17 years old, children from low SES households had 3.4–4.3

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times higher odds of being obese than their high SES counterparts (Singh, Siahpush, & Kogan, 2010). This same study demonstrated that while obesity prevalence increased only 10% for all US children from 2003 to 2007, it increased 23–33% for children of low SES. Additional research has demonstrated that the association with income may be more complicated, with trends within poverty-stricken households varying based on age, race, and ethnicity (Miech et al., 2006).

Behaviors of children and adolescents from low SES households may be a contributing factor to the higher rate of obesity in this population. For instance, research shows that youth and adults of low SES tend to consume fewer fruits, vegetables, and high fiber foods, while consuming more high fat foods as compared to their counterparts of high SES (Ball et al., 2009; Kant & Graubard, 2007). The relationship between sedentary behaviors and physical activity with SES has shown mixed results throughout the literature, but is still an area of concern due to the higher rate of obesity among lower SES households (Whitt-Glover et al., 2009).

The school environment may also affect behaviors of students in low SES areas. Title I schools, defined as having ≥40% of the student population receiving free or reduced price school meals, have been identified as schools with higher rates of poverty (US Department of Education, 2014). Students of Title I schools generally perform poorer on standardized academic tests than non-Title I schools, but whether this disparity is also demonstrated for nutrition and physical activity knowledge, and moreover how any disparity relates to behavior outcomes, has not been researched (Stullich, Eisner, & McCrary, 2007). Determining and understanding the differences between students from Title I and non-Title I schools for nutrition- and physical activity-related behavioral constructs is vital to creating school-based interventions.

Although there are serious concerns that socioeconomic inequality may significantly influence an individual's lifestyle habits, leading to poor health conditions, the underlying mechanisms of how the variation in SES can affect nutrition behaviors among children and adolescents has not been fully established. Albert Bandura's social cognitive theory (SCT) is one widely used model for behavior change (Glanz & Bishop, 2007). This theory emphasizes that human behavior depends on the reciprocal interaction of personal, behavioral, and environmental factors (Glanz, Rimer, & Viswanath, 2008). Key constructs include knowledge, outcome expectations, self-efficacy, collective-efficacy, self-regulation, observational learning, behavioral capacity, incentive motivation, and social support (Glanz et al., 2008; Bandura, 2004; DiClemente, Salazar, & Crosby, 2011; Edberg, 2015; McKenzie, Neiger, & Thackeray, 2013). According to the SCT, knowledge of health risk and benefits, along with knowledge as a component of behavioral capacity, creates the precondition for change (Bandura, 2004). However, beliefs of self-efficacy are needed for most people to overcome the barriers to adopting and maintaining healthy lifestyle habits (Bandura, 2004). Previous literature suggests that the influences of cognitive factors, such as nutrition knowledge, attitude, and beliefs about health behaviors are varied across SES. For example, in a study of 2529 Australian adolescents, Ball et al. reported that participants of low SES had lower positive attitudes, self-efficacy, and perceived importance toward healthy eating than their high SES counterparts (Ball et al., 2009).

Many SCT-based nutrition interventions target the improvement of knowledge and self-efficacy in addition to behavioral change; however, little research has been conducted to examine the relationships of knowledge and/or self-efficacy with behavior for children and adolescents of different income levels. Elucidating these relationships can be instrumental in forming SCT-based interventions for the socioeconomically disadvantaged youth population. Thus, the purposes of this study were: 1) to determine the relationships between knowledge, self-efficacy, and behavior among fifth grade students; 2) to compare the difference in behavior predicting relationships between students from Title I and non-Title I schools; and 3) to examine the differences in scores of knowledge, self-efficacy, and behavior variables between Title I and non-Title I school participants. With the integral nature of knowledge, self-efficacy, and behavior within the SCT, we hypothesized significant relationships between all three constructs among study participants. We predicted that students attending non-Title I schools would demonstrate stronger relationships between knowledge, self-efficacy, and behavior as well as higher scores of nutrition related knowledge, self-efficacy, and behavior variables, due to better resources and support they receive as compared to those attending Title I schools.

2. Materials and methods

2.1. Participants and procedures

This investigation was approved by the Internal Review Boards of the University of Nebraska–Lincoln and the participating school district. Title I (≥40% of students receiving free or reduced price school lunch) and non-Title I (<40% of students receiving free or reduced price school lunch) schools were compared to represent schools whose majority of attendees came from lower and higher income homes, respectively (US Department of Education, 2014). Eligibility for free school lunch is defined as being ≤130% of the Federal poverty guidelines while eligibility for reduced price school lunch is defined as being >130% and ≤185% of Federal poverty guidelines, based on the National School Lunch Program guidelines (USDA, 2014a, 2014b, 2014c), thus represents a good reflection of the income level of attending students. Some Title I schools are also eligible for government funded nutrition programs, such as the Fresh Fruit and Vegetable Program (USDA, 2014a, 2014b, 2014c), which are not offered to non-Title I schools, but this funding is limited.

A total of 193 fifth grade students (aged 9–12 years) were recruited from eight public elementary schools. Four Title I and four non-Title I elementary schools were randomly selected from one Midwestern school district. Principals of each school were contacted and invited to participate; one Title I school with three classrooms (n = 58) and three non-Title I schools with six classrooms (n = 135) agreed to participate. Among the participating schools, one non-Title I school participated in Fuel up to Play 60 (National Dairy Council, 2015) and the Title I school participated in the Fresh Fruit and Vegetable Program (USDA, 2014a, 2014b, 2014c). The Title I school received some supplementary educational resources due to assistance funding allotted for low income schools. However, school nutrition and physical education and wellness environments remained similar due to identical district expectations for health learning objectives, allotment of teaching time for nutrition, district-provided nutrition and physical activity education resources, wellness policy, physical education objectives and movement experiences, and daily menus meeting the National School Lunch and Breakfast Program guidelines (USDA, 2014a, 2014b, 2014c). Permission was obtained from the school district, principals, and teachers from the four participating elementary schools. Parent notification letters were sent home with each student. Youth assent for each student was obtained before the data collection.

The Healthy Habits Survey (Hall, Chai, Koszewski, & Albrecht, 2015) was administered by the primary researcher and two assistants in fifth grade students' regular classrooms during a two-week period in spring 2014 so that the research would not interfere with schools' regular academics. Prior to administering the survey, the trained research team read a standardized script that provided instructions to students on completing the survey and allowed time for questions. The research team abided by the following guidelines when answering student inquiries during the survey: 1) Helped students read an item or clarify a word that they did not understand, unless clarification would lead to influencing an answer to a knowledge item; 2) Provided no leading or assistance in answering knowledge items; and 3) Encouraged students to pick the *best* answer that represents their self-efficacy or behavior *most of the time* when students were unsure. The classrooms took approximately 20–30 min to complete the survey. Data collection was performed by the same research team across all four participating schools.

2.2. Survey instrument

The Healthy Habits Survey, including knowledge, self-efficacy, and behavior sections was previously validated for fifth grade students attending both Title I and non-Title I schools (Hall et al., 2015). Behavior items (12 items) measured nutritional intake in a count per day format, focusing on the five food groups, salty foods, sugary foods, and beverages. Breakfast intake, family meal planning, and physical activity were measured in a count per week format. Knowledge items (14 items) measured knowledge of food groups, nutrition benefits, physical activity recommendations and benefits, recommended daily intake, healthy snacks, and breakfast benefits. Twelve items had only one correct answer, while two items had multiple correct answers. Self-efficacy items (10 items) assessed confidence concerning physical activity, healthy meal identification, healthy meal choices, food group choices, meal planning, healthy choices in the presence of social pressure, healthy snack choices, and breakfast consumption.

For behavior questions, the responses to the items were scored from 1 to 4 (or 1 to 5 if there were 5 responses to the question) with a higher score reflecting a more positive response. Items were reversely scored when questions were related to an unhealthy behavior. Similarly, items for self-efficacy were scored from 1 to 3, indicating low, medium, and high self-efficacy, respectively. For each of the knowledge items, "1" was given if the student had the correct answer, if not, "0" was marked for the item. The two multi-answer knowledge questions each were scored with a total of 5 points, with "1" point given for each correct answer and "0" given for each incorrect answer.

2.3. Data analysis

Initially there were 193 participants (58 in Title I group and 135 in non-title I group); however not all surveys were complete. The data analyses were based on 177 participants (55 in Title I group and 122 in non-title I group) who completed all the items on the survey. The average scores for each item as well as the respective summary scores for all the knowledge, self-efficacy, and behavior items between the Title I and non-Title I groups were compared using t test. Analyses were repeated after adjusting for gender, race, and Hispanic ethnicity using the General Linear Model and results did not change materially. Analysis of Variance (ANOVA) was used to determine if there were any differences in knowledge, self-efficacy, and behavior items between the participants from the three non-Title I elementary schools. To account for the variations associated with participating schools, the model was further adjusted by including participating schools as a covariate in the model (a total of four schools [four levels]). Multiple regression analysis was used to determine the relationships between knowledge, self-efficacy, and behavior and how they predicted each other among our study participants (e.g., how knowledge and/or self-efficacy predicted behavior outcomes). The regression analysis was repeated in students attending Title I school and in those attending non-Title I schools.

The power analysis was in part based on the results from our pilot study which was conducted in participants within the same age range (fifth grade students) from both Title I and non-Title I schools by using the same survey instrument (Hall et al., 2015). To have statistical power of 80%, approximately 64 subjects would be needed in each group for a t-test comparing means between two groups, assuming medium effect size ($d = 0.50$) (Cohen, 1992) and $\alpha = 0.05$ (2-tailed). In the current study, there were 55 and 122 students (who had no missing items in the survey) in the Title I and non-Title I groups, respectively. With 55 participants in Title I group, we had 74% statistical power to detect the differences between the two groups. SPSS 22 (SPSS, Inc, Chicago, IL) was used for all statistical analyses with a two-sided p value of <0.05 considered statistically significant.

3. Results

3.1. Demographics

Table 1 provides the demographics for the Title I and non-Title I groups. A total of 193 students participated in the study and 177 (76 males and 101 females) completed all the items of the survey. A majority of students were white (42.4%), however, 21.4% did not know their race. Hispanic or Latino students made up 5.2% of the sample, although 30.7% of students reported that they did not know whether they were Hispanic/Latino or not. Race was significantly different between Title I and non-Title I groups ($P = 0.003$); no significant differences in gender were observed between the two groups ($P = 0.39$). The average percentage of students receiving free or reduced price school lunch was 68.78% and 21.76% (9.12%, 24.34%, and 31.82%) for the Title I and non-Title I schools, respectively (Nebraska Department of Education, 2015). The collected school lunch percentages include only those who have applied and are approved for receiving free or reduced price school lunch, not all those that are eligible.

3.2. Knowledge, self-efficacy, and behavior

Scores on knowledge, self-efficacy, and behavior items among participants from the three non-Title I schools are demonstrated in Table 2. For knowledge items, significant differences were observed for identifying food items in the grains ($P = 0.04$) and vegetable ($P = 0.04$) groups, whole grains versus refined grains ($P = 0.01$), recommended amount of physical activity ($P = 0.02$), recommended daily intakes of fruit and vegetables ($P = 0.02$) and healthy snack choices ($P = 0.03$) among the three participating non-Title I school groups. With respect to behavior items, there were significant differences in scores for intakes of vegetables ($P = 0.018$), whole grains ($P = 0.002$), and sweets ($P = 0.01$), physical activity ($P = 0.004$), and summary behavior score (summary of all behavior items; $P = 0.04$). The non-Title I school that had the highest percentage of students receiving free and reduced school meals (31.8% vs. 24.3% and 9.1%) had significantly lower scores on the majority of the above items compared to either one or both of the remaining non-Title I schools (Table 2). There were no significant differences in scores of self-efficacy items among the three non-Title I schools.

Overall the non-Title I group scored better than the Title I group for knowledge variables, including significantly higher average scores for knowledge when identifying food in the vegetable ($P = 0.026$) and lean protein ($P = 0.008$) groups, whole grains versus refined grains ($P = 0.01$), recommended amount of physical activity ($P = 0.006$), benefits of physical activity ($P = 0.03$), and

Table 1
Demographics of study participants (n = 177).

Demographic	Title I school participants N (%)	Non-Title I school participants N (%)	P value[a]
Gender			0.39
Male	21 (38.2)	55 (45.1)	
Female	34 (61.8)	67 (54.9)	
Race			0.003
White	19 (34.6)	56 (45.9)	
American Indian/Alaska Native	2 (3.6)	6 (4.9)	
Asian	4 (7.3)	1 (0.8)	
Black/African American	6 (10.9)	2 (1.6)	
Native Hawaiian/Other Pacific Islander	0 (0)	1 (0.9)	
Two or more races	8 (14.5)	10 (8.2)	
Other, not listed	10 (18.2)	14 (11.5)	
I don't know	6 (10.9)	32 (26.2)	
Ethnicity			0.73
Hispanic Latino	3 (5.5)	6 (5.0)	
Non-Hispanic or Latino	33 (60.0)	80 (65.5)	
I don't know	19 (34.5)	36 (29.5)	
Free & Reduced School Lunch Percentage	63.16%	22.30%	

[a] P values calculated by Chi-square test.

Table 2
Knowledge, self-efficacy, and behavior scores of participants from non-Title I schools.

Variable	School 1 (n = 30)	School 2 (n = 68)	School 3 (n = 24)	P value[a]
	Mean ± SD	Mean ± SD	Mean ± SD	
Free & reduce school lunch %	31.82%	24.34%	9.12%	
Knowledge				
Food groups-in a meal	0.80 ± 0.40	0.82 ± 0.38	0.92 ± 0.28	0.47
Food groups-grains	0.87 ± 0.35[a]	0.68 ± 0.47[b]	0.88 ± 0.34[a]	0.04
Food groups-vegetables	0.93 ± 0.25[a]	1.00 ± 0.00[b]	1.00 ± 0.00[ab]	0.04
Food groups-fruits	1.00 ± 0.00	0.97 ± 0.17	1.00 ± 0.00	0.45
Food Groups-protein	0.90 ± 0.31	0.97 ± 0.17	1.00 ± 0.00	0.14
Food groups-dairy	0.87 ± 0.35	0.97 ± 0.18	0.96 ± 0.20	0.12
Whole grains vs. refined grains	0.37 ± 0.49	0.67 ± 0.47	0.65 ± 0.49	0.01
Nutrition benefits	1.00 ± 0.00	0.97 ± 0.17	1.00 ± 0.00	0.47
Amount of physical activity	0.67 ± 0.48[a]	0.90 ± 0.31[b]	0.83 ± 0.38[b]	0.02
Physical activity benefits	0.47 ± 0.51	0.65 ± 0.48	0.46 ± 0.51	0.13
Daily intake-fruit &vegetables	0.07 ± 0.25[a]	0.24 ± 0.43[ab]	0.38 ± 0.49[b]	0.02
Daily intake-dairy	0.53 ± 0.51	0.60 ± 0.49	0.54 ± 0.51	0.77
Snacks	4.60 ± 0.77[a]	4.09 ± 1.00[b]	4.42 ± 0.83[ab]	0.03
Breakfast	3.57 ± 1.11	3.44 ± 1.24	3.13 ± 0.90	0.36
Summary knowledge[b]	16.86 ± 2.86	16.94 ± 2.96	17.23 ± 2.69	0.90
Behavior				
Dairy intake	3.28 ± 0.75	3.33 ± 0.92	3.33 ± 0.92	0.50
Fruit intake	2.20 ± 0.92	2.51 ± 1.04	2.71 ± 0.81	0.18
Vegetable intake	1.76 ± 0.69[a]	2.32 ± 1.09[b]	2.46 ± 1.02[b]	0.018
Whole grain intake	2.20 ± 1.00[a]	2.90 ± 1.04[b]	3.09 ± 0.95[b]	0.002
Lean Protein Intake	2.50 ± 0.90[a]	2.76 ± 0.98[ab]	3.17 ± 0.87[b]	0.038
Intake less French Fry/chip	3.27 ± 0.64	3.24 ± 0.79	2.83 ± 1.01	0.08
Intake less fruit drink	3.40 ± 0.73	3.18 ± 0.79	2.96 ± 0.81	0.12
Drink less soda	3.47 ± 0.78	3.47 ± 0.76	3.54 ± 0.66	0.91
Intake less sweets	2.90 ± 0.76[a]	3.34 ± 0.59[b]	3.33 ± 0.87[b]	0.01
Breakfast	4.57 ± 0.86	4.48 ± 0.89	4.67 ± 0.56	0.62
Physical activity	3.77 ± 0.97[a]	4.24 ± 0.85[b]	4.54 ± 0.66[b]	0.004
Meal planning	2.73 ± 1.11	2.66 ± 1.21	2.58 ± 1.14	0.90
Summary behavior[b]	36.03 ± 3.71[a]	38.36 ± 5.47[b]	39.00 ± 3.26[b]	0.04
Self-Efficacy				
Be Physically active	2.70 ± 0.53	2.76 ± 0.46	2.83 ± 0.38	0.58
Healthy meal identification	2.67 ± 0.48	2.62 ± 0.52	2.79 ± 0.42	0.33
Healthy Meal choice at home	2.63 ± 0.49	2.59 ± 0.53	2.75 ± 0.44	0.40
Healthy meal choice at school	2.43 ± 0.68	2.56 ± 0.56	2.50 ± 0.66	0.64
All food groups choice	2.43 ± 0.63	2.50 ± 0.56	2.50 ± 0.51	0.86
Meal planning	2.80 ± 0.48	2.82 ± 0.38	2.88 ± 0.34	0.78
Social pressure	2.43 ± 0.57	2.51 ± 0.56	2.38 ± 0.49	0.52
Choosing healthy snacks	2.70 ± 0.53	2.65 ± 0.51	2.50 ± 0.60	0.37
Physical activity instead of Screen	2.30 ± 0.60	2.53 ± 0.61	2.54 ± 0.51	0.17
Breakfast	2.80 ± 0.48	2.69 ± 0.53	2.79 ± 0.41	0.51
Summary self-efficacy[b]	25.90 ± 3.69	26.24 ± 3.07	26.46 ± 1.96	0.79

Note: Mean values within a row with different superscript letters (a,b,c) are significantly different (Post Hoc analysis [Tukey test], $P < 0.05$).
[a] P values were estimated by Analysis of Variance (ANOVA).
[b] Summary scores of all knowledge items, or all behavior items, or all self-efficacy items.

recommended daily intakes of fruit and vegetables (P = 0.004) after adjusting for participating schools. The summary knowledge score (summary of all the knowledge items) was also significantly higher in the non-Title I than the Title I group (P = 0.04) after adjusting for the covariate (participating schools) (Table 3).

The self-efficacy results for Title I and non-Title I groups are demonstrated in Table 4. The non-Title I group scored slightly higher for the majority of the self-efficacy variables. However, compared to the non-Title I group, the Title I group had significantly higher average scores on confidence for planning a meal with different food groups (P = 0.04) and choosing healthy snacks (P = 0.036) after adjustment for participating schools. There were no statistically significant differences in the summary score of self-efficacy (summary of the all self-efficacy items) between the two groups (P = 0.43).

Overall the non-Title I group scored higher than the Title I group for the majority of the behavior variables. The average scores for several items were significantly higher in the non-Title I group, including daily intake of fruits (P = 0.02), vegetables (P = 0.0005), whole grains (P = 0.0003), and lean protein (P = 0.047), physical activity (P = 0.002) and summary behavior (P = 0.001) after adjusting for participating schools (Table 5).

3.3. SCT construct relationships

Table 6 shows the relationships between constructs of knowledge, self-efficacy, and behavior and how they predict each other. For all participants, behavior was significantly, positively correlated with knowledge (P = 0.001) and self-efficacy (P < 0.0001). Positive correlations between behavior and self-efficacy were also observed in both non-Title I (P < 0.0001) and Title I (P < 0.0001) groups. Knowledge and self-efficacy were not correlated overall (P = 0.21) or among the non-Title I participants (P = 0.95) but were significantly correlated in the Title I group (P = 0.001). Significant correlations between knowledge and behavior were observed in the non-Title I group (P = 0.02) but not in the Title I group (P = 0.10), possibly due to the relatively smaller sample size (n = 55) in the Title I as compared to the non-Title I group (n = 122).

Although both knowledge and self-efficacy significantly predicted behavior outcomes among all the participants and non-Title I subjects, self-efficacy appeared to be a stronger predictor than knowledge for behavior (all participants: knowledge, P = 0.002, self-efficacy, P < 0.0001; non-Title I: knowledge, P = 0.01, self-efficacy, P < 0.0001). For the Title I group, self-efficacy (P = 0.0003) but not knowledge (P = 0.59) was a significant predictor for behavior. As for knowledge, behavior not self-efficacy was a strong predictor overall (behavior, P = 0.002; self-efficacy, P = 0.65) and among non-Title I participants (behavior, P = 0.01; self-efficacy, P = 0.21). Finally, self-efficacy was strongly predicted by behavior but not knowledge overall (behavior, P < 0.0001; knowledge, P = 0.65), and among Title I (behavior, P = 0.0003; knowledge, P = 0.067) and non-Title I participants (behavior, P < 0.0001; knowledge P = 0.21). In addition, results for construct relations were similar after the adjustment for participating schools.

4. Discussion

In our study, overall there were significant differences in approximately half of the measured variables for knowledge and behavior, but few significant differences in self-efficacy variables between the Title I and non-Title I groups after the adjustment for participating schools. The Title I group had significantly lower scores for several knowledge items such as knowledge of food in the vegetable and protein groups, whole versus refined grains, recommended amount of physical activity, physical activity benefits, daily recommended intake for fruits and vegetables, and summary knowledge scores. The Title I group also demonstrated significantly lower scores on behavior items including daily intakes of fruit, vegetables, whole grains, and lean protein, physical activity, and summary behavior compared to the non-Title I group. However, Title I schools had significantly higher scores on self-efficacy of meal planning with different food groups and choosing a healthy snack.

Nutrition knowledge of children from high- and low-income households has not been well studied; however, academic achievement, a reflection of general knowledge gained in the school setting, has been examined in many studies in terms of how

Table 3
Knowledge scores of Title I and non-Title I school participants.

Variable	Model I[a]			Model II[b]		
	Title I school (N = 55)	Non-title I schools (N = 122)	P value[a]	Title I school (N = 55)	Non-title I schools (N = 122)	P value[b]
	Mean ± SD	Mean ± SD		Mean (95% CI)[c]	Mean (95% CI)[c]	
Food groups-In a meal	0.78 ± 0.42	0.84 ± 0.37	0.39	0.67 (0.52, 0.87)	0.87 (0.78, 0.97)	0.15
Food groups-grains	0.65 ± 0.48	0.76 ± 0.43	0.14	0.66 (0.46, 0.87)	0.76 (0.65, 0.87)	0.50
Food groups-vegetables	0.94 ± 0.26	0.98 ± 0.13	0.14	0.88 (0.79, 0.96)	1.01 (0.96, 1.05)	0.026
Food groups-fruits	1.00 ± 0.00	0.98 ± 0.13	0.16	1.00 (0.95, 1.05)	0.98 (0.96, 1.01)	0.52
Food Groups-Protein	0.84 ± 0.37	0.95 ± 0.20	0.025	0.76 (0.64, 0.89)	0.99 (0.93, 1.06)	0.008
Food groups-dairy	0.89 ± 0.32	0.94 ± 0.23	0.27	0.81 (0.69, 0.94)	0.97 (0.91, 1.04)	0.06
Whole grains vs. refined grains	0.49 ± 0.50	0.60 ± 0.49	0.12	0.27 (0.04, 0.50)	0.69 (0.57, 0.82)	0.01
Nutrition benefits	1.00 ± 0.00	0.98 ± 0.13	0.16	1.00 (0.95, 1.05)	0.98 (0.96, 1.01)	0.64
Amount of physical activity	0.64 ± 0.49	0.83 ± 0.38	0.01	0.51 (0.31, 0.70)	0.89 (0.78, 0.99)	0.006
Physical activity benefits	0.24 ± 0.43	0.57 ± 0.50	<0.0001	0.22 (0.01, 0.44)	0.57 (0.45, 0.69)	0.03
Daily intake-fruit &vegetables	0.16 ± 0.37	0.22 ± 0.42	0.36	−0.06 (−0.24, 0.13)	0.32 (0.22, 0.42)	0.004
Daily intake-dairy	0.64 ± 0.49	0.57 ± 0.50	0.43	0.62 (0.39, 0.85)	0.58 (0.46, 0,70)	0.80
Snacks	4.04 ± 1.07	4.28 ± 0.94	0.32	4.19 (3.74, 4.65)	4.21 (3.96, 4.45)	0.97
Breakfast	3.07 ± 1.13	3.41 ± 1.15	0.22	3.37 (2.83, 3.90)	3.28 (3.00, 3.56)	0.82
Summary Knowledge[d]	15.52 ± 2.91	16.97 ± 2.87	0.003	15.17 (13.78, 16.56)	17.13 (16.40, 17.85)	0.04

[a] Model I: Basic model without the adjustment for any covariates; P values (for Model I) for differences between Title I school and non-Title I school groups using t test.
[b] Model II: Model with the adjustment for participating schools (four participating schools [4 levels]); P values (for Model II) for differences between Title I school and non-Title I school group adjusting for participating schools using the General Linear Model.
[c] Mean and 95% confidence interval (95% CI) for the mean after the adjustment for participating schools.
[d] Summary Knowledge = summary scores of all knowledge items.

Table 4
Self-efficacy scores of Title I and non-Title I school participants.

Variable	Model I[a]			Model II[b]		
	Title I school (n = 55)	Non-title I schools (n = 122)	P value[a]	Title I school (n = 55)	Non-title I schools (n = 122)	P value[b]
	Mean ± SD	Mean ± SD		Mean (95% CI)[c]	Mean (95% CI)[c]	
Be physically active	2.76 ± 0.47	2.76 ± 0.46	0.99	2.67 (2.46, 2.89)	2.80 (2.69, 2.92)	0.39
Healthy meal identification	2.74 ± 0.52	2.66 ± 0.49	0.32	2.67 (2.44, 2.90)	2.70 (2.57, 2.82)	0.86
Healthy meal choice at home	2.62 ± 0.59	2.63 ± 0.50	0.88	2.54 (2.29, 2.79)	2.67 (2.54, 2.80)	0.46
Healthy meal choice at school	2.33 ± 0.70	2.52 ± 0.61	0.068	2.27 (1.97, 2.56)	2.54 (2.39, 2.70)	0.18
All food groups choice	2.38 ± 0.59	2.48 ± 0.56	0.28	2.33 (2.07, 2.60)	2.51 (2.36, 2.65)	0.36
Meal planning	2.60 ± 0.53	2.83 ± 0.40	0.006	2.55 (2.30, 2.81)	2.46 (2.32, 2.59)	0.04
Social pressure	2.53 ± 0.57	2.47 ± 0.55	0.51	2.55 (2.35, 2.76)	2.85 (2.74, 2.96)	0.59
Choosing healthy snacks	2.78 ± 0.46	2.63 ± 0.53	0.07	2.92 (2.68, 3.16)	2.57 (2.44, 2.70)	0.036
Physical activity instead of screen	2.40 ± 0.62	2.48 ± 0.59	0.44	2.21 (1.94, 2.49)	2.56 (2.41, 2.71)	0.07
Breakfast	2.81 ± 0.48	2.74 ± 0.49	0.34	2.83 (2.60, 3.06)	2.73 (2.61, 2.85)	0.55
Summary self-efficacy[d]	26.04 ± 2.80	26.20 ± 3.04	0.74	25.62 (24,23, 27.01)	26.38 (25.65, 27.11)	0.43

[a] Model I: Basic model without the adjustment for any covariates; P values (for Model I) for differences between Title I school and non-Title I school groups using t test.
[b] Model II: Model with the adjustment for participating schools (four participating schools [4 levels]); P values (for Model II) for differences between Title I school and non-Title I school group adjusting for participating schools using the General Linear Model.
[c] Mean and 95% confidence interval (95% CI) for the mean after the adjustment for participating schools.
[d] Summary self-efficacy = summary scores of all self-efficacy items.

Table 5
Behavior scores of Title I and non-Title I school participants.

Variable	Model I[a]			Model II[b]		
	Title I school (N = 55)	Non-title I schools (N = 122)	P value[a]	Title I school (N = 55)	Non-title I schools (N = 122)	P value[b]
	Mean ± SD	Mean ± SD		Mean (95% CI)[c]	Mean (95% CI)[c]	
Dairy intake	3.15 ± 0.93	3.24 ± 0.81	0.47	2.97 (2.58, 3.36)	3.32 (3.11, 3.53)	0.20
Fruit intake	2.28 ± 0.98	2.48 ± 0.98	0.22	1.91 (1.46, 2.37)	2.64 (2.40, 2.88)	0.02
Vegetable intake	2.02 ± 0.95	2.21 ± 1.02	0.23	1.52 (1.06, 1.98)	2.44 (2.20, 2.69)	0.0005
Whole grain intake	2.45 ± 1.09	2.76 ± 1.06	0.08	1.80 (1.31, 2.29)	3.06 (2.80, 3.32)	0.0003
Lean protein intake	2.83 ± 0.98	2.77 ± 0.96	0.71	2.37 (1.93, 2.81)	2.99 (2.75, 3.22)	0.047
Intake less French fry/chip	3.02 ± 1.04	3.16 ± 0.82	0.36	3.29 (2.89, 3.70)	3.04 (2.82, 3.26)	0.37
Intake less fruit drink	2.83 ± 0.86	3.18 ± 0.78	0.009	3.14 (2.77, 3.52)	3.05 (2.85, 3.25)	0.72
Drink less soda	3.35 ± 0.73	3.48 ± 0.74	0.31	3.30 (2.95, 3.64)	3.51 (3.33, 3.69)	0.37
Intake less sweets	3.24 ± 0.86	3.23 ± 0.71	0.96	2.92 (2.57, 3.27)	3.37 (3.19, 3.56)	0.06
Breakfast	4.50 ± 0.96	4.54 ± 0.83	0.84	4.44 (4.04, 4.84)	4.57 (4.35, 4.78)	0.66
Physical activity	4.02 ± 1.13	4.18 ± 0.88	0.35	3.46 (3.02, 3.90)	4.43 (4.20, 4.67)	0.002
Meal planning	2.58 ± 1.23	2.66 ± 1.17	0.67	2.68 (2.13, 3.23)	2.62 (3.33, 2.92)	0.89
Summary behavior[d]	36.19 ± 4.32	37.92 ± 4.82	0.028	33.94 (31.74, 36.14)	38.90 (37.75, 40.04)	0.001

[a] Model I: Basic model without the adjustment for any covariates; P values (for Model I) for differences between Title I school and non-Title I school groups using t test.
[b] Model II: Model with the adjustment for participating schools (four participating schools [4 levels]); P values (for Model II) for differences between Title I school and non-Title I school group adjusting for participating schools using the General Linear Model.
[c] Mean and 95% confidence interval (95% CI) for the mean after the adjustment for participating schools.
[d] Summary behavior = summary scores of all behavior items.

it was affected by income and/or SES. Most research suggests that parental SES is one of the strongest predictors of academic achievement of a child (Reardon, 2011). As a result, students entering kindergarten from families of the bottom quintile of SES scored more than a standard deviation lower than those of the top quintile of SES on math and reading. These differences did not decrease as children continued with their schooling (Reardon, 2011). It is suggested that home environment, parental involvement, school environment, and neighborhood conditions of low SES areas account for low reading achievement (Aikens & Barbarin, 2008). Such low reading achievement may affect student ability to read and comprehend assessment items, even if they are written at the given grade level, such as the survey used in this study.

The most recent evaluation from the US Department of Education (2009) found that 82% of the 13,103 schools identified for improvement in 2006–2007 were Title I schools. These schools did not show adequate yearly progress toward students reaching proficiency for math and reading by 2013–2014, demonstrating a gap between Title I and non-Title I schools, which has the potential to effect nutrition education, as more time may need to be dedicated to core subjects to meet proficiency. State assessments demonstrate that although there has been a small reduction in the achievement gap between low-income and all students, this reduction has not been statistically significant (Stullich et al., 2007).

The home environment may also cause emotional and psychological problems for students that can affect their learning abilities at school. For example, children with lower SES parents are more likely to have behavior problems that impact their learning ability, attention, and interest (Morgan, Farkas, Hillemeier, & Maczuga, 2009). Additionally, family stress caused by low income has been shown to cause emotional distress in children, leading to poor academic performance (Mistry, Benner, Tan, & Kim, 2009). Children from these homes were also more likely to be absent from school (Zhang, 2003), which affects the amount of knowledge they receive in a formal educational setting.

Aside from the home environment, the school setting itself also plays a significant role in students' achievement. The No Child Left Behind Act of 2001's key provisions state that all teachers of core

Table 6
Relations between constructs of knowledge, self-efficacy, and behavior.[a]

Construct equation	Predictor in the equation	All participants (n = 177)		Title I school participants (n = 55)		Non-title I school participants (n = 122)	
		β coefficient for the predictor[b]	P value[b]	β coefficient for the predictor[b]	P value[b]	β coefficient for the predictor[b]	P value[b]
B = K	K	0.41	0.001	0.36	0.10	0.36	0.02
B = SE	SE	0.72	<0.0001	0.83	<0.0001	0.68	<0.0001
B = K + SE	K	0.35	0.002	0.11	0.59	0.37	0.01
B = K + SE	SE	0.70	<0.0001	0.82	0.0003	0.69	<0.0001
K = B	B	0.15	0.001	0.15	0.10	0.13	0.02
K = SE	SE	0.10	0.21	0.37	0.001	−0.01	0.95
K = B + SE	B	0.17	0.002	0.06	0.59	0.16	0.01
K = B + SE	SE	−0.04	0.65	0.32	0.067	−0.12	0.21
SE = K	K	0.08	0.20	0.13	0.01	−0.01	0.95
SE = B	B	0.28	<0.0001	0.34	<0.0001	0.27	<0.0001
SE = K + B	K	−0.03	0.65	0.23	0.067	−0.12	0.21
SE = K + B	B	0.29	<0.0001	0.31	0.0003	0.29	<0.0001

Note: B = behavior; K = knowledge, SE = self-efficacy.
[a] Summary scores of each construct (i.e. summary scores of all behavior items, summary scores of all knowledge items, summary scores of all self-efficacy items) were used to compute the associations.
[b] Values were estimated using regression analysis.

academic subjects must meet requirements of highly qualified teachers (US Department of Education, 2009). However, several studies suggest that more qualified teachers are employed at schools serving higher income areas, and those that do serve lower income areas may switch schools (Glazerman & Max, 2011; Luebchow, 2009; Muijs, Harris, Chapman, Stoll, & Russ, 2004; Lankford, Loeb, & Wyckhoff, 2002; Clotfelter, Ladd, Vigdor, & Wheeler, 2007; Clotfelter, Ladd, & Vigdor, 2006; Hanushek, Kain, & Rivkin, 2004). New teachers at low-income schools also report having no mentor or having an inexperienced mentor, a lack of curricular guidance, impersonal hiring procedures, and curriculum that is too prescriptive, which may reduce satisfaction and affect student success (Johnson, Kardos, Kauffman, Liu, & Donaldson, 2004). Since experience and teacher training quality are correlated with academic achievement (Gimbert, Bol, & Wallace, 2007), this places students attending Title I schools at a disadvantage. These barriers with educators may have influences not only on core subjects but also on overall education, including nutrition education, as supported by our results that significantly lower scores on several knowledge items as well as knowledge summary scores were observed in those with low SES.

Though research on nutrition knowledge is limited, SES has been shown in several studies to have significant effects on nutrition-related behaviors. Measurement of diet quality and biomarkers from the National Health and Nutrition Examination Survey (NHANES) showed that poor diet quality was associated with lower SES (Kant & Graubard, 2007). Higher SES families are more likely to consume foods such as fresh fruits and vegetables, whole grains, and low-fat dairy (Darmon & Drewnowski, 2008). Sedentary behavior was also found to be more common in adolescents from lower SES households (Hanson & Chen, 2007). Indeed, our results further showed that the fifth grade students from Title I schools had lower scores on fruit, vegetable, whole grain, and lean protein intakes, physical activity, and summary behavior than those attending non-Title I schools. Poor food environments may also contribute to these low behavior scores. For example, research shows that the number of students eligible for free or reduced price school meals is also associated with a higher number of convenience stores surrounding their schools, which has the potential to worsen eating behaviors (Sturm, 2008). Higher crime rate and lower street quality were also observed around elementary schools in low income neighborhoods, which could affect the amount of time for students to be physically active outside (Zhu & Lee, 2008).

Contrary to behavior and knowledge results, two self-efficacy variables, confidence for meal planning and choosing healthy snacks, scored significantly higher for Title I students compared to non-Title I students. Previous literature has reported that a variety of interventions for low income students resulted in increased self-efficacy for these students (McCarthy, Wolff, Biano-Simeral, Crozier, & Goto, 2012). However there is no evidence in the literature which compares nutrition-related self-efficacy for low and high income students. With many parents from low income households working multiple jobs, particularly in single-parent households, it is possible that youth from these households are responsible for making meals for themselves, and in some cases, for siblings. This responsibility and experience may be related to high self-efficacy for meal planning, however should be further researched. It is possible that participation in the Fresh Fruit and Vegetable Program contributed to Title I students' confidence that they could choose healthy snacks since this program provides them with this healthy snack resource on a consistent basis. Future studies are necessary to confirm and further investigate the current findings regarding group differences in aforementioned self-efficacy variables.

In our study, there were significant differences in scores of several knowledge and behavior items among the students from the three non-Title I schools. Among these items, participants from the school with the highest percentage of students receiving free and reduced school meals (31.8% vs. 24.3% and 9.1%) had significantly lower scores in four areas of knowledge and five areas of behavior as compared to either one or both of the remaining non-Title I schools, supporting the overall conclusion from our study that students attending lower income schools (as defined by the percentage of students receiving free and reduced school meals) had poorer nutrition-related knowledge and behaviors than those attending higher income schools. In addition to the proportion of the students from low income families, the school's exposure to nutrition education programs may play a role. Among the three non-Title I schools, only one school (with 24.3% students receiving free and reduced school meals) participated in additional nutrition intervention (Fuel up to Play 60). Knowledge and behavior scores obtained from participants attending this school were more aligned with those attending the school with the lowest percentage of low income students (9.1%), demonstrating that it may be beneficial to implement nutrition interventions and increase resources for schools which are not qualified for government funded nutrition programs, but still have a considerable number of students from low income families.

Our results demonstrated significant, positive relations between nutrition related knowledge, self-efficacy, and behavior among our fifth grade participants. Although both significant, relative to knowledge, self-efficacy appeared to be a stronger predictor for behavior in the current study population. Similarly, behavior had a much stronger relation with self-efficacy than knowledge did. Our finding was in agreement with the SCT, which also suggests that self-efficacy is a focal determinant because it affects behavior both directly and by its influence on other determinants. According to the SCT, health related knowledge creates the precondition for change; however, additional self-influences are needed for most people to overcome the barriers of adopting new lifestyle habits and maintaining them. Therefore, beliefs of self-efficacy play a central role in personal change and are the foundation of human motivation and action (Bandura, 2004).

Interestingly, our results indicated that self-efficacy played a much stronger role in predicting behavior outcomes in the Title I group which was defined by low income, contradicting our hypothesis that knowledge would also play a role. Generally, self-efficacy is higher in high-income groups due to the resources available to develop confidence (Schunk & Meece, 2005), however behavior in the Title I group was only predicted by self-efficacy and not knowledge. Although previous studies have shown the association between self-efficacy and behavior for this age group (Thompson, Bachman, Baranowski, & Weber Cullen, 2007), to our knowledge, none have separated findings by Title I and non-Title I schools, an essential criteria of the school-based learning environment. Our conclusion was further supported by the findings reported by Ball et al. (2009) that cognitive factors, especially self-efficacy and the perceived importance of healthy behavior were important mediators of socioeconomic variations in fruit consumption from a community-based sample of 2529 adolescents in Australia.

Our findings on construct relations, coupled with our results showing low knowledge and behavior scores for Title I relative to non-Title I students demonstrate a general need for increased nutrition education and resources for low income students, considering that many Title I schools are eligible for receiving government-funded nutrition programs. In fact, the Title I school in this study participated in the Fresh Fruit and Vegetable program as an extra resource for students; however, students from this school still had significantly lower fruit and vegetable intakes. Other behavior variables, both dietary and physical activity, were also lower in the Title I group, even though all schools offered the same breakfast and lunch menus daily. This suggests that a lack of resources may be preventing families from providing healthy foods and movement opportunities, so this should be further investigated to determine whether additional resources in schools can be justified to assist students who may not have enough resources at home.

Knowledge results imply a need for increased nutrition education in Title I schools. Due to the pressures of standardized testing in this age group, particularly in lower achieving schools, nutrition education may be compromised to meet academic achievement goals. Although health objectives exist, there is no standardized testing for nutrition and little accountability or incentive for teaching it. Districts should strengthen wellness policies and implement systems that hold schools and teachers more accountable for completing nutrition education and meeting health objectives. In addition to policy, nutrition education interventions should directly target the improvement of self-efficacy of children who are socioeconomically deprived. A movement away from traditional lecture-based learning toward interactive programs can engage students in mastery experience through hands-on learning, and verbal/social persuasion through group learning, which can improve self-efficacy (Glanz et al., 2008; DiClemente et al., 2011).

Moreover, nutrition professionals can improve school nutrition education through working with teachers to educate them on simple ways to integrate more education and self-efficacy improvement strategies without sacrificing preparation for standardized testing. Nutrition professionals should train teachers on methods to enhance a given curriculum to improve student learning and self-efficacy. Teachers can integrate techniques into any curriculum, such as role modeling, adapting curriculum or scaffolding to assure curriculum is at an appropriate level for their specific students (particularly low achieving students that are more prevalent in Title I schools), affirming successes, and helping students apply learning strategies from other disciplines to nutrition. These techniques may help to improve both learning and self-efficacy, to help translate to behavior change.

Our study is one of the few studies which assessed main SCT constructs including nutrition knowledge, self-efficacy, and behavior and their relations in children with both high and low income. There are limitations of this investigation. After the random selection, only one Title I school agreed to participate in the study. Therefore, the results may not fully represent the fifth grade students from all Title I schools in the district. Although we used a validated survey instrument, additional objective indicators may have helped to provide a more accurate evaluation of behaviors and reduce self-report/response bias, particularly among children. Title I schools may receive nutrition-related government benefits that non-Title I schools do not receive, which might have minimized the differences demonstrated between the two groups. There were also variations in the percentage of low income students and the degree of exposure to nutrition inventions among non-Title I schools which might influence the results. However, the group differences (Title I vs. non-Title I group) remained significant or became significant after the adjustment for participating schools. Furthermore, despite the relatively small sample size in the Title I group, our results nevertheless indicated a strong association between self-efficacy and behavior in this group, providing valuable insights for future directions of nutrition interventions among socioeconomically deprived children.

5. Conclusions

The current results indicate that children from Title I schools had lower knowledge and behavior scores compared to their counterparts from non-Title I schools, suggesting that more resources should be allocated for implementing nutrition education interventions among Title I schools. By targeting programing at those who particularly need it, we can help to reduce the divides which may lead to the perpetuation of health disparities in the future. Our findings that self-efficacy was a much stronger predictor compared to knowledge for behavior outcomes, especially among socioeconomically disadvantaged children, further suggest that future nutrition interventions should focus on facilitating the improvement of self-efficacy.

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