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The Kids' Calcium Project: An In-School Educational Intervention

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Please note that this study was published before the implementation of Healthy, Hunger-Free Kids Act of 2010, which went into effect during the 2012-13 school year, and its provision for Smart Snacks Nutrition Standards for Competitive Food in Schools, implemented during the 2014-15 school year. As such, certain research may not be relevant today.

ABSTRACT

Objectives
The purpose of this study is to test the effectiveness of the Kids' Calcium Project, a milk promotion campaign targeting middle school children.

Methods
The Kids' Calcium Project is an in-school educational intervention program to increase calcium consumption among teenagers. The program develops promotional materials, provides education objectives, and stimulates environmental changes. Pre- and post-intervention surveys that tested calcium knowledge and beverage consumption behavior were given to assess the overall effectiveness of the program for eighth- and ninth-grade students. Sales of milk consumption were tracked before, during, and after the intervention period.

Results
The program resulted in an increase in students' knowledge of calcium. This new knowledge had a two-fold effect: as the amount of calcium intake increased, the sweetened beverage consumption rate decreased, especially among boys. As a result, an increase in milk sales occurred during school hours. Six weeks after environmental changes were discontinued, however, milk sales returned to previous levels.

Application to Child Nutrition Professionals
This study provides evidence that changing the student environment and adding specific nutrition content to curricula can impact positively students' knowledge of calcium and consumer behavior.

INTRODUCTION

The role of calcium has expanded recently to encompass more than bone and teeth health. Current research highlights the pivotal role calcium plays in reducing the onset of various diseases, such as osteoporosis, hypertension, stroke, kidney stones, colon cancer, and breast cancer (American Academy of Pediatrics, 1999; National Dairy Council, 1999; Nicklas, 2003). Despite its importance, calcium is one nutrient most likely to be missing from the diets of most Americans, and it is of critical importance in children's diets due to its role in bone development and growth (American Academy of Pediatrics, 1999; Nicklas, 2003).

The Recommended Dietary Reference Intakes Guidelines recommend that children between four and eight years old consume 800 mg of calcium per day (National Academy of Sciences, 2001).

The recommendation for children ages nine to eighteen years old is 1,300 mg (National Academy of Sciences, 2001). Milk, which contains about 300 mg calcium per cup, is considered an optimal source of calcium. In addition to calcium, milk provides vitamin D, potassium, and magnesium, all of which play roles in bone health and growth (American Academy of Pediatrics, 1999). The purpose of this study is to test the effectiveness of the milk promotion campaign, the Kids' Calcium Project, which targets middle school children who are beginning to make lifetime food choice habits and are at a critical point in their bone development.

Literature Review

The ever-increasing preference for soda and fruit-flavored drinks shown by adolescents is having a negative impact on their milk consumption and essential micronutrient intake (Bowman, 2002; Harnack et al., 1999; Johnson et al., 2002; "Major Trends," 2000). For example, a threefold increase in soda consumption, with a corresponding reduction in milk and fruit juice, has been observed as children move from elementary school to junior high school (Lytle et al., 2000). This low rate of calcium intake by adolescents is, unfortunately, creating a generation at risk for osteoporosis. Recent research suggests that osteoporosis will manifest itself in the next generation in their late twenties and early thirties (National Dairy Council, 1999), therefore, beverage choice plays an important role in diet adequacy. Initiating programs that guide children and adolescents to maximize calcium consumption could have a significant, positive impact on public health in years to come. Children who consume milk during lunch are more likely to achieve their recommended daily calcium intake (Johnson et al., 1998). Furthermore, participation in the National School Lunch Program (NSLP) is associated with a higher percentage of children meeting their daily calcium requirements (Nicklas, 2003).

Humans use concrete experiences to understand their world (Bandura, 1997). The cafeteria provides an environment in which children can draw immediate conclusions about what items are appropriate to consume during lunch. Social cognitive theory examines the development of cognition through competencies and the symbolizing capability of humans (Bandura, 1989). For example, humans construct realities about food through rules (Counihan, 1992). Nutrition and health education programs are most successful when they fit into the cultural and peer rules that ultimately dictate behavioral patterns in school children. In social cognitive theory, behavior, cognition, and environment interact to cause, "major sociocultural changes that make life markedly different [and] … modify the character of the society" (Bandura, 1989). School-based social marketing campaigns reinforce healthy eating patterns through presentation and repetition of highlighted themes (Connors et al., 2001; Wechsler et al., 1998). Repeated exposure to food over time results in the development of food preferences (Fischer & Birch, 1995). An important focus of school-based interventions is to create specific eating behaviors in students. The intervention programs also should provide multiple opportunities for children to choose those healthy foods that are highlighted. In fact, significant, sustained, positive changes have resulted from school-based nutrition interventions and social marketing campaigns (James et al., 2004; Wechsler et al., 1998).

The Kids' Calcium Project was a one-month intervention program involving middle school children. The purpose of the Project was to develop and implement an intervention program that would contribute to an increase in students' milk consumption. The program's strategy involved providing information, support, and modeling to students, followed by a study on the effects the intervention had on students' knowledge and consumer behavior.

Methodology

Participants and the Intervention

Intervention participants were Eighth and Ninth Grade children from one school in a medium-sized upper Midwestern city with an enrollment of 1,200 students. Participation was optional and open to all the students. The one-month milk-consumption goal, 27,600 cartons of milk, was set by students and was 150% of their usual intake. The school's student council promoted the intervention's activities and encouraged peers to participate. An incentive for meeting the goals of the intervention was a free dance for the student body. Progress was charted on a poster of a milk carton, with a straw showing increments of 2,000 milk cartons (Figure 1). The milk carton poster and a similar dancing cow poster were placed at the cashier section of the school cafeteria.

Educational and Environmental Intervention Features

The Kids' Calcium Project uses promotion, education, and environmental changes to increase calcium intake among middle school students. Promotion materials included posters of cow faces featuring fun facts in speech bubbles, student-designed posters that were displayed in the school, and a weekly calcium trivia contest with prizes. Additionally, a cow mascot was in the lunch room at least two times a week to encourage milk consumption. The mascot distributed free items, including cow print pencils and stickers. Students developed a promotional video (which was shown on the school morning news), decorated homeroom areas with posters to promote activities, and helped coordinate "milk and snack breaks" between classes. A "Cow-mooflage Day" promotion featured school administrators wearing cow print aprons serving lunch, a milk

mustache photo opportunity, educational materials, and prizes. Reporters from two local television stations interviewed project coordinators.

To provide a nutrition education component, the "Crash Course on Calcium" video (National Fluid Milk Processor Promotion Board, 1997) was divided into five 5-minute segments and shown each week after the morning news program to all students. Each week, five different fun and educational calcium facts were posted throughout the school, and a new display was placed in the school library. Project coordinators developed calcium trivia questions. The library display, and the five-minute video segments contained the answers to the weekly trivia questions. A weekly prize drawing was held for students who provided correct answers to the trivia questions.

Environmental changes included the additional offerings of fat-free yogurt shakes and pint-size milk servings in attractive containers, known as "slammers," on the a la carte line. "Slammers" and yogurt shakes were discontinued after the intervention. Grant money was provided to the student council to offer morning "milk breaks," in which milk and snacks were sold on certain days of the week. Although these environmental changes were discontinued after the intervention, the coordinators developed a manual for other schools in the district that were interested in launching a similar program. The manual describes the procedures and the promotional materials available for replication in other middle schools.

Intervention Evaluation

Approval from the North Dakota State University Institutional Review Board for conducting research on human subjects, as well as the district's school board and administration, was obtained. The intervention evaluation consisted of two parts. Part One involved tracking milk and sweetened beverage sales before, during, and after the intervention. Milk "slammers" and yogurt shakes served on the a la carte line and milk pints sold during milk breaks and during lunch were counted in the total amount of milk products sold during the intervention. Intervention sustainability was determined by monitoring the sale of milk products six weeks after the end of the intervention period.

Part Two of the evaluation involved administering brief pre- and post-surveys to assess student knowledge and behavior regarding milk calcium. Surveys were administered to approximately 25% of the student body during study hall sessions. Students in the same study hall sessions were surveyed pre- and post-intervention. The survey was adapted from the calcium consumption questions included in the *Youth Behavioral Risk Factor Survey* (Centers for Disease Control and Prevention, 2001). Behavioral variables were categorical. For example, daily intakes of milk or soda categories ranged from 1=zero servings to 5=four or more servings.

The surveys included six multiple-choice questions that directly pertained to the students' knowledge of the intervention. These questions focused on 1) the recommended calcium intake for teenagers; 2) the amount of calcium in one glass of milk; 3) the percentage of bone developed during the teen years; 4) types of weight-bearing exercise; 5) alternate sources of calcium; and 6) physical consequences of a low-calcium intake.

Data Analysis
Both surveys were scanned, and SAS (1999) was used to analyze data. Researchers used a simple Interactive Statistical Analysis (2000) t-test to ascertain the differences between milk and soda sales before, during, and after the intervention period. The result of this t-test is reported as a "z" value. They applied chi-square analysis to compare student reports from pre- to post-intervention for 1) overall daily milk and soda consumption; 2) male and female daily milk and soda consumption; and 3) types of milk consumed (e.g. no milk, skim, 1%, 2%, or whole). To simplify the analysis, soda consumption categories were compressed from five categories into two categories: no soda consumption and one or more daily cans of soda. Chi-square analysis was used to test the difference between individual knowledge questions answered correctly both pre- and post-intervention. They applied a t-test to assess whether overall knowledge scores increased or decreased from pre- to post-intervention. ANOVA was used to test the relationship between knowledge questions answered correctly and students' reported daily consumption of milk and soda pre- to post-intervention.

Results

Overall Behavior
According to milk product sales, 8-ounce milk cartons served with lunch made up the largest proportion of milk sold during the intervention, followed by 16-ounce milk slammers, milk served at milk breaks, and yogurt shakes. Average daily milk sales one month prior to the intervention period were 800 cartons. During the intervention, the average daily milk sales increased to 1,203 cartons per day ($z=9.00$; $p=0.00$). Six weeks after the intervention period, average daily milk sales dropped to 864 cartons. The difference between milk product sales before the intervention period and six weeks after was not significant ($z=1.57$; $p=0.06$). During the intervention, students met their sales goal and earned the incentive dance party.

Various sweetened, flavored beverages were available for sale on the school's a la carte line. Prior to the intervention period, daily sales of these beverages averaged 287 items. During the month of the intervention, the 16-ounce milk slammers also were available on the serving line. The milk slammers were popular with students, and sales of sweetened beverages declined, to an average of 233 items per day ($z=2.37$; $p=0.009$).

Reported Consumption of Milk and Soda
Students did not report a change in overall daily milk consumption from before to after the intervention, $\chi 2(4, n = 562) = 3.56$, $p = 0.47$). The relative proportion of students selecting no milk, skim, 1%, 2%, or whole milk also did not change from pre- to post-test, $\chi 2$ $(4, n = 559) = 4.08$, $p = 0.39$. Girls consumed significantly less milk than boys both before the intervention and after the intervention (Table 1).

A significant change in daily soda consumption was reported. The number of students drinking "no soda" significantly increased from pre- to post-intervention. The change in soda intake was significant for boys, but not for girls (Table 2).

Knowledge
The pre-test was completed by 297 students (51% girls), and the post-test was completed by 266

students (54% girls). Knowledge scores increased from pre-test (M=2.8; SD=1.2) to post-test (M=3.4; SD=1.3), t(265) = 3.46, p = 0.00 (one-tailed). In particular, a significant increase occurred in the number of students who knew that broccoli is a source of calcium, and that too little calcium in the diet can cause osteoporosis (Table 3).

Knowledge and Milk Consumption

Prior to the intervention, there was no difference in overall milk consumption related to mean pre-test scores (six possible points), F (4/292) = 1.66, p = 0.16, R2 = 0.02. There also was no difference in the type of milk consumed as mean pre-test scores increased, F (4/294) = 0.82, p = .051, R2 = 0.01. Post-intervention, there was a significant trend for students who drank milk to score higher on the post-test compared with students who did not drink milk, F (4/260) = 6.69, p = 0.00, R2 = 0.09. To assess differences among the five levels of milk consumption as compared to the number of questions answered correctly, the Bonferroni (Dunn) procedure was performed (p=0.05). Results indicated that students who reported drinking four or more glasses of milk scored higher on the test (M=3.6) than students who reported drinking no milk (M=2.2) or one glass of milk (M=2.8). No difference was found in post-test scores and type of milk consumed, F(4/259) = 2.31, p = 0.06, R2 = 0.03.

Knowledge v. Soda Consumption

Pre-intervention, there was no relationship between test scores and soda consumption, F (4/296) = 1.04, p = 0.34, R2 = 0.01. Post-intervention, students who drank no soda scored higher than students who reported drinking any amount of soda, F (4/264) = 7.43, p = 0.00, R2 = 0.10. To assess the differences among the five levels of soda consumption as compared to the number of questions answered correctly, the Bonferroni (Dunn) procedure was performed (p=0.05). Results indicated that students who reported drinking four or more servings of soda scored significantly lower on the test (M=1.6) than students who reported drinking no soda (M=3.2), one serving (M=2.6), or three servings (M=2.3).

Discussion

This study shows that altering the environment and raising awareness of the importance of calcium can impact middle school students' consumption of milk, sweetened beverages, and soda, while also increasing their knowledge of calcium. During the intervention period, when environmental changes were in place, milk sales increased and sweetened beverage sales decreased; however, this effect was not sustained when environmental changes were discontinued.

Although the results from this study showed that the intervention had no effect on overall self-reported milk consumption among boys and girls, milk sales in the cafeteria increased significantly. This discrepancy between sales and self-reported consumption could be explained by the combining of data from boys and girls. When results were separated by gender, there was a significant increase in self-reported consumption by boys. Other studies have shown a difference between boys' and girls' milk consumption, highlighting the challenge of impacting girls' milk consumption (Auld et al., 2002; Seungmin & Reicks, 2003).

Food and beverage choices can be affected by environmental changes (French et al., 1997; Jeffrey et al., 1994; Martinko et al., 1989; Wechsler et al., 1998). As demonstrated in this study, sustaining improvement is challenging when environmental changes are discontinued. Results from this study therefore suggest that interventions should be designed to sustain long-term educational activities and environmental changes, including incentives to accompany these changes. In this project, sustainability can be achieved through permanent changes in menu offerings, such as the milk slammers, and investment in equipment, such as coolers and frozen yogurt machines. The continuation of the educational aspects of this project could be achieved through partnering with local extension service offices or public health agencies. The primary incentive, a free school dance, could become an annual event, with contributions from local businesses.

When children consume a variety of sweetened beverages such as soda, juice, tea, and fruit drinks, they fail to achieve the recommended daily intake of calcium (Harnack et al., 1999; Johnson et al., 1998). This study countered children's habitual consumption of sweetened beverages with positive messages about milk and environmental changes, including more access to milk products and an increased level of education about calcium. These changes were associated with an increase in milk sales, a decrease in sweetened beverage sales, a decrease in daily reported soda consumption, and an increase in knowledge about calcium.

Reports of daily milk consumption by students did not change from pre- to post-intervention. Perhaps students did not consider the yogurt shakes and milk slammers as "milk" and, therefore, did not report an increase in milk consumption on their surveys. This might explain the difference between total milk sales and reported daily milk consumption.

Despite the lack of overall change in milk consumption, boys reported drinking significantly more milk than girls, both before and after the intervention period. Boys also reported a significant decrease in soda consumption, whereas girls' soda consumption was unaffected by the intervention. Inadequate consumption of dietary calcium is a known nutritional issue among adolescent girls (Amschler, 1999), suggesting that middle school girls should be targeted with appropriate pro-calcium messages in future interventions.

Knowledge about calcium was related to an increase in milk consumption. Conversely, a lower level of knowledge about calcium was associated with an increase in soda consumption. The knowledge effect was not observed pre-intervention, which suggests that the intervention period played a role in altering milk and soda consumption. Adolescents who are aware of daily requirements for calcium tend to consume larger amounts of this nutrient (Harel et al., 1998). Adults can contribute to the milk-drinking behavior of adolescents by providing information, support, and role-modeling.

Conclusions And Applications

If others schools were to follow this model program, there are several guidelines available to help ensure the success and sustainability of the intervention. For example, a school nutrition program could begin the intervention with a kick-off event, such as promoting "Cow-mooflage Day" or organizing milk mustache photographs. Such events increase awareness of the activity

and generate excitement. To draw attention to the subject matter in educational materials, place posters in close proximity to each other, such as on a bulletin board or wall. It is not uncommon for key messages get lost among other materials when displayed individually in larger areas.

Involve student leaders and student groups in the promotion, and enlist the support of student counselors, teachers, cafeteria staff, and parents. Involve students as much as possible in the planning and implementing interventions. For example, encourage "calcium challenges" among homerooms or student organizations, support student efforts to plan and implement "milk breaks" in middle schools, and encourage students to design their own posters and other promotional materials with input and/or review of the project coordinators to ensure accuracy and appropriateness of content. Designate student responsibilities clearly and provide follow-up and support. Finally, keep communication lines open among all partners involved in the intervention, and meet regularly to discuss and evaluate progress toward meeting project goals and establishing local policies. A project like this could be included in the local school wellness policies that schools must have in place by the 2006-07 academic year, as mandated by the Child Nutrition and WIC Reauthorization Act of 2004.

This study provides evidence that changing the environment and adding specific nutrition content to curricula can impact milk sales, change soda consumption patterns, and increase nutrition knowledge. Positive behavior changes are possible through interventions that increase knowledge and simultaneously change the environment to enable students to act upon their newly attained knowledge. Sustaining changes created such as this calcium intervention is an opportunity for schools to positively influence the health behavior of middle school children at a critical time in bone development.

School nutrition personnel can use these findings to advocate for sustained changes that limit availability of beverages that compete with milk, such as limiting vending machine hours of operation. Districts could use this project as a model for inclusion in their local school wellness policies. With systemic changes it is possible to have lasting effects on the nutrition beliefs, knowledge, and behaviors of students.

This research shows that to achieve behavioral change, a multi-faceted plan of intervention that includes education, environmental changes, and incentives is required. Girls' consumption of milk was unaffected by this intervention, therefore, further assessment of the relative impact of program components on behavior change could help researchers understand and design effective interventions targeting female students. Also, research that evaluates actual consumption of milk through plate waste studies may show further impact of nutrition education programs. Finally, research is needed to determine if the results of this project would be replicated in school systems with a high percentage of students qualifying for free and reduced-price lunches.

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