Got Calcium? - A youth curriculum that promotes dairy and non-dairy sources of calcium

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Abstract

Most children are not meeting dietary calcium requirements. To address this issue, a four-lesson youth curriculum called *Got Calcium?*, which promotes dairy and non-dairy calcium-rich foods, was developed. Two hundred and thirty-two students and 196 family members participated in the study. After four lessons, students significantly increased (p<0.001) their knowledge of calcium...
and calcium-rich foods. A parent take-home food frequency form revealed that students’ current intake of calcium came from dairy (milk, cheese, yogurt) products. By the end of the four lessons, approximately 40 percent to 70 percent of students selected non-dairy calcium-rich foods (kale, greens, tofu, and salmon) when planning calcium-rich meals.

Introduction

It is recommended that youth ages 4-8 consume 800 mg of calcium per day and those ages 9-18 consume 1,300 mg of calcium per day (Institute of Medicine 1997). Unfortunately, as calcium recommendations have increased, calcium intake has decreased. It is estimated that 38 percent of males and 20 percent of females ages 6-11 and 32 percent of males and 12 percent of females ages 12-19 meet these recommendations (U.S. Department of Agriculture 1999). Calcium consumption is low in youth because this population lacks knowledge about the importance of calcium (Harel et al. 1998), substitutes soda for milk (Rampersaud et al. 2003), and dislikes the taste of dairy foods (James 2004). A low intake of calcium may increase the likelihood of bone fractures during childhood and adolescence (Martin et al. 1997), and in adulthood, it may manifest as osteoporosis (Greer and Krebs 2006).

Got Calcium? curriculum

To promote consumption of calcium-rich foods in youth, a four-lesson curriculum called Got Calcium? was developed. It focuses on the importance of calcium in the diet and ways to incorporate calcium-rich foods throughout the day.

The national 3-A-Day of Dairy for Stronger Bones campaign, launched in 2003, promotes consumption of dairy products (National Dairy Council 2003). The Got Calcium? curriculum is more inclusive by promoting both dairy and non-dairy food sources of calcium. It was designed by Extension faculty with input from third and fourth grade teachers. In the United States, there are approximately 33.7 million children enrolled in elementary school, which makes schools an ideal location for implementing this curriculum (U.S. Census Bureau 2006). This article describes the development, testing, and evaluation of the Got Calcium? curriculum to third and fourth graders in elementary schools.

Methods

Curriculum development, components, and evaluation tools. Got Calcium?, a four-lesson curriculum, was developed by two of the authors and underwent extensive pilot testing and review. Approximately 2,000 third and fourth graders and 16 teachers from six schools participated in the three-year pilot testing (2002-2004) to ensure that the information and activities were age appropriate. In addition, five external reviewers with nutrition, health, or
education backgrounds evaluated the curriculum to ensure either technical accuracy or that a variety of state education standards were met.

The *Got Calcium?* curriculum contains two components. The first component provides students with background information about calcium, and the second component teaches students about dairy and non-dairy calcium-rich food sources and how to include them in the diet. These two components are covered in the four lessons using numerous graphics, handouts, and in-class and take-home activities.

Eight calcium-rich foods that fell into two categories (dairy and non-dairy) were emphasized in each lesson. The three calcium-rich foods from the dairy category were milk, cheese, yogurt; and the five calcium-rich foods from the non-dairy category were kale, greens, tofu, canned salmon, and sardines with bones. The eight calcium-rich foods that were selected are either good or excellent sources of calcium (USDA ARS 2006).

A description of the four lessons is provided.

**Lesson 1: Bone Up on Calcium**

In order to become knowledgeable about calcium, children learn (1) where the body stores calcium, (2) food sources of calcium, (3) calcium recommendations, (4) and calcium intake and its effect on bones. Students were introduced to the dairy and non-dairy calcium-rich food sources.

**Lesson 2: Making and Keeping Bones Strong**

In lesson 2, students learn about the skeletal system. For example, they not only learn how many bones are in the body but also their names, by participating in a classroom activity called “The Sticky Note Activity.” Working in pairs, students were given a handout of a skeleton, a pencil, and a sticky note pad. Each student wrote down the name of six bones on individual sticky notes and placed the notes on their partner’s corresponding bone. The eight calcium-rich foods are reinforced in class by having them displayed on the skeleton handout. In addition, these are listed on a take-home food frequency form that students complete with their parents to determine which of these eight foods they consumed.

**Lesson 3: Hunt for Calcium on the Nutrition Facts Label**

Lesson 3 discusses how to use the percent Daily Value of Calcium (% DV) on the Nutrition Facts label. A graphic shows the % DV of calcium concept and how to evaluate if a product is a
good or excellent source of calcium. Students practiced this skill by evaluating 13 different food labels in class; these included the dairy and non-dairy foods being reinforced in each lesson.

Lesson 4: Boost Your Calcium Intake

In this last lesson, students learned how the three dairy and five non-dairy calcium rich foods could be incorporated into breakfast, lunch, and dinner meals. This information was incorporated into an activity called Café Calcium (a restaurant which serves only high-calcium foods). They were each given a breakfast, lunch, and dinner Café Calcium menu. All of the menu items were shown on PowerPoint slides. After seeing and discussing the breakfast items, students were asked to use the Breakfast menu and select which calcium-rich foods they would eat at Café Calcium. The same procedure was repeated for lunch and dinner.

Evaluation Tools

(1) Knowledge about calcium: Pre- and post-tests, completed before lesson 1 and after lesson 4, evaluated the changes in knowledge. The pre- and post-tests contained a combination of four questions and seven pictures. The questions were based on calcium concepts covered in lessons 1 and 3, and students were asked if the questions were true or false. The pictures included calcium and non-calcium-rich products and students were asked to circle those items that contained calcium. Three of the four calcium-rich foods pictured on the tests are dairy foods. These pictures were chosen to be on the pre- and post-tests because children were unable to identify pictures of kale, collard greens, and tofu during the pilot testing.

(2) Eight calcium-rich foods: Data was collected on which of these eight calcium-rich foods the students consumed at home (from the take-home food frequency form) and selected from the Café Calcium meal planning class activity.

Training, sample size, data collection, and data analyses

In 2005, three Family and Consumer Science faculty (two were Extension educators and one was a university instructor) were trained on the final Got Calcium? curriculum and the research protocol. They taught a single lesson each week over a four-week period at eight elementary schools. The project received approval from the University Human Assurances Committee.

Data was collected and analyzed on students whose parents signed a subject consent form. Subjects came from a convenience sample.
Two hundred and ninety-eight students participated in the study, but data was analyzed on the 232 students that completed the pre- and post-tests and menu planning activity. One hundred ninety-six family members completed the take-home food frequency form.

Frequencies and paired t-tests were calculated on the pre- and post-tests. Frequencies were also calculated on the take-home and in-class Café Calcium menu planning activity to determine the percentage of students that consumed or selected the three dairy and the five non-dairy calcium-rich foods.

**Results**

Results on the two components of the curriculum are listed in Tables 1 through 4. Knowledge results are listed in Tables 1 through 3, and current and selected dairy and non-dairy food results are listed in Table 4.

Table 2 contains results on which foods students correctly identified as being calcium-rich. Table 3 contains results on which foods students incorrectly identified as being calcium-rich. The information contained in Table 1 includes each knowledge concept covered in the curriculum, its corresponding question on the pre- and post-survey, the percentage of students who answered the question correctly on the pre- and post-surveys, the percent difference, the level of significance (p), and the T statistic.

There was a significant (p<0.001) increase in the number of students who answered all four knowledge questions correctly and a significant increase (p<0.001) in the number who identified three of four foods as being a rich source of calcium. On the pre-test, the percentage of students who answered the four knowledge questions correctly ranged from 39-81 percent and on the post-test, this number was 87-97 percent. Analysis of answers to each of the four questions showed that the percent increase in correct responses ranged from ~16 percent increase (where the body stores calcium and calcium recommendations) to 53 percent increase (that eating a low-calcium diet results in large holes in the bones). There was a significant increase (p<0.001) in the number of students who correctly identified yogurt, cheese, and sardines as calcium-rich foods, with the greatest increase occurring in those selecting sardines (59 percent). Almost all students correctly identified milk as a calcium-rich food on the pre- (97 percent) and post-test (98 percent). It was surprising that 30 percent to 45 percent of students incorrectly circled apples, carrots, and bananas as rich sources of calcium on the pre-test. When the correct response was discussed in lesson 1, students commented that these foods were “healthy” or “good for you,” which prompted them to circle those items. The post-test results showed a significant (p<.001) decrease in the percentage of students who circled these three items as being calcium-rich foods.
Data collected on current and selected intake of eight calcium-rich foods is shown in Table 4. The take-home food frequency form that students completed with their parents on current intake of calcium shows that a very high percentage of parents reported that their children currently consumed the three dairy (milk, 94 percent; cheese, 68 percent; and yogurt, 63 percent) calcium-rich foods and 0 percent reported that their child currently ate the five non-dairy calcium-rich foods. In the Café Calcium class activity, children chose from these eight items to plan high-calcium meals. The results showed that a very high percentage of students chose the three dairy items – milk (82 percent), cheese (63 percent), and yogurt (77 percent) – when planning their high-calcium meals. For the non-dairy food items, a high percentage chose greens (68 percent); followed by approximately 40 percent for canned salmon, kale, and tofu; and 26 percent for sardines, when planning their high calcium meals.

Table 1. Knowledge Concepts: Pre- and post-test knowledge results (N=232)

<table>
<thead>
<tr>
<th>Concept</th>
<th>Statement</th>
<th>% Correct pre-test</th>
<th>% Correct post-test</th>
<th>% Change</th>
<th>p</th>
<th>T Stat</th>
</tr>
</thead>
<tbody>
<tr>
<td>Where the body stores calcium</td>
<td>Most of the calcium in the body is found in bones and teeth</td>
<td>81% said true</td>
<td>97% said true</td>
<td>16% inc</td>
<td>&lt;.001</td>
<td>-6.55</td>
</tr>
<tr>
<td>Calcium recommendations</td>
<td>You should have three servings of calcium-rich foods every day.</td>
<td>70% said true</td>
<td>87% said true</td>
<td>17% inc</td>
<td>&lt;.001</td>
<td>-6.73</td>
</tr>
<tr>
<td>Calcium intake</td>
<td>A food that contains 30% Daily Value of calcium is an excellent source of calcium.</td>
<td>59% said true</td>
<td>88% said true</td>
<td>29% inc</td>
<td>&lt;.001</td>
<td>-9.30</td>
</tr>
<tr>
<td>Impact of low versus high calcium diet on bones</td>
<td>If you don’t eat enough calcium, your bones will have large holes.</td>
<td>39% said true</td>
<td>92% said true</td>
<td>53% inc</td>
<td>&lt;.001</td>
<td>-15.87</td>
</tr>
</tbody>
</table>

Table 2. Pictures of calcium-rich foods: Pre- and post-test knowledge results (N=232)

<table>
<thead>
<tr>
<th>Food</th>
<th>% Correct pre-test</th>
<th>% Correct post-test</th>
<th>% Change</th>
<th>p</th>
<th>T Stat</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yogurt</td>
<td>88</td>
<td>96</td>
<td>8% inc</td>
<td>&lt;.001</td>
<td>-3.92</td>
</tr>
<tr>
<td>Cheese</td>
<td>83</td>
<td>96</td>
<td>13% inc</td>
<td>&lt;.001</td>
<td>-5.86</td>
</tr>
</tbody>
</table>
Table 3. Pictures of non-calcium-rich foods: Pre- and post-test knowledge results (N=232)

<table>
<thead>
<tr>
<th>Food</th>
<th>% Incorrect pre-test</th>
<th>% Incorrect post-test</th>
<th>% Change</th>
<th>p</th>
<th>T Stat</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apple</td>
<td>30</td>
<td>18</td>
<td>12% dec</td>
<td>&lt;0.001</td>
<td>-5.63</td>
</tr>
<tr>
<td>Carrot</td>
<td>39</td>
<td>17</td>
<td>22% dec</td>
<td>&lt;.001</td>
<td>-7.25</td>
</tr>
<tr>
<td>Bananas</td>
<td>45</td>
<td>18</td>
<td>27% dec</td>
<td>&lt;.001</td>
<td>-8.85</td>
</tr>
</tbody>
</table>

Table 4. Dairy and non-dairy food frequency results and menu selection results

<table>
<thead>
<tr>
<th>Foods</th>
<th>Percentage of students that consumed these calcium-rich products at home (N=196)</th>
<th>Percentage of students that selected these calcium-rich foods from the Café Calcium menu (N=232)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dairy products</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Milk</td>
<td>94%</td>
<td>82%</td>
</tr>
<tr>
<td>Cheese</td>
<td>68%</td>
<td>63%</td>
</tr>
<tr>
<td>Yogurt</td>
<td>63%</td>
<td>77%</td>
</tr>
<tr>
<td>Non-dairy products</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kale</td>
<td>0%</td>
<td>42%</td>
</tr>
<tr>
<td>Greens</td>
<td>0%</td>
<td>68%</td>
</tr>
<tr>
<td>Tofu</td>
<td>0%</td>
<td>42%</td>
</tr>
<tr>
<td>Sardines</td>
<td>0%</td>
<td>26%</td>
</tr>
<tr>
<td>Salmon</td>
<td>0%</td>
<td>38%</td>
</tr>
</tbody>
</table>

Discussion

The pre-test results showed that a majority of students already had some knowledge about calcium. However, this curriculum significantly increased knowledge levels so that most students answered the post-test questions correctly. Three of the concepts that showed the largest percent increase in knowledge and may have been new to the students included (1) how to interpret the percent DV of calcium on the Nutrition Facts label (29 percent increase), (2) the
link between calcium intake and formation of large holes in their bones (53 percent increase), and (3) those that picked canned sardines as a good source of calcium (65 percent increase). Since dairy products comprise 70 percent of the available calcium in the food supply (Grerrior, Putnam, and Bente 1998), it was expected that many parents would report that their children ate these dairy foods at home. Many students and parents were initially unfamiliar with some of the non-dairy calcium foods based on the parents’ take-home activity that showed 0 percent of children ate these foods. But by lesson 4, after repeatedly exposing students to these foods, approximately 40 percent or more of the students chose four of the five non-dairy calcium rich foods (kale, greens, tofu, and canned salmon) to plan high-calcium meals, the exception being sardines (26 percent). This repeated exposure concept was used in the lessons because it has been effective in getting children to try and eventually like unfamiliar foods (Pliner, Pelchat, and Grabski 1993).

There may be several reasons that a low percentage of children selected sardines on the Café Calcium menu. Even though children were not asked to taste sardines, researchers have found that they exhibit a higher sensitivity to a ‘fishy odor’ (trimethylamine) (Solbu, Jellestad, Straetkvern 1989), and children could have associated sardines on the menu to a fishy odor. A second reason is that children may inherit their taste for fish (Breen, Plomin, Wardle 2006), and the take-home food frequency form indicated that none of the parents in this study consumed sardines.

Limitations of the study

Limitations of the study included subjects and the evaluation tools. Children in this study were predominantly white and lived in the Northwest USA and therefore the results may not generalize to all children. Three of the four high-calcium foods on the pictorial pre-and post-tests were dairy foods familiar to children. The take-home food frequency form was based on self-reported information supplied by the parents/family member, which makes it open to bias. For the Café Calcium activity, children were not given the opportunity to choose foods that were not high in calcium, and the items they selected may not have been ones they would actually try. There was no follow-up to see if children retained the knowledge.

Impact of Got Calcium?

The Got Calcium? curriculum may become useful in helping reverse the decrease in calcium intake in youth. In order to influence thinking and change dietary behaviors, it may be necessary for them to be exposed to more than a single lesson on calcium. Providing relevant information in a fun environment that includes numerous hands-on activities may help them grasp the importance of an adequate calcium intake and how to incorporate it in their meals. Future plans include measuring the impact of this curriculum on actual calcium intake of youth, using the
school lunch program and providing additional information to parents on how to include these dairy and non-dairy calcium-rich food sources in home meals.

Having the University work with elementary teachers in developing and testing this curriculum has strengthened ties between them. During the summer of 2007, the two authors conducted five trainings on *Got Calcium?* for 177 teachers. The teachers regularly request that the university Extension conduct not only the *Got Calcium?* lessons, but have expanded this to other lessons on nutrition. Some teachers have also turned to the university for input on how their nutrition classes can meet the state education standards and also fit into their school’s federally mandated wellness program.

**References**


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