

The Effects of an Educational Program on the Calcium Intake of Junior High School Students

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Citation

D Damore, L Robbins, T Karl. *The Effects of an Educational Program on the Calcium Intake of Junior High School Students*. The Internet Journal of Pediatrics and Neonatology. 2006 Volume 6 Number 2.

Abstract

Objective: To determine the effects of an educational program on the daily calcium intake (DCI) of junior high students.

Methods: A case control study, with eighth graders receiving the program and seventh graders serving as controls, was conducted. All students completed a DCI diary for a day prior and a day after the program.

Results: Eighty-three eighth grade students and 71 seventh grade students completed pre- and post-diaries. When grouped by gender and grade, all subgroups showed an increase in DCI; however, this was only significant for the seventh grade girls ($p=0.02$). The seventh and eighth grade students had similar changes in DCI ($p=0.2$). Seventeen to nineteen percent of adolescents achieved the DRI of calcium after the intervention but not before while 8-11% achieved it before but not after. This was not significantly different ($p=0.68$).

Conclusion: An educational program did not seem to impact on the DCI of these students.

STUDY SITE

Isaac Newton Junior High School
114th Street and FDR Drive
New York, NY 10029

FINANCIAL SOURCES

None

INTRODUCTION

A mere 19% of adolescent girls and 52% of adolescent boys meet the daily reference intake (DRI) for calcium of 1300mg for their age group¹. If an adolescent's diet is poor in calcium or vitamin D, then he or she may not attain maximal peak bone mineral density. During adolescence there is a 2 to 4% increase in bone mineral density per year such that by the end of adolescence 90% of peak bone mineral density is reached². Adolescents with lower peak bone mineral density are at risk for developing osteoporosis and fractures at an earlier age. More than 1.5 million fractures and over \$10 billion in medical expenditures are associated with osteoporosis annually³. The treatments for osteoporosis mainly help to prevent fractures by preventing further bone mineral losses but often cannot increase bone mineral

density. Osteoporosis prevention includes promoting peak bone density attainment. Peak bone mass is affected by genetics, gender, ethnicity, calcium and vitamin D intake, and exercise. Dairy and calcium supplementation have been shown to increase bone mineral density in adolescent females and males^{4,5,6,7,8,9,10}. If an educational intervention can lead to an increase in calcium intake in the diets of adolescents and then continue into adulthood then osteoporosis and its fractures and other associated complications may be reduced.

Healthy Girls is a Hospital for Special Surgery (HSS) Education Division program that promotes good bone health by focusing on encouraging young girls to make healthy lifestyle choices. The original curriculum was developed by HSS staff in collaboration with five high school students as a pilot project in the fall of 2000. The pilot data from Healthy Girls found improved intake of calcium via natural food sources. This study seeks to replicate these results in a younger, junior high school population.

METHODS

An interventional case control study was conducted at the

Isaac Newton Junior High School in Spanish Harlem, an inner city area in New York City. The intervention performed was an educational program consisting of two 40 minute classroom lectures given one month apart to all eighth grade students during their health curriculum in the spring of 2002. Seventh grade students served as controls for this study and did not receive the educational program. All seventh and eighth students were eligible to participate in the program as controls and cases, respectively.

The first lecture focused on nutrition, particularly calcium and its role in bone health. The food pyramid was discussed along with how the average American fails to meet this recommendation. The role of proteins, carbohydrates, fats, vitamins, and minerals in a healthy diet was discussed, and general dietary recommendations were given. The importance of a diet containing sufficient calcium and vitamin D for bone health and bone density was emphasized. Changes in bone density over one's life span was discussed, stressing the fact that peak bone density attainment occurs during adolescence.

The second lecture addressed osteoporosis and its prevention through exercise and a diet meeting the DRI for calcium and vitamin D. The clinical effects of osteoporosis including vertebral body compression, kyphosis and fractures were discussed. Modifiable and non-modifiable risk factors for osteoporosis were given. It was discussed that osteoporosis is more common in women but that it also occurs in men and that it actually starts during adolescence but has its effects usually later in life. The importance of aerobic, strength training, stretching and flexibility exercises was emphasized.

The principal investigator gave both lectures to the eighth grade students utilizing pictures and graphs in a lecture style. There were 4 health classes, each with approximately 30 students.

All students completed a daily calcium intake (DCI) diary for a single day prior and a single day after the educational program. Seventh grade students completed this diary as well, although they did not receive the intervention. In this diary, the students recorded their daily intake of milk, yogurt, cheese, dishes made with cheese, calcium fortified orange juice, calcium fortified cereal and calcium supplements.

Students were excluded if they had had an osteoporotic fracture, were being treated for osteoporosis or if they were undergoing physical therapy. Students were also excluded if

they had a history of kidney stone, renal disease, hypoparathyroidism, hyperparathyroidism, peptic ulcer disease, inflammatory bowel disease, malabsorption or endometriosis. Finally, students were excluded if they were taking calcium-based antacids, digitalis, bile acid resin binders, or calcium supplements in excess of that found in multivitamins. Students and parents provided information about the exclusions for medical conditions.

An increase of 20% in the number of students consuming the DRI of 1300mg was considered significant. To detect this with 80% power, a sample size of 120, in each of the intervention and control groups, was determined using a t-test (two-tailed, $\alpha=0.05$).

The mean DCI, measured in milligrams, was compared based on gender and grade using the Wilcoxon test. The mean difference between pre- and post-intervention DCI was compared between grades using the Mann-Whitney U test. Comparing whether the DRI was met after the intervention but not before and met before the intervention but not after between grades was done using the Mann-Whitney U test.

Institutional review board approval was given to this study. Consent and assent forms were completed by parents and students, respectively.

RESULTS

Eighty-three eighth grade students and 71 seventh grade students completed pre- and post-daily calcium diaries. Five eighth grade students and 16 seventh grade students refused to participate. Twenty-six eighth grade students and 40 seventh grade students were present on only one day (Table 1).

Figure 1

Table 1: Seventh and Eighth Grade Enrollment Data

Data	Seventh Grade	Eighth Grade
Target	120	120
Total Available	127	114
Incomplete, only one calcium diet completed	40	26
Refusal	16	5
Complete	71	83
Male	26	45
Female	45	38

No students met any of the exclusion criteria. Males had significantly greater DCI than females (1150mg vs. 850mg, $p<.01$). Only 12% percent of the girls and 35% of the boys met the DRI for calcium on both days while 55% of the girls and 41% of the boys failed to meet it on both days (Table 2).

Figure 2

Table 2: Meeting the Calcium DRI by Grade and Gender

Grade	Neither Day	Before and Not After	After and Not Before	Both Days
7 th Grade Girls	56% (25/45)	9% (4/45)	20% (9/45)	16% (7/45)
7 th Grade Boys	27% (7/26)	8% (2/26)	12% (3/26)	54% (14/26)
Total 7 th Grade	45% (32/71)	8% (6/71)	17% (12/71)	30% (21/71)
8 th Grade Girls	55% (21/38)	18% (7/38)	18% (7/38)	8% (3/38)
8 th Grade Boys	49% (22/45)	7% (3/45)	20% (9/45)	24% (11/45)
Total 8 th Grade	52% (43/83)	12% (10/83)	19% (16/83)	17% (14/83)
Total Girls	55% (46/83)	NA	NA	12% (10/83)
Total Boys	41% (29/71)	NA	NA	35% (25/71)

DRI = daily reference intake

NA = not applicable since 7th graders did not receive the intervention while 8th graders did

The seventh and eighth grade students both increased their DCI. This was only significant for the seventh grade students ($p < 0.1$, Table 3). When grouped by gender and grade, all subgroups showed an increase in DCI; however, this was only significant for the seventh grade girls ($p = 0.02$, Table 3).

Figure 3

Table 3: Pre- and Post- Intervention Median Calcium Intakes by Grade and Gender

Grade	Pre	Post	P
7 th Grade Girls	850mg	1000mg	0.02
7 th Grade Boys	1300mg	1425mg	0.07
Total 7 th	900mg	1150mg	< .01
8 th Grade Girls	750mg	925mg	0.68
8 th Grade Boys	1000mg	1150mg	0.30
Total 8 th	850mg	1000mg	0.34

The seventh and eighth grade students had similar changes in DCI ($p = 0.2$, Table 3). We found that 17-19% of adolescents had achieved the DRI of calcium after the intervention, who previously had not. This compares with 8-12% who achieved it prior but not after. This was not significantly different between the seventh and eighth grade students ($p = 1.0$, Table 4).

Figure 4

Table 4: DRI for Calcium met Before or After the Intervention but not both

Grade	Met DRI Before Intervention	Met DRI After Intervention	P
Seventh	8% (6/71)	17% (12/71)	0.18
Eighth	12% (10/83)	19% (16/83)	0.32

DRI = daily reference intake

DISCUSSION

Since the seventh and eighth grade students had similar changes in calcium intake, the educational program did not seem to make a difference. When categorized by gender and grade, all subgroups showed an increase in calcium intake; however, this was only statistically significant for the seventh grade girls. Simply completing the daily calcium diaries may have made some impression on the seventh grade girls.

Males consumed more calcium in their diets than females. It may be that females may consume fewer calcium rich foods, especially milk products, since they may believe that these foods are fattening. However, recent studies have found that increased calcium intake may aid weight loss in adolescent girls and adults,^{11,12,13,14,15}

Meeting the DRI for calcium of 1300mg is more important than increasing calcium intake. We found no difference between the seventh and eighth grade students meeting the DRI after the intervention but not before versus meeting it before the intervention but not after. Large studies have found that 19% of adolescent girls and 52% of adolescent boys meet the DRI for calcium of 1300mg for their age group.¹ In our study, only 1% percent of the girls and 35% of the boys met the DRI for calcium on both days while 55% of the girls and 41% of the boys failed to meet it on both days.

There are several limitations to this study. First, we did not reach our sample size of 120 in each group due to refusals and incomplete diaries. More seventh grade students may have refused since they were missing gym class or because they were not receiving the educational intervention. Our study is also limited in that dietary recall of the previous day can be difficult, and serving size estimation may be inexact. Also, a prospective weekly dietary record would be more representative of intake as opposed to a retrospective one day diet. If improvement occurred, following the effect over time would be important. Two classroom lectures is a very

limited intervention. Five to seven nutritional sessions with WIC-eligible Vietnamese immigrants, comparing one day dietary recall before and after, lead to increased calcium intake₁₆. Changes in the educational curriculum might include shorter more frequent educational sessions, greater repetition of key concepts, and more interactive sessions involving greater student participation with interesting activities. Also, calcium knowledge testing before and after the intervention would help to demonstrate the effectiveness of the educational program.

We conclude that an educational program on the importance of dietary calcium and the risk of osteoporosis did not seem to impact on the DCI of junior high school students. Further study is needed to determine whether curriculum or other changes results in greater changes in the dietary intake of calcium at this critical age, particularly in females.

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