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Comparison of Intake Levels and Sources of Dietary Calcium among McPherson College Students

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ABSTRACT

The objective of this research was to determine the major sources of calcium, the specific intake levels of dietary calcium, and the correlation between calcium and Body Mass Index (BMI). Ten males and ten females from the McPherson College student body participated in the research. Each student kept a food journal, and the contents of each journal were transferred into Nutrition Calc 3.0 software to determine the amount of calcium present. The hypothesis was that the majority of the students would be getting calcium from animal based calcium sources, no one would be calcium deficient therefore meeting the Recommended Daily Allowance (RDA) of calcium, and that there would be an inverse relationship between a subject's calcium intake and their BMI. It was found that males and females both receive the majority of their calcium from animal based calcium sources rather than plant based calcium sources. On average males received higher amounts of calcium than females, and both males and females were not reaching the RDA for calcium of 1,000 milligrams per day. There was no correlation found between BMI of the subjects and their intake of calcium. Further research could be done to determine why males received more calcium than females, and why animal based sources are chosen more regularly than plant based sources. Further insight into the role of exercise and the role of Vitamin D would be helpful to understand the absorption and storage of calcium in the body.

Keywords: *Body Mass Index (BMI), Calcium, Dietary Calcium, Recommended Daily Allowance (RDA)*

INTRODUCTION

Calcium is one of the most important and abundant substances in the body. Normally we only associate calcium with bone growth and strength; however it is important for many other physiological functions. Calcium is needed for contraction and relaxation of blood vessels, muscle movement, nervous system function, the secretion of hormones, and a reduction in body fat. It has been said that calcium may be able to bind to fatty cells ingested from the diet and not allow them to be absorbed into the body, therefore reducing the amount of fat the body will gain. A higher calcium intake may also increase the amount of certain hormones that cause the breakdown of fat cells. (NIH: Office of Dietary Supplements) Calcium also allows the body's smooth muscle to relax and contract. Through the formation of myosin-action cross bridges, calcium allows for the formation of strong ties that the actin filaments can travel along. As long as these spaces remain within the myosin cross-bridges, the contractions can continue. (Silverthorn, 2010)

One of the most important ways by which the human body obtains sufficient amounts of calcium is through the diet. The recommended daily allowance (RDA) of calcium changes all throughout a person's life. For a new born child the RDA of calcium is 200 milligrams, but for a college student, who is 20 years of age the RDA is 1,000 milligrams. To live a healthy life it is vitally important for one to have the proper amounts of calcium in your diet. Consumption of calcium rich foods such as milk, yogurt, cheese, salmon, oranges, and broccoli would supply one with sufficient amounts of calcium. (NIH: Office of Dietary Supplements)

In addition, not only is the source of calcium important, but also the amount of calcium being consumed. Recent research has found that people who are taking calcium supplements may in fact be injuring themselves more than they are helping. Most people have the perception that more is always better; however, an article that came out in 2010 stated that often times taking calcium supplements can increase your calcium to a dangerously high level, or an unnatural level. Calcium that comes from your diet is slowly absorbed into your body, unlike calcium that comes from supplements. The supplements cause the calcium level in the body to increase at a rapidly high rate that the body is not familiar with. (Bolland, et al., 2010) There are also different types of foods we can eat that will inhibit the absorption of calcium. For example foods that are high in phytic and oxalic acids can cause calcium to not be absorbed. The acid binds to the calcium and makes it so the body cannot recognize it. Foods that are high in these acids include collard greens, rhubarb, wheat bran, and nuts.

There are also factors that promote the absorption of calcium. A very common example of this would be Vitamin D. Vitamin D is produced by the skin when exposed to the sun and can also be obtained from different types of foods. Foods fortified with Vitamin D such as milk, some fruit juices, and breakfast cereals can promote the absorbance of calcium. Vitamin D fortified foods are the main source of

Vitamin D for most Americans. (Bailey, et al., 2010) Alcohol and caffeine are also examples of items most people use on a daily basis, and when taken in moderation will most likely have no effect on calcium absorption. However, if a person is constantly introduced to large amounts of alcohol, it can inhibit the liver from producing the proper enzymes to turn Vitamin D into a form that can actively absorb calcium. (NIH: Office of Dietary Supplements) Calcium deficiency is not as common in young adults, as it can be in older populations, and can often time lead to osteoporosis or hypocalcemia. In a study done by Bailey, et al. 2010, they found less than 10% of women between the ages of 14 and 71 are meeting the RDA of calcium through their diet. Even with the added use of supplements, only 13% of women between the ages of 14 and 18 meet the RDA of calcium.

In this study I hope to provide a better understanding of dietary calcium sources, and determine if the average McPherson College student is receiving the proper amount of dietary calcium.

MATERIALS AND METHODS

The materials used for this research were food portion guides so the subjects could accurately and consistently record their diet; food journals for diet record; Nutrition Calc 3.0, diet analysis software to determine the amount of calcium in each type of food; and finally, Microsoft Excel to run the statistical tests.

McPherson College students participated in this study, ten males and ten females were chosen on a volunteer basis. Once the participants had been determined, each person was given a food portion guide provided by WebMD (Figure 1). This ensured that each person could record their diet accurately and consistently throughout the study. Each participant was then given a food journal to record their meals for each day. They were asked to record their diet for three days out of the week. The test was repeated two additional times for a total of nine days per subject. Once the journals were collected, the data was entered into the Nutrition Calc 3.0 software. This software was able to determine the intake levels and sources of their dietary calcium per test period; it also calculated the body mass index (BMI) of each person, which was later used in analyzing the results. After the data was collected for each individual participant, the data was separated into different groups based on gender and BMI. An F-Test and t-Test were run on the different groups, and the results were used to determine if there was a significant difference between the intake levels and sources among the selected groups.

Figure 1. WebMD portion guide given to each participant. (Modified from original) (Zelmen, 2008)

RESULTS

The intake levels, sources of calcium and the correlation between calcium intake and BMI were all different factors that were looked at.

When looking at the males and females, it was found that males on average had a higher intake of calcium per day than women. (Figure 2) An F-Test was performed first to determine equal or unequal variances. For this research, a P-value of less than 0.05 is considered to be significant. A P-value of 0.15 was calculated meaning the values did not vary significantly and equal variances were assumed. These results determined a two sample t-Test assuming equal variances should be performed. A P-value of 0.009 was calculated. This shows that the intake levels of calcium between men and women are significantly different from one another.

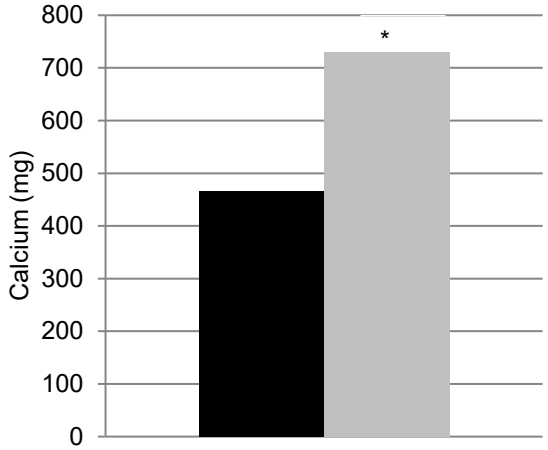

Figure 2. Average intake levels of calcium for men (grey bar) and women (black bar). P-value at P=0.009 indicated a significant difference.

The data were also analyzed to determine if the subjects were meeting the RDA of calcium. The amount of calcium each subject had for the whole trial was divided to determine the calcium intake for one day. Based on the results, it was very clear that nearly all of the subjects did not meet the RDA for calcium. (Figure 3)

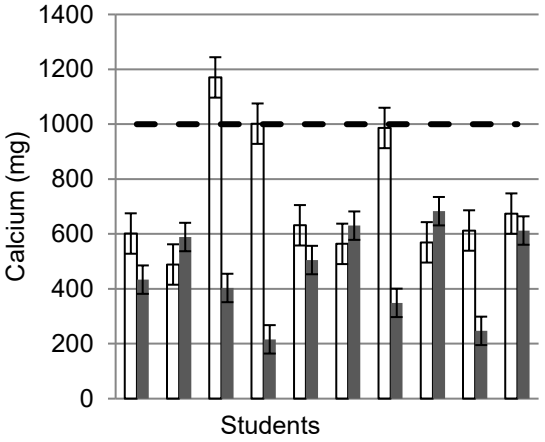

Figure 3. Clear bars represent the calcium intake per day for men, grey bars represent calcium intake per day for women, and the dashed line represents the RDA for both men and women between the ages of 19 and 50. The error bars represent the standard error within each subject. When one error bar overlaps another it means the intake level is not significantly different from the other.

When looking at the sources of calcium, it was very evident from the data that both males and females get more calcium from animal based sources rather than plant based. (Figures 4 and 5) A t-Test assuming unequal variances was run for both the men and women. A P-value of 0.0001 was calculated for the men, and a P-value of 0.00002 was calculated for the women. Both of these values are much lower than 0.05, therefore meaning the intake of calcium from animal based foods was significantly different than that of the plant based foods in both men and women.

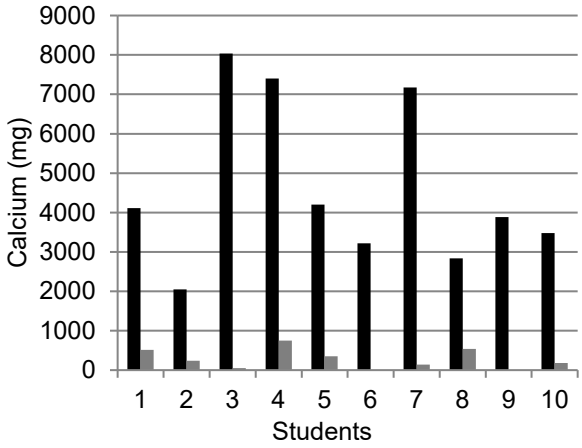

Figure 4. Calcium intake in animal and plant based sources for men during the whole trial (9 days). The black bars represent the calcium intake from animal based sources and the grey bars represent the calcium intake from plant based sources.

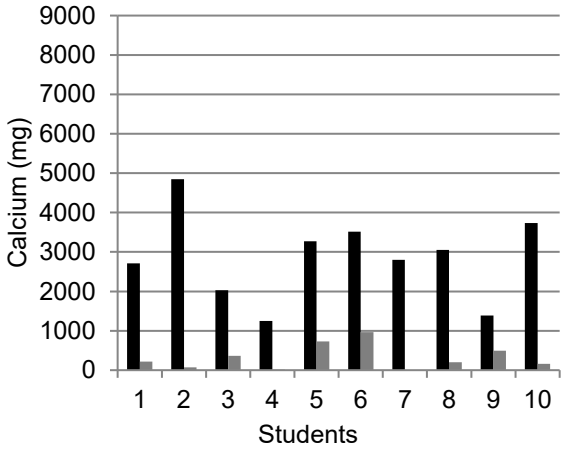

Figure 5. Calcium intake in animal and plant based sources for women during the whole trial (9 days). The black bars represent the calcium intake from animal based sources and the grey bars represent the calcium intake from plant based sources.

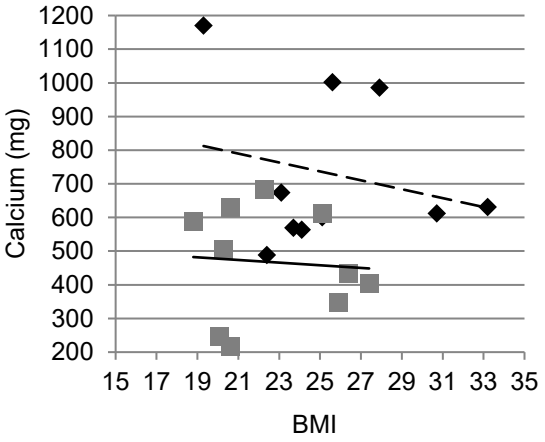

Figure 6. This plot shows the relationship between BMI and calcium intake in men and women. The linear regression line shows the correlation between the two sets of data. The grey squares and solid regression line represent the women, and the black diamonds and dotted regression line represent the men.

DISCUSSION

Based on the findings from this research it is evident that the students who participated are most definitely not getting the recommended amount of calcium in their every day diet. This was shown in Figure 3 from above. Although this may not be a problem at the time, it could cause problems later in life. This research also found that on average, men had a higher calcium intake per day than women, as shown in Figure 2.

It is also evident that providing knowledge of plant based sources of calcium could be beneficial to students, because plant based sources of calcium are lower in calories and fats. Based on Figures 4 and 5, all students received more calcium from animal based sources than from plant based sources.

There was no correlation found between BMI and calcium intake, as shown in Figure 6. A larger test group could provide more insight in this area.

To further the research that was done, it would be helpful to increase the test group size. This was only a small sampling of the McPherson College students, and a larger group size could provide more insights on the topic of dietary calcium. It would also be interesting to look at the activity level of students, perhaps by keeping an activity log, compared to dietary calcium since a majority of the student body consists of athletes. Looking at Vitamin D intake would also be helpful to determine the interaction between calcium intake and other nutrients.

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