Reflections on Disproportionate Calcium Consumption By Calvin Cho

I. Overview and History

Calcium oxide (CaO), or more popularly known as "lime," is a useful material that has served a significant role in history by being a cornerstone substance of "plaster and mortar." (Royal Society of Chemistry). It was initially classified as "earth" by Antoine Lavosier as calcium oxide did not process further - however, he strongly hypothesized that it was an oxide of an unknown element.

In 1808, Sir Humphry Davy electrolyzed lime and mercuric oxide, calcium was isolated and scientifically discovered for the first time. Davy discovered what is known to be the fifth most abundant dissolved ion in seawater, a nutrient that can be found easily within our lives: calcium. In the modern world, calcium can be obtained through "the electrolysis of a fused salt such as calcium chloride. Once exposed to air, elemental calcium rapidly forms a gray-white oxide and nitride coating" (Royal Society of Chemistry).

Today, calcium is seen as one of the most essential minerals humans need for survival and a key player in muscle strength and energy conservation.

II. Medical Significance

1) Key Functions

Calcium's main purpose is to "build and maintain strong bones" (Newman). The body's "heart, muscles, and nerves" (Mayo Clinic Staff) also need calcium in order to function properly.

2) Disproportionate Consumption

In the advent that one consumes too little calcium, they could be subjected to health issues due to weaker bones. Deficiency can lead to hypocalcemia with symptoms including:

- Being unable to reach maximum height potential.
- Lower bone mass.
- Higher chance of osteoporosis, causing bones to become weak and brittle that minor collisions could lead to serious fracture.
- Muscle cramps or weakness.
- Numbness or tingling in the fingers.
- Abnormal heart rate.
- Poor appetite.

However, excessive amounts of calcium in one's body could lead to an increased chance of hypercalcemia (literally hyper - calcium); this could lead to the irony of weaker bones as well as kidney stones and interference between the heart and the brain's functions. Symptoms can include the unrestrained desire to use the restroom and unconsciousness due to the nervous system malfunctioning. University of North Carolina, Chapel Hill Virtual Internship Program, Nutrition Research Institute

This is due to the parathyroid glands being too overactive whenever calcium levels get too high. Normally, these glands release parathyroid hormone (PTH) whenever calcium levels get low to match the desired amount of calcium; the body will absorb more calcium and the amount of calcium that becomes secreted through pee decreases, allowing more calcium to be conserved. It can also redirect calcium from the bones to the bloodstream. In the case that these parathyroid glands become overactive, it will formulate more PTH than the recommended amount and can lead to noncancerous tumors in the glands. Other side effects may include:

- Depression.
- Memory loss.
- Heartburn.
- Sleep deprivation.
- Bone and muscle pain.
- Fatigue.

Hypercalcemia can be discovered through a blood test and the delay of treatment may lead to long-term health issues. Treatments may include more liquid, exercise, and the increase of certain nutrients and minerals. Cacliminetics, a drug specializing in lowering calcium levels, may also be used. In the most serious cases, a surgeon may undergo a procedure to remove the parathyroid glands to halt the excessive secretion of PTH.

3) Recommended Consumption

The recommended daily amount for everyone differs per person but generally ranges between 1,000 mg to 1,200 mg. For men, those between the ages of 19-70 should consume around 1,000 mg and those older than 71 should consider around 1,200 mg. On the other hand, women 19 to 50 should consume 1,000 mg and should begin considering a daily intake of 1,200 mg at 51, 20 years earlier than the average male.

III. Sources of Calcium

Sources of calcium differ as the body does not naturally produce it on its own. Calcium can be found in a variety of foods (Mayo Clinic):

- Dairy products, such as cheese, milk and yogurt.
- Dark green leafy vegetables, such as broccoli and kale.
- Fish with edible soft bones, such as sardines and canned salmon.
- Calcium-fortified foods and beverages, such as soy products, cereal and fruit juices, and milk substitutes.

In order to absorb calcium, the body additionally requires Vitamin D. While a few selection of foods contain vitamin D such as salmon with bones and egg yolks, vitamin D can be consumed from mere sun exposure. However, calcium supplements should be considered by all even for those with a more balanced diet. Those currently undergoing the following should consider calcium supplements (Mayo Clinic):

• Follow a vegan diet.

University of North Carolina, Chapel Hill

Virtual Internship Program, Nutrition Research Institute

- Have lactose intolerance and limit dairy products.
- Consume large amounts of protein or sodium, which can cause your body to excrete more calcium.
- Are receiving long-term treatment with corticosteroids.
- Have certain bowel or digestive diseases that decrease one's ability to absorb calcium, such as inflammatory bowel disease or celiac disease.

These supplements too have risks, so medical staff should be consulted with prior to taking them.

IV. Storing and Processing Calcium

Due to calcium's organic traits, it is a large mineral and the body often struggles to process it. As a result, the body often consumes less calcium from a food than it is stated on a nutrition label and the actual amount consumed is referred to as the "calcium bioavailability" (Harvard T.H. Chan).

For the storing process, calcium will travel down the bloodstream and get stored in the bone crystals along with another element, phosphorus. "Calcium remains there until it is required - for example when the levels of calcium in the blood fall - when it is released." (Duncan).

V. A Study: Consumption of Calcium and Knowledge About Calcium Sources and Nutrition Labels Among Lower Secondary Students in Thailand

1) Context

Published online on September 14th, 2021 in the National Library of Medicine, Raksaworn Jaissard, Tipaporn Kanjanarach, Sutin Chanaboon, and Borey Ban investigated the consumption of calcium by Thailand secondary school students. This research study was done in three parts:

- The first study was to identify high-calcium products available in the consumer's local market
- The second study was to identify high-calcium products that lower secondary students in Thailand were aware of.
- The third study consisted of calculating the amount of calcium the students had actually consumed in the past 24 hours of the study.

Given this, the research objective was simple: examine the amount of calcium lower secondary students have access to, are aware of, and actually consume. The students were all around the ages of 11 to 14 and were enrolled in grades 7 to 9. Around 309 students were invited in total with 168 students participating in study 1 and the other 209 students participating in study 2.

2) Findings

It was found that in the local market, there were around 94 total high-calcium products. However, only around 49 were identified by the students as "known" or consumed. "The median University of North Carolina, Chapel Hill Virtual Internship Program, Nutrition Research Institute

amount of calcium consumed in the previous 24 hours was 410 mg with only around 31.1% students (65/209) consuming what the government set out as daily recommendations.

As expected, the main source of calcium was through milk as well as malt drink, minnow, canned fish, calcium fortified soy milk, and Chinese kale. "The overall average knowledge score was 6.5 ± 2.4 out of a maximum of 17. The average knowledge scores for high calcium food sources and for interpreting the calcium information on a sample nutrition label were 4.6 ± 1.8 (out of 12), and 1.9 ± 1.2 (out of 5), respectively" (Jaisaard et al.).

3) Study Relevance

With such a low percentage of students being able to identify high-calcium products and actually consuming them, it is evident that young children are not getting access to the nutrients that they need. With calcium being the most essential mineral, we can draw a similar conclusion that other minerals and nutrients key to childhood growth are also in deficit.

4) Potential Study Modifications

If there were ways to modify the study though, I would zoom out and do a comparative study, contrasting different communities - rural and urban, rich and poor, developed and undeveloped - and bringing to light a wider range of data. By doing this, the study would be able to identify inequalities and disparities in access to nutrients and foods in both Thailand, its neighboring nations, and countries all across the world.

VI. Conclusion

1) Reflection

In reading this research study, I was appalled to see just how few students were aware of high-calcium products even in their own local communities. This strongly indicates that children and people all across the world are often at a deficit of key nutrients.

2) Education

I believe that the first step in truly recognizing the disproportionate calcium issue at hand is to rethink education. For entire generations, dairy companies have put into place the idea that milk is sufficient to take care of one's daily recommended calcium intake. However, research often indicates that this is not true and that supplements may be needed to increase or to decrease calcium levels.

3) Public Policy

Additionally, it is essential that policymakers are aware of the nutrition deficiencies in calcium and beyond. With the rise of globalization in the food industry and the normalization of processed foods, it is more important now than ever to reconsider policies on nutrition labels, food and drug regulation, but over anything else, the driving factor behind every nation and its peoples: health.

University of North Carolina, Chapel Hill Virtual Internship Program, Nutrition Research Institute

Works Cited

Family Doctor, Staff. "Calcium: What You Need to Know." *Familydoctor.org*, 10 Aug. 2020,

https://familydoctor.org/calcium-what-you-need-to-know/#:~:text=Unfortunately%2C%20 getting%20more%20calcium%20than,much%20calcium%20from%20food%20alone.

Jaisaard, Raksaworn, et al. "Consumption of Calcium and Knowledge about Calcium Sources and Nutrition Labels among Lower Secondary School Students in Thailand." *Risk Management and Healthcare Policy*, Dove, 14 Sept. 2021, https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8450672/.

Mayo Clinic , N/A. "Are You Getting Enough Calcium?" *Mayo Clinic*, Mayo Foundation for Medical Education and Research, 26 Feb. 2022,

https://www.mayoclinic.org/healthy-lifestyle/nutrition-and-healthy-eating/in-depth/calcium -supplements/art-20047097#:~:text=The%20benefits%20of%20calcium,diabetes%20and% 20high%20blood%20pressure.

Newman, Tim. "Calcium: Health Benefits, Foods, and Deficiency." *Medical News Today*, MediLexicon International, 2020,

https://www.medicalnewstoday.com/articles/248958#:~:text=Calcium%20is%20a%20nutri ent%20that,in%20the%20bones%20and%20teeth.

Royal Society of Chemistry, 207890. "Calcium - Element Information, Properties and Uses: Periodic Table." *Calcium - Element Information, Properties and Uses* | *Periodic Table*, n.d.,

https://www.rsc.org/periodic-table/element/20/calcium#:~:text=It%20was%20first%20isola ted%20in,white%20oxide%20and%20nitride%20coating.

T.H. Chan, Harvard University. "Calcium." *The Nutrition Source*, 19 Oct. 2020, https://www.hsph.harvard.edu/nutritionsource/calcium/#:~:text=About%2099%25%20of% 20the%20body's,in%20the%20blood%20and%20tissues.

Wiginton, Keri. "What Causes Hypercalcemia? Here Are 6 Known Causes." *WebMD*, WebMD, 2022, https://www.webmd.com/a-to-z-guides/hypercalcemia-causes.