

# Calcium & Osteoporosis

## HASPI Medical Anatomy & Physiology 08b

### Lab Activity

## Background

Name(s): \_\_\_\_\_

Period: \_\_\_\_\_ Date: \_\_\_\_\_



<http://img2.timeinc.net/health/images/slides/calcium-pills-400x400.jpg>

### Calcium

Calcium is an important mineral needed for multiple functions within the body. It is the most abundant mineral in the body, and is used so often that it must constantly be replenished through the diet. More than 99% of the calcium in your body is stored in the bones. The calcium found in bones helps maintain the strength and structure of bones, along with other minerals such as phosphorus, but it is also stored in bones for removal when the body needs it. Specialized cells in bone tissue are responsible for adding and removing calcium from the bones depending on the amount of calcium in the bloodstream. This means only 1% of calcium is normally found in the body outside of bone and is crucial to important functions of the body.

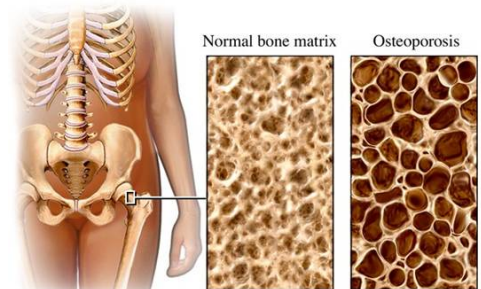
### Calcium in the bloodstream and body tissues functions to:

- Allow cells to respond to cellular signals, such as hormones
- Stabilize the blood pressure in vessels
- Assist insulin in allowing glucose to enter cells
- Assist in blood clotting
- Assist in the release of neurotransmitters at the synapse of nerves
- Facilitate muscle contractions (contractions WOULD NOT occur without calcium)
- Assist sperm in the fertilization of the egg

Essentially calcium is needed for the heart to pump, the brain and nerves to work, to keep our bones hard, to make our muscles move, even for reproduction of the human species, and this is only a list of the most important functions!

### Osteoporosis

Calcium is continually added to bone from about the third trimester of pregnancy into early adulthood. At this point, a small amount of calcium will be lost from bones naturally, as bone-forming processes become slower than bone removal. This natural bone loss is called osteopenia, and makes bones slightly less dense and more prone to fracture. In some individuals, the rate and amount of mineral loss is accelerated and can lead to a condition called osteoporosis, in which bones become very porous, fragile, and brittle. More than 80% of those who suffer from osteoporosis are women over the age of 65. More than 55% of people over the age of 50 have some degree of osteoporosis. Risk factors for developing osteoporosis include:



[http://www.arnoldehret.org/images/clip\\_image002\\_0024.jpg](http://www.arnoldehret.org/images/clip_image002_0024.jpg)

- Being over the age of 50
- Being female
- Low estrogen or testosterone
- A family history of fractures or low bone density
- Smaller than average stature (weight/height)
- Excess alcohol consumption
- Malnutrition
- Smoking
- Inactivity
- Heavy metal exposure
- Excess sodium, caffeine, or protein
- Soft drinks containing phosphoric acid (most of them)
- Some medications

Using a specialized x-ray machine, the density of bone minerals, such as calcium, can be determined through a bone mineral density (BMD) test. A BMD test can diagnose the onset of osteoporosis. There are treatment options that can decrease the risk of osteoporosis that include diet changes, exercise, and medications.

Rubin, A.L. 2009. What are the Functions of Calcium in the Body? Vitamin D For Dummies.

WHO. 2003. Prevention and Management of Osteoporosis: Report of a WHO Scientific Group. WHO Scientific Group on the Prevention and Management of Osteoporosis, [www.who.int](http://www.who.int).

## Materials

30 ml Vinegar	30 ml Bleach	30 ml Water
Weighing boat	3 Chicken bones	3 Beakers/cups
Scale	Graduated cylinder	Paper towels

## Procedure

### Scenario

You are a family physician at HASPI Medical Center. You have just informed a 43-year-old female patient that her bone mineral density test shows early signs of osteoporosis. She is a pack-a-day smoker and does not really want to change any of her lifestyle habits, or take calcium supplements. The patient does not understand why it is such a big deal that she is losing calcium, and thinks it is just a lie made up by the supplement companies. In order to create a visual example of the impact of calcium loss on bone tissue, you have set up the following experiment for your patient. Conduct the experiment over the next week to show your patient what can happen when important minerals and/or bone tissues are lost.

### Procedure

✓ when complete

#### Experiment Set Up

<b>Step 1</b>	Obtain three beakers/cups and label one with a “W” for water, one with a “V” for vinegar, and the other with a “B” for bleach.	
<b>Step 2</b>	Using the graduated cylinder, measure out 30 ml of water and pour it into the beaker/cup labeled “W”.	
<b>Step 3</b>	Using the graduated cylinder, measure out 30 ml of vinegar and pour it into the beaker/cup labeled “V”.	
<b>Step 4</b>	Using the graduated cylinder, measure out 30 ml of bleach and pour it into the beaker/cup labeled “B”.	
<b>Step 5</b>	Choose three chicken bones and remove all excess muscle from the bone. Dry off the bones with a paper towel. <b>MAKE SURE TO WASH YOUR HANDS AFTER HANDLING RAW CHICKEN!!!</b>	
<b>Step 6</b>	Obtain a weighing boat and scale. Place the weighing boat on the scale and tare.	
<b>Step 7</b>	Place one of the bones in the weighing dish and record its weight in grams in the starting weight for the “Water” column in Table 1.	
<b>Step 8</b>	Remove the bone and place it in the beaker/cup containing water. Make sure the bone is completely covered. If it is not covered, then add more water.	
<b>Step 9</b>	Place the second bone in the weighing dish and record its weight in grams in the starting weight for the “Vinegar” column in Table 1.	
<b>Step 10</b>	Remove the bone and place it in the beaker/cup containing vinegar. Make sure the bone is completely covered. If it is not covered, then add more vinegar.	
<b>Step 11</b>	Place the third bone in the weighing dish and record its weight in grams in the starting weight for the “Bleach” column in Table 1.	
<b>Step 12</b>	Remove the bone and place it in the beaker/cup containing bleach. Make sure the bone is completely covered. If it is not covered, then add more bleach.	

<b>Step 13</b>	Make your initial observations of the bones in Table 1. This could include the bones' color, texture, smell, firmness, etc.	
<b>Step 14</b>	Place all three beakers/cups and your weighing dish in a safe place where they will not be disturbed. Use a piece of paper or paper towel with your group name placed under the beakers/cups to identify them. The bones will be observed and weighed every class period over the next week.	
<b>Step 15</b>	WASH YOUR HANDS WITH SOAP AND WATER EVERY TIME YOU HANDLE THE CHICKEN BONES!	

### Weighing Directions

<b>Step 1</b>	Remove the bone from the water beaker/cup and dry it off on a paper towel.	
<b>Step 2</b>	Place the weighing boat on the scale and tare. Place the bone in the weighing dish and record its weight in grams, for the time period you are testing, in the "Water" column in Table 1. Make a note of any visual observations as well.	
<b>Step 3</b>	Place the bone back into the water beaker/cup and dry off the weighing dish.	
<b>Step 4</b>	Remove the bone from the vinegar beaker/cup and dry it off on a paper towel.	
<b>Step 5</b>	Place the weighing boat on the scale and tare. Place the bone in the weighing dish and record its weight in grams, for the time period you are testing, in the "Vinegar" column in Table 1. Make a note of any visual observations as well.	
<b>Step 6</b>	Place the bone back into the vinegar beaker/cup and dry off the weighing dish.	
<b>Step 7</b>	Remove the bone from the bleach beaker/cup and dry it off on a paper towel.	
<b>Step 8</b>	Place the weighing boat on the scale and tare. Place the bone in the weighing dish and record its weight in grams, for the time period you are testing, in the "Bleach" column in Table 1. Make a note of any visual observations as well.	
<b>Step 9</b>	Place the bone back into the bleach beaker/cup and dry off the weighing dish.	

**Table 1. Bone Observations & Weight**

Time Period	Water		Vinegar		Bleach	
	Weight (g)	Observations	Weight (g)	Observations	Weight (g)	Observations
Initial (0 hr)						
24 hours						
48 hours						
72 hours						
96 hours						

## Analysis Questions - on a separate sheet of paper complete the following

1. Create a line or bar graph of the weights for each bone over the five-day test period on the graph provided. Label your graph!
2. Explain what happened to the bone in water. How did the water affect the minerals or tissues of the bone?
3. Explain what happened to the bone in vinegar. How did the vinegar affect the minerals or tissues of the bone?
4. Explain what happened to the bone in bleach. How did the bleach affect the minerals or tissues of the bone?
5. Your patient will be returning for her appointment soon and you will be showing your experiment to her. Explain how you will use the results to teach your patient about the impact of calcium loss in bones (1 paragraph minimum.)
6. **CONCLUSION:** In 1-2 paragraphs summarize the procedure and results of this lab.

## Review Questions - on a separate sheet of paper complete the following

1. Where is most of the calcium stored in the body?
2. What are the functions of calcium in the bones?
3. List what you think are the three MOST important functions of calcium.
4. Until what stage of life is calcium continually added to bone?
5. What is osteopenia?
6. What is osteoporosis?
7. What percentage of people in the United States over the age of 50 have osteoporosis?
8. What risk factors (as far as you know) do you currently have for osteoporosis?
9. How can a BMD test diagnose osteoporosis?
10. What are treatment options to prevent osteoporosis?

Title: \_\_\_\_\_


**Key**