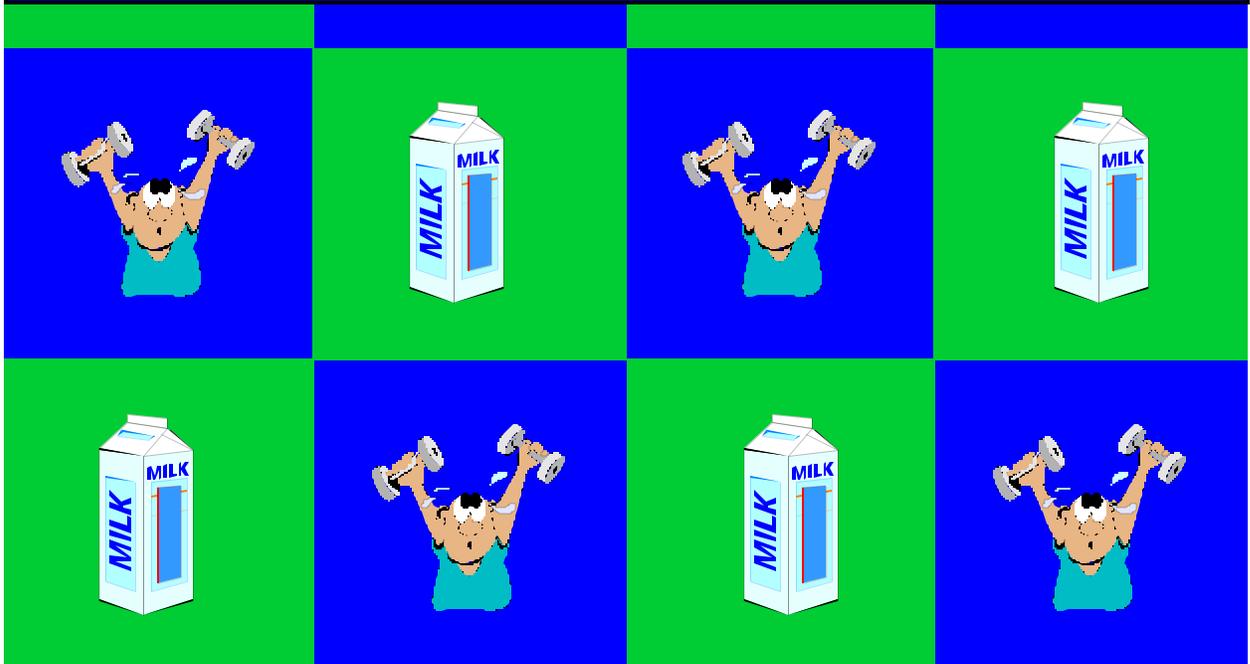




**JUMP START YOUR BONES**





## Table of Contents

About Jump Start Your Bones .....	3
About the Principal Authors .....	4
Acknowledgements .....	5-7
For the Educator, Background Information.....	8-13
<b>Consumer Sciences Curriculum</b>	
Here's Looking at You, Calcium .....	15-17
Create and Sell a Smoothie .....	18-21
Calcium Detective.....	22-25
<b>Health Curriculum</b>	
Magazine Editor .....	27-30
Contract to Move .....	31-35
Teens Take Over .....	36-39
<b>Physical Education Curriculum</b>	
Got A Bone to Pick...Bring It on Home! .....	41-45
A New Twist on Turns.....	46-49
Skip Your Way to Healthier Bones .....	50-52
<b>Life Science Curriculum</b>	
Don't Chicken Out.....	54-58
Digest This .....	59-64
What's G Got to Do With It?.....	65-70
<b>Handout Packet (pages are unnumbered)</b>	



## About Jump Start Your Bones

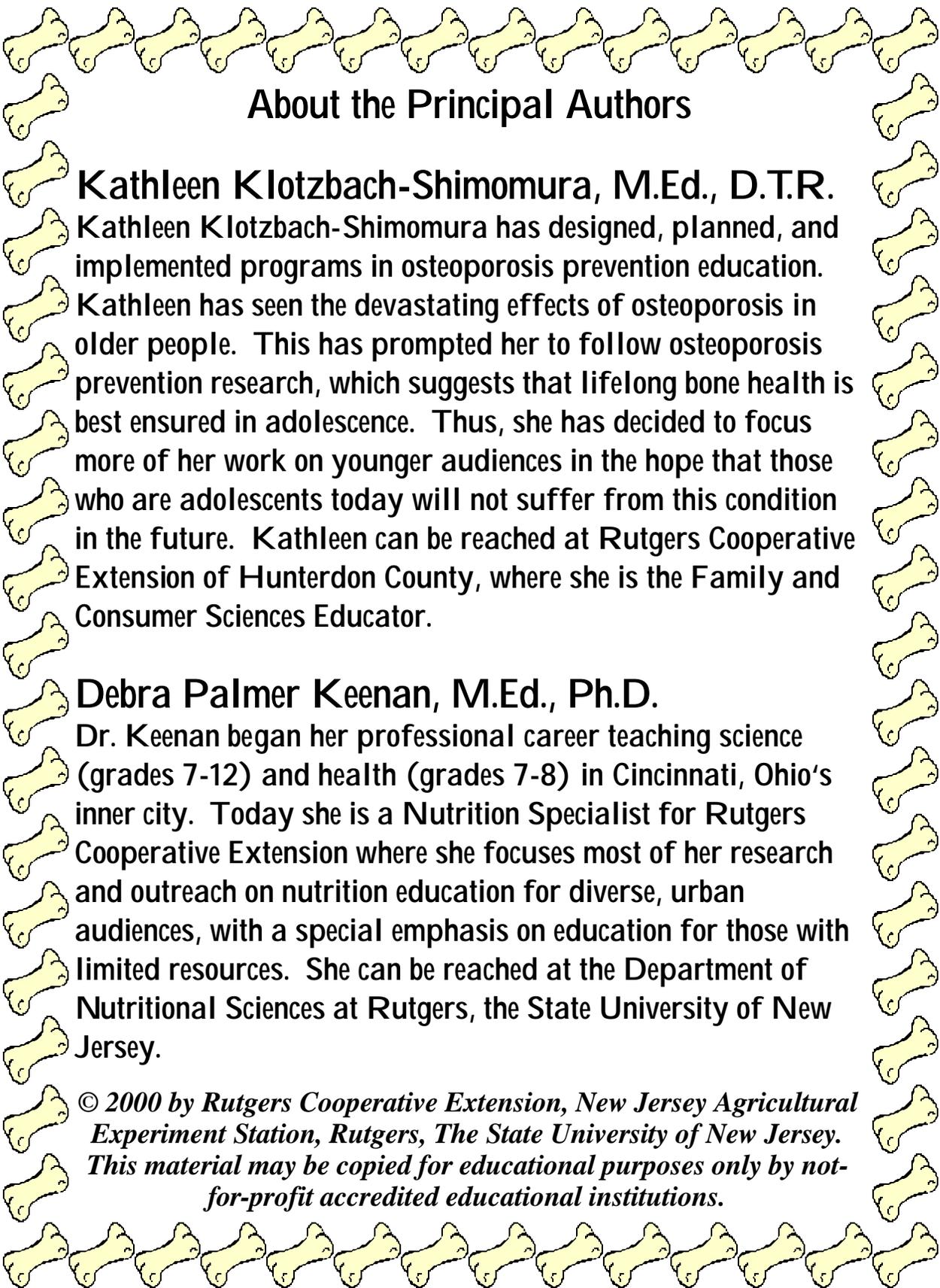
*Jump Start Your Bones* is a comprehensive, multi-disciplinary osteoporosis prevention curriculum that can be utilized by School Nurses, School Teachers, Extension Educators, and other Health Professionals. The intended target audience is middle school (6th-9th grades) students receiving classroom education.

This curriculum is organized as follows:

- ⇒ Background information for the educator.
- ⇒ Full color lesson plans for Family and Consumer Sciences, Health, Physical Education, and Life Science.
- ⇒ Handouts (black and white masters), organized as referenced in the lessons.

We hope you enjoy providing these osteoporosis prevention lessons in a variety of educational venues. In fact, we hope you enjoy these lessons so much that you will share them with the classroom teachers and others with whom you work.

Good Luck and Enjoy!



## About the Principal Authors

### **Kathleen Klotzbach-Shimomura, M.Ed., D.T.R.**

Kathleen Klotzbach-Shimomura has designed, planned, and implemented programs in osteoporosis prevention education.

Kathleen has seen the devastating effects of osteoporosis in older people. This has prompted her to follow osteoporosis prevention research, which suggests that lifelong bone health is best ensured in adolescence. Thus, she has decided to focus more of her work on younger audiences in the hope that those who are adolescents today will not suffer from this condition in the future. Kathleen can be reached at Rutgers Cooperative Extension of Hunterdon County, where she is the Family and Consumer Sciences Educator.

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Dr. Keenan began her professional career teaching science (grades 7-12) and health (grades 7-8) in Cincinnati, Ohio's inner city. Today she is a Nutrition Specialist for Rutgers Cooperative Extension where she focuses most of her research and outreach on nutrition education for diverse, urban audiences, with a special emphasis on education for those with limited resources. She can be reached at the Department of Nutritional Sciences at Rutgers, the State University of New Jersey.

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## Special Thanks to the Teachers who Assisted in the Development and/or Field Testing of the Jump Start Your Bones Curriculum

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### Acknowledgements

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## For the Educator, Background Information

### Why is bone health important for adolescents?

Adolescence is the best time in your students' lives for them to favorably impact their bone development and to decrease their odds of developing osteoporosis later in life. Most bone mass is built during the growth spurt that is associated with puberty (1). By age 18, the individual has developed most of the bone mass he or she will have during his or her lifetime (2). Once people reach their 20s, it is usually too late for them to greatly increase their bone mass.

When bones are as strong and dense as they can get, it is said that peak bone mass has been reached. Peak bone mass is, in part, genetically determined. However, whether a person reaches his or her peak bone mass depends principally on three other factors: eating enough calcium-rich foods, performing enough weight-bearing exercise, and having normal hormonal status. Although teens have little or no control over their growth patterns or when they achieve peak bone mass, they have a large degree of control over the amount of calcium they consume and the amount of weight-bearing exercise they do. By helping your students know what to do and why it is important, and by helping them figure out how to engage in these behaviors, you can favorably influence their lives.

### What is osteoporosis?

Osteoporosis is a bone thinning disease. Loss of bone mass often results in increased risk of fractures (1). One and a half million osteoporotic fractures of the spine, hip, wrist, and other sites occur each year, primarily in postmenopausal women. The medical costs to treat this disease are high. Among the population aged 45 and older, total costs to treat osteoporotic-related fractures in 1995 were over 14 billion dollars (3).

### Who does osteoporosis effect?

Osteoporosis occurs in both women and men, but it is more common in women. In fact, complications from osteoporosis are the second leading cause of death for women 45 to 74 years old (4). Beginning at puberty, boys acquire bone density at a greater rate than girls, resulting in bones that are more dense in adulthood. For this reason, men are generally at a lower risk for osteoporosis than women. However, osteoporosis in men is often undiagnosed, and consequently, goes unreported. Therefore, the actual number of cases may be higher. Half of all women and 20 percent of men will have at least one fracture caused by osteoporosis in their lifetime. By helping teens improve their intake of calcium and physical activity levels, their risk of osteoporosis can be reduced (5, 6).

All ethnic groups, especially post-menopausal women, are at risk for developing osteoporosis (1).

For Caucasian women:

- ☆ Post-menopausal Caucasian women are at the highest risk for developing osteoporosis.
- ☆ Ninety percent of hip fractures can be linked to osteoporosis after the age of 65. Ninety-five percent of hip fractures in women over 85 are linked to osteoporosis (7).

In African-American women:

- ☆ Approximately 300,000 African-American women currently have osteoporosis (8).
- ☆ Between 80 to 95 percent of bone fractures in African-American women over 64 are due to osteoporosis (9).
- ☆ African-American women are more likely than Caucasian women to die following a hip fracture (10).
- ☆ As African-American women age, their risk for hip fracture doubles approximately every 7 years (11).
- ☆ Diseases more prevalent in the African-American population, such as sickle-cell anemia and systemic lupus erythematosus, are linked to increased osteoporosis risk (12).
- ☆ Adequate intake of calcium plays a crucial role in building peak bone mass and preventing bone loss. Studies indicate that African-American women consume 50 percent less calcium than the Recommended Dietary Allowance (13).

Asian-American women also are at risk for developing osteoporosis. Below are some statistics relating to this population:

- ☆ Although Asian-American women generally have lower hip fracture rates than Caucasian women, their prevalence of vertebral fractures seems to be as high as that in Caucasians (14, 15). In recent decades, there have been sharp increases in hip fracture incidents in some parts of the Far East. In 2050, about half of the expected 6.3 million hip fractures worldwide will occur in Asia (16).
- ☆ Asian women tend to be lighter in weight and have smaller bones than Caucasian women, putting them at a higher risk for low bone mass and osteoporotic bone fractures than other racial/ethnic groups (15).
- ☆ The average calcium intake among Asian-American women has been observed to be about half that of other groups in the Western population (17).

Latino women are at a significant risk for developing osteoporosis as well:

- ☆ Studies have shown that Latino women consume less calcium than the Recommended Dietary Allowance in all age groups (18).
- ☆ It is estimated that the number of hip fractures will increase over the next half century in Latin-American populations, worldwide (18).

Many of the risk factors for osteoporosis cannot be controlled. However, people can control some lifestyle habits that lead to osteoporosis, such as alcohol and tobacco use. Moderate alcohol use (4-12 drinks per week) can significantly increase the risk of

hip fracture in women under the age of 65 (19). When alcohol is abused heavily, there is a marked increase in the risk for bone fractures. This is attributed to a few different causes. People under the influence of alcohol suffer from more motor vehicle accidents and falls. Also, many alcohol abusers have lower bone density. This is because alcohol is thought to affect bone metabolism by inhibiting vitamin D (19). Another study concludes that alcohol may inhibit the functioning of osteoblast cells in the bones (20). Smoking cigarettes may decrease calcium absorption and influence bone metabolism as well. Smokers also do not absorb calcium from supplements or from their diets as well as non-smokers (21). There is also a significant effect on calcium and vitamin D metabolism because smoking slows it down (22).

### **How can my students' diets improve their bone health?**

Increasing calcium consumption to 1300 milligrams (mg) daily is the best dietary means for adolescents to improve their bone health. Calcium also is important for the development of strong teeth, a regular heartbeat, and normal nerve functioning (1). Research shows that increased calcium intake additionally may play a part in decreasing the risk of high blood pressure (23).

Although the Food Guide Pyramid recommends 3 servings of dairy foods daily, this alone results in an intake of only about 900 mg of calcium, 400 mg short of current recommendations. To build strong bones, individuals between the ages of 9 and 18 should consume at least 4 servings of calcium-rich foods a day, or as the Dietary Reference Intakes (DRIs) recommends 1300 mg of calcium daily. Thus, 3 servings of calcium-rich foods per day may not be enough for adolescents. As a rule of thumb, adolescents should incorporate at least 1 calcium-rich food into every meal and snack to meet their daily calcium requirements. Examples of calcium-rich foods include: dairy products, calcium-fortified orange juice, and fortified breakfast bars and cereals. For more examples of calcium-rich foods, see the *Calcium Hall of Fame* handout in the Handouts Section.

Dairy foods are the best source of calcium. This is because in addition to calcium, dairy foods contain vitamin D, that is needed for optimum calcium absorption. Dairy foods also contain 2 other minerals, magnesium and phosphorous, which are important for bone development. One problem is that teens are consuming more soft drinks and less milk. This challenges osteoporosis prevention because soft drinks often replace milk in the diet and do not contain calcium. Drinking more soft drinks often means that the body is getting less calcium (24). Be sure to share this information with your students.

### **What if my student can't eat dairy foods?**

Lactose is the sugar in milk that causes problems for some people. Some people do not have adequate levels of lactase, the enzyme needed to break down this sugar, and therefore have a difficult time digesting milk products. That is to say, they may experience flatulence (or gas), diarrhea, and/or sometimes cramps after consuming dairy products. While these individuals may have problems digesting milk, research

has shown that they may be able to tolerate up to 2 cups of milk if it is spread gradually throughout the day or consumed with a meal, and/or eat cheeses and yogurts that contain much less lactose than milk (25). Lactose intolerance can be a permanent condition, or a temporary condition brought about by illness or stress. If someone says that they have a difficult time digesting milk, you might suggest they try lactose-free milk; or take lactase pills or add lactase drops to milk.

Students who have problems digesting the lactose in milk can also get calcium from non-dairy sources such as calcium-fortified foods or calcium-rich plant foods. Calcium-fortified foods can be great non-dairy sources of calcium. For example, glass for glass, most brands of calcium-fortified orange juice have as much calcium as milk, and the calcium is easily absorbed. Plant sources, like kale and collards, are not as rich in calcium as dairy sources. Moreover, some plant foods like spinach, beans, and rhubarb contain calcium, but their calcium is not as well absorbed by the body as calcium from other sources.

If adolescents do not get enough calcium from dietary sources, which often happens if they cannot consume dairy products, they may need to take supplements. An inexpensive supplement is calcium carbonate, which is available in over-the-counter antacids. These supplements work best when taken with food, because food in the stomach increases acid production and the acid hastens calcium absorption.

If non-dairy sources are primarily used for calcium intake, students need to make sure they get enough vitamin D in their diets. They can do this by spending 5 to 15 minutes outside with their faces, hands, and arms exposed to sunlight two to three times a week (26). Sunlight helps the body make vitamin D. Milk is fortified with vitamin D and is one of the few sources of vitamin D in the diet.

### **What activities will improve my students' bone health?**

The type of physical activity that builds strong bones is called weight-bearing exercise. Weight-bearing refers to any exercise where there is mechanical loading on the bones (4). In other words, the bones are holding the weight of the body or pushing against some other object, like a weight. Swimming and bicycling are examples of exercises that are not typically considered to be weight-bearing. In casual, recreational swimming and biking, bones are not supporting the full weight of the body. Below are some examples of weight-bearing exercises:

- |                  |                 |                   |                  |
|------------------|-----------------|-------------------|------------------|
| ☆ football       | ☆ jump rope     | ☆ stair climbing  | ☆ aerobics       |
| ☆ roller-blading | ☆ ice-skating   | ☆ volleyball      | ☆ hockey         |
| ☆ hiking         | ☆ rock climbing | ☆ rugby           | ☆ martial arts   |
| ☆ tennis         | ☆ double Dutch  | ☆ dancing         | ☆ walking        |
| ☆ lacrosse       | ☆ running       | ☆ baseball        | ☆ softball       |
| ☆ wrestling      | ☆ gymnastics    | ☆ boxing          | ☆ weight lifting |
| ☆ field hockey   | ☆ soccer        | ☆ track and field | ☆ basketball     |

The Dietary Guidelines for Americans recommend that teens engage in at least one hour of physical activity each day. However, excessive exercise by girls can cause bone loss, or bone weakening. A girl is exercising too much if she experiences amenorrhea (the loss of her regular menstrual period). Estrogen (a female hormone) is critical to bone health and amenorrhea can be a result of reduced estrogen levels due to fat loss in young women. Anorexia nervosa also can lead to amenorrhea, resulting in decreased bone mass. Even after regular menstrual periods return, the significant bone loss that can result may never be recovered.

In summary, adolescence is the time for students to JUMP START their BONES! With this curriculum, you can help your students work toward achieving their peak bone mass by eating 4 servings of calcium-rich foods each day and getting plenty of weight-bearing exercise. Good Luck!

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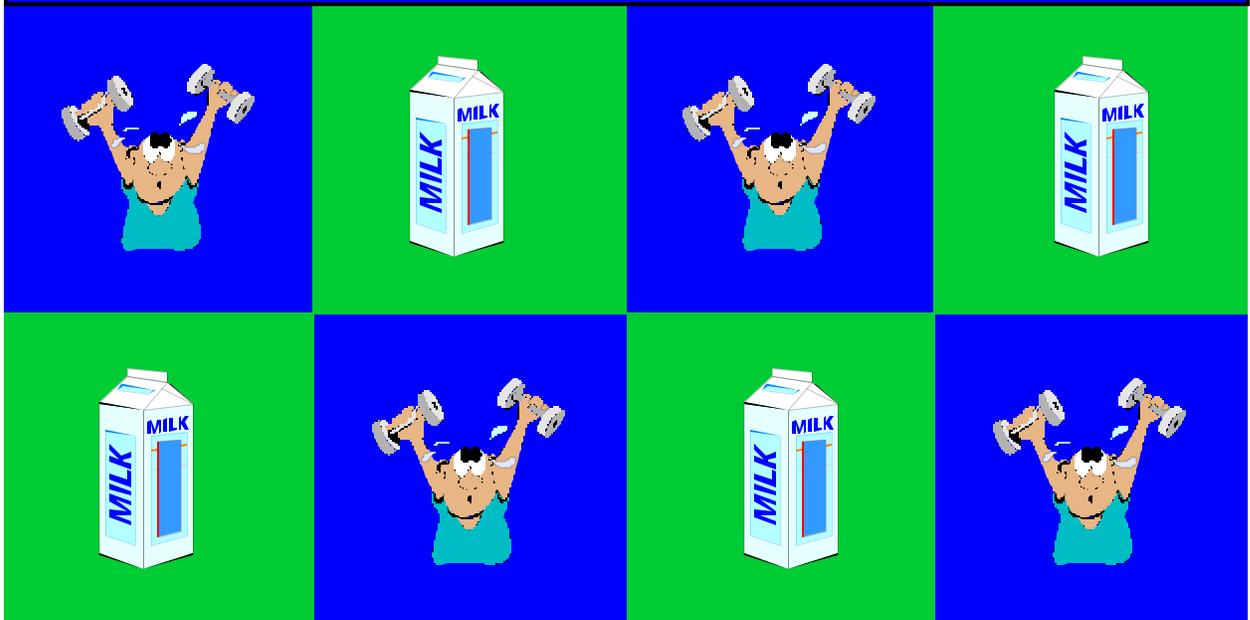
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# JUMP START YOUR BONES

The text 'JUMP START YOUR BONES' is written in a large, bold, yellow, bubbly font with black outlines. A cartoon illustration of a yellow bone is positioned behind the text, with one end at the bottom left and the other at the top right, appearing to support the letters.



# Here's Looking at You, Calcium

## JUMP START YOUR BONES

Subject Matter Area Family and Consumer Sciences

Target Audience Middle school students

Topics Covered Calcium-rich foods, weight-bearing exercises, bone health

Time required 1 class period (40-45 minutes)

Materials

Handouts:

Check-Out Your Calcium! worksheet - 1 per student

Scene 1: Sherice - 1 per group

Scene 2: Eric - 1 per group

Scene 3: Kristen - 1 per group



If this is the first **Jump Start Your Bones** lesson that you are teaching, you will need the following handouts: *Calcium Hall of Fame*, *Osteoporosis (Just the Facts) Fact Sheet*, *Calcium and Bones*, *I Can't Eat Dairy Foods*, *Weight-Bearing Exercises and Bones* - 1 per student



Curriculum Connection This lesson meets the following New Jersey Core Curriculum Content Standards for 5th to 8th grade:

⇒ **Standard 1.4** All students will demonstrate knowledge of the process of critique.

⇒ **Standard 2.1** All students will learn health promotion and disease prevention concepts and health-enhancing behaviors.

⇒ **Standard 2.6** All students will learn and apply health-related fitness concepts.

⇒ **Standard 3.4** All students will read various materials and texts with comprehension and critical analysis.

⇒ **Standard 4.4** All students will develop reasoning ability and will become self-reliant, independent, mathematical thinkers.



# Learning Objectives

## Knowledge Objectives

- ☆ Students will analyze the amount of calcium in their diets.
- ☆ Students will state that they should be physically active at least 1 hour each day.
- ☆ Students will recognize the benefits of participating in weight-bearing exercises.
- ☆ Students will identify ways to reduce their risk for osteoporosis.



## Behavioral Objectives

- ☆ Students will increase the amount of calcium-rich foods in their diets.
- ☆ Students will perform more weight-bearing exercises.

## New Terms

- ☆ *Calcium* - a mineral found in bone
- ☆ *Prevention* - to stop an event from happening
- ☆ *Calcium fortified* - extra calcium added to a food normally low in calcium

## Skills Used

- ☆ Self assessment
- ☆ Working in groups
- ☆ Analyzing and solving problems

# Lesson Plan

If this is the first *Jump Start Your Bones* lesson that you will be teaching, you will need to provide all students with a copy of the following handouts: *Calcium Hall of Fame*, *Osteoporosis (Just the Facts) Fact Sheet*, *Calcium and Bones, I Can't Eat Dairy Foods*, and *Weight-Bearing Exercises and Bones*.

1. Ask students to take out their *Osteoporosis (Just the Facts) Fact Sheet*, *Calcium and Bones* handout, *Calcium Hall of Fame* handout, and *Weight-Bearing Exercises and Bones* handout. Hand out the *Check Out Your Calcium!* worksheet.
3. Read the *Osteoporosis (Just the Facts) Fact Sheet* and the *Calcium and Bones* handouts aloud. Help the students complete the *Here's Lookin' At You, Calcium!* worksheet.
4. Divide the class into approximately equal groups of 4 students.
5. Assign each group a scene. Have students read their scene, and using the *Calcium Hall of Fame*, and *Weight-Bearing Exercise and Bones* handouts, plan how the student in the scene can get at least 1300 mg of calcium and weight-bearing exercise each day.
6. Ask students to describe their scenes and present their ideas to the class.
7. Lead a discussion on calcium, weight-bearing exercise and bone health.

Suggestions for the teacher

- ☆ This lesson works well before a dairy foods lab, calcium lab, or any other cooking lab that uses calcium-rich foods.
- ☆ This lesson can be incorporated as part of any nutrition unit.
- ☆ If you are teaching other **Jump Start Your Bones** lessons, this lesson should be taught first.

Lesson Created By Dana Geissler, Bethany Beckerdite, Andrea S. Smith,  
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Funding For The Development of This Lesson Was Provided By The New Jersey Department of Health and Senior Services through a grant received by the Piscataway Board of Education, the Florence Griffin Joyner Grant through the National Osteoporosis Foundation's Osteoporosis Business Coalition, and the Fiscal Year 2000 New Jersey Food Stamp Nutrition Education Program

# Create and Sell a Smoothie

## JUMP START YOUR BONES

Subject Matter Area Family and Consumer Sciences

Target Audience Middle school students

Topics Covered Calcium-rich foods, bone health, creating recipes, selling food products

Time required 1½-2 class periods (60-90 minutes)

### Materials

Kitchen equipment: spoons, knives, measuring spoons, measuring cups, blenders

Ingredients for smoothies (see *All About Smoothies* sheet)

Paper cups

### Handouts

All About Smoothies handout - 1 per student

My Smoothie handout - 1 per student

Calcium and Bones fact sheet - 1 per student



**If this is the first *Jump Start Your Bones* lesson that you are teaching, you will need the following handouts: *Calcium Hall of Fame*, *Osteoporosis (Just the Facts) Fact Sheet*, *Calcium and Bones*, *I Can't Eat Dairy Foods*, *Weight-Bearing Exercises and Bones* - 1 per student**

Curriculum Connection This lesson meets the following New Jersey Core Curriculum Content Standards for 5th to 8th grade:

- ⇒ **Standard 1.4** All students will demonstrate knowledge of the process of critique.
- ⇒ **Standard 2.1** All students will learn health promotion and disease prevention concepts and health-enhancing behaviors.
- ⇒ **Standard 5.2** All students will develop problem-solving, decision-making and inquiry skills, reflected by formulating usable questions and hypotheses, planning experiments, conducting systematic observations, interpreting and analyzing data, drawing conclusions, and communicating results.



# Learning Objectives

## Knowledge Objective

- ☆ Students will recognize that smoothies taste good and identify them as a calcium-rich food.
- ☆ Students will state that calcium strengthens their bones.



## Behavioral Objectives

- ☆ Students will increase the amount of calcium-rich foods in their diets.
- ☆ Students will make smoothies.

## Skills Used

- ☆ Use of kitchen equipment, creativity, marketing skills, following directions in a recipe

## New Terms

- ☆ *Calcium* - a mineral found in bone
- ☆ *Prevention* - to stop from happening
- ☆ *Peak bone mass* - the heaviest and strongest the bones are able to become

# Lesson Plan

If this is the first *Jump Start Your Bones* lesson that you will be teaching, you will need to provide all students with a copy of the following handouts: *Calcium Hall of Fame, Osteoporosis (Just the Facts) Fact Sheet, Calcium and Bones, I Can't Eat Dairy Foods, and Weight-Bearing Exercises and Bones.*

1. Demonstrate how to make a smoothie to the class (see *All About Smoothies* handout).
2. Distribute the *All About Smoothies* and *My Smoothie* handouts.
3. Allow students to break up into groups to develop their own smoothie recipes. Each smoothie should include milk and frozen yogurt or light ice cream. Lactose-reduced or lactose-free milk or calcium fortified orange juice should be available for students who are unable to consume dairy products. Students should use the available ingredients to develop a recipe for a smoothie that they believe they will like. Encourage them to be creative, but make sure they don't waste ingredients because they get "too creative." Instruct students to record their ingredient choices and the amount of each used on the *My Smoothie* handout.
4. Using blenders, allow the students to assemble their smoothies. Afterwards, have the students taste them, rate their own smoothie's taste and rate each others'. Have students record their ratings on the *My Smoothie* handout. To prevent spreading illnesses, make sure the students have their own cups to drink from when tasting others' smoothies. Students could rinse out their cups between trying new flavors to reduce the number of cups used.
5. Discuss with the students that smoothies are easy to make at home. They are great for breakfast, as an after school snack, or as a bedtime snack. Encourage them to make smoothies for their parents, siblings, or friends.
6. Use facts in the *Calcium and Bones* handout to help create a name, slogan, and advertising campaign to sell each group's smoothie as a low-fat, bone-strengthening drink. Once again, encourage the students to be creative. If time runs out, allow them to complete the assignment at home or during the next period. Students may use the *My Smoothie* handout to write their ideas.
7. The next day, have students discuss the names and advertising campaigns that they created for their smoothies. Some examples of names are "Awesome Orange," "Mighty Mango," "Kiwi Strongberry," and "Bone-ana."

Suggestions for the teacher

- ☆ If necessary, send students home with a list of available ingredients, and assign them to develop the recipes for homework. Having the students develop the recipes in advance, will allow recipes to be approved and improved, thereby preventing possible “disasters.”
- ☆ Ask class members to record their recipes and make a smoothie recipe book to take home.

Lesson Created By Dana Geissler, Bethany Beckerdite, Andrea S. Smith,  
Kathleen Klotzbach-Shimomura, Debra Palmer Keenan

Funding For The Development of This Lesson Was Provided By The New Jersey Department of Health and Senior Services through a grant received by the Piscataway Board of Education, the Florence Griffin Joyner Grant through the National Osteoporosis Foundation’s Osteoporosis Business Coalition, and the Fiscal Year 2000 New Jersey Food Stamp Nutrition Education Program

# Calcium Detective

## JUMP START YOUR BONES

Subject Matter Area Family and Consumer Sciences

Target Audience Middle school students

Topics Covered Calcium-rich foods, bone health



Time required 1 class period (40-45 minutes)

Materials



Kitchen equipment (see: *Choose Your Recipe - Prepare for Infiltration* handout)  
Recipe ingredients (see: *Choose Your Recipe - Prepare for Infiltration* handout)

Handouts

Sneaking Up on Calcium handout - 1 per student  
Choose Your Recipe: Prepare for Infiltration! handout - 1 per student  
Stealth Calcium handout - 1 per student

**If this is the first *Jump Start Your Bones* lesson that you are teaching**, you will need the following handouts: *Calcium Hall of Fame*, *Osteoporosis (Just the Facts) Fact Sheet*, *Calcium and Bones*, *I Can't Eat Dairy Foods*, and *Weight-Bearing Exercises and Bones* - 1 per student



Curriculum Connection This lesson meets the following New Jersey Core Curriculum Content Standards for 5th to 8th grade:

- ⇒ **Standard 2.1** All students will learn health promotion and disease prevention concepts and health-enhancing behaviors.
- ⇒ **Standard 4.4** All students will develop reasoning ability and will become self-reliant, independent, mathematical thinkers.
- ⇒ **Standard 4.9** All students will develop an understanding of, and will use, measurement to describe and analyze phenomena.
- ⇒ **Standard 5.2** All students will develop problem-solving, decision-making and inquiry skills, reflected by formulating usable questions and hypotheses, planning experiments, conducting systematic observations, interpreting and analyzing data, drawing conclusions, and communicating results.

# Learning Objectives

## Knowledge Objective

- ☆ Students will identify ways to increase the calcium content of foods, without compromising flavor.

## Behavioral Objectives

- ☆ Students will try new foods that are high in calcium.
- ☆ Students will increase the amount of calcium in their diets by augmenting the calcium content of foods they already eat.

## Skills Used

- ☆ Self-assessment, working in groups, analyzing and solving problems

## New Terms

- ☆ *Calcium* - a mineral found in bone
- ☆ *Prevention* - to stop an event from happening
- ☆ *Calcium-fortified* - extra calcium added to a food normally low in calcium



# Lesson Plan

If this is the first *Jump Start Your Bones* lesson that you will be teaching, you will need to provide all students with a copy of the following handouts: *Calcium Hall of Fame*, *Osteoporosis (Just the Facts) Fact Sheet*, *Calcium and Bones, I Can't Eat Dairy Foods*, and *Weight-Bearing Exercises and Bones*.

1. Have stations/trays set up with 1 set of ingredients on each tray. See, *Choose Your Recipe: Prepare for Infiltration!* handout for ingredients. On a separate tray, place calcium-rich foods that students can add to their recipes. Include foods like: tofu with calcium sulfate (check the label), cheeses, evaporated or powdered milk, spinach, bok choy, canned salmon or sardines with bones, or any other calcium-rich food.
2. Explain that students can make almost any dish high in calcium, with a little creativity, and that this will be the purpose of today's lesson.
3. Hand out the *Sneaking Up On Calcium* and *Choose Your Recipe: Prepare for Infiltration!* handouts. Allow groups to choose their own recipes or assign recipes by allowing students to draw them from a hat.
4. Explain to the class that they need to increase the amount of calcium in the recipes listed on the *Choose Your Recipe: Prepare for Infiltration!* handout. Have students get out their *Calcium Hall of Fame* handouts to learn the amounts of calcium in the different calcium-rich foods. Tell students to be creative, but that whatever they create they should plan to eat! Encourage the inclusion of powdered milk and non-dairy products.
5. Instruct students to prepare their recipes.
6. Distribute the *Stealth Calcium* handout. Using this handout, ask students to list the ingredients and amounts they used of each calcium-rich ingredient. Instruct students to use the *Calcium Hall of Fame* handout to help calculate the total calcium increase in the recipe and the increase of calcium per serving. Turn the process into a game and try to see how many points each group can earn. For each mg of calcium added, give 1 point.
7. Allow students to taste other groups' products and evaluate the flavor and texture of each product.
8. On the black board, keep a tally of both the calcium mg and taste quality totals for each group.

Suggestions for the Teacher

- ☆ Suggestions for calcium inclusion in recipes:
  - ⇒ **stir-fry:** bok choy, tofu with calcium sulfate, canned salmon with bones
  - ⇒ **mac and cheese:** powdered milk, evaporated milk, yogurt
  - ⇒ **pizza:** part skim ricotta cheese, spinach, broccoli, Parmesan cheese
  - ⇒ **nachos:** Mexican-blend cheese, bok choy, non-fat or low-fat sour cream
- ☆ If the students choose foods not located on the *Calcium Hall of Fame* handout, you can use a food composition chart in the back of a nutrition text book or go to the *Nutrient Database* at: <http://www.nal.usda.gov/fnic/foodcomp/>. The *Interactive Healthy Eating Index* is another source to find nutrient information on the calcium in ingredients (<http://www.cnpp.usda.gov>).
- ☆ Have students modify their “recipe of choice” at home. You can ask them to bring in a sample and do another tally of the points (mg) they accumulated to identify a student as the “Calcium Champ.”

Lesson Created By Dana Geissler, Bethany Beckerdite, Andrea S. Smith,  
Kathleen Klotzbach-Shimomura, Debra Palmer Keenan

Funding For The Development of This Lesson Was Provided By The New Jersey  
Department of Health and Senior Services through a grant received by the  
Piscataway Board of Education, the Florence Griffin Joyner Grant through the  
National Osteoporosis Foundation’s Osteoporosis Business Coalition, and the  
Fiscal Year 2000 New Jersey Food Stamp Nutrition Education Program



Osteoporosis Prevention Lessons for  
Middle School Health Classes

# JUMP START YOUR BONES



# Magazine Editor

## JUMP START YOUR BONES

Subject Matter Area Health

Target Audience Middle school students

Topics Covered Calcium-rich foods, weight-bearing exercise, bone health, osteoporosis prevention



Time required 2 class periods (80-90 minutes)

Materials



Magazines and newspapers  
Markers, pencils and crayons  
Poster-board or large paper  
Scissors  
Paste, glue or tape  
A computer can be used

Handouts:

Group 1: Cover and Centerfold Design handout - 1 copy  
Group 2: Interview handout - 1 copy  
Group 3: Teen Health Article handout - 1 copy  
Group 4: Dear Sam and Sonia Column handout - 1 copy  
Dear Sam and Sonia Letters handout - 1 copy

\*If the class size exceeds 16, you will need 2 copies of each of the above dittos.

**If this is the first *Jump Start Your Bones* lesson that you are teaching**, you will need the following handouts: *Calcium Hall of Fame*, *Osteoporosis (Just the Facts) Fact Sheet*, *Calcium and Bones*, *I Can't Eat Dairy Foods*, and *Weight-Bearing Exercises and Bones* - 1 per student



Curriculum Connection This lesson meets the following New Jersey Core Curriculum Content Standards for 5th to 8th grade:

- ⇒ **Standard 2.1** All students will learn health promotion and disease prevention concepts and health-enhancing behaviors.
- ⇒ **Standard 2.2** All students will learn health-enhancing personal, interpersonal, and life skills.

# Learning Objectives

## Knowledge Objectives

- ☆ Students will list several strategies to prevent osteoporosis.
- ☆ Students will identify foods that are calcium-rich.
- ☆ Students will state that they should be physically active at least one hour each day.
- ☆ Students will state the difference between weight-bearing exercises and non-weight-bearing exercises.



## Behavioral Objectives

- ☆ Students will increase the amount of calcium-rich foods in their diets.
- ☆ Students will perform more weight-bearing exercises.
- ☆ Students will develop a daily plan to obtain sufficient dietary calcium.

## Skills Used

- ☆ Writing skills
- ☆ Interactive group skills
- ☆ Creative skills
- ☆ Decision making skills

## New Terms

- ☆ *Calcium* - a mineral found in bone
- ☆ *Prevention* - to stop an event from happening
- ☆ *Weight-bearing exercise* - any activity that involves supporting one's weight with one's bones, or pushing against an object; examples: running, walking, weight training, gymnastics, dance, soccer
- ☆ *Calcium-fortified* - extra calcium added to a food normally low in calcium

# Lesson Plan

**If this is the first *Jump Start Your Bones* lesson that you will be teaching, you will need to provide all students with a copy of the following handouts: *Calcium Hall of Fame, Osteoporosis (Just the Facts) Fact Sheet, Calcium and Bones, I Can't Eat Dairy Foods, and Weight-Bearing Exercises and Bones.***

1. Discuss with students that adolescence is the best time to build their peak bone mass. Teens need to make sure they get plenty of calcium and exercise. If not, they increase their odds of ending up with osteoporosis when they grow old.
2. Discuss with students the importance of eating calcium-rich foods daily, focusing on the different types of calcium-rich foods available. Be sure to describe how students can get enough calcium if they can't eat dairy foods. Discuss weight-bearing exercise; explain why certain exercises are considered weight-bearing (any exercise that involves supporting one's weight with one's bones, or pushing against an object) and give examples of weight-bearing exercises (running, walking, weight-training, gymnastics, dance). Note that swimming and biking are not weight-bearing exercises.
3. If the class size exceeds 16, split the class in half to make 2 separate magazines. Divide each half of the class again into smaller groups of 2 to 4 students to do separate sections for each magazine.
4. Discuss with students that they have been put in charge of designing a magazine for their friends. Each group will work on one of the following sections of the magazine: cover, famous person interview, teen health article, and Dear Sam and Sonia Column. Students should be creative, yet focused on the issue of bone health. The magazine should concentrate on telling their peers, friends, or siblings how important it is to eat at least 4 calcium-rich foods and to do weight-bearing exercise for at least one hour every day to ensure bone health and prevent osteoporosis.
5. Depending on supplies available, the magazine can be poster size or letter size (11 x 14" paper works well). Students can use magazine clippings or their own drawings to illustrate the magazine. They can include advertisements, letters, and/or editorials.
6. Distribute the appropriate handout(s) to each group: (1) Cover and Centerfold Design, (2) Interview, (3) Teen Health Article, (4) Dear Sam and Sonia Column and the Dear Sam and Sonia Letters. Ask students to use their copies of Osteoporosis (Just the Facts) Fact Sheet, Calcium and Bones, Weight-Bearing Exercise and Bones, and I Can't Eat Dairy Foods as references when creating the magazine.

Suggestions for the teacher

- ☆ Make copies of the magazine for all members of the class to take home and share with their parents.
- ☆ Publicize the magazine in the school newspaper or newsletter, or make a special issue.
- ☆ Put the magazine in the school library.
- ☆ Create the magazine on poster size paper and display it for the entire school in the school cafeteria or library.

Lessons Created By Dana Geissler, Bethany Beckerdite, Tracy Horner,  
Andrea S. Smith, Kathleen Klotzbach-Shimomura, Debra Palmer Keenan

Funding For The Development of This Lesson Was Provided By The New Jersey  
Department of Health and Senior Services through a grant received by the  
Piscataway Board of Education, the Florence Griffin Joyner Grant through the  
National Osteoporosis Foundation's Osteoporosis Business Coalition, and the  
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# Contract to Move

## JUMP START YOUR BONES

Subject Matter Area Health

Target Audience Middle school students

Topics Covered Weight-bearing exercise



Time required 1 class period (40-45 minutes)

Materials



Handouts

- Activities I Do handout - 1 per student
- Times I Exercise handout - 1 per student
- Exercise Log - 1 per student
- Scene 1: Felicity - 1 per group
- Scene 2: Will - 1 per group
- Scene 3: Jennifer - 1 per group
- Coach's Contract - 1 per student
- Certificate of Achievement (for coaches) - 1 per student who completes his or her exercise log
- Certificate of Achievement (for students)- 1 per student who completes his or her exercise log

**If this is the first *Jump Start Your Bones* lesson that you are teaching, you will need the following handouts: *Calcium Hall of Fame, Osteoporosis (Just the Facts) Fact Sheet, Calcium, and Bones, I Can't Eat Dairy Foods, Weight-Bearing Exercises and Bones* - 1 per student**



Curriculum Connection This lesson meets the following New Jersey Core Curriculum Content Standards for 5th to 8th grade:

- ⇒ **Standard 2.1** All students will learn health promotion and disease prevention concepts and health-enhancing behaviors.
- ⇒ **Standard 2.2** All students will learn health-enhancing personal, interpersonal, and life skills.
- ⇒ **Standard 2.5** All students will learn and apply movement concepts and skills that foster physical activities throughout life.
- ⇒ **Standard 3.4** All students will read various materials and texts with comprehension and critical analysis.

# Learning Objectives

## Knowledge Objectives

- ☆ Students will identify 10 weight-bearing exercises they enjoy.
- ☆ Students will evaluate the amount of weight-bearing exercise they perform.
- ☆ Students will classify exercise into weight-bearing and non-weight-bearing categories.
- ☆ Students will know that they should be physically active at least one hour each day.



## Behavioral Objectives

- ☆ Students will perform more weight-bearing exercises.

## Skills Used

- ☆ Self assessment

## New Terms

- ☆ *Calcium* - a mineral found in bone
- ☆ *Prevention* - to stop an event from happening
- ☆ *Weight-bearing exercise* - any activity that involves supporting one's weight with one's bones or pushing against an object; examples: running, walking, weight training, gymnastics, dance, soccer

# Lesson Plan

If this is the first *Jump Start Your Bones* lesson that you will be teaching, you will need to provide all students with a copy of the following handouts: *Calcium Hall of Fame, Osteoporosis (Just the Facts) Fact Sheet, Calcium and Bones, I Can't Eat Dairy Foods, and Weight-Bearing Exercises and Bones*.

1. Ask students to refer to their *Weight-Bearing Exercise and Bones* handout.

2. Discuss the following points with your class:

**Describe weight-bearing exercise.**

Weight bearing exercise is any activity, sport, or exercise where you are placing weight on your bones. For example, when you are standing, the bones in your feet, legs, and back are supporting the weight of your body. When you are lying down, they are not. Therefore, any sports or activities where you are running, jumping, walking, or pushing against an object can be considered weight bearing.

**Name 1 activity that is not considered to be weight-bearing? Why is it not weight-bearing?**

Swimming is an example of a NON-weight-bearing exercise, because the body is floating and the bones are not supporting the body's weight. Although swimming is good for your muscles, it does not build much bone strength and density. Biking is another example. The kind of recreational biking that most teens do for fun is not commonly considered weight-bearing. Biking strengthens the muscles but is not a good way to build bone strength and density.

**What are examples of weight-bearing exercises?**

Weight-bearing exercises are those that require the bones to hold the weight of the body or to push against some other object, like a weight.

☆ Review the list of weight-bearing exercises.

☆ Add that weight-lifting, running, and jumping are excellent weight-bearing exercises.

3. Reinforce the following concepts:

Weight-bearing exercises increase your muscle and bone strength.

Weight-bearing exercises create toned, strong muscles to keep you looking great.

Teens should engage in at least 1 hour of physical activity each day.

4. Distribute the *Activities I Do* handout. Help the students follow the instructions by reading them aloud 1 step at a time.

5. Upon completion of the handout, the students should have identified weight-bearing exercises they already like to do.

6. Discuss the following:

**How many people have done exercises listed on the handout?**

**What weight-bearing exercises do you perform that are not on this handout?**

Make sure that they list them in on the handout (as long as they are weight-bearing exercises).

**How many people found exercises they like on the handout?**

**Who did not find exercises that they like on the handout?**

If any students did not find exercises they liked, brainstorm to identify weight-bearing exercises they like to do and ask them to write these in.

7. Next, distribute the *Times / Exercise* handout. Instruct the students to put a check next to all of the times they perform weight-bearing exercise. Tell them to use the lines provided and to add other times or places not listed. Remind them that playing sports and games with their friends is exercise.
8. Upon completion of the handout, the students should have identified times that they already exercise. Comment, "All (or many) of you are already doing weight-bearing exercises, either after school, or during school hours. You should be physically active at least 1 hour each day. If you are not, try working towards getting 1 hour a day." Offer suggestions on how they can increase the amount of weight-bearing exercise they are getting, like walking to the park, jogging, and/or going to school dances.
9. Distribute the *Exercise Log*. Help the students follow the directions to write in the dates. Instruct them to keep it in a notebook, on their mirror, on the refrigerator, or on a bulletin board at home. The students should check off each day they exercise for at least 1 hour during the dates listed in their log.
10. Distribute the *Coach's Contract*. Ask students to choose a "coach." Examples of people who could be their coach include: a parent, sibling, aunt, uncle, or friend. Remind the students to tell their coaches that they were chosen to encourage them and to help them be physically active a minimum of 1 hour each day. The students and their coaches should both read and sign the *Coach's Contract* and return it. Each student who performs 1 hour of exercise each day on their exercise log will receive a *Certificate of Achievement* to award to his or her coach and a *Certificate of Achievement* for his or herself.
11. Divide the class into groups of 4 students. Give each group one of the 3 "Scene" handouts. Tell students that as tough as it is for them to get enough exercise now, it may become more difficult as they get older and take on more responsibilities. Inform them that in this activity they will be looking ahead and considering how students who have hectic school schedules, work, drive, and date can maintain a

regular exercise plan. Give students 15 minutes to review their case studies and plans with the group. Allow students to then read and discuss their solutions with the class.

12. After approximately 1 month has passed, ask students to bring in their exercise logs, signed by their coaches. Award *Certificate(s) of Achievement* to the students and coaches who completed their exercise assignment of 1 hour of physical activity each day.

Suggestions for the teacher

- ☆ Lead the students in a discussion about their plans for high school, for example, high school clubs they might join, community activities they may participate in, and jobs they would like to have. Discuss opportunities that may exist within each activity described to perform weight-bearing exercise.
- ☆ Instruct students to bring the exercise log back to school at the end of every week (or every 2 weeks). On these days take 10 minutes to discuss whether the students are getting exercise and what obstacles they are facing.
- ☆ Continue the activity by issuing more exercise grids, and continuing the recognition.

Lesson Created By Dana Geissler, Bethany Beckerdite, Andrea S. Smith,  
Kathleen Klotzbach-Shimomura, Debra Palmer Keenan

Funding For The Development of This Lesson Was Provided By The New Jersey Department of Health and Senior Services through a grant received by the Piscataway Board of Education, the Florence Griffin Joyner Grant through the National Osteoporosis Foundation's Osteoporosis Business Coalition, and the Fiscal Year 2000 New Jersey Food Stamp Nutrition Education Program

# Teens Take Over

## JUMP START YOUR BONES

Subject Matter Area Health

Target Audience Middle school students



Topics Covered Healthful eating, calcium-rich foods

Time required 2 class periods (80-90 minutes)

Materials



Students will negotiate their audio-visual needs from the following list:

- Chalk and chalkboard
- Poster-board and/or flip-charts
- Markers
- Transparencies
- Transparency markers
- Overhead Projector
- Computer

Handouts

- Teens Take Over: Lunch handout - 1 per group member
- Teens Take Over: After-School Snacking handout - 1 per group member
- Teens Take Over: What to Drink? handout - 1 per group member
- Teens Take Over: Dessert handout - 1 per group member

**If this is the first *Jump Start Your Bones* lesson that you are teaching**, you will need the following handouts: *Calcium Hall of Fame*, *Osteoporosis (Just the Facts) Fact Sheet*, *Calcium and Bones*, *I Can't Eat Dairy Foods*, and *Weight-Bearing Exercises and Bones* - 1 per student

Curriculum Connection This lesson meets the following New Jersey Core Curriculum Content Standards for 5th to 8th grade:

- ⇒ **Standard 2.1** All students will learn health promotion and disease prevention concepts and health-enhancing behaviors.
- ⇒ **Standard 2.2** All students will learn health-enhancing personal, interpersonal, and life skills.



# Learning Objectives

## Knowledge Objectives

- ☆ Students will identify 4 foods that are high in calcium.
- ☆ Students will illustrate how they can incorporate more calcium into their diets.

## Behavioral Objectives

- ☆ Students will eat more high-calcium foods.

## Skills Used

- ☆ Working in groups
- ☆ Writing skills
- ☆ Developing lessons
- ☆ Public speaking

## New Terms

- ☆ *Prevention* - to stop an event from happening
- ☆ *Calcium-fortified* - extra calcium is added to a food normally low in calcium



# Lesson Plan

If this is the first *Jump Start Your Bones* lesson that you will be teaching, you will need to provide all students with a copy of the following handouts: *Calcium Hall of Fame, Osteoporosis (Just the Facts) Fact Sheet, Calcium and Bones, I Can't Eat Dairy Foods, and Weight-Bearing Exercises and Bones*.

## Class Period 1

1. Tell students that one of the most important things they can do to improve their bone health and lessen their risk for getting osteoporosis later in life is to eat at least 4 calcium-rich foods daily during their teen years. Continue by saying that this is the time in their lives when most of the calcium is deposited into their bones. After their teen years, they will not be able to build bone mass as well and will need to eat calcium-rich foods to replace calcium that they lose as they age! Define and discuss osteoporosis, if necessary. Draw from information included in the *For the Teacher, Background Information*, as needed.
2. Ask students to refer to the handouts - *Calcium Hall of Fame, Osteoporosis (Just the Facts) Fact Sheet, Calcium and Bones, I Can't Eat Dairy Foods, and Weight-Bearing Exercises and Bones*.
3. Ask the students to divide into 4 groups of 6 students or less. If there are more than 24 in the class, break up into more than 4 groups and double-up on groups that will work on the topics of snacks and drinks.
4. Assign each group a topic or allow them to choose from lunch, snacks, drinks, and desserts. Give each group the appropriate handout: *Teens Take Over: Lunch, After-School Snacking, What to Drink?, or Dessert*. Be sure to encourage students to consider all of their options for increasing calcium in their designated areas, including those that involve non-dairy products.
5. Provide students with art supplies like chalk, overheads, transparencies, and markers.
6. Tell students to read their handouts carefully before beginning their work. Help them develop lessons according to their assignments on the handouts. Encourage creativity and different approaches to presenting their lessons. Assist with any technical equipment that the students may be using, i.e. overhead projector, chalk board, music during skits, hanging posters, flip charts, or computers.
7. Emphasize that students will have a 5-minute time limit for teaching their lesson and a 5-minute time limit for doing their skit.
8. Encourage the students continue to work on their lessons at home, if necessary.

## Class Period 2

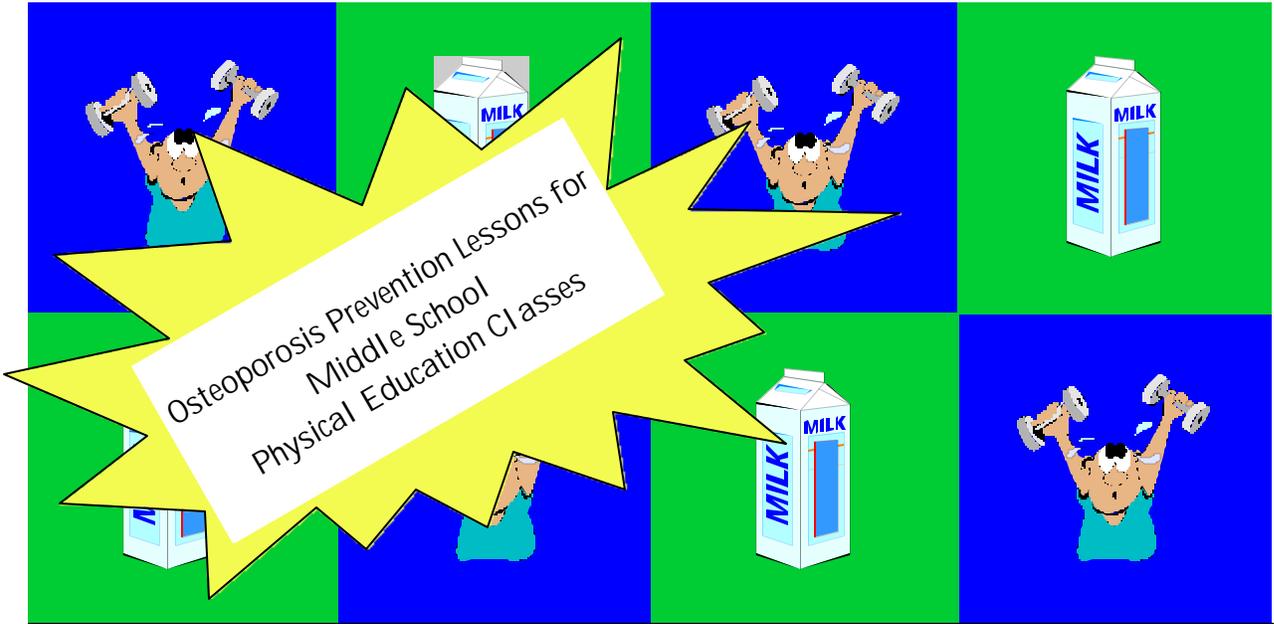
1. Have each group present their lesson and skit.
2. Help guide discussions on the skits' accuracy of information, depth of information, creativity, and delivery (e.g. could the students hear the skit). Encourage students to recognize what was good about each skit, what they liked and disliked, and what they learned.

### Suggestions for the teacher

- ☆ Encourage students to bring in food for a taste test.

Lesson Created By Dana Geissler, Bethany Beckerdite, Andrea S. Smith,  
Kathleen Klotzbach-Shimomura, Debra Palmer Keenan

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Department of Health and Senior Services through a grant received by the  
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# JUMP START YOUR BONES

The title is rendered in large, bold, yellow, 3D-style block letters with black outlines. The word 'JUMP' is partially framed by a large, stylized bone illustration on the left. The word 'BONES' is partially framed by a large, stylized bone illustration on the right. The background is a solid blue color.



# Got a Bone To Pick ... Bring It on Home!

## JUMP START YOUR BONES

Subject Matter Area Physical Education

Audience Middle school students

Topics covered Weight-bearing activities that can be done at home



Time Required 1 class period (40-45 minutes)

Materials



- Safety mats - 1 per student or 1 to share between 2 students
- Sturdy chairs - 1 per student or 1 to share between 2 students
- Extra items for students who forget to bring in weights. Suggestions include:
  - ☆ textbooks
  - ☆ plastic bags (double-bagged) and filled with sand
  - ☆ cans of fruits or vegetables
  - ☆ water bottles or plastic milk jugs filled with varying amounts of sand or water
  - ☆ hand weights or velcro leg weights available from supermarkets, discount retail stores, or “dollar stores”
  - ☆ a belt or long piece of material that can be used to strap weights onto legs

Handouts:

Bring “Weighty” Objects To Next Week’s PE Class handout - 1 per student; distributed **1 week before class**

**If this is the first *Jump Start Your Bones* lesson that you are teaching**, you will need the following handouts: *Calcium Hall of Fame*, *Osteoporosis (Just the Facts) Fact Sheet*, *Calcium and Bones*, *I Can’t Eat Dairy Foods*, *Weight-Bearing Exercises and Bones* - 1 per student

Curriculum Connection This lesson meets the following New Jersey Core Curriculum Content Standards for 5th to 8th grade:



- ⇒ **Standard 2.1** All students will learn health promotion and disease prevention concepts and health enhancing behaviors.
- ⇒ **Standard 2.5** All students will learn and apply movement concepts and skills that foster participation in physical activities throughout life.
- ⇒ **Standard 2.6** All students will learn and apply health-related fitness concepts.

# Learning Objectives

## Knowledge Objectives

- ☆ Students will state that weight-bearing exercise promotes bone health and decreases the risk for osteoporosis.
- ☆ Students will describe the benefits of participating in weight-bearing exercises in class and on their own.
- ☆ Students will state that they should be physically active at least 1 hour each day.



## Behavioral Objectives

- ☆ Students will perform more weight-bearing exercises.
- ☆ Students will use items they already have at home to design their own weight-bearing exercise routines.

## Skills Used

- ☆ Problem solving to develop creative exercise routines and to identify weights that can be found and used at home
- ☆ Weight-training

## New Terms

- ☆ *Weight-bearing exercise* - any exercise that involves supporting one's weight with one's bones; examples: running, walking, weight-training, gymnastics, dance, soccer

# Lesson Plan

If this is the first *Jump Start Your Bones* lesson that you will be teaching, you will need to provide all students with a copy of the following handouts: *Calcium Hall of Fame*, *Osteoporosis (Just the Facts) Fact Sheet*, *Calcium and Bones, I Can't Eat Dairy Foods*, and *Weight-Bearing Exercises and Bones*.

1. Introduce the day's activity by talking with the students about weight-bearing exercises. Let the students answer the following questions. Provide supplemental information from the lesson background only if they are unable to answer the questions completely.

**When is the best time for people to greatly increase their bone mass?**  
the teen years

**What happens if people don't have enough bone mass when they get older? Or, does anyone have a relative that has had bone problems? If so, tell us about the problems.**

**What happens:** osteoporosis

**Problems:** bone fractures, making such things as hip replacements necessary

**What kinds of exercises can help teens ensure that they have strong bones?**  
weight-bearing

**What are weight-bearing exercises? Name some examples.**

**Weight-bearing exercises:** those that require the bones to hold the weight of the body or to push against some other object, like a weight.

**Examples include:** stair climbing, baseball, dancing, basketball, walking, running, boxing, cheerleading, volleyball, football, martial arts, aerobics, soccer

**What parts of the body benefit from weight-bearing activities?**

Weight-bearing exercises benefit various bones and muscles, depending on the bone or muscle exercised. It is important to perform different types of weight-bearing exercises to strengthen all bones and muscles.

**What is an exercise that would not be considered to be weight-bearing? Why is it not weight-bearing?**

Swimming is an example of a NON-weight-bearing exercise. This is because the body is floating and the bones are not supporting the body's weight. Although swimming is good for your muscles, it does not build your bone strength and density very much. Biking is another example of an exercise that is not typically considered weight-bearing. Casual biking does not put much weight on your bones.

2. Inform the class that they will be using the weights they brought from home to do some weight-bearing exercise. Demonstrate warm-up and stretching activities with the class before beginning with the weights.
3. Ask the students to get the weights that they have brought. You can explain that lifting weights (for boys and girls) is an excellent way to build up their bones. Emphasize that it is important to do at least 1 hour of physical activity every day - even on days when there is no school. Tell the students that they can lift weights made with things that they find in their own homes. Today, they are going to come up with some exercise routines that they can do at home.
4. Assign chairs to individuals (or groups of 2 if there are not enough chairs), and invite each student to design a weight-bearing exercise that involves the lighter weight that they brought and the chairs. Monitor students to make sure that they are doing exercises that will not hurt their bodies. If students need suggestions, instruct them to:
  - ☆ Sit in chairs with their arms down at their sides. Hold the weights in their hands with their wrists up. Bring their hands up shoulder level and then back down. (Bicep curl)
  - ☆ Sit in the chairs with a weight in one hand. Extend the arm above the head. Bending only the elbow, bring the weighted hand down to meet the back of the shoulder and then back up. They may want to support the weighted elbow with the opposite hand. (Tricep curl)
  - ☆ Sit in the chairs, holding a weight in each hand, palms facing forward, elbows bent, with hands slightly above the shoulders. Slowly raise the weights straight up, without locking the elbows and then back down again. (Military press)
5. Instruct the students to do 10 repetitions of their exercises. If they choose to do an exercise that only involves one side of their body, they should do 5 repetitions on each side.
6. Ask students to repeat the same exercises with the heavier weights. As before, they should do 10 repetitions, if using their whole bodies. If they choose to do an exercise that only involves one side of their body, they should do 5 repetitions on each side.
7. Invite students to stretch out the muscles that they were just strengthening. Remind students that stretching is always important to do after they've exercised a particular muscle to avoid tightening of that muscle.
8. Get out the mats. Invite students to approach the mats. At this time, students will perform those exercises that involve their lighter weights and the mats. If students need suggestions, instruct them to:
  - ☆ Lie on their backs with their arms outstretched and the weights in their hands, palms facing up. With elbows slightly bent, they should lift the weights until they are side-by-side above their chests. (Fly)
  - ☆ Lie on their backs, holding the weights at chest level, palms facing forward. They should raise the weights without locking their elbows, and then slowly lower them. (Press)

- ☆ Lie on their backs. Grasp both ends of a single weight. With elbows bent, students should hold their weights a few inches behind their head, so their elbows are facing the ceiling. Students should raise the weights high over their chests, then slowly lower the weights back down. (Tricep curl)
- 9. Ask the students to do 10 repetitions of their exercises. If they choose an exercise that only involves one side of their body, they should do 5 repetitions on each side.
- 10. Invite the students to repeat the same exercise with the heavier weights. Again, doing a combination of 10 repetitions or 5 repetitions to each side.
- 11. Now, ask the students to stretch out the muscles that they were just strengthening. Again, remind them that this is always important to do after exercising particular muscles to prevent soreness.
- 12. Discuss the different weights that the students brought, and which were the best to use. Ask students who had success with their exercises (and weights) to demonstrate them to the class. Make sure that students who had a difficult time with the weights that they brought discuss their challenges. For example, the weights may have been too unbalanced or clumsy or perhaps the diameter was too large.
- 13. You will want to stress that they can use many things at home for weights, as long as they are not breakable, are the appropriate weight, and are easy to handle. Reiterate that physical education in school is very important, but coming up with exercise routines they can do at home is important, too. It is important to do at least 1 hour of physical activity every day. Students need to remember to use different exercises and vary their routines so that all their bones and muscles get strong. As they continue to lift, they will need to use heavier and heavier weights because they will be building more muscle and stronger bones! Emphasize that they should never lift more weight than is comfortable for them. Also, exercising with a partner is a good practice both for incentive and for having a spotter to ensure safety.
- 14. End the class by telling the students: **The teen years are the most important time to build strong bones!**

Lesson Developed By Tracy Horner, Andrea S. Smith, Kathleen Klotzbach-Shimomura, Debra Palmer Keenan

Funding For The Development of This Lesson Was Provided By The New Jersey Department of Health and Senior Services through a grant received by the Piscataway Board of Education, the Florence Griffin Joyner Grant through the National Osteoporosis Foundation's Osteoporosis Business Coalition, and the Fiscal Year 2000 New Jersey Food Stamp Nutrition Education Program

# A New Twist on Turns

## JUMP START YOUR BONES

Subject Matter Area Physical Education

Target Audience Middle school students

Areas covered Gymnastics



Time Required 1 class period (40-45 minutes)

Materials



Gymnastics equipment - Choose 3 to 6 activities according to the equipment and facilities that you have available. Set up 1 or 2 stations per activity. **Assign 3 to 4 students per station**, so they will rotate to each station and will not be standing around waiting to use the equipment. The activities from which you can choose are listed below. For each station, the needed equipment also is listed. If you plan to set up 2 stations for a particular activity, you will need 2 sets of all equipment listed.

☆ **Floor Exercise**

1. 3 to 4 tumbling mats
2. 3 to 4 jump ropes

☆ **Take Off Board and Vault**

1. 1 take-off board (springboard)
2. 1 tumbling mat
3. 1 vault (horse)

☆ **Balance Beam**

1. 1 balance beam (low or high)
2. 2 safety mats

☆ **Monkey Bars**

1. 1 set of monkey bars
2. 2 safety mats

☆ **Rope Climb/Peg Board**

1. 1 rope climb or peg board
2. 1 safety mat
3. 1 stopwatch

☆ **Pyramid Building**

1. 3 to 4 safety mats
2. laminated pyramid cards

Handouts:

Gymnastic Activity Sheets

(laminated if possible) to correspond to those activities that you have chosen to set-up (1 per station)

Gymnastics Activity Summary and pens - 1 per group

**If this is the first *Jump Start Your Bones* lesson that you are teaching**, you will need the following handouts: *Calcium Hall of Fame*, *Osteoporosis (Just the Facts) Fact Sheet*, *Calcium and Bones*, *I Can't Eat Dairy Foods*, and *Weight-Bearing Exercises and Bones* - 1 per student

Curriculum Connection This lesson meets the following New Jersey Core Curriculum Content Standards for 5th to 8th grade:



- ⇒ **Standard 2.1** All students will learn health promotion and disease prevention concepts and health enhancing behaviors.
- ⇒ **Standard 2.5** All students will learn and apply movement concepts and skills that foster participation in physical activities throughout life.
- ⇒ **Standard 2.6** All students will learn and apply health-related fitness concepts.

## Learning Objectives

### Knowledge Objectives

- ☆ Students will associate exercise with building stronger bones and muscles.
- ☆ Students will state the benefits of participating in weight-bearing exercises in class and at home.
- ☆ Students will be able to answer one weight-bearing related knowledge question for each exercise that they perform.
- ☆ Students will state that they should be physically active at least 1 hour each day.



### Behavioral Objectives

- ☆ Students will perform weight-bearing exercises during class.
- ☆ Students will perform more weight-bearing exercises at home on their own.

### Skills Used

- ☆ Jumping
- ☆ Balancing
- ☆ Fine motor coordination
- ☆ Strength training
- ☆ Cooperation
- ☆ Team building
- ☆ Qualitative learning assessment

### New Terms

- ☆ *Weight-bearing exercise* - any exercise that involves supporting one's weight with one's bones; examples: running, walking, weight-training, gymnastics, dance, soccer

# Lesson Plan

**If this is the first *Jump Start Your Bones* lesson that you will be teaching, you will need to provide all students with a copy of the following handouts: *Calcium Hall of Fame, Osteoporosis (Just the Facts) Fact Sheet, Calcium and Bones, I Can't Eat Dairy Foods, and Weight-Bearing Exercises and Bones.***

Most physical education teachers are already familiar with teaching gymnastics to their students. This lesson was not created to “re-invent the wheel,” but to help teachers emphasize to students that they should begin osteoporosis prevention during adolescence.

## Before The Lesson

Once you have chosen which activities to do, pull out the appropriate Gymnastic Activity Sheets. Set up the gym with individual activity centers, and mount the activity sheets next to the equipment. Now, proceed in a clockwise manner around the gym, and use a marker to write sequential numbers (1, 2, 3) in the starred boxes provided at the top of the activity sheets. This will allow the students to move systematically from each activity to the next.

1. Introduce the day's lesson by talking to the students about weight-bearing exercise. Provide supplemental information from the lesson background only if they are unable to answer the questions completely on their own.

### **What is weight-bearing exercise?**

Weight-bearing exercises are those that require the bones to hold the weight of the body or to push against some other object, like a weight.

### **Why is weight-bearing exercise important?**

Weight-bearing exercise is important because it strengthens bone density. By building strong bones during adolescence, students can reduce their risk for developing a bone loss disease called osteoporosis. Osteoporosis occurs when people get older, but the foundation for healthy bones is determined between the ages of 11 to 18. The best thing teens can do to prevent osteoporosis is to eat foods high in calcium and to engage in 1 hour of physical activity each day.

### **What is an example of a weight-bearing exercise? What is an example of a non-weight bearing exercise?**

Examples of weight-bearing exercises are numerous. Some are: playing basketball, soccer, kickball, dancing, lifting weights, gymnastics, tumbling, and hanging on the monkey bars. Swimming would be an example of a NON-weight-bearing exercise. This is because the body is floating and the bones are not supporting the body's weight. Although swimming is a good exercise, it does not build bone strength and density.

2. Tell the students that they will be doing weight-bearing exercises as they rotate through some gymnastic stations. Instruct them to think about why each of the exercises is weight-bearing and which bones and muscles they are using during each exercise. Challenge them to think of ways they could adjust the activities to do them at home. Their answers will be discussed at the end of the period.
3. Break the class up into groups of 3 to 4 students, and assign the groups to their stations (Group #1 starts at Activity Station #1, Group #2 at Activity Station #2, etc.). Students will spend about 7 to 10 minutes at each station and will change stations in a clockwise fashion, following the numbers, when the teacher says "rotate" or blows the whistle. Instruction cards are posted at each station.
4. Give **each group** a *Gymnastics Activity Summary* handout and a pen. At each station, they should fill in the answers to the questions as a GROUP on their handout. The answers will be discussed when the class comes back together.
5. Let the students go to each station. The teacher should walk around and ask the students which exercise they are working on and why. It is important that students understand why they are doing these weight-bearing exercises and how the activity will help them in the future.
6. Move the students around the room from station to station. Leave about 15 minutes for discussion.
7. Bring the students back together, and ask what they learned. Go through each of the activities and ask:
  - a. What bones did they work on in each activity?
  - b. What made each of the activities weight-bearing?
  - c. How could they modify the activities so that they could do them at home?

Some examples might be:

- ☆ Using a carpeted area for the mat activities and practicing while watching TV.
- ☆ Using a curb outside or a piece of tape as a balance beam.
- ☆ Thinking of their own pyramid combinations and doing them with their friends.

8. End the class by reminding the students that weight-bearing exercise is important. They should do at least 1 hour of physical activity and eat 4 servings of calcium-rich foods every day to achieve peak bone mass and healthy bodies!

Lesson Developed By Tracy Horner, Andrea S. Smith, Kathleen Klotzbach-Shimomura,  
Debra Palmer Keenan

Funding For The Development of This Lesson Was Provided By The New Jersey  
Department of Health and Senior Services through a grant received by the  
Piscataway Board of Education, the Florence Griffin Joyner Grant through the  
National Osteoporosis Foundation's Osteoporosis Business Coalition, and the  
Fiscal Year 2000 New Jersey Food Stamp Nutrition Education Program

# Skip Your Way to Healthier Bones

## JUMP START YOUR BONES

Subject Matter Area Physical Education

Target Audience Middle school students

Areas covered Jump rope



Time Required 1 class period (40-45 minutes)

Materials



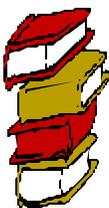
Jump ropes (enough for each group of 3 to 4 students to have 2)

Handouts

You will use the *Weight Bearing Exercises and Bones* handout distributed in the first class

**If this is the first *Jump Start Your Bones* lesson that you are teaching**, you will need the following handouts: *Calcium Hall of Fame*, *Osteoporosis (Just the Facts) Fact Sheet*, *Calcium and Bones*, *I Can't Eat Dairy Foods*, *Weight-Bearing Exercises and Bones* - 1 per student

Curriculum Connection This lesson meets the following New Jersey Core Curriculum Content Standards for 5th to 8th grade:



⇒ **Standard 2.1** All students will learn health promotion and disease prevention concepts and health enhancing behaviors.

⇒ **Standard 2.5** All students will learn and apply movement concepts and skills that foster participation in physical activities throughout life.

⇒ **Standard 2.6** All students will learn and apply health-related fitness concepts.

# Learning Objectives

## Knowledge Objectives

- ☆ Students will associate exercise with building stronger bones and muscles.
- ☆ Students will describe the benefits of participating in weight-bearing exercises.
- ☆ Students will state that they should be physically active at least 1 hour each day.



## Behavioral Objectives

- ☆ Students will perform weight-bearing exercises during class.
- ☆ Students will perform more weight-bearing exercises at home on their own.

## Skills Used

- ☆ Jumping
- ☆ Balancing
- ☆ Fine motor coordination
- ☆ Cooperation
- ☆ Team work

## New Terms

- ☆ *Weight-bearing exercise* - any exercise that involves supporting one's weight with one's bones; examples: running, walking, weight-training, gymnastics, dance, soccer

# Lesson Plan

**If this is the first *Jump Start Your Bones* lesson that you will be teaching, you will need to provide all students with a copy of the following handouts: *Calcium Hall of Fame*, *Osteoporosis (Just the Facts) Fact Sheet*, *Calcium and Bones, I Can't Eat Dairy Foods*, and *Weight-Bearing Exercises and Bones*.**

1. Ask students to read the handout- *Weight-Bearing Exercises and Bones*. Instruct several of the students to read the 5 bullet points aloud to the class. Ask if they think jumping rope is a weight-bearing exercise.

**Why would jumping rope be an example of a weight-bearing exercise?**

When jumping rope, legs are absorbing the whole weight of the body and thereby getting stronger. Also, the bones are working to push the body's weight off the ground, which makes them stronger. Jumping rope is an activity performed by many athletes to get into shape. It's great for the heart, muscles, and bones.

2. Divide the class into small groups, depending on the number of jump ropes available. The groups should contain 3 to 4 students for every 2 ropes.
3. Challenge the students to jump 50 times in a row without stopping.
4. Instruct students to try to double Dutch with 2 jump ropes. Make sure they switch jumpers. If some groups master this, ask them to try jumping on 1 foot, touching the floor, or turning around while they double Dutch.
5. Ask each group to create their own jump rope rhymes about the strengthening effect weight-bearing exercise has on bones. If time allows, encourage each group perform their rhyme in front of the class.
6. Invite the students to try these jump rope activities at home. Tell them that all they need is a jump rope and some space. They should be active at least 1 hour every day to make sure their bones stay healthy and strong for life!
7. End the class by telling the students: **The teen years are the most important time to build strong bones by doing plenty of weight-bearing exercises!**

Lesson Developed by Dana Geissler, Tracy Horner, Andrea S. Smith,  
Kathleen Klotzbach-Shimomura, Debra Palmer Keenan

Funding For The Development of This Lesson Was Provided By The New Jersey Department of Health and Senior Services through a grant received by the Piscataway Board of Education, the Florence Griffin Joyner Grant through the National Osteoporosis Foundation's Osteoporosis Business Coalition, and the Fiscal Year 2000 New Jersey Food Stamp Nutrition Education Program



# JUMP START YOUR BONES



# Don't Chicken Out

## JUMP START YOUR BONES

Subject Matter Area Life Science

Target Audience Middle school students



Topics Covered Observation, hypothesizing, osteoporosis

Time required 1/2 class period, and 1 period 3 days later (20 minutes, 40-45 minutes)



Materials

2 - 250 ml or 500 ml beakers

Vinegar

Thin chicken bone, for example wing bone - 1 per class

Beef bone, for example hind shank or flat marrow bone - 1 per class

Aluminum foil or plastic wrap to cover the beakers

Triple-beam balance

Handouts:

Don't Chicken Out worksheet (2 pages) - 1 set per student

Pulling It All Together worksheet - 1 per student

**If this is the first *Jump Start Your Bones* lesson that you are teaching, you will need the following handouts: *Calcium Hall of Fame, Osteoporosis (Just the Facts) Fact Sheet, Calcium and Bones, I Can't Eat Dairy Foods, Weight-Bearing Exercises and Bones* - 1 per student**

Curriculum Connection This lesson meets the following New Jersey Core Curriculum Content Standards for 5th to 8th grade:



- ⇒ **Standard 5.1** All students will learn to identify systems of interacting components and understand how their interactions combine to produce the overall behavior of the system.
- ⇒ **Standard 5.2** All students will develop problem-solving, decision-making and inquiry skills, reflected by formulating usable questions and hypotheses, planning experiments, conducting systematic observations, interpreting and analyzing data, drawing conclusions, and communicating results.
- ⇒ **Standard 5.6** All students will gain an understanding of the structure, characteristics, and basic needs of organisms.

# Learning Objectives

## Knowledge Objectives

- ☆ Students will state that bone size is a primary factor in maintenance of bone strength.
- ☆ Students will associate a diet high in calcium with stronger bones.
- ☆ Students will associate weight-bearing activity with stronger bones.



## Behavioral Objectives

- ☆ Students will increase the amount of calcium-rich foods in their diets.
- ☆ Students will perform more weight-bearing exercise.

## Skills Used

- ☆ Analyzing
- ☆ Working in groups
- ☆ Inferring
- ☆ Hypothesizing

## New Terms

- ☆ *Density* - thickness, compactness, mass per unit volume
- ☆ *Weight-bearing exercise* - any exercise that involves supporting one's weight with one's bones; examples: running, walking, weight training, gymnastics, dance, soccer
- ☆ *Prevention* - to stop an event from happening
- ☆ *Calcium-fortified* - extra calcium is added to a food normally low in calcium

# Lesson Plan

If this is the first *Jump Start Your Bones* lesson that you will be teaching, you will need to provide all students with a copy of the following handouts: *Calcium Hall of Fame, Osteoporosis (Just the Facts) Fact Sheet, Calcium and Bones, I Can't Eat Dairy Foods, and Weight-Bearing Exercises and Bones.*

## Before the Lesson

- ☆ You may want to boil the chicken and beef bones to cook them. Clean off all visible meat from the bones and rinse them well to prevent odor later. Do not clean with soap, bleach, or abrasives. Dry bones overnight before using them. Use thin chicken bones, such as wing bones for this experiment. The thick, marrow-filled leg bones can be too large for the experiment to work. For the beef bones, either the round hind-shank bones or flat marrow bones work well.

## Class Period 1

This lesson features a demonstration experiment. This portion of the lesson should only take 1/2 class period. The students work together in groups to observe and hypothesize, but the teacher will perform the experiment.

1. Distribute the *Don't Chicken Out-Day 1* worksheet
2. Ask a student to come forward and help you find the masses of the bones that you brought for the experiment. Instruct the class to record the starting masses in Starting Observations on the *Don't Chicken Out-Day 1* worksheet.
3. Aid the students in filling out the remaining parts of the *Starting Observations*. Pass the bones around or, again, have a student come forward and assist. Ask the class use 1-word descriptions for strength (hard, soft, rubbery) and color (off-white, white, gray).

Chicken bone: *strong, hard, thin, whitish-cream color*

Beef bone: *very strong, hard, thick, bright white*

4. Place the bones in the beakers. Add enough vinegar to cover the bones. Cover the beaker with plastic wrap or aluminum foil. Place in a safe place for 2 days.
5. Divide into lab groups to “brainstorm” about what might happen to the bones. Have each group choose one possibility for their hypothesis.
  - a. What do you expect to happen to the chicken bone?  
Answers will vary. Some possible hypotheses may be:

- ☆ *It will get lighter or darker in color.*
- ☆ *It will dissolve.*
- ☆ *It will increase or decrease in mass.*
- ☆ *It will stay the same.*
- ☆ *It will become soft and flexible.*

- b. What do you expect to happen to the beef bone?  
*Answers will vary. They should be similar to those above.*

**2 days later, rinse off the bones and set them out to dry overnight.**

### 3 Days Later

1. Hand out the *Don't Chicken Out-Day 2* worksheet. Allow the class to observe the changes that have occurred in the bones, and their masses. Ask students to review their starting observations from their *Don't Chicken Out-Day 1* worksheet, and record both their starting and ending observations about the bones' mass, color, and hardness in the chart in the top section of the worksheet.
2. Instruct the groups to prepare for discussion by completing the *Discussion* section of the worksheet. Possible answers follow. They are italicized.
  - a. How did the bones change from the start to the end times?
 

*Chicken bone: changed from off-white to a brownish-gray color; is flexible and pliable; its mass decreased by as much as 10%*

*Beef bone: color did not change significantly, except for the marrow color; its outside is slightly soft; overall it is still hard and strong*
  - b. How do the bones differ in relation to each other (at ending time)?  
*Answers will vary as variation of responses in 2.a., above.*
  - c. How are the bones the same (at ending time)?  
*They have a similar color.*
  - d. Was your hypothesis correct? If not, what was different?  
*Answers will vary according to hypothesis.*
  - e. What other observations did you make?  
*Answers will vary according to hypothesis.*
3. Lead the class in a discussion of the *Conclusion* section, assessing why the bones changed as they did.
 

Like the chicken bone, the more dense beef bone will have lost mass. However, because the beef bone had a greater mass and density going into the experiment, it should have been stronger in the end. A person with stronger, more dense bones will suffer fewer effects from bone loss during the aging process than someone with weaker and less dense bones.

- ☆ The chicken bone should have become rubbery and flexible. Its mass should have decreased slightly. The acetic acid in the vinegar leeches the calcium from the bone. Although human bones do not lose calcium from ingesting acetic acid, they naturally become less strong as a person ages. If bones do not achieve peak bone mass during the teen years, they will not be as dense (like the chicken bone) and will suffer more from loss of calcium than someone with bones that have reached peak bone mass and are denser (like the beef bone). This is why calcium intake and weight-bearing exercise are especially important during the teen years and throughout life.
4. Introduce the new terms: density, weight-bearing exercise, prevention, and calcium-fortified (see the page titled, *Learning Objectives* for definitions).
  5. Distribute *Pulling It All Together*, and ask students to get out their *Calcium and Bones* and *Weight-Bearing Exercise and Bones* fact sheets. During the last 10 to 15 minutes of class, bring the class together to discuss the experiment. Read the top of *Pulling it All Together* out loud with the class. Then, instruct the class to complete the worksheet and discuss how these results apply to their bone health and eating and exercise patterns.
    - ☆ When humans age, their bones deteriorate, not because of vinegar, but because of natural processes. Like what took place in this experiment, the differences in bone loss that occur among people depend on their bone density. Some people have bones that are more dense or thicker than others.
    - ☆ Think of your bone density as a bone bank account. The best time to deposit calcium into your bone bank account is during adolescence. Calcium will be withdrawn from the bones throughout your life. The more bone there is to start with, the longer it will last. It is important to deposit plenty of calcium into the bones so that you will have enough calcium throughout your life. Osteoporosis is like bone bankruptcy.

#### Suggestions for the teacher

- ☆ Remember to use thin chicken bones, such as wing bones for this experiment. The thick, marrow-filled leg bones can be too large for the experiment to work. For the beef bones, either the round hind-shank bones or flat marrow bones work well. You can ask a butcher to save bones for you to use in class.

Lesson Created By Dana Geissler, Bethany Beckerdite, Andrea S. Smith,  
Kathleen Klotzbach-Shimomura, Debra Palmer Keenan

Funding For The Development of This Lesson Was Provided By The New Jersey  
Department of Health and Senior Services through a grant received by the  
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# Digest This

## JUMP START YOUR BONES

Subject Matter Area Life Science

Target Audience Middle school students

Topics Covered Anatomy, digestion, osteoporosis



Time required 1 class period (40-45 minutes)

Materials

For each lab group you will need:



4 antacid tablets that contain calcium (Tums, for example)

2 50-ml beakers

50 ml of lemon juice (25 ml per beaker)

Baking soda

Graduated cylinder

Mortar and pestle

2 pieces of paper (for handling the crushed antacids tablets)

Measuring spoon(s) for measuring 1/8 teaspoon baking soda

Handouts

Breaking it Down handout (2 sides, copy front to back) - 1 per student

Digest This! - 1 per student

Review handout - 1 per student

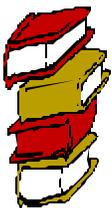
**If this is the first *Jump Start Your Bones* lesson that you are teaching, you will need the following handouts: *Calcium Hall of Fame, Osteoporosis (Just the Facts) Fact Sheet, Calcium and Bones, I Can't Eat Dairy Foods, Weight-Bearing Exercises and Bones* - 1 per student**

Curriculum Connection This lesson meets the following New Jersey Core Curriculum Content Standards for 5th to 8th grade:

⇒ **Standard 5.1** All students will learn to identify systems of interacting components and understand how their interactions combine to produce the overall behavior of the system.

⇒ **Standard 5.2** All students will develop problem-solving, decision-making, and inquiry skills, reflected by formulating usable questions and hypotheses, planning experiments, conducting systematic observations, interpreting and analyzing data, drawing conclusions, and communicating results.

⇒ **Standard 5.6** All students will gain an understanding of the structure, characteristics, and basic needs of organisms.



# Learning Objectives

## Knowledge Objectives

- ☆ Students will identify the organs involved in digestion and list the main function of each one.
- ☆ Students will identify fortified-antacids as a source of calcium.
- ☆ Students will determine that supplements are better absorbed when consumed with a meal.
- ☆ Students will identify osteoporosis as a disease that causes bones to become weak and break.



## Behavioral Objectives

- ☆ Students will increase the amount of calcium in their diets.
- ☆ Students will identify strategies for reducing the risk for osteoporosis.

## Skills Used

- ☆ Analyzing
- ☆ Working in groups
- ☆ Inferring
- ☆ Performing experiments

## New Terms

- ☆ *Prevention* - to stop an event from happening
- ☆ *Supplements* - products made up of 1 or more essential nutrients, such as vitamins, minerals, and protein. (According to the *Dietary Supplement Health and Education Act*, supplements are products intended for ingestion as a supplement to the diet including vitamins; minerals; herbs, botanicals, and other plant-derived substances; and amino acids (the individual building blocks of protein) and concentrates, metabolites, constituents and extracts of these substances.)
- ☆ *Nutrients* - chemical substances that nourish the body
- ☆ *Esophagus* - an organ that participates in digestion by providing a connection from the mouth to the stomach
- ☆ *Stomach* - an organ that acts as a “holding tank” for food; it participates in digestion by breaking down foods; releasing enzymes and acids, and churning the mixture
- ☆ *Small Intestine* - the organ most responsible for nutrient absorption; it is lined with villi
- ☆ *Villi* - tiny finger-like cells in the small intestine that release digestive enzymes and absorb nutrients
- ☆ *Large Intestine* - the organ most responsible for absorption of water
- ☆ *Peak Bone Mass* - when your bones are as strong and as dense as they can get

## Lesson Plan

If this is the first *Jump Start Your Bones* lesson that you will be teaching, you will need to provide all students with a copy of the following handouts: *Calcium Hall of Fame*, *Osteoporosis (Just the Facts) Fact Sheet*, *Calcium and Bones, I Can't Eat Dairy Foods*, and *Weight-Bearing Exercises and Bones*.

1. Distribute the *Breaking it Down* handout and ask students to take out their *Calcium and Bones*, *Weight-Bearing Exercise and Bones*, and *Osteoporosis Just the Facts* handouts. Discuss calcium-rich foods using the *Calcium and Bones* handout.
2. Introduce the experiment by telling students that today they will examine calcium digestion and absorption. Explain that calcium is important to them throughout their lives, but that it is particularly important for teens, because adolescence is the best time to build peak bone density. Explain that they also will be examining whether it is better to take supplements with or without food. State that a supplement is most effective when it is dissolved in the stomach within 30 minutes of arriving there (1). If it takes longer to dissolve, it will pass into the intestines and is not likely to dissolve and be absorbed well.
3. Have the students gather their materials and perform their experiments in groups of 2 to 4, according to the directions on the *Breaking It Down* handout.

**For Teacher:** The lemon juice in this experiment has an approximate pH of 2.2 (2). The pH of the stomach with food is approximately 1 to 2 (or very acidic). As you can see, the pH of the lemon juice is similar to that of a stomach with food. The pH of the stomach without food is approximately 3.5, or less acidic (more basic) than the stomach with food. The pH of the lemon juice with 1/8 teaspoon of baking soda added is also approximately 3.5. When the students dissolve the 2 crushed antacid tablets (inexpensive calcium supplements) in the plain lemon juice, the time it takes for the supplements to dissolve should range from approximately 18 to 22 minutes. When students dissolve the supplements in the more basic solution, the lemon juice with baking soda, the time it takes for the supplements to dissolve should range from 34 to 48 minutes. Therefore, students can correctly conclude that it is much better for people to take supplements with food.

4. While waiting for the experiments' reactions to occur, distribute the *Digest This!* and *Review* handouts to each student. Remind the students that they should take turns monitoring the tablets, while they dissolve. When they are not serving as monitor, instruct them to review all handouts, so they will be prepared to play *Calcium Pursuit*.

5. Lead a group discussion on the digestion of calcium and the anatomy and physiology involved.
6. Discuss:
  - ☆ the time it took for the supplement in the 2 solutions to dissolve;
  - ☆ whether it is better to consume supplements with or without food; and,
  - ☆ the potential benefits of supplements for those who do not consume at least 4 calcium-rich foods a day.
7. If necessary, allow students to continue to prepare for *Calcium Pursuit*.
8. Play *Calcium Pursuit* with the class.

Suggestions for the teacher

- ☆ If time permits, you can set up and compare other supplements, using the same methods.
- ☆ It may be helpful to have one student be the scorekeeper during *Calcium Pursuit*.

Lesson Created By Bethany Beckerdite, Sonya Sadani, Kathleen Klotzbach-Shimomura, Debra Palmer Keenan

Funding For The Development of This Lesson Was Provided By The New Jersey Department of Health and Senior Services through a grant received by the Piscataway Board of Education, the Florence Griffin Joyner Grant through the National Osteoporosis Foundation's Osteoporosis Business Coalition, and the Fiscal Year 2000 New Jersey Food Stamp Nutrition Education Program

1. Clarke, Mary Ph.D., *Dairy Council Digest* 66, no.1 (Jan/Feb 1995).
2. Horrace & Davenport W. *Physiology of the Digestive System*. 4th ed. Yearbook Publishing Co., 1977

# Calcium Pursuit

Ask students to put away all of their fact sheets and notes. In groups, allow students to answer questions by having only 1 person per group raise her or his hand. Questions 1 to 10 are worth 500 points and questions 11 to 18 are worth 1000 points. Inform students that responses must be given in the form of a question.

## Round 1 – 500 points each

**Question 1: The small particles into which the digestive system breaks down food**

**Answer:** What are nutrients?

**Question 2: The site where most nutrient absorption takes place**

**Answer:** What is the small intestine?

**Question 3: The finger-like cells inside the small intestine**

**Answer:** What are villi?

**Question 4: What happens to good calcium supplements after 30 minutes in the stomach**

**Answer:** What is dissolve?

**Question 5: The two things that break down food in the stomach**

**Answer:** What are churning and acid?

**Question 6: This causes the amount of acid in the stomach to increase**

**Answer:** What is food (or the presence of food)?

**Question 7: The site of calcium deposits**

**Answer:** What are bones (or the skeleton)?

**Question 8: The tube that connects the mouth and the stomach**

**Answer:** What is the esophagus?

**Question 9: The fluid that begins the breakdown of sugar in the mouth**

**Answer:** What is saliva?

**Question 10: A disease where your bones become weak and break**

**Answer:** What is osteoporosis?

## Round 2 – 1000 points each

**Question 11: 3 calcium-rich foods**

**Answer:** (answers will vary)

**Question 12: The type of exercise that promotes bone strength**

**Answer:** What is weight-bearing exercise?

**Question 13: The body parts most affected by osteoporosis**

**Answer:** What are bones?

**Question 14: The food group containing foods that are the best dietary source of calcium**

**Answer:** What is the dairy food group?

**Question 15: The starting place for digestion**

**Answer:** What is the mouth?

**Question 16: Two purposes of calcium circulation in the blood**

**Answer:** What are muscle contraction and nerve functioning?

**Question 17: An exercise which is not considered weight-bearing**

**Answer:** What is swimming (or biking)?

**Question 18: The minimum number of calcium-rich foods teens should eat every day**

**Answer:** What is 4?

## **Final Round**

Each team has the opportunity to wager the points that they have won. Teams should write their answer to the final question on a piece of paper. Allow 30 seconds for wagering (each team can bet as many points as they have acquired) and 60 seconds for writing the answer on the paper. After 60 seconds, tell each team to hold up its paper, so that answers cannot be changed.

**Final Question: The best time in your life to build peak bone mass**

**Answer:** What are your teen years (is adolescence)?

# What's G Got to Do With It?

## JUMP START YOUR BONES

Subject Matter Area Life Science

Target Audience Middle school students

Topics Covered Weight-bearing exercise, gravity, space missions, astronauts, osteoporosis



Time required 1 class period (40-45 minutes)

Materials

At least 1 computer with internet access for every 2-3 students



Handouts

What's G Got To Do With It? Web Notes - 1 per group

NASA Physical Training Log - 1 per group

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- ⇒ **Standard 5.6** All students will gain an understanding of the structure, characteristics, and basic needs of organisms.

# Learning Objectives

## Knowledge Objectives

- ☆ Students will describe the relationships among gravity, weight, and bone health.
- ☆ Students will design an exercise plan that keeps bones and muscles strong.
- ☆ Students will identify that weight-bearing exercise is needed daily on Earth to prevent bone loss.
- ☆ Students will state that teens should be physically active at least 1 hour each day.
- ☆ Students will state that teens should consume at least 4 calcium-rich foods daily.



## Behavioral Objectives

- ☆ Students will perform more weight-bearing exercise.

## Skills Used

- ☆ Using the internet
- ☆ Analyzing
- ☆ Working in groups
- ☆ Inferring

## New Terms

- ☆ *Weight bearing exercise* - any exercise that involves supporting one's weight with her/his bones; examples: running, walking, weight training, gymnastics, dance, soccer
- ☆ *Prevention* - to stop an event from happening
- ☆ *Gravity* - a force that pulls 2 objects toward each other and its strength is dependent on mass
- ☆ *Resistance* - a force that opposes motion
- ☆ *DXA* - an x-ray like machine used to measure bone density (strength)
- ☆ *Rowing machine* - a machine that allows you to move as if rowing a boat

## Additional Background Information

This lesson focuses on weight-bearing exercises and space flight. Lack of gravity in space means that weight-bearing exercise is only available in the form of resistance exercise. Without gravity, astronauts can lose about 1 percent of their bone mass per month when they are in space. If a mission lasts 30 months, astronauts could lose close to 30 percent of their bone mass.

Experiments are being run in space on the following types of bone cells:

- ☆ Osteoblasts - cells that build new bone cells; production of these cells ceases in space flight.
- ☆ Osteoclasts - cells that clear out old bone cells; they are not affected by space flight so more bone is removed than is being replaced.

Osteoclasts and osteoblasts work together in clearing out old bone and replacing it with new bone. Scientists are trying to determine why osteoblasts die at a more rapid rate in space than on Earth, and are looking for ways to prevent the bones from weakening. If humans are to live in space, this problem must be overcome.

The following information is from the web-site (as of 6/22/01):

<http://www.kingston.ac.uk/sec/ask/toll.htm>

Astronauts must participate in vigorous exercise in space to help maintain bone and muscle mass. If they don't, muscles and bones shrink due to the lack of gravity.

“This is particularly true of the legs, that are used very little in everyday space flight. This has led to all missions now carrying exercise machines, including treadmills and exercise bicycles. However, to combat the effects of micro-gravity it is often necessary for the astronauts to exercise up to 3 hours per day! This amount of exercise will maintain their fitness and ensure they do not suffer too many ill effects when they return to Earth.”

Aside from problems created as a result of reduced weight-bearing activity in the absence of gravity, bones start to break down while in orbit. On Earth, the body is constantly building new bone with osteoblast cells. Cells called osteoclasts then clear out the old cells. This process is known as remodeling. In space, the bones break down in orbit because the body stops producing osteoblasts, while the osteoclasts continue to work. “This can also be a major problem when returning to Earth after a long space flight, when brittle bones could increase the chance of breakage.”

Similar problems can occur on earth when a person does not consume enough calcium or participate in adequate weight-bearing exercises. Adolescence is an especially vulnerable time, because it is the time when the most bone is

being built. Therefore, it is important that adolescents eat at least 4 calcium-rich foods and participate in weight-bearing exercises every day. Teens should be physically active each day for at least 1 hour.

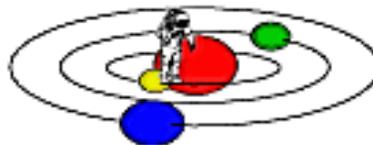
Check out (as of 6/22/01): <http://www.spacedu.com>

From this website you can download a Power Point presentation on "Living and Working in Space." Featured is more discussion on osteoporosis as well as a picture of an astronaut doing weight-bearing exercise.

Astronauts also use exercise bicycles, rowing machines, and treadmills to combat bone loss associated with weightlessness. They are attached to these machines so they won't float away. The main exercise machine used by astronauts is called an ergometer. An ergometer is better than a treadmill, and much better than a bicycle in providing resistance activity. Recreational biking, the kind that teens may typically do at home, is generally not considered to be a weight-bearing exercise. However, biking promotes cardiovascular health. The ergometer resembles a bicycle but differs in that the user lies down and pedals with his or her legs parallel to the ground. There are bands around the 'wheel' to make sure that the pedals have a lot of resistance pushing against the user's legs. Rowing machines are also used for keeping the arm, shoulder, back, and chest muscles strong. While using the machine, your lower body is strapped down in a sitting position while you alternate moving each arm forward and then pulling it backward, in a rowing motion. Pictures of these exercises are included on the website that students will access for this lesson:

<http://www.fsneprutgers.edu>

Once students are on the website, they will click on the section that is labeled:



[Walk Through a  
Space Mission](#)

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## Activity 1 - 10 minutes

1. Explain to the students the following scenario:  
As NASA physicians, they have been chosen to develop an exercise plan for astronauts on a space station. To do this, they need to receive special training from the Web, as well as learn about weight-bearing exercise from their handouts.
2. Define and discuss any new terms listed in the *New Terms* section at the beginning of the lesson. Ask students to take out their *Weight-Bearing Exercise and Bones* handouts.
3. Review the *Weight-Bearing Exercise and Bones* handout.

## Activity 2 - 10-15 minutes

1. Ask the students to break into small groups of 2 to 3 students per group, depending on what you feel would work best for that class.
2. Pass out one copy of the *What's G Got To Do With It? Web Notes* worksheet to each group.
3. Instruct students to:
  - ☆ Go to the website: <http://www.fsnep.rutgers.edu>.
  - ☆ Click on *Walk Through a Space Mission* (It is on the right side of the home page.)
  - ☆ Read the text, view the pictures, and record their answers on their worksheets.

## Activity 3 - 10-15 minutes

1. Distribute the *NASA Physical Training Log* to each group.
2. Allow each group to design an exercise plan. Remind students that there is no gravity in space and for the exercises to be effective, they must include resistance in place of weight-bearing exercise.
3. Bring the class together to discuss plans the groups have made.

4. Lead a class discussion about osteoporosis on Earth.
  - ☆ Ask, "What can people do to avoid osteoporosis on Earth?" Be sure that the discussion includes performing weight-bearing exercise and eating at least 4 calcium-rich foods every day. Stress that the most important time for storing calcium in the bones is during adolescence, when the bones are most available for calcium deposition.
  - ☆ Suggest that at least 1 hour of physical activity is needed every day on Earth to maintain good health. Ask students if they think they do weight bearing exercises each day and what they exercises they do. (Refer to the *Weight Bearing Exercise and Bones* handout.)
  - ☆ Discuss how adolescence is the most important time for building strong bones to avoid osteoporosis later in life.

Suggestions for the teacher

- ☆ This assignment can be stretched to a 2-period lab by allowing more time to design the experiment, more discussion, or having the groups present their results (or do additional related web searches).
- ☆ If time is short, assign the worksheet for homework and discuss it the following class period.

Lesson Created By Bethany Beckerdite, Dana Geissler, Kathleen Klotzbach-Shimomura, Debra Palmer Keenan

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