

THE SCIENCE OF

FOOD AND

FITNESS



## Serving Sizes

*by*

**Nancy P. Moreno, Ph.D.**

**Sonia Rahmati Clayton, Ph.D.**

**Paula H. Cutler**

**Martha S. Young**

**Barbara Z. Tharp, M.S.**

## RESOURCES

For online presentations of each activity and downloadable slide sets for classroom use, visit <http://www.bioedonline.org> or <http://www.k8science.org>.

**BCM**<sup>®</sup>  
Baylor  
College of  
Medicine

© Copyright 2012 Baylor College of Medicine  
All rights reserved.  
Printed in the United States of America

ISBN-13: 978-1-888997-56-9

# BioEd<sup>SM</sup>

Teacher Resources from the Center for Educational Outreach at Baylor College of Medicine.  
The mark "BioEd" is a service mark of Baylor College of Medicine.

The information contained in this publication is intended solely to provide broad consumer understanding and knowledge of health care topics. This information is for educational purposes only and should in no way be taken to be the provision or practice of medical, nursing or professional health care advice or services. The information should not be considered complete and should not be used in place of a visit, call or consultation with a physician or other health care provider, or the advice thereof. The information obtained from this publication is not exhaustive and does not cover all diseases, ailments, physical conditions or their treatments. Call or see a physician or other health care provider promptly for any health care-related questions.

The activities described in this book are intended for school-age children under direct supervision of adults. The authors, Baylor College of Medicine (BCM) and the National Space Biomedical Research Institute (NSBRI) cannot be responsible for any accidents or injuries that may result from conduct of the activities, from not specifically following directions, or from ignoring cautions contained in the text. The opinions, findings and conclusions expressed in this publication are solely those of the authors and do not necessarily reflect the views of BCM, NSBRI or the National Aeronautics and Space Administration (NASA).

Cover Images: Photographs of people and scales © Rubberball Productions. Photographs of fruit © JupiterImages Corporation.

Authors: Nancy P. Moreno, Ph.D., Sonia Rahmati Clayton, Ph.D., Paula H. Cutler, B.S., Martha S. Young, B.F.A., and Barbara Z. Tharp, M.S.  
Senior Editor: James P. Denk, M.A.  
Creative Director: Martha S. Young, B.F.A.

## ACKNOWLEDGMENTS

The authors gratefully acknowledge the support of Bobby R. Alford, M.D., Jeffrey P. Sutton, M.D., Ph.D., William A. Thomson, Ph.D., Jeanne Lynn Becker, Ph.D., Marlene Y. MacLeish, Ed.D., and Kathryn S. Major, B.A., as well as the contributions of the following guest content reviewers: Lindsey Briggs, B.S., Michael Grusak, Ph.D., Helen W. Lane, Ph.D., Joanne Lupton, Ph.D., Barbara Rice, R.D, L.D., and Lisa Sanders, Ph.D.

This work was supported by National Space Biomedical Research Institute through NASA NCC 9-58.

No part of this book may be reproduced by any mechanical, photographic or electronic process, or in the form of an audio recording; nor may it be stored in a retrieval system, transmitted, or otherwise copied for public or private use without prior written permission of the publisher. Black-line masters reproduced for classroom use are excepted.

## NATIONAL SPACE BIOMEDICAL RESEARCH INSTITUTE

1 Baylor Plaza, NA-425, Houston, Texas 77030-3498  
[www.nsbri.org](http://www.nsbri.org)

## CENTER FOR EDUCATIONAL OUTREACH

Baylor College of Medicine, 1 Baylor Plaza, BCM411, Houston, Texas 77030  
713-798-8200 / 800-798-8244 / [www.bcm.edu/edoutreach](http://www.bcm.edu/edoutreach)

**BCM**  
Baylor  
College of  
Medicine



## SOURCE URLs

### AMERICAN HEART ASSOCIATION

[www.americanheart.org](http://www.americanheart.org)

### BAYLOR COLLEGE OF MEDICINE BIOED ONLINE / K8 SCIENCE

[www.bioedonline.org](http://www.bioedonline.org) / [www.k8science.org](http://www.k8science.org)

### CENTER FOR EDUCATIONAL OUTREACH

[www.bcm.edu/edoutreach](http://www.bcm.edu/edoutreach)

### CENTERS FOR DISEASE CONTROL AND PREVENTION

[www.cdc.gov](http://www.cdc.gov)

### NATIONAL AERONAUTICS AND SPACE ADMINISTRATION (NASA)

#### NASA CONNECT™

<http://connect.larc.nasa.gov>

#### NASA IMAGES

[www.nasaimages.org](http://www.nasaimages.org)

#### NASA JOHNSON SPACE CENTER

[www.nasa.gov/centers/johnson/astronauts/  
journals\\_astronauts.html](http://www.nasa.gov/centers/johnson/astronauts/journals_astronauts.html)

### NATIONAL INSTITUTES OF HEALTH

#### NATIONAL HEART, LUNG, AND BLOOD INSTITUTE

[www.nhlbi.nih.gov](http://www.nhlbi.nih.gov)

#### NATIONAL INSTITUTE OF ALLERGY AND INFECTIOUS DISEASES

[www3.niaid.nih.gov](http://www3.niaid.nih.gov)

#### NATIONAL INSTITUTE OF DIABETES AND DIGESTIVE AND KIDNEY DISEASES

[www2.niddk.nih.gov](http://www2.niddk.nih.gov)

### NATIONAL RESEARCH COUNCIL

#### NATIONAL SCIENCE EDUCATION STANDARDS

[www.nap.edu/openbook.php?record\\_id=4962](http://www.nap.edu/openbook.php?record_id=4962)

### NATIONAL SPACE BIOMEDICAL RESEARCH INSTITUTE

[www.nsbri.org](http://www.nsbri.org)

### U.S. FOOD AND DRUG ADMINISTRATION

#### MY PYRAMID.GOV

[www.mypyramid.gov](http://www.mypyramid.gov)

#### USDA NATIONAL NUTRIENT DATABASE FOR STANDARD REFERENCE

[www.nal.usda.gov/fnic/foodcomp/search](http://www.nal.usda.gov/fnic/foodcomp/search)

# TEAMING WITH BENEFITS

by Jeffrey P. Sutton, M.D., Ph.D., Director, National Space Biomedical Research Institute (NSBRI)

Space is a challenging environment for the human body. With long-duration missions, the physical and psychological stresses and risks to astronauts



Dr. Jeffrey P. Sutton

are significant. Finding answers to these health concerns is at the heart of the National Space Biomedical Research Institute's program. In turn, the Institute's research is helping to enhance medical care on Earth.

The NSBRI, a unique partnership between NASA and the academic and industrial communities, is advancing biomedical research with the goal of ensuring a safe and productive long-term human presence in space. By developing new approaches and countermeasures to prevent, minimize and reverse critical risks to health, the Institute plays an essential, enabling role for NASA. The NSBRI bridges the research, technological and clinical expertise of the biomedical community with the scientific, engineering and operational expertise of NASA.

With nearly 60 science, technology and education projects, the NSBRI engages investigators at leading institutions across the nation to conduct goal-directed, peer-reviewed research in a team approach. Key working relationships have been established with end users, including astronauts and flight surgeons at Johnson Space Center, NASA scientists and engineers, other federal agencies, industry and international partners. The value of these

collaborations and revolutionary research advances that result from them is enormous and unprecedented, with substantial benefits for both the space program and the American people.

Through our strategic plan, the NSBRI takes a leadership role in countermeasure development and space life sciences education. The results-oriented research and development program is integrated and implemented using focused teams, with scientific and management directives that are innovative and dynamic. An active Board of Directors, External Advisory Council, Board of Scientific Counselors, User Panel, Industry Forum and academic Consortium

help guide the Institute in achieving its goals and objectives.

It will become necessary to perform more investigations in the unique environment of space. The vision of using extended exposure to microgravity as a laboratory for discovery and exploration builds upon the legacy of NASA and our quest to push the frontier of human understanding about nature and ourselves.

The NSBRI is maturing in an era of unparalleled scientific and technological advancement and opportunity. We are excited by the challenges confronting us, and by our collective ability to enhance human health and well-being in space, and on Earth.

## NSBRI RESEARCH AREAS

### CARDIOVASCULAR PROBLEMS

The amount of blood in the body is reduced when astronauts are in microgravity. The heart grows smaller and weaker, which makes astronauts feel dizzy and weak when they return to Earth. Heart failure and diabetes, experienced by many people on Earth, lead to similar problems.

### HUMAN FACTORS AND PERFORMANCE

Many factors can impact an astronaut's ability to work well in space or on the lunar surface. NSBRI is studying ways to improve daily living and keep crewmembers healthy, productive and safe during exploration missions. Efforts focus on reducing performance errors, improving nutrition, examining ways to improve sleep and scheduling of work shifts, and studying how specific types of lighting in the craft and habitat can improve alertness and performance.

### MUSCLE AND BONE LOSS

When muscles and bones do not have to work against gravity, they weaken and begin to waste away. Special exercises and other strategies to help astronauts' bones and muscles stay strong in space also may help older and bedridden people, who experience similar problems on Earth, as well as people whose work requires intense physical exertion, like firefighters and construction workers.

### NEUROBEHAVIORAL AND STRESS FACTORS

To ensure astronaut readiness for spaceflight, preflight prevention programs are being developed to avoid as many risks as possible to individual and

group behavioral health during flight and post flight. People on Earth can benefit from relevant assessment tests, monitoring and intervention.

### RADIATION EFFECTS AND CANCER

Exploration missions will expose astronauts to greater levels and more varied types of radiation. Radiation exposure can lead to many health problems, including acute effects such as nausea, vomiting, fatigue, skin injury and changes to white blood cell counts and the immune system. Longer-term effects include damage to the eyes, gastrointestinal system, lungs and central nervous system, and increased cancer risk. Learning how to keep astronauts safe from radiation may improve cancer treatments for people on Earth.

### SENSORIMOTOR AND BALANCE ISSUES

During their first days in space, astronauts can become dizzy and nauseous. Eventually they adjust, but once they return to Earth, they have a hard time walking and standing upright. Finding ways to counteract these effects could benefit millions of Americans with balance disorders.

### SMART MEDICAL SYSTEMS AND TECHNOLOGY

Since astronauts on long-duration missions will not be able to return quickly to Earth, new methods of remote medical diagnosis and treatment are necessary. These systems must be small, low-power, noninvasive and versatile. Portable medical care systems that monitor, diagnose and treat major illness and trauma during flight will have immediate benefits to medical care on Earth.

For current, in-depth information on NSBRI's cutting-edge research and innovative technologies, visit [www.nsbri.org](http://www.nsbri.org).

# OVERVIEW

Students will estimate serving sizes of different foods and compare their estimates to serving size information provided on Nutrition Facts food labels.



# SERVING SIZES

**F**ood labels and other guides often use “serving size” to describe a recommended single portion of a food. Serving sizes are different for various kinds of food (liquid versus solid foods, and cooked versus raw foods). In many cases, the amount specified as a serving size for a particular food is smaller than the amount typically eaten.

Frequently, the serving sizes listed on Nutrition Facts labels of food packages are larger than the serving sizes listed by other guides to healthy eating, such as the USDA Food Pyramid. Serving sizes listed on food labels are designed to make it easier to compare the calorie, carbohydrate and fat content of similar products, and to identify nutrients present in a food. Used appropriately, the information on food labels can help consumers make better food choices.

## SCIENCE EDUCATION CONTENT STANDARDS\* GRADES 5–8

### LIFE SCIENCE

- Plants and some microorganisms are producers—they make their own food. All animals, including humans, are consumers, which obtain food by eating other organisms.

### SCIENCE IN PERSONAL AND SOCIAL PERSPECTIVES

- Food provides energy and nutrients for growth and development. Nutrition requirements vary with body weight, age, sex, activity, and body functioning.

### SCIENCE, HEALTH & MATH SKILLS

- Estimating dry and liquid measures of volume
- Estimating appropriate portion sizes

\* National Research Council. 1996. National Science Education Standards. Washington, D.C., National Academies Press.

This activity introduces students to solid and liquid measures and to the concept of “serving size.”

## TIME

15 minutes for setup; 45 minutes to conduct activity

## MATERIALS

- 3 large containers for dry sample foods
- 2-liter bottle of regular soft drink
- 2 identical packages of each of the following: frozen peas, dry breakfast cereal, popped popcorn

**Note.** Remove and save the Nutrition Facts labels from all items (see Setup).

## Each group will need:

- 6 paper plates (for dry foods)
- 2 large cups or containers (for liquids)
- 2 measuring cups (one for solids, one for liquids)
- Permanent marker
- Copy of “What is a Serving Size?” sheet (p. 3)
- Prepared copy of “Nutrition Facts Labels” page (see Setup)
- 4 copies of “Estimates and Labels” sheet (p. 4)

## SETUP & MANAGEMENT

Create a “Nutrition Facts Labels” page by pasting all of the labels saved from the food items above onto a sheet of paper (eliminating duplicates). Display the three dry food items and the bottle of soft drink at a food station within the classroom. Place all materials in a central location

## Labels are Important

The Nutrition Facts labels on packaged foods can help people make better choices. Labels list the amounts of nutrients present in each food, in grams or as a percentage of the Recommended Dietary Allowance (RDA). The Nutrition Facts label is designed to help consumers select foods that will meet their dietary needs.

## Food Labels and Fats

If an ingredient list on a food label includes the words “shortening,” “partially hydrogenated vegetable oil,” or “hydrogenated vegetable oil,” the food contains trans fats and might not be a healthy choice. Diets high in trans fats may increase the risks of heart disease and stroke. (See sidebars, pp. 6 and 17 for more information on fats and trans fats.)



### Equivalent Measures

- 1 tbs = 3 tsp
- 4 tbs = 1/4 cup
- 8 tbs = 1/2 cup
- 12 tbs = 3/4 cup
- 16 tbs = 1 cup

### Liquid Measures

- 1 oz = 2 tbs
- 2 oz = 1/4 cup
- 4 oz = 1/2 cup
- 6 oz = 3/4 cup
- 8 oz = 1 cup
- 16 oz = 2 cups
- 32 oz = 4 cups

### Dry Measures

- 4 oz = 1/4 lb
- 8 oz = 1/2 lb
- 12 oz = 3/4 lb
- 16 oz = 1 lb

### Reliable Sources

Reliable information about health and related topics is available online at the following Web sites.

**American Heart Association**  
www.americanheart.org

**Centers for Disease Control and Prevention**  
www.cdc.gov

**MedLine Plus\***  
http://medlineplus.gov

**National Heart, Lung, and Blood Institute**  
www.nhlbi.nih.gov

**National Institute of Allergy and Infectious Diseases**  
www3.niaid.nih.gov

**National Institute of Diabetes and Digestive and Kidney Diseases**  
www2.niddk.nih.gov

\*Health information is available in more than 40 languages.

## PORTIONS VERSUS SERVINGS\*

Food Item	Normal Portion	No. of Servings Represented
Bagel	1 whole (4 oz)	4
Muffin	1 large (5 oz)	5
Cinnamon bun	1 large (3 oz)	3
Flour tortilla	1 burrito-sized (10 in.)	3
Tortilla chips	1 individual bag (9–13 chips)	2
Popcorn	Movie theatre medium (16 cups)	8
Baked potato	One large (about 4-1/4 in. diameter)	4
French fries	Medium size order (5 oz)	4
Fried chicken	3 pieces (7–8 oz)	3
Steak	1 large (13 oz)	5
Sliced ham or roast beef	Amount in typical deli sandwich (5 oz)	2

\* Portions of many common foods consist of more than one “serving size.”

for Materials Managers to collect. Have students work in groups of four.

### PROCEDURE

1. Ask students, *What is a serving size?* Use students’ answers to guide them into a discussion of food portions. Explain that food portions frequently are measured in terms of “cups,” pieces or other units. Show students the measuring cups that they will be using to measure dry and liquid foods. Point out to students that each unit commonly used in cooking can be translated to standard international (metric) units, such as liters or grams.
2. After students have discussed food portions and serving sizes, challenge them to predict serving sizes for liquid and solid foods.
3. Have Materials Managers pick up the materials for each group. Give each group a copy of the “What is a Serving Size?” sheet. Have students follow the instructions on their activity sheets to label the plates and cups, and predict appropriate portion sizes for each of the four foods.
4. Once students have completed their predictions, allow each group to measure and place the corresponding amounts of each food into the cup and on the plates labeled “Estimate.”
5. After students have measured out the amounts of food representing their predicted serving sizes, give each group a copy of the “Nutrition Facts Labels” page.
6. Help students find the manufacturers’ suggested serving sizes for each food on the labels. Have students measure and place one serving (as indicated on the label) into the cup and on the plates marked “Food Label.” Have students observe and compare the amounts they estimated as one serving size with the amounts actually listed on the food labels.
7. Allow each group to share its findings with the rest of the class.
8. Distribute a copy of the “Estimates and Labels” sheet to each student. Help students find other relevant information on the label, such as total calories needed and amounts of important nutrients. Point out the Quick Hand Measures of portion sizes on the sheet. Ask, *Do you think food labels can help you make better decisions about what and how much to eat?*

### EXTENSIONS

- In order to learn about “hidden sugar” in different foods and drinks, have students compare the amounts of sugar listed on the labels of fruit juices, soft drinks, cookies, cereal, baked goods and other foods (4g of sugar = 1 tsp).

# ACTIVITY

## WHAT IS A SERVING SIZE?

Have you ever wondered what are appropriate serving sizes of different foods? You will be investigating serving sizes of the foods displayed in your classroom. You will need six plates and two cups. Label three of the plates and one cup as "Estimate." Mark the other three plates and cup as "Food Label."

### Serving Size: Estimates

1. Write the name of each food under the Food Name column on Table 1.
2. For each food, decide how many cups (or fractions of cups) make up one serving size. Record your estimates on the table.
3. Take the plates and cup labeled "Estimate" to the station where the foods are displayed. Also bring this sheet with your serving size estimates. Measure out what you recorded (estimated) for one serving size of each food on a plate or in the cup. Take a look at the amounts you measured. Are they more or less than you expected?

**Table 1. Estimates**

Food Name	Estimate one serving of this food. Use cups as a measure.

### Serving Size: Nutrition Facts Labels

1. Look at the copy of the Nutrition Facts labels of the foods. Write the name of each of the foods under the Food Name column on Table 2.
2. Find the serving size recommendations on each Nutrition Facts label. Write the recommended serving size listed on the Nutrition Facts label for each food in the appropriate space.

**Table 2. Nutrition Facts Label Recommended Serving Size**

Food Name	Nutrition Facts label serving size. Use cups as a measure.

2. Take the plates and cup marked "Food Label" to the food station. Measure out the appropriate amounts of each food, based on the Nutrition Facts labels. Put each portion on a plate or in the cup.
3. Compare your serving size estimates to the serving sizes recommended by the Nutrition Facts labels. Describe any differences below.

---



---



---



---

4. Based on the information you collected, why do you think it might be important to look at the serving sizes listed on food labels? Record your answer on the back of this sheet.

# ACTIVITY

# ESTIMATES AND LABELS

Serving sizes often are smaller than the portions we actually eat.

Look for low levels of saturated, hydrogenated and trans fats. These are unhealthy.

Cholesterol is found in foods of animal origin.

Look for foods that have more carbohydrates as fiber and fewer as sugar. Only foods from plants provide fiber.

Protein is important for muscles and growth. It is found in animal and plant foods.

Vitamins and minerals are essential for health. Calcium is important for bones and teeth.

Use this section as a guide for daily planning. The amount of calories needed by each person depends on many factors, including exercise. Foods with high amounts of saturated fats or sugars may not represent the best choices.

## Refried Beans Fat Free

### Nutrition Facts

Serving Size 1/2 cup (125g)  
Serving Per Container 3.5

Amount Per Serving	
<b>Calories</b> 130	Calories from Fat 0
% Daily Value*	
<b>Total Fat</b> 0g	<b>0%</b>
Saturated Fat 0g	
Trans Fat 0g	<b>0%</b>
<b>Cholesterol</b> 0mg	<b>0%</b>
<b>Sodium</b> 490mg	<b>20%</b>
<b>Total Carbohydrate</b> 24g	<b>8%</b>
Dietary Fiber 7g	<b>28%</b>
Sugars 0g	<b>0%</b>
<b>Protein</b> 9g	<b>16%</b>
Vitamin A	<b>0%</b>
Vitamin C	<b>0%</b>
Calcium	<b>6%</b>
Iron	<b>15%</b>

\* Percent Daily Values are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your calorie needs:

	Calories:	2,000	2,500
Total Fat	Less than	65g	80g
Sat Fat	Less than	20g	25g
Cholesterol	Less than	300mg	300mg
Sodium	Less than	2,400mg	2,400mg
Total Carbohydrate		300g	375g
Dietary Fiber		25g	30g

## Quick Hand Measures

Use the Quick Hand Measures to estimate the size of one serving of different foods.



A closed fist

=

Piece of fruit or cup of raw vegetables



Two fingers

=

Ounce of cheese



A cupped hand

=

Cup of dry cereal



An open palm

=

Single serving of meat



Tip of thumb

=

Teaspoon of butter

