

## Anti-oxidants and Free Radicals

### *A math and science lesson with a nutrition component*



**Grade level: 4** (Lesson plan and activities adaptable for grades 2, 3 and 5)

**Subjects:** Math, Science, Health and Nutrition

**Time Allotted for the Lesson:** 45 to 60 minutes for lesson plan and 1 activity

**Brief lesson description:** This lesson will focus on the benefits of antioxidants, found in plant based foods, and practical ways to incorporate them into the diet. Students will use the ORAC (Oxygen Radical Absorbance Capacity) scale to measure the amount of antioxidants found in fruits and vegetables.

#### **Classroom Layout and Grouping of Students:**

Students will need to come up to the front of the classroom.

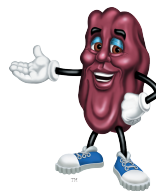
Optional: If equipped with a computer lab, integrate the bar graph activity on PowerPoint.

#### **Instructional Objectives:**

1. Students will be able to describe how antioxidants work in their bodies.
2. Students will be able to list the benefits of eating foods high in antioxidants.
3. Students will be able to state what ORAC stands for and what it measures.
4. Students will demonstrate an understanding of pie charts and bar graphs.
5. Students will understand and be able to conceptualize simple fractions.
6. Students will identify which food groups on USDA's MyPlate are high in antioxidants.

#### **Materials needed:**

1. California raisins
2. "Free radical" sign (included in kit)
3. Graph paper, pencil and ruler
4. ORAC chart handout
5. Antioxidant and Free Radicals PowerPoint presentation for overhead projector or utilized as handouts
6. Pie chart activity handout
7. Fun with California Raisins take-home learning activity
8. Stop Free Radicals in their Tracks activity handout
9. Help Marcus Save the Apple
10. Computer Lab– (optional) to build a pie chart digitally in place of graph paper





### Instructional Procedure:

(see accompanying PowerPoint slides for details on each of the following topics and step-by-step directions)

1. Introduce Super Crew, and their rationale on eating a variety of colorful healthy foods.
2. What is an antioxidant?
3. Free radicals explained
4. What is oxidation and how antioxidants work
5. Which food groups (or foods) have antioxidants? Help children identify foods with antioxidants.
6. Antioxidant Classroom activity:
  - Foods that have high ORAC have more antioxidants. Raisins have lots of electrons to give to unstable atoms because of their high ORAC value.
7. What is ORAC? Oxygen Radical Absorbance Capacity
8. How ORAC is measured and units of measurement explained
9. Create a bar graph using different ORAC values of foods from ORAC handout.
10. Best ways to get antioxidants in our diets
  - Real food is better than overly processed foods (foods that are pretending to be real food)
  - Choose a diet high in fruits, vegetables, whole grains, herbs, spices, beans, nuts and seeds
11. MyPlate – identify which parts of MyPlate contain foods with antioxidants. This includes the fruit, vegetable and grain groups. Some fats, like nuts and oils, also contain antioxidants.
12. Reinforce new healthy eating behaviors with the “Start, Stop and Keep” activity. Ask the class what they plan to start doing, stop doing and keep doing for good health. Answers will vary; For example, **Start:** Eating more foods high in antioxidants, **Stop:** Choosing fruit roll-ups every day, and **Keep:** Eating fruit at breakfast.

**Activities:** You may prefer to spread out the activities over the course of a week.

1. **Antioxidant classroom activity:** 4 students will demonstrate how free radicals steal electrons from other atoms. See power point presentation for more details on the activity. The children will demonstrate by representing atoms or free radicals. 1 child holding 2 boxes of raisins = 1 atom. 1 child holding 1 box of raisins = 1 free radical. When all the atoms have 2 electrons, they are all “stable,” and sitting in their seats. Once they become a “free radical,” they lose an electron and have to stand up. The teacher starts by taking a box of raisins from one of the students. This student then takes another electron from someone else, and sits in that student’s seat. This continues, and when an “anti-oxidant” comes in, he or she is able to give everyone the electrons they are missing, and make all the atoms happy and stable again.
2. **Charting a bar graph:** Students will view the ORAC chart handout. Then using graph paper or during computer lab, they will create a bar graph by plotting 3 to 5 foods ranging in ORAC values. Suggested ORAC values include: potatoes (1,058), oranges (2,103) and raisins (3,406). Ask the students to provide one reason why raisins could have a high ORAC value. Possible answers



are that the antioxidant value is more concentrated since the raisins are a dry fruit, or the nutrition make-up is different. (Optional discussion point: discuss water and dilution. Fruits and vegetables are made with water. When you dry them, they lose water. Antioxidants and other nutrients become more concentrated when the fruit dries.)

3. **Pie chart activity handout:** The student is the scientist and will interpret the pie chart's ORAC values by answering a series of questions.
4. **SuperKids Nutrition and California Raisins**, take home learning activity: Features math decoding activity, benefits of raisins and fun nutrition and fitness tips.
5. **Stop Free Radicals in their Tracks:** This activity will help reinforce sources of free radicals and actions students can take to prevent free radical damage.
6. **Help Marcus Save the Apple:**

[http://www.superkidsnutrition.com/sckids/nutrition-adventures/na\\_marcus1.pdf](http://www.superkidsnutrition.com/sckids/nutrition-adventures/na_marcus1.pdf)

At the beginning of the lesson, cut an apple in half, exposing the inside of both halves to oxygen in the air. Add lemon juice to one half. At the end of the lesson, observe the effects of oxidation or browning and compare the two pieces. Which piece has more browning? Why?

#### **Summary:**

1. Remind students of utilizing the ORAC scale as one tool in determining the antioxidant power of food.
2. Emphasize the benefits of eating foods high in anti-oxidants such as fruits, vegetables, whole grains, beans, nuts, seeds, herbs and spices
3. Encourage students to complete the take home learning activity to reinforce key messages.

#### **Key Vocabulary Words:**

**Plant based foods:** fruits, vegetables, whole grains, beans, nuts, seeds, herbs and spices

**Free radical:** an atom that has become unstable after losing an electron. It tries to become stable by stealing electrons from other atoms, leading to an oxidation cascade.

**Oxidation:** the process whereby atoms lose electrons, sometimes causing atoms to become unstable free radicals

**Antioxidant:** a type of nutrient that can prevent damage to your body by donating electrons to free radicals (atoms that have lost electrons)

**ORAC:** a measurement of the power of an antioxidant; measured in Trolox equivalents

**Atom:** a basic unit of matter

**Electron:** a very small particle, found in pairs on the outside of an atom.

**DNA:** A set of instructions, or ingredients for our body. DNA makes us who we are.

## **National Science Standards: Levels K-4**

### **Science as Inquiry Standards:**

Abilities necessary to do scientific inquiry  
Understanding about scientific inquiry

### **Physical Science Standards:**

Properties of objects and materials  
Position and motion of objects  
Light, heat, electricity, and magnetism

### **Science and Technology Standards:**

Abilities to distinguish between natural objects and objects made by human  
Abilities of technological design  
Understanding about science and technology

### **Science in Personal and Social Perspectives:**

Personal health

## **Additional science objectives covered by grade**

### **Grade 2**

Investigation and experimentation  
Recording observations on a bar graph  
Measuring length, weight, temperature, and liquid volume with appropriate tools and expressing those measurements in standard metric system units  
Constructing bar graphs to record data, using appropriately labeled axes

### **Grade 3**

Physical sciences  
Atoms and electrons and their structure and functions

### **Grade 4**

Physical sciences  
Electricity, magnetism and properties of electrically charged particles

### **Grade 5**

Physical Science  
Chemical and Nuclear Reactions  
Maintenance and improvement of healthy by behaviors

## **Academic Core Math Standards – Adopted by most states**



### **Grade 2 Math Standards:**

Representing and Interpreting Data:  
Drawing a picture graph and a bar graph (with single-unit scale) to represent a data set with up to four categories. Solving simple put-together, take-apart, and compare problems using information presented in a bar graph.

### **Grade 3 Math Standards:**

Representing and Interpreting Data: Drawing a scaled picture graph and a scaled bar graph to represent a data set with several categories. Solving one- and two-step “how many more” and “how many less” problems using information presented in scaled bar graphs.

### **Grade 4 Math Standards**

Measurement and Data: Representing and interpreting data.

### **Grade 5 Math Standards**

Measurement and Data: Representing and interpreting data.

## **Education Standards References:**

### **Math Standards:**

<http://www.corestandards.org/about-the-standards>  
Common Core Standards for Mathematics  
coordinated by National Governors Association  
Center for Best Practice and the Council of Chief State

### **Science Standards:**

<http://www.nsta.org/publications/nse.aspx>  
National Science Education Standards  
published by National Research Council  
implemented by National Science Teachers Association

### **California State Science Curriculum Standards**

<http://www.cde.ca.gov/ci/sc/cf/index.asp> by  
California State Board of Education

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[www.SuperKidsNutrition.com](http://www.SuperKidsNutrition.com) contact page