

Energy In /Energy Out

Subjects Taught: Health, Physical Education, Language Arts, Science, Mathematics

Grade Levels: 6th-12th Grade

Brief Description: Students will evaluate their meal selections, determine the caloric content and evaluate eating and exercise options to maintain a healthy weight.

Objectives: Students will:

1. Track their food consumption over a period of time.
2. Research caloric content of foods eaten.
3. Identify and conduct physical activities necessary to meet the recommended balance of calories and exercise.
4. Research information on nutritional recommendations and exercise habits to build a comprehensive understanding of maintaining a healthy lifestyle.
5. Journal about food intake and exercise and how it influences a healthy lifestyle.

Life Skills: Analyzing, applying, assessing, communicating, comparing and contrasting, constructing, designing, evaluating, interpreting, researching

Materials Needed:

- Research capabilities (library, classroom laptops)

Time:

Four to five, 50-minute class periods, plus time to document food consumption over a period of days as an assignment.

Preparation:

1. Schedule research time with the school library or have access to a classroom set of computers.
2. Arrange a cooperative project with the physical education teacher and language arts, health or science teachers to conduct this lesson.

Vocabulary:

calorie, diet, nutrients, RDA (Recommended Daily Allowance)

Background Information:

It has been widely reported that a significant portion of the American adult population is overweight and an increasing proportion of the overweight are morbidly obese. According to the Centers for Disease Control (CDC), 33 percent of adults over the age of 20 are overweight and another 36 percent of the population over 20 is obese. This is also a significant concern for a large percentage of children and teens also overweight. Again, the latest figures from the CDC indicate that 12 percent of 2-5 year olds, 18 percent of children ages 6-11 and another 18 percent of juveniles ages 12-19 are obese.

These numbers have risen dramatically in recent decades. Many factors contribute to this issue but the problem stems from a basic increase in the overall intake of high calorie foods and decreased physical activity. Contributing to this increased food intake is super-size portions. Please see a comparison in the chart on page 163 of restaurant portion sizes today compared to 60 years ago.

Florida Standards Met At-A-Glance

National Next Generation Science	MS-PS3-f., MS-LS2-F, MS-LS1-k., HS-LS1-a., HS-LS2-e.
English /Language Arts	6.W.3.7, 6.W.3.9, 6.L.3.6, 6.RST.2.4, 7.W.3.7, 7.W.3.9, 7.L.3.6, 7.RST.2.4, 8.W.3.7, 8.W.3.9, 8.L.3.6, 8.RST.2.4, 68.WHST.3.7, 68.WHST.3.9, 910.W.3.9, 910.W.3.7, L.9-10.6., RST.9-10.4., WHST.9-10.7., WHST.9-10.9., W.11-12.7., W.11-12.9., L.11-12.6., RST.11-12.4. WHST.11-12.7., WHST.11-12.9.
Mathematics	6.NS.1.1, 6.NS.2.3, 6.EE.1.1, 6.EE.1.2.B, 6.EE.2.5, 7.NS.1.1, 7.NS.1.2, 7.NS.1.2.C
Physical Education	PE.6.C.1.1, PE.6.L.2.3, PE.6.R.2.2, PE.912.C.1.13
Health	HE.6.B.1.1, HE.6.B.1.2, HE.6.B.1.3, HE.6.B.1.5, HE.6.B.1.6, HE.7.B.1.1, HE.7.B.1.2, HE.7.B.1.3, HE.7.B.1.5, HE.7.B.1.6, HE.8.B.1.1, HE.8.B.1.2, HE.8.B.1.3, HE.8.B.1.6, HE.8.B.3.4, HE.8.B.4.1, HE.8.P.1.3, HE.912.B.1.1, HE.912.B.1.2, HE.912.B.1.3, HE.912.B.3.6, HE.912.P.1.2
Science	SC.6.L.14.3, SC.7.L.17.1, SC.8.L.18.1, SC.912.L.18.7

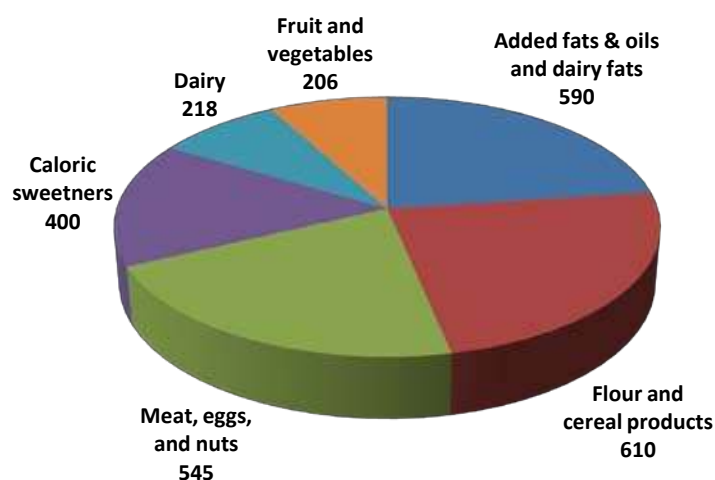
Fast Food Restaurant Serving	1950s	Today
Hamburger	1.6 ounces	4 to 8 ounces
French Fries	2.4 ounces	7.1 ounces
Fountain Drink	7 fluid ounces	42 fluid ounces

As a result, diabetes has risen significantly and for the first time children are being diagnosed with Type 2 diabetes (previously adult-onset diabetes) and high cholesterol. At the same time, consumption of fruits and vegetables is very low. Fewer than 10 percent of adolescents consume the minimum recommended three vegetable servings and two fruit servings per day. Adults are only slightly better at 14 percent. *MyPlate* recommendations indicate that half of every meal plate should be fruits and vegetables with an emphasis on vegetables.

Students need to be made aware of these trends and taught that the way to have a healthy diet is to make healthy food choices. Familiarize yourself with the USDA recommended daily allowance for nutrition, and the USDA *MyPlate* to better explain the recommendations to students at www.myplate.gov.

Flour and cereal products provided more calories per day for the average American than any other food group in 2010

Fruit and vegetables and dairy products provided smaller shares of calories per day for the average American



Notes: Added fats and oils and added sugars and sweeteners are added to food during processing or preparation. They do not include naturally occurring fats and sugars in food (e.g., fats in meat or sugars in fruits).

¹ Food availability data serve as proxies for food consumption.

Source: Calculated by ERS/USDA based on data from various sources (see Loss-Adjusted Food Availability Documentation). Data as of February 2014.

Activity One:

1. Have students track their food consumption over a period of time (three days) making a list of the foods they eat, the quantities in which they eat these foods, the major ingredients used, preparation methods used (fried, broiled, baked, roasted, steamed, barbequed, raw, pre-processed, pre-packaged, ready-to-eat) and condiments, sauces or dressings added. Breakfast, lunch, dinner, snacks and beverages should be included.
2. Students also should track the type of exercise they do and the length of time they spend doing it during the three-day period. Exercise should be identified as to whether it's high intensity (running, playing tennis, swimming, riding a bike) or moderate intensity (hiking, playing golf while walking the golf course, gardening, playing volleyball or baseball).
3. Using the meals they have identified, students will break down their meals by food group.
 - a. Explain that most foods will be combination foods rather than a single food group. A good worksheet that helps identify proportion of foods to categorize is at www.nourishinteractive.com. If Internet access is not available, they can estimate the proportion of foods that should be in each food group and the number of servings.
 - b. Ask them to compare these foods to the food groups they have been advised to consume. What is the result? (Answers will vary.)
4. Have students research the caloric content of their meals, and their calorie needs as determined by the U.S. Department of Health and U.S. Department of Agriculture. Two good sites for information are: www.ndb.nal.usda.gov and www.fnict.nal.usda.gov. Students should ensure that their age and the activity level (that they instinctively feel is theirs) be used for this calculation. Their actual activity level will be revealed later, or use the information they will gather completing the "Nutrient Database" lesson on page 167.
5. Students will then research the calories burned through various forms of exercise. They will compile a list of exercises that they typically participate in and determine the total caloric value of these exercises. Any number of credible sources are available for this information.
6. Have students select two days - one day during which they eat the foods and servings that most closely meet the recommended levels, and a second day that is far from those healthy recommendations. Have students journal about how they felt physically and emotionally on both days.
7. Share background from the Centers for Disease Control with students and explain that maintaining an ideal

weight means balancing the energy consumed with the energy used. Explain these components and that energy consumed is either used to perform bodily functions or it is stored (energy in versus energy out):

- Energy is used while you are young for the growth of every part of your body (skin, bones, blood, nerves, organs, among others) as you are growing. Adolescence is the fastest growing period in a child's life next to the early toddler years.
- Energy is needed for bodily functions (breathing, hormone production, digestion, thinking, circulation, temperature control, among others).
- Energy is needed for exercise (walking, running, swimming, playing sports, among others).
- Energy is also needed for reproduction, gestation (pregnancy) and lactation (breast feeding). As many as 300 extra calories per day may be needed during the last trimester of pregnancy and 500 calories per day for breast feeding.
- Energy is commonly measured in calories but the correct terminology is Kilocalories. 1,000 calories = 1 kilocalorie. A kilocalorie is the amount of energy it takes to heat 1 gram of water 1° C (4,184 J).
- While we think of calories in terms of food, any source of energy can be measured in the same way.
- Share with students that a 16-ounce can of soda contains 200 kilocalories. How many kilocalories would be in a gallon of soda? (8 ounces = 1 cup, there are 2 cups in a pint, 2 pints in a quart and 4 quarts in a gallon, so there are 16 cups in a gallon. 16 cups x 200 kilocalories = 3,200 kilocalories in a gallon of soda. This amount equals more kilocalories than a middle school or high school student would need in two days.) It is actually the sugar in the soda that provides the energy. Most of soda is water.
- Compare that with a gallon of gasoline that contains 31,000 kilocalories.
- All of this energy originates with the sun and the photosynthesis of plants. All other energy sources on the planet are from that transfer of energy from one organism to another or into one form or another. During that transfer, energy is lost to the environment in the form of heat or sometimes light (light bulbs, fire, explosions, internal combustion engines).
- Explain that in human nutrition if the energy consumed equals the energy needs for the body – no matter what level those needs are – the weight will remain stable. If the energy consumed is less, weight loss will occur. If the energy consumed is more, weight gain will occur. The focus here is not on appearance

but health. Discuss that one size does not fit all.

People come in different shapes, sizes, body types, and metabolic rates. The focus should be on an individual meeting their own health needs not fitting into an idealized shape, size or weight. (Attempting to do so can lead to eating disorders.)

- Provide students with this generalized information:

Estimated Calorie Needs – Males			
Age	Sedentary	Moderately Active	Active
11	1800	2000	2200
12	1800	2200	2400
13	2000	2200	2600
14	2000	2400	2800

Estimated Calorie Needs – Females			
Age	Sedentary	Moderately Active	Active
11	1600	1800	2000
12	1600	2000	2200
13	1600	2000	2200
14	1800	2000	2400

Institute of Medicine Dietary Intakes Micronutrients Report. 2002.
(Actually Kilocalories)

- After determining their recommended caloric and nutrient intake per day for a period of days, students will then determine the discrepancy between what he or she consumes (based on their meals they typically consume from their food journal created in activity 1), activity level and energy consumed for those activities, and what is required. Research activities or exercises needed to burn off these calories and the time required to do so.
- Ask students to journal to answer these questions:
 - “If what is consumed exceeds the calories recommended, what options are there to maintain a healthy weight? How much exercise would be needed to accommodate for the additional caloric intake? What options are there to reduce the calories consumed? Can nutrient-rich fruits and vegetables be exchanged for high calorie but nutrient-sparse snack foods?”
 - “If the amount of caloric intake does not meet the recommended amount, what options are there to maintain a healthy weight? What healthy fruits and vegetables could be consumed as snacks to bring them up to a level of maintenance? If you plan to undertake energetic

sports or are growing rapidly, what steps do you need to take to meet your caloric needs?”

“What are your internal hunger cues? Thirst cues? Can the two be confused? Can they be confused with boredom, anxiety or emotional needs?”

“What are your internal cues that indicate you are full and that you should stop eating? Can they be confused with boredom, anxiety or other emotional feelings?”

Activity Two:

1. In cooperation with the physical education teacher, have the class participate in sample exercises using the U.S. Department of Health and U.S. Department of Agriculture recommendations and record the number of calories burned.
2. Have each student report to the class or write in their journal their accomplishments, the type of exercise completed, the length of time it took to burn off the calories and their feelings about how much effort it took to equal the amount of calories eaten.
3. Based on the student’s meal plan selected, the caloric and nutrient requirements, and exercise needs, students



will create a chart that clearly details their findings. They should include in their submissions the sources of their information.

Activity Three:

1. Depending on the outcome of these activities, discuss students’ perceptions of the options they have to maintain a healthy weight.
2. Have students determine what their optimal (healthy) weight is. Current thought is that it should be a range focused on Body Mass Index (BMI) but there is much discussion on this topic and new options are in the development stages.
3. Ask each student to design a meal and exercise plan to reach that weight. Remind them that they are still growing and changing and that the focus should be on health.
 - a. Have each student create a step-by-step approach to make changes slowly over time. Make sure that their plans include eating recommended serving sizes, selecting items from each food group and participating in recommended physical activity. Research indicates that a slow, methodical approach is more successful than a sudden, radical change.
 - b. Ask each student to indicate the ways they will plan to incorporate more fruits and vegetables in their diet.
 - c. Utilize the school garden to encourage fruit and vegetable consumption.
 - d. Have students refer back to their consumption chart and make sure their plans include all food groups.

Evaluation Options:

1. Students will submit their charts containing their meal options, calorie counts, nutritional requirements and accommodations for variances in the consumed and required ratio to be evaluated, and math calculation to be checked for accuracy.
2. Have students write about the days they felt healthy, alert, physically sound and had a sense of well being and identify the factors that lead to that experience. Then have them write about the days they felt the opposite – unhealthy, sluggish, tired, and physically unsound - and identify the factors that led to those feelings.
3. Have students develop a plan to eat better and exercise more. Assess students’ completion of their future plans and credibility of process they plan to undertake.

Extensions and Variations:

1. People say the high cost of fruits and vegetables limits their ability to consume these items. How real is this limitation? Students will research and evaluate the actual

costs associated with buying whole fruits and vegetables by following the instructions below.

a. Provide the following scavenger hunt questions.

Scavenger Hunt Questions:

1. Find a fresh vegetable that costs more than 90 cents a pound.
 2. Determine the difference in price between two different foods that grow underground.
 3. Locate a red fruit that grows above the ground on a bush and costs more than 99 cents a pound but less than \$2.99 a pound.
 4. Identify a food that grows on a tree that costs less than 50 cents a pound.
 5. Locate a food that contains wheat or oats. Calculate the cost per pound.
 6. Find green produce that might be used in a salad that has a 9 in the hundredth's place.
 7. Determine the total cost of 3.5 pounds of a vegetable that is any color other than green.
 8. Calculate the price of two pounds of a red, orange or green food that grows on a vine.
 9. Write out all the ingredients you have selected for your meals and the price per pound of each fresh food item.
 10. If you were to buy four pounds of every item that can be found in the produce section, how much would you spend?
- b.** Have students answer the questions using the resources listed in the Resource Section at the end of this lesson as well as grocery store ads.
- 2.** Have students use the “Fruit and Vegetable Calculator” at the Centers for Disease Control website (CDC) at www.cdc.gov/nutrition/everyone/fruitsvegetables/howmany.html and compare their actual daily food intake and create a plan to meet their recommended dietary levels.

3. Have students research and create a visual depiction of one of these topics:

- a.** Your state’s consumption of fruits and vegetables using State Indicator Report on Consumption of “Fruits and Vegetables,” Centers for Disease Control www.cdc.gov/nutrition/downloads/stateindicatorreport2009.pdf
- b.** “Portion Distortion” at the National Heart, Lung and Blood Institute www.nhlbi.nih.gov/health/public/heart/obesity/wecan/eat-right/distortion.htm
- c.** The change in obesity over time and the health implications. They can begin with the information at the Centers for Disease Control at <http://www.cdc.gov/nchs/fastats/obesity-overweight.htm>
- d.** Compare the energy in food to the energy it takes to operate other energy dependent appliances and machines. (For example: The energy in a slice of cherry cheesecake could power a 60 watt light bulb for an hour and-a-half.)
- 4.** Use any of the resources available at Choose *MyPlate* at www.choosemyplate.gov.
- 5.** Have students research and write about eating disorders.

Resources:

US Department of Agriculture at www.usda.gov

National Institutes of Health
www.nih.gov

ChooseMyPlate
www.choosemyplate.gov

USDA Nutrient Database, United States Department of Agriculture
www.ndb.nal.usda.gov

Nutrient Data Laboratory, U. S. Department of Agriculture
www.ars.usda.gov