



FOOD FOR
9 BILLION

The Challenge of Feeding the World

The Faces of Malnutrition

Teacher Notes

Before You Start

Grade Level:

Grade 9-12, could be adapted for middle school

Concepts Covered:

Calories, macronutrients, micronutrients, nutrition, malnutrition

Estimated Time:

50 minutes

Materials Needed:

Computers with Internet access, student handout (optional):

Nutrition Notes Worksheet

Overview

What do the faces of malnutrition look like? Let your students be the doctors and researchers as they identify the causes of the ailments that young people experience. The resources and case studies can be accessed online.

Objectives

- Students will understand that malnutrition presents in many different ways.
- Students will know what Calories, macronutrients, carbohydrates, proteins, lipids, micronutrients, vitamins and minerals are.
- Students will apply their knowledge of nutrition (Calories, macronutrients, and micronutrients) and deduce the cause of example children's ailments.
- Students will practice critical reading and reasoning skills.

Prior Knowledge

none

Teaching Tips/ Activity Sequence

1. Start by activating students' prior knowledge about malnutrition. Ask, "What is malnutrition? How do you define malnutrition?" Solicit students' answers.
2. Introduce the activity and its objectives. Students will use an online interactive to learn about the basics of nutrition and then they will apply that information to diagnose different cases of malnutrition. Review the parts of the interactive with the whole group.
3. Students can work through the Faces of Malnutrition interactive (link) alone or in small groups.
 - i. Encourage students to take notes for the first three sections. They can use their own note-taking style or you can provide the ***Nutrition Notes*** sheet.

- ii. After learning about macronutrients and micronutrients, students will diagnose various cases of malnutrition. Be clear with students about how many cases they need to diagnose. You might wish to assign certain cases to students, or you might wish to let them choose. Answers to the malnutrition cases are included in these teacher notes.
4. After everyone is finished, gather the group for a final discussion. Guide the students back to their original definitions of malnutrition and ask them to evaluate the definition of malnutrition that they began with at the beginning of this exercise. For example, was their definition correct and complete, or would they change it now that they know more? Why or why not? You can also ask students to share and explain their diagnoses for the different cases.
5. You can conclude by listening to a story about the shift away from a traditional diet and the rise of obesity in Greece at <http://cironline.org/reports/greeces-diet-crisis-3953>. Ask the students to listen for how diets have changed in Greece and what that means in terms of what they learned today about micronutrients, macronutrients, and Calories.

Extensions

- More lessons about nutrition – including Macronutrient Analysis, The Mighty Micronutrients, and You Are What You Eat - are available at <http://ricediversity.org/outreach/educatorscorner/foodfor9billion/>
- A variety of radio and TV news stories about food, famine and hunger are available at <http://cironline.org/projects/food-for-9-billion>.

Standards

National Science Education Standards Grades 9-12

Life Science
Matter, energy, and organization in living things
5.2, 5.3, 5.6
Science in Personal and Social Perspectives
Personal and Community Health 1.1, 1.2, 1.5

Common Core State Standards for Literacy in History / Social Studies, Science and Technical Subjects 6-12

Reading Standards
Key Ideas and Details RST1
Integration of Knowledge and Ideas RST7, RST9
Writing Standards
Text Types and Purposes WHST2
Production and Distribution of Writing WHST4
Range of Writing WHST10

Acknowledgements

Darcy A. Dyll for Cornell University created the online interactive. Susan Dodge, M.S. Ed for Creative Curriculum produced these teacher notes in conjunction with the “Food for 9 Billion” project (<http://foodfor9billion.org>), with funding from the National Science Foundation (PGRP grant #1026555; <http://ricediversity.org>) and Cornell University.

Eduardo suffers from partial paralysis due to spina bifida caused by folate deficiency in his mother's diet.

- Eduardo's mother other used to eat leafy greens and chicken livers, but her diet changed when she was pregnant.
- The family eats mostly rice and beans, plantains, and seafood, foods not rich in folate.
- After Eduardo was born, a researcher came to visit his parents, asking questions about his mother's diet while she was pregnant with him. As a result of that research, some foods are now being fortified with a certain nutrient.

John suffers from malnutrition as a result of irregular access to food and not getting enough Calories. He might also not be getting enough of various micronutrients.

- John's family has had economic difficulties; his dad can't work, and then his mom lost a shift. That meant they couldn't buy enough groceries to last the week.
- John's family eats cheap foods with long shelf lives.
- John grows tired easily; he has low energy.
- John's sisters get sick often.

Rustam suffers from iodine deficiency.

- Rustam and others in the region experience slow growth, low energy, and difficulties learning. Rustam's sister is mentally handicapped.
- Rustam lives in a mountainous region. Some food micronutrient levels depend on the amount of minerals in the soil, and or in the plants that food animals eat.
- Rustam's family did not use salt when he was growing up.

Adeline suffers from iron deficiency.

- Adeline eats a diet of mainly starches, with very little red meat and no beans.
- Adeline is very tired and loses her breath easily.
- Adeline suffers more childhood infections than normal.
- Adeline's mother, Valerie, showed symptoms of the same deficiency when she was pregnant with Adeline. Valerie was very tired, Adeline was born at a low birth weight, and the midwife recommended that Adeline stay connected via umbilical cord extra three minutes to allow additional blood transfer.

Julia suffers from obesity.

- Julia's diet includes healthy foods, but its heavy on starches (bread, pasta, rice) and empty calories (soda, candy bars, energy drinks).
- Julia doesn't walk to school or play sports any more.
- Julia's amount of sleep has decreased and she has started snacking for more energy.
- Julia's portion sizes are too large.

The Faces of Malnutrition



Teacher Notes: Answers to Cases

Tigist suffers from Vitamin D deficiency.

- Tigist has bowed legs, pain in her bones, and her legs tire easily.
- Tigist has dark skin (melanin serves as protection from sunlight, but also inhibits vitamin D production in the skin) and was kept out of sunlight as a child.
- Tigist's family's diet is low in foods that contain Vitamin D.

Abia suffers from zinc deficiency.

- Abia has three sisters and one brother. All of them are short in height with a slender bone structure. One of her sisters is so small that she is considered a dwarf.
- Abia and her sibling often get sick and Abia's hair is falling out.
- Abia's brother cannot taste food.
- Abia's family's diet is low in foods that contain zinc.

Nutrition Notes

Instructions: Read through the Faces of Malnutrition web interactive and take notes on this sheet. In some places you fill in the blanks while in other places you have to fill in the details yourself.

Big Idea/ Concept	Details
<p>Nutrition Basics</p> <p style="text-align: right;">Calories</p> <p style="text-align: right;">Macronutrients</p> <p style="text-align: right;">Micronutrients</p>	<p>Energy and nutrients come from <u> <i>food</i> </u>.</p> <p>A person can become <u> <i>malnourished</i> </u> if he/ she doesn't get the correct amount of energy or nutrients.</p> <p><i>A Calorie is a unit of energy supplied by food. Carbohydrates, fats, and proteins all provide Calories.</i></p> <p><i>Macronutrients are carbohydrates, fats and proteins. The human body needs many grams of each macronutrient each day.</i></p> <p><i>Micronutrients are substances, like minerals and vitamins, which are crucial in tiny amounts for normal growth and metabolism.</i></p>
<p>Macronutrients</p> <p style="text-align: right;">Carbohydrates</p> <p style="text-align: right;">Fats</p> <p style="text-align: right;">Proteins</p>	<p>Our bodies need many <u> <i>grams</i> </u> of macronutrients each day.</p> <ul style="list-style-type: none"> <i>• Molecules made up of sugars.</i> <i>• Our body breaks down carbohydrates to make glucose.</i> <i>• Can be simple or complex.</i> <i>• Examples: Starch and dietary fiber and sugars</i> <ul style="list-style-type: none"> <i>• a type of lipid; molecules that store energy.</i> <i>• Fats store nearly twice as much energy as proteins and carbohydrates.</i> <i>• Essential for health: store and transport vitamins, help keep skin healthy, protect organs and make hormones.</i> <i>• Some fats, such as polyunsaturated and monounsaturated fats, are healthier than others, such as trans-fats and saturated fats.</i> <ul style="list-style-type: none"> <i>• molecules made up of subunits called amino acids</i> <i>• part of every cell in our body and are important in almost all life processes</i> <i>• Complete protein sources are foods that have all 20 amino</i> <i>• protein deficiency can lead to mental retardation or kwashiorkor.</i>

Nutrition Notes

Micronutrients

Micronutrients include vitamins and minerals. They are crucial in tiny amounts for normal growth and metabolism.

	How is it used in the body?	How do we acquire it?	Symptoms of deficiency	Treatment
Vitamin A	<i>Plays an important role in vision (particularly night vision), bone growth, reproduction, cell division, and cell differentiation. Helps regulate the immune system and may help fight infections. Promotes healthy surface linings of the eyes and the respiratory, urinary, and intestinal tracts</i>	<i>Eat colorful fruits and vegetables (especially carrots, cantaloupes, sweet potatoes, and spinach), eggs, liver, whole milk, and some fortified food products.</i>	<i>Blindness, night blindness, decreased immunity, as well as increased respiratory and diarrheal infections are all symptoms of vitamin A deficiency.</i>	<i>In general a person can make dietary changes or take supplements.</i>
Iron	<i>Part of many proteins and enzymes including the proteins (hemoglobin & myoglobin) involved in oxygen transport.</i>	<i>Red meat, fish, poultry, lentils, beans, fortified cereal, tofu, and spinach.</i>	<i>Fatigue, decreased immunity, poor work performance, slow cognitive development, difficulty maintaining body temperature, and glossitis (inflammation of the tongue) are all associated with iron deficiency.</i>	<i>Make dietary changes to include more iron or different form of iron (ex. meat) or take supplements.</i>
Folate	<i>Used to make DNA and RNA, to protect DNA, and to make normal red blood cells. It's important that pregnant women have enough folate because folate is critical during periods of rapid cell division and growth.</i>	<i>Liver, citrus, green leafy vegetables, lentils, and beans. Folate is also found in fortified cereals and breads.</i>	<i>Fetus can develop neural tube defects, which can result in the brain or spinal cord not developing properly. Children with folate deficiency can have slow growth, while adults with folate deficiency can have anemia, heart palpitations, fatigue, diarrhea, weakness, and irritability.</i>	<i>Eat folate-rich foods or take a folate supplement.</i>
Zinc	<i>Critical to the immune system as it fights off invading bacteria and viruses. Zinc also helps make proteins and DNA. It is important during pregnancy, infancy, and childhood. It helps wounds heal and is important for proper senses of taste and smell.</i>	<i>Found in many foods, including oysters, red meat, poultry, seafood, fortified breakfast cereals, beans, nuts, whole grains, and dairy products.</i>	<i>Slow growth in infants and children, delayed sexual development in adolescents, impotence in men, hair loss, diarrhea, eye and skin sores, loss of appetite, weight loss, problems with wound healing, decreased ability to taste food, and reduced alertness</i>	<i>Include more zinc-rich foods or take zinc supplements.</i>

Nutrition Notes

<p>Vitamin B-12</p>	<p><i>Required for proper red blood cell formation, neurological function, and DNA synthesis.</i></p>	<p><i>Fish, meat, poultry, eggs, milk, and milk products, fortified breakfast cereals, some nutritional yeast products are all good sources of vitamin B12.</i></p>	<p><i>May experience fatigue, weakness, constipation, loss of appetite, weight loss, numbness and tingling in the hands and feet, difficulty maintaining balance, depression, confusion, dementia, poor memory, and soreness of the mouth or tongue. Also causes a type of anemia that stops DNA synthesis in red blood cells, called megaloblastic anemia.</i></p>	<p><i>A person may need vitamin B12 injections. In some cases, changing the diet or taking supplements will help a vitamin B12 deficiency.</i></p>
<p>Iodine</p>	<p><i>Make thyroid hormones that control the body's metabolism and other important functions including proper bone and brain development during pregnancy and infancy.</i></p>	<p><i>Eating iodized salt, fish, seaweed, or shrimp. Also from grains, etc, but amount depends on soil type.</i></p>	<p><i>Cannot make enough thyroid hormone. Stunted growth, mental retardation, delayed sexual development in a fetus, lower-than-average IQ in infants and children, decreased ability to work and think clearly, and possibly development of goiter, a swelling of the thyroid gland in the neck.</i></p>	<p><i>Make dietary changes or can take iodine supplements</i></p>
<p>Vitamin D</p>	<p><i>Promotes calcium absorption, maintains adequate blood calcium and phosphate concentrations. Vitamin D is needed for bone growth. Vitamin D also has other roles in the body, including modulation of cell growth, neuromuscular and immune function, and reduction of inflammation.</i></p>	<p><i>Fatty fish and fish liver oil, fortified foods. Sunlight on your skin (in moderation!) is another good way to absorb vitamin D! Vitamin D is produced when UV rays from sunlight strikes the skin.</i></p>	<p><i>Deficiency can cause rickets (softening of the bones) in children and osteomalacia (softening of the bones) and osteoporosis in adults.</i></p>	<p><i>Carefully increase exposure to sun, make dietary changes, or take supplements. Cod liver oil is used to treat rickets.</i></p>

Name: _____

Date: _____ Class: _____



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Big Idea/ Concept	Details
Nutrition Basics Calories Macronutrients Micronutrients	Energy and nutrients come from _____. A person can become _____ if he/ she doesn't get the correct amount of energy or nutrients.
Macronutrients Carbohydrates Fats Proteins	Our bodies need many _____ of macronutrients each day.

Name: _____

Date: _____ Class: _____



Nutrition Notes

Micronutrients	Micronutrients include _____ and _____. They are crucial in _____ amounts for normal growth and metabolism.
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	<i>How is it used in the body?</i>	<i>How do we acquire it?</i>	<i>Symptoms of deficiency</i>	<i>Treatment</i>
Vitamin A				
Iron				
Folate				
Zinc				

Name: _____

Date: _____ Class: _____



Nutrition Notes

Vitamin B-12				
Iodine				
Vitamin D				