

3 - Go With the Flow

You are on the move, just like the hydration levels of your body.

■ Grade Level:
Ages 8-12

■ Subject Areas:
Health, Life Science

■ Duration:
Preparation time:
Parts I and II: 15 minutes
Part III: 5 minutes
Activity time:
Part I: 15 minutes
Part II: 30 minutes
Part III: 20 minutes

■ Setting:
Classroom or playground

■ Skills:
Gathering (observing, listening)

Organizing (arranging, categorizing)

Analyzing (identifying relationships among components, identifying patterns, discussing)

Interpreting (generalizing, summarizing, identifying cause and effect)

Applying (predicting)

■ Vocabulary
Water balance, hydration, dehydration

Summary

Water is critical for keeping our bodies properly hydrated. Everyday we take in water by drinking and eating. We lose water daily through different ways such as perspiration and sweating, respiration (breathing), urination and defecation. The amount of water coming into our bodies should be equal to the amount going out. Maintaining a water balance within our bodies helps to maintain physical and mental performance in adults. A body out-of-balance can lead to dehydration with mild to severe side-effects.

Objectives

Students will:

- describe the concept of water balance in the body.
- describe the mechanisms through which the human body gains and loses water.
- list symptoms of dehydration.
- list ways to combat dehydration.

Materials

- tape or chalk
- large clear plastic (or glass) container
- pitcher
- cup (approx. 0.25 liters)
- second plastic container (bowl or bucket)
- copies of *Symptoms of Dehydration - Resource Page*

Technology Tools

- "<http://projectwet.org/use-project-wet/children-water-games/hydration-game/>
Project WET hydration game that teaches you about keeping your body properly hydrated

- "<http://hydrate.whomwah.com/>
download an application for your iPhone or iPod touch that allows you to track the number of glasses of water you drink per day

Making Connections

Many students are not aware of the potential impact of mild dehydration on physical and mental performance in adults or the simple choices they can make to maintain water balance in their bodies.

Background

Water is an important component of our bodies. Water is a carrier. It helps us to regulate our body temperature by sweating, and remove our waste through urination. Staying hydrated means having sufficient body water levels for tissues and organs to function correctly. It is critical to maintain a water balance where the amount of water coming into our bodies is equal to the amount of water going out. If that balance is maintained, we stay hydrated and provide our bodies with enough water to complete its functions.

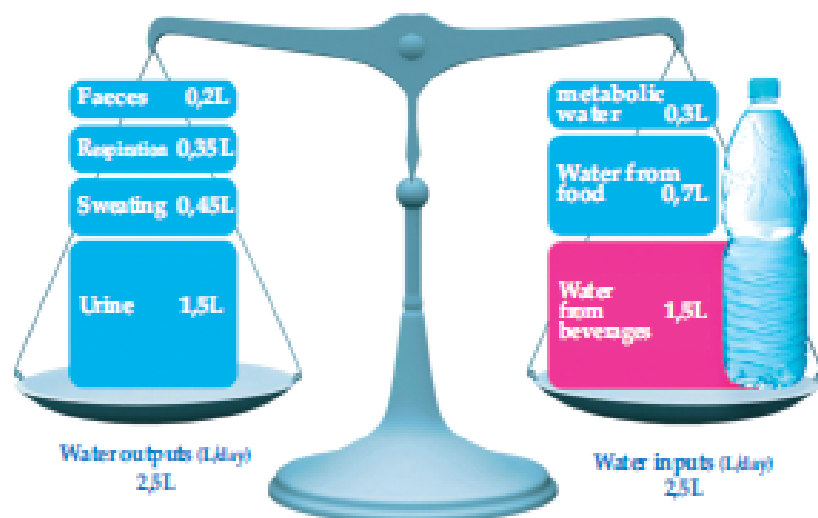
However, if we don't maintain our water balance, we risk becoming dehydrated. Water is regularly moving out of our bodies throughout the day. The body loses water daily through breathing, skin, urinating and defecating. On average, a sedentary adult loses 2.5l/day. We replace water lost by drinking beverages and also by eating—all foods contain some amount of water, but some contain much more than others. One-third of an individual's water needs are derived from food. Fruits and vegetables are 80 to 95 percent water; meats are 50 percent water; and grain has as much as 35 percent water. Our bodies also produce a small amount of water through the natural process of metabolism, called meta-

bolic water. Many factors influence the amount of water we lose and we need to adjust our water intake accordingly to compensate for the water loss. Activity level, environmental factors (such as temperature,

amount of water to perform essential bodily functions. This is called dehydration. Symptoms of dehydration can occur with as little as one percent decrease in body weight from fluid loss. Thirst is a late-stage

- sleepiness
- headaches
- dry mouth
- reduced urine production
- muscle weakness

MATCHING WATER INPUTS WITH WATER LOSSES



(adapted from Jéquier E and Constant F, EJCIN, 2010)

humidity) and illness can all affect the amount of water we need to consume to maintain water balance. It is important to understand how these factors influence us so that we do not allow our bodies to become dehydrated. Water intake should be increased when exercising or when exposed to hot conditions. It is also extremely important to stay properly hydrated when ill—especially with symptoms such as diarrhea, vomiting and /or fever which can cause a large water loss. As a consequence, in these conditions, you should drink more water.

When the body loses more water than is replaced, it lacks an adequate

sign of dehydration, and dehydration stimulates the brain's thirst center to take in more fluids. If water intake cannot keep up with water loss, dehydration intensifies and is evidenced through decreased sweating and urination. As the body tries to maintain blood pressure, water moves from the inside of cells to the bloodstream. Tissues begin to dry out and cells shrink and dysfunction. If dehydration is not reversed, a coma can result and the kidneys, liver and brain may be damaged.

Symptoms that may result from mild dehydration include but are not limited to:

- thirst

Symptoms worsen with additional fluid loss. Although humans are able to live for about one month without food, they can only live three to five days without water.

While thirst may be an adequate indicator of dehydration for adults, as reported by the Institute of Medicine, children often lack the ability to identify or communicate their needs making them more vulnerable to water imbalance. Therefore, voluntary drinking of water is a key behavior for maintaining water balance. Consequently drinking water before being thirsty is a good habit for maintaining a good body hydration status. In addition, you should continue to drink water even when thirst has disappeared since the balance is taking some time for coming back to equilibrium... Children are also at greater risk of dehydration than adults because of different factors: the high surface-to-body-weight ratio, the high metabolic rate and a thermoregulatory strategy different from adults so that they are more sensitive to temperature changes especially during a physical activity. An easy way for anyone to gauge hydration status is to monitor the color of urine. Light colored urine is an indicator of good hydration status, while dark or amber urine indicates that our body is not properly hydrated and that we should consume fluids.

Water requirements are dependent on age, gender, climate, activity level and health. According to the Food and Nutrition Board 2004 of the Institute of Medicine, in temperate

climates, average daily adequate water intakes through beverages by age are the following:

- 1 to 3 years: 0.9 liters/day
- 4 to 8 years: 1.2 liters/day
- 9 to 13 years (girls): 1.6 liters/day
- 9 to 13 years (boys): 1.8 liters/day
- 14 to 18 years (girls): 1.8 liters/day
- 14 to 18 years (boys): 2.6 liters/day
- Over 19 years (male): 3.0 liters/day
- Over 19 years (female): 2.2 liters/day

Since water requirements vary by age and gender, it is difficult to pinpoint an amount that works for everyone. Studies in Europe generally recommend drinking 1.5 liters of water per day which corresponds to eight glasses of water, while in the U.S.A. recommendations are higher. Drinking 1.5 liters (1500 ml) of water per day is a recommended daily average for a sedentary adult living in temperate climate (Note: 1.5 liters of fluids are approximately equal to eight 200 ml glasses to simplify math calculations).

Developing healthy hydration habits requires awareness, knowledge, an honest personal assessment and strategies to maintain water balance every day. This may require keeping a water journal or recording in some way the amount of water consumed daily. It may help to have a hydration or fitness partner...

Procedure

▼ Warm Up

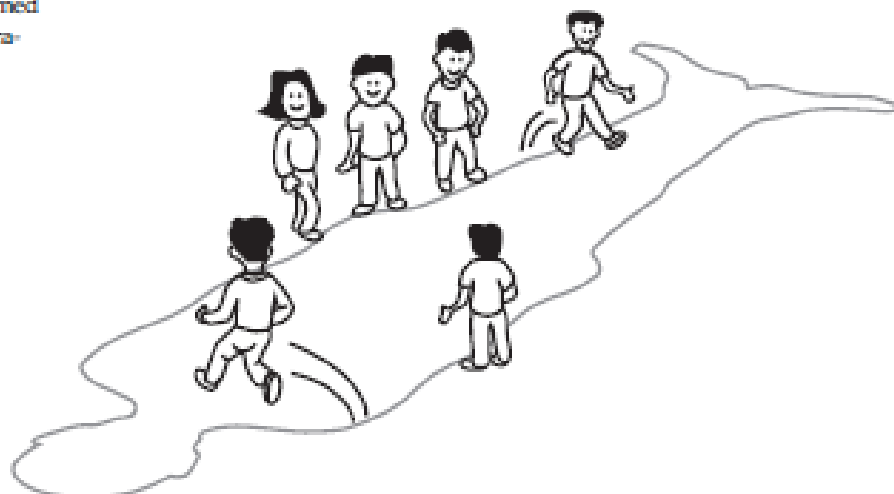
We all drink water when we get thirsty, but why is water important to our bodies? Explain to students that they are going to do an active warm up before the activity. Have the students stand up and jog in place or do jumping jacks for one or two minutes. After one to two minutes of this physical activity, immediately ask them to explain some of the changes they see in their bodies from this exercise. For example, they will likely say things like out of breath, hot, sweaty, thirsty, etc. Discuss these changes as related to water in their bodies.

- Sweat—sweat is mostly water, you sweat when your body gets hot. The sweat evaporates from the skin, cooling your body down.
- Faster breathing (out of breath)—when we feel out of breath it is because we are breathing more rapidly. Water vapor escapes from our bodies through our breath. Have students breathe on a mirror or window to demonstrate this.
- Feeling thirsty with a dry mouth - water coats our mouths and throats.

What is water balance? Introduce the idea of water balance to the students. Water balance is the idea that the amount of water your body loses is equal to the amount of water your body takes in. If you maintain a water balance, your body stays properly hydrated and gets enough water to perform critical functions like regulating your body temperature or transporting nutrients to cells and removing waste from cells. If you don't take in as much water as you lose, you will start to exhibit symptoms of dehydration such as headache, irritability and tiredness.

Discuss a few additional scenarios that focus on the importance of water to the function of our bodies.

- You are sitting near a fire when smoke blows into your eyes. What happens to your eyes? (Your eyes get watery as your tear ducts produce tears to wash out the smoke particles.)
- How is waste removed from your body? (Water carries waste out of our body in urine)



The Activity

Part I

1. Explain that, students will focus on some of the daily activities and factors that contribute to water balance in their bodies. Draw a large outline of a human body on the playground in chalk, or move desks to the edge of the classroom and use tape to outline a human body on the floor. The outline needs to be large enough for all of the students to fit inside of it.

2. Divide the students into 10 groups by counting off one through 10. Students should stand on the line representing the border of the body. Tell the students they will represent water and that each group will be presented with a different scenario and have to decide whether to move into or out of the body. (For small classes you may choose to divide the class into five groups and choose five of the scenarios).

3. Read the first scenario to group one. Only group one should move into the body and the other groups

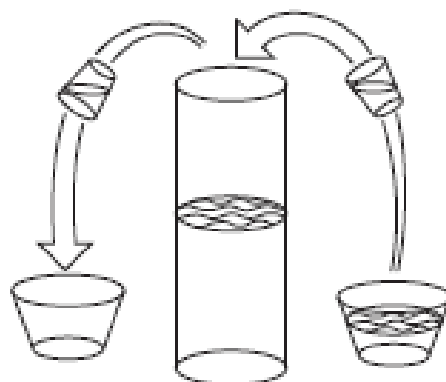
should stay on the line until they have been presented with a scenario. Once a group decides to move into or out of the body they should remain there until the end of the activity. You may prompt older students to enter or leave the body through the appropriate body part.

4. Read the other scenarios in order, until all of the groups have moved in or out of the body accordingly.

5. Have the students remain in their chosen spot and read through the list of scenarios again one at a time, asking the students in each group to explain to the class the mechanism by which they (water) entered or left the body. Some scenarios will involve multiple mechanisms. Complete the activity by reading each scenario one last time and having all of the students move in or out at the same time.

Part II

Note: This activity is written as a demonstration, but could be done by the students in groups if materials are available.



1. Before the students arrive, fill a large transparent container with water to a level that represents 60 percent. Use a dry erase marker or piece of tape to clearly mark the level of the water. Label this level "hydrated". Label the area below the line "dehydrated". This container

Group	Scenario	Water Movement	Mechanisms
1	Drink juice in the morning	move into body through the mouth	Ingest water by drinking
2	Walk to school	move out through skin and mouth	Sweat, exhale water vapor
3	Eat fresh fruit	move in through the mouth	Ingest water by eating
4	Play at recess	move out through the skin and the mouth	Sweat, exhale water vapor
5	Drink water with lunch	move in through the mouth	Ingest water by drinking and eating
6	It's a hot day; sweat during class	move out through the skin and the mouth	Sweat, exhale water vapor
7	Drink water with an after school snack	move in through the mouth	Ingest water by drinking and eating
8	Use the toilet	move out through the urinary/digestive tract	Excrete water through urine/feces
9	Play soccer/football after school	move out through the skin and the mouth	Sweat, exhale water vapor (more due to exertion)
10	Read a book before bed	move out through the mouth and the skin	Exhale water vapor, small amount of water evaporation through skin

will represent a human body. Set out a pitcher of water and an empty bowl or other container next to the "body" of water.

2. Remind students that we now know how water moves in and out of the body. Next we are going to look more closely at water balance in the body. Explain to the students that the container with 60 percent water represents a body, and as long as the water is up to the line (at 60 percent), the body is hydrated with body water in balance. If the water level falls below the line, the body becomes dehydrated. Explain that you will now demonstrate how a body loses and gains water through a series of daily activities. Ask the students to tell you whether or not the body is in balance after each activity. Start by asking the students if the body is in balance now. Read each scenario and have students guess whether you will remove or add water to the "body" and why. Read the instructions from each scenario explaining why the body loses or gains water after each action.

- **Sleep though the night** (remove one glass of water from the transparent container and pour it into the extra container)—the body loses water even while sleeping and has become dehydrated
- **Drink water in the morning** (pour water from the pitcher into the glass, and pour one glass of water into the transparent container)—the body is hydrated and in balance
- **Walk to school** (remove one glass of water from the transparent container and put it in the extra container)—the body is not hydrated and is out of balance
- **Eat fresh fruit**—(pour water from the pitcher into the glass, and pour the glass of water into the transparent container)—fruit contains water, the body is hydrated and in balance
- **Play at recess** (remove two glasses of water from the transparent container and put it in the extra container)—vigorous play causes us to lose more water, the body is not hydrated or in balance
- **Drink water with lunch** (pour water from the pitcher into the glass, and pour two glasses of water into the transparent container)—the body is now in balance and hydrated
- **Hot day, sweat during class** (remove one glass of water from the transparent container and put it in the extra container)—the body is not hydrated or in balance
- **Drink juice with an after school snack** (pour one glasses of water from the pitcher into the glass, and pour glass of water into the transparent container)—water in food and drink, this addition helps the body become hydrated and in balance
- **Play soccer/football after school** (remove three glasses of water from the transparent container and put it in the extra container)—more vigorous activity, the body is not in balance and becomes dehydrated
- **Drink water and milk with evening meal** (pour two glasses of water into the transparent container) - you are becoming hydrated through drinking and eating
- **Read a book before bed** (remove 1/2 glass of water from the transparent container and put it in the extra container)—the body loses water even when we are just sitting, the body is not completely in balance and is slightly dehydrated.

3. Ask the students to reflect on the water balance activity. Is this body in balance? Why or why not? What does this person need to do to maintain their water balance? Is this body hydrated or dehydrated?

Part III

1. Inform students that the symptoms of dehydration have negative effects on the body. The "body" from the previous activity (the container of water) is out of water balance and is now experiencing symptoms of dehydration. To learn more about what these symptoms are, the students will play mime. Write down the symptoms on separate slips of paper (or photocopy the table below and cut into separate slips) and put the slips into a container. Choose a student to pick a symptom out of the container and act it out without using words while the class guesses what it is.

Symptoms of Dehydration
Tired
Sleepy
Headache
Muscle weakness
Dry Mouth
Thirsty

2. Ask the class if any of them have ever experienced any of these symptoms. If so, do they think they could have been dehydrated?

3. Explain that an additional symptom of dehydration is decreased urine production. Urine color is one of the best ways to constantly monitor personal hydration. Light colored urine indicates good hydration status, while dark colored

urine indicates dehydration and a need for water.

4. Explain that the best way to prevent mild dehydration (indicated by these symptoms) is to drink water on a regular basis. Eight glasses a day are recommended to maintain an adequate level of hydration.

▼ Wrap Up

Combating dehydration. Ask students for examples of how they lost water today. Ask them what they can do to remedy this dehydration. The best way to treat mild dehydration is to rehydrate by drinking water.

Assessment

Have students:

- Explain the concept of water balance (Warm Up, Part III, step 2)
- List mechanisms that cause water to leave the body (Part II, step 1)
- List symptoms of dehydration (Part III, steps 1 and 3)
- List ways to combat dehydration (Part III, step 4, Wrap Up)

Extensions

Encourage students to keep a hydration journal for one day or several days writing down activities and processes in their own lives that cause water to enter and leave their systems and the specific mechanisms through which their body loses water. Remind students that it is important to consume at least 1.5 liters or eight cups of water each day to maintain hydration and that urine color can be used as an indicator of hydration status. Is their body in balance? What changes might they need to make for better hydration?

ActionEducation™

Create posters for school hallways and the lunchroom to encourage students to stay hydrated. Invite a guest speaker to the class to discuss the

importance of hydration. Create stations for each of the hydration activities and have students present them to other classes.

Resources

Constant, Florence. 2009. Hydration in Children. Paper presented at Health and Wellbeing in education, November 10-11, Birmingham, Alabama.

Food and Nutrition Board; Institute of Medicine of the National Academy, February 11, 2004

Jequier, E and F Constant. 2009. Water as an essential nutrient: the physiological basis of hydration. *European Journal of Clinical Nutrition*. 64:115-123.

Panel on Dietary Reference Intakes for Electrolytes and Water, Standing Committee on the Scientific Evaluation of Dietary Reference Intakes, Food and Nutrition Board; and Institute of Medicine of the National Academies. *Dietary Reference Intakes for Water, Potassium, Sodium, Chloride, and Sulfate*. The National Academies Press, Washington, D.C. February 11, 2004.

e-Resources

- "Dehydration." Mayo Clinic. <http://www.mayoclinic.com/health/dehydration/DS00561/DSECTION=prevention>
- <http://www.mayoclinic.com/health/dehydration/DS00561/DSECTION=risk-factors> and <http://www.mayoclinic.com/health/dehydration/DS00561/DSECTION=causes> (accessed July 9, 2010).
- "Dehydration." OSF Healthcare. <http://www.stayinginshape.com/3osforp/libv/s10.shtml> (accessed July 9, 2010).
- "Exercise". The Merck Manuals

Online Medical Library.

<http://www.merck.com/mmpe/sec21/ch324/ch324b.html?q=hydration&alt=sh#sec21-ch324-ch324b-951>

<http://www.merck.com/mmpe/index.html> (accessed July 9, 2010).

- The National Academies Press. <http://www.nap.edu>
- "Hydration and Health". UW Medicine. <http://www.depts.washington.edu/hhpccweb/article-detail.php?ArticleID=335&ClinicID>
- National Health Service. <http://www.nhs.uk/Conditions/Dehydration/Pages/Symptoms.aspx>
- "Water in dief". National Institute of Health. <http://www.nlm.nih.gov/medlineplus/ency/article/002471.htm> (accessed July 9, 2010).



Tired

Sleepy

Headache

Muscle weakness

Dry Mouth

Thirsty