

Knowledge Is Power

Teaching children about type II diabetes

By Natalie Feild-Berner and Meena Balgopal

World Diabetes Day (November 14) offers a wonderful opportunity to educate elementary children about the power they have to control their health. First lady Michelle Obama has urged Americans to educate themselves about childhood obesity, which is often associated with the onset of type II diabetes (Rabin 2010). We describe several engaging activities that teach elementary children about diabetes and how to prevent its onset by making healthful decisions about diet and exercise. Just as Chris Ohana (2006) implored teachers to do, we teach “kids to mix knowledge with personal action. Now *that* is power!”

We developed activities to teach elementary children about insulin function in conjunction with lessons on portion control. These diabetes education “workshops” were entitled, “Knowledge Is Power” in our effort to convey to our students that they can play a role in preventing the onset of type II diabetes. Our students were in fourth grade and participated in these activities during after-school activities (e.g., school science fair, scout troop meetings) for which we received parental permission.

We used National Science Education Standards and the National Health Education Standards (Figure 1) to design lessons that were grade appropriate. We describe five activities that can be set up as “stations,” although our students participated in each activity as a whole group.

Figure 1.

National Health Education Standards.

- 1: Students will comprehend concepts related to health promotion and disease prevention to enhance health.
- 2: Students will analyze the influence of family, peers, culture, media, technology, and other factors on health behaviors.
- 5: Students will demonstrate the ability to use decision-making skills to enhance health.
- 7: Students will demonstrate the ability to practice health-enhancing behaviors and avoid or reduce health risks.

From the Center for Disease Control and Prevention at www.cdc.gov/healthyyouth/sher/standards.



Figure 2.

How much sugar* are you drinking?

| Beverage name | Grams of sugar per bottle | Teaspoons of sugar per bottle |
|--------------------------|---------------------------|-------------------------------|
| Dr. Pepper | 64.0 | 13.0 |
| Pepsi | 69.0 | 14.0 |
| Sierra Mist | 65.0 | 13.0 |
| Gatorade | 34.0 | 7.0 |
| Rockstar-Pomegranate | 46.0 | 9.0 |
| Rockstar-Double Strength | 62.0 | 12.0 |
| Monster | 81.0 | 16.0 |
| Cranberry-Tropicana | 60.0 | 12.0 |
| Red Bull | 39.0 | 8.0 |
| Dole Orange Juice | 42.0 | 8.0 |
| Vitamin Water | 7.5 | 1.5 |

*based on 5 grams of sugar per teaspoon.

How Much Sugar am I Drinking?

Ask students whether they know how much added (number of teaspoons) or natural sugar is present in drink bottles (e.g., soda pop, juices, energy drinks). This can be done as a whole class or in small groups. Students were presented with several prewashed and dried drink bottles. The labels had not been removed. Using a funnel, spoon, and a bowl of “sugar” (we used salt because it is cheaper and less sticky) students guessed and poured the number of spoonfuls of “sugar” they believed each drink to contain. Teachers should remind students to not put any of the salt in their mouths.



We only revealed the correct answers for each bottle after students had made their own estimates, showing students a list of the amount of sugar in each bottle along with measurement values (Figure 2). Next, on a large poster we provided a list of ingredients often found on labels that are essentially different forms of sugar (e.g., high fructose corn syrup, maple syrup, glucose, fructose, lactose, sucrose, honey, dextrose).

Then students examined labels on the bottles and cans for the various names of sugar. The following discussion was enlightening for many students, who did not realize that sugar had so many monikers. We also explained that carbohydrates are broken down into forms of sugar by the body and that it is impossible to cut out *all* sugar in one’s diet. Rather, we stressed the importance of limiting sugar and explained that high levels of sugar consumption contribute to weight gain and incidence of type II diabetes. This is a nice segue into the next activity.

Portion Patrol (and Control)

In this activity, modified from the University of Georgia Department of Food and Nutrition (see Internet Resources), we provided students with bags filled with different-size household objects.

The students then tried to decide what the correct portions of different food groups are using these items (Figure 3). After showing participants the correct object, we asked them to evaluate themselves on how close or far they were from the answer. We related these portions to



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Figure 3.

What are the correct portions?

Cup of:
Potato, Pasta, Rice



Tennis ball

½ cup of:
Fruit, Cereal,
Pasta, Rice



Palm of a woman’s hand

3 ounces of:
Meat, Poultry, Fish



Deck of cards

2 tablespoons of:
Peanut butter (serving size)



Golf ball

Medium size:
Apple, Orange (serving size)



Baseball

A muffin should be
the size of a large egg



Large Egg

Half of a bagel should
be the size of a
large coffee cup lid



large coffee cup lid

the new version of the USDA food pyramid, now called *MyPlate* (see Internet Resources). Using household objects helped visual learners translate the portion control that is listed in the *MyPlate* guidelines. For example, two tablespoons of peanut butter is equivalent to a golf ball.

Food on My Plate

A follow-up activity to the *Portion Patrol* is *Food on My Plate*. To reinforce the concept of food portions, we asked students to divide a paper plate into a one-half section and a two-fourths section using their rulers. After examining a template of a plate divided into sections (Figure 4), students filled the largest section (half the plate) with their own drawings of vegetables and fruits, and then filled each quarter with either starch or protein sources. Students used colored pencils and markers to draw their foods. This activity allowed students to discuss with one another the types of foods they like to eat and where they should be categorized. Many foods are a mixture of these items, so students needed to decide where pizza or

macaroni and cheese should be placed. We told students to consider what the largest portion of the food item was (e.g., there is more starch in a thick-crust pizza than protein or vegetable). We helped students draw some of their favorite foods in the correct places.

Again, this activity helped visual learners consider how much of their lunch or dinner plate should be filled with food items. An extension activity would be to ask students to keep a daily food log. One way to do this is to have students create a logbook with four place-setting drawings per day. These place settings will represent breakfast, lunch, snack, and dinner, but can be modified as needed by the teacher and students. Students should fill in their place settings after each meal for several days. This is a great way for students to visualize how balanced their meals are over the course of each day.

Insulin Relay Race

After conducting activities on healthful eating and sugar consumption, we polled students to see how many

Diabetes Facts

About 23.6 million people in America have diabetes, and 5.7 million of them do not even know they have it (CDC 2008). Possible complications of this disease, if untreated or not kept under control, include diabetic comas, insulin shock, lower limb amputations, cardiovascular disease, and neuropathy (CDC 2008). Prevention of the onset of diabetes is a major national issue, and it begins in our elementary schools as children learn to develop habits regarding healthy eating and physical activity.

There are two main forms of diabetes. Type I diabetes, also called juvenile-onset or insulin-dependent diabetes mellitus, often occurs early in life. It likely begins when the body does not recognize its own insulin-producing cells and attacks and destroys them. Insulin is a hormone that helps keep the body's blood sugar levels in check. When there is not enough insulin, the blood sugar continues to increase and potentially results in a diabetic coma, if not controlled (Vader-Lindholm 2007). Type I diabetes is usually unpreventable but can be controlled by insulin injections in conjunction with balanced meals and activity. The combination of the two often allows people to live relatively normal lives.

Out of all the children in the United States that were diagnosed with diabetes in 2000, about 45% had type II diabetes, which up until then had been thought to be an adult disease (American Diabetes Association 2000). Not only are more children developing this disease, but it is often associated with complications due to obesity. Although family history may predispose some people to getting type II diabetes, 90% of those who have this disease are obese upon onset of the symptoms (Vader-Lindholm 2007). According to the American Diabetes Association (2000), warning signs of type II diabetes include behavioral changes (such as being tired all of the time), blurry vision, constant hunger or thirst, rapid weight loss, and frequent urination. Some of the suggestions for preventing type II diabetes include maintenance of a healthy weight (with physician consultation), balanced diet, portion control, and appropriate physical activity.

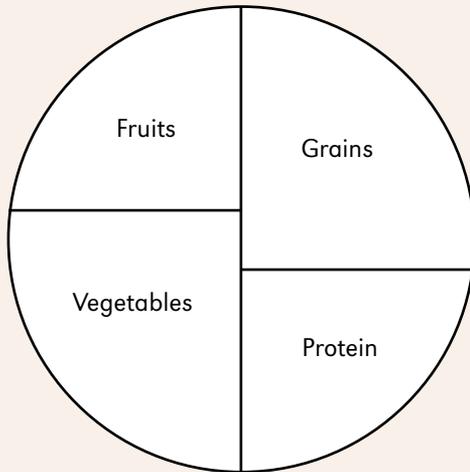
The problem for those with type II diabetes is that their cells will not allow glucose (sugar) to enter them because there are not enough recognition receptors to accept the sugar. The result is that blood sugar levels are excessively high in type II diabetics. Blood sugar levels are affected by the consumption of many forms of sugar (e.g., simple sugars like table sugar, and complex carbohydrates like bread). All carbohydrates are broken down into simple sugars during the digestive process. For both type I and type II diabetics, the bottom line is that insulin cannot remove sugar from the bloodstream at an appropriate rate to maintain normal blood sugar levels.

Making healthful choices (with controlled diet and regular physical exercise) can sometimes prevent the onset of type II diabetes, even if there is a family history of the disease. Sometimes the body can even return to the prediabetic state if a healthy lifestyle is embraced and maintained. Type II diabetes risk factors include obesity, race/ethnicity, economic status, and family history. Although most of these risk factors cannot be altered in our elementary school classrooms, teachers can help children take control over their physical health by educating them about the effects of obesity and how they can make healthful choices (Koch et al. 2007). For additional information on diabetes, refer to Internet Resources at the end of the article.

Figure 4.

Examining diet and portion size.

This place setting template can be used if students create food logs of what they eat over several days.



had heard of diabetes, as well as how many of them knew diabetics. Then, we explained that prevention and control of diabetes is accomplished by eating a balanced diet, practicing portion control, and reducing sugar intake.

Once sugar is in the body, it is absorbed into the bloodstream from our digestive system. We explained that sugar is used for energy or for storage by cells and

that insulin moves sugar from the bloodstream to our cells. If the insulin pathway is functioning normally, then sugar can be removed efficiently from the bloodstream. However, if the insulin pathway is not functioning normally, then sugar will be removed very slowly.

We used an insulin relay race to initiate a discussion about the function of insulin and its role in diabetes. This activity uses household items to represent the main players in diabetes physiology. To set up, we prepared 5.7 L clear plastic tubs (representing arteries) by filling them halfway with colored water (by whisking 1 teaspoon of washable red tempera paint in warm water—representing blood; we have found that red food coloring stains hands). The tubs were labeled “blood vessel.” In the tubs we placed large wooden or plastic beads (representing sugar). Keep in mind that the beads should float. Small bowls (representing cells) were labeled as such and placed about 3–4 meters away. By each plastic tub we placed either a plastic teaspoon (representing insulin in a diabetic person) or a paper/Styrofoam cup (representing insulin in a healthy person) that had a perforated bottom (we poked holes in the bottom using a pen). We told students that the spoon and the perforated cups represented insulin and would be used to grab the beads (representing sugar) and transfer them to the bowl (cell) (Figure 5).

Tell students to not step into tubs or shake them to prevent too much water spilling. We want to ensure that the activity is safe and that no one slips. To implement the activity, we divided the class into groups of three to four students. One student in each group was



Figure 5.

Insulin relay race props.



The relay race simulated the movement of sugar to the bloodstream.

the timer for his or her group and calculated how long it took his or her teammates to completely remove the beads from their group tub. The other students focused on picking up as many beads as possible, transferring them to a bowl placed next to the tub.

In order to assess, we asked students which item (spoon or cup) was the most efficient for removing beads. They were able to identify that the cup was the most efficient, even though it was perforated. The teacher can help students make a connection between the items and insulin function in type II diabetes. Students with spoons took longer to collect their wooden beads compared to students with cups, illustrating that diabetic insulin (spoon) cannot remove the sugar from the bloodstream at the rate compared to normal insulin (cup). Remind students that we started the activity with a set number of beads (sugar/glucose) in each tub, but in reality, as we eat throughout the day, sugar is continually entering the bloodstream. This accounts for the high levels of blood sugar that diabetics often experience.

Making Connections

We wrapped up the “Knowledge is Power” workshop by reminding students that healthful eating, limited sugar intake, and plenty of physical activity are all important to stay healthy and prevent the onset of type II diabetes. As an assessment activity, students wrote letters to Mrs. Obama explaining what they had learned about the power of personal choices. We were thrilled to see that the students were able to make connections between food portions consumed, the amount of sugar that is often found in bottled and canned drinks, and the negative effects that too much dietary sugar may have on their bodies. We were even more thrilled when Mrs. Obama wrote back (to some of the students in a local Girl Scout troop) to share her excitement that elementary students valued their personal health! ■

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Internet Resources

- American Diabetes Association
www.diabetes.org
- Barbara Davis Center for Childhood Diabetes
www.barbaradaviscenter.org
- Eat Well, Live Well – Diabetes Lesson Plans
noahnet.myweb.uga.edu/plansdb.html
- National Diabetes Fact Sheet
www.cdc.gov/diabetes/pubs/pdf/ndfs_2007.pdf
- USDA Website
www.choosemyplate.gov
- World Diabetes Day
www.worlddiabetesday.org

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Connecting to the Standards

This article relates to the following *National Science Education Standards* (NRC 1996):

Grades K–4

Content Standards

Standard F: Science in Personal and Social Perspectives

- Personal Health

National Research Council (NRC). 1996. *National science education standards*. Washington, DC: National Academies Press.