PROGRAM GUIDE

The Power of pH

PURPOSE

According to the Centers for Disease Control and Prevention, cavities are one of the most common chronic diseases of childhood. The consumption of sugar sweetened beverages is a leading cause of cavities in children, but cavities are preventable. The MouthScience® Education Kit provides 3rd through 6th grade students with an engaging, hands-on experiment that demonstrates the levels of acid and sugar contained in common drinks. The purpose of the exercise is to motivate students to make intentional and healthier drink choices that will decrease their chances for cavities and gum disease.

SUPPLIES

The MouthScience® Kit contains all necessary materials for a class of up to 30 students.

Quantity	Item	Explanation
1	$10 Wal-Mart Gift Card	Recommended drinks: 20 oz. Coca-Cola; 16 oz. Rockstar Energy Drink; 1 Pint Hiland Chocolate Milk; 20 oz. Fruit Punch Gatorade; 1 Pint Red Diamond Sweet Tea; 11.5 oz. Tropicana Orange Juice
30	Small Plastic Cups	Students will pour a small amount of drink to be tested into cups.
30	Paper Towels	Students will place a paper towel under cup to catch spills.
30	pH Strips	Students will dip end of strip into liquid to be tested.
30	Lab Sheets	Students will complete lab sheet while performing hands on activity.
30	Toothbrushes	Distribute to students to help keep those smiles healthy!

STANDARDS

The MouthScience® Power of pH Lesson utilizes basic science and math skills that are aligned with the following Oklahoma Academic Standards:

- **Health Standard 3:** Students will demonstrate the ability to access valid information, products, and services to enhance health.
- **Health Standard 5:** Students will demonstrate the ability to use decision-making skills to enhance health.
- **Health Standard 7:** Students will demonstrate the ability to practice health-enhancing behaviors and avoid or reduce health risks.
- **Math Standard 4.D.1:** Collect, organize, and analyze data.

LESSON PLAN: POWER OF PH

Learning Outcomes

- Understand the relationship between sugar, acid, and cavities.
- Determine which drinks are healthy choices for teeth and which drinks are not.
- Identify ways to avoid or reduce damage to their teeth caused by sugary drinks.

Key Messages

- Cavities are caused by the acid produced when sugar mixes with bacteria (plaque) on teeth.
- Children regularly consume drinks that are high in sugar and very acidic.
- It is important to choose water most often and limit sugary drinks and acidic drinks.

Key Vocabulary

- Acid – High concentration of hydrogen ions; tastes sour
- Alkaline (Base) – Low concentration of hydrogen ions; tastes bitter
- Enamel – Hard outer layer of the tooth
- Neutral - Equal concentration of hydrogen/hydroxyl
- pH – The acidity or alkalinity of a solution
- pH scale – measures how acidic or alkaline a substance is

Rationale for Calculations

- 4 grams = 1 teaspoon
- 1 teaspoon = .009186 pounds

Prepare

Visit ddokfoundation.org/mouthscience to view the **instructional video** and **download the PowerPoint** with corresponding visual aids.

Each child receives:

- 1 lab sheet
- 1 paper towel
- 1 cup
- 1 pH strip

Divide class into six groups. Each group receives:

- 1 drink

Activity

Introduction

1. **Ask students to tell you why they have teeth. Exactly what do their teeth do?** (eat, talk, smile) **Explain that it is important to keep their teeth healthy. Part of keeping teeth healthy is avoiding cavities. Ask students to tell you what causes cavities.** (sugar, candy, soda, not brushing their teeth)
    a. *Display slide 2 of the PowerPoint.* **Explain that when sugar they eat or drink mixes with the bacteria (plaque) in their mouth, acid is formed. The acid wears away at the enamel (hard outer surface of the tooth), creating a hole, or cavity.**

2. **Remind students that sugar is a big factor in causing cavities. Ask them to think about drinks they have on a regular basis.**
    a. *Display slide 3 of the PowerPoint.* **Discuss the amount of sugar found in (1) one 20 oz. bottle of orange juice.**
    b. *Display slide 3 of the PowerPoint.* **Discuss the amount of sugar found in (1) one 20 oz. serving of chocolate milk.**
    c. *Display slide 3 of the PowerPoint.* **Discuss the amount of sugar found in (1) one 20 oz. bottle of soda.**

    Ask students if they consider that amount to be a lot of sugar. Remind them that it *is* a lot of sugar – especially when it doesn't count the sugar consumed from food.
    d. *Display slide 4 of the PowerPoint.* **Discuss the amount of sugar found in yogurt.**
    e. *Display slide 4 of the PowerPoint.* **Discuss the amount of sugar found in ketchup.**
    f. *Display slide 4 of the PowerPoint.* **Discuss the amount of sugar found in a granola bar.**

3. **Remind students that <u>acid</u> is what eats away the enamel and causes a cavity. Ask them if they are aware that some foods and drinks are acidic (contain acid). Are they curious to know which drinks are acidic? Let them find out by testing the pH (or acidity) of common drinks.**

Distribute Materials

4. *Divide the class into (6) six groups. Distribute (1) one lab sheet, (1) one paper towel, (1) cup, and (1) pH strip to each child.*
5. **Remind students the drinks are for the investigation, not for drinking.**

Activity Steps

6. *Give each group a drink.* **Instruct students to pour a small amount of the drink into the cup.**

7. **Have students dip the pH strip into the liquid, take the strip out, and set it on their paper towel.**

8. *Display slide 5 of the PowerPoint.* **Introduce the pH scale by asking students: What tool is used to measure temperature?** (thermometer) **What tool is used to measure the length of a piece of paper?** (ruler) **Explain that a <u>pH scale</u> is the tool we use to measure the pH of a substance.**

9. **Tell students to compare the wet end of the pH strip to the colorful boxes on the pH scale. When they find the box that matches the closest in color, ask them to circle the number on top of the box.**

Record the Information

10. *Display slide 6 of the PowerPoint.* **Tell students if they were to test pure water, its pH would measure at 7. Have students write *7* for the pH of water.**

11. **Record the pH of each drink by asking each group what the pH of their drink is.**

12. **What do the numbers mean? Tell students it is 100°F degrees outside. Ask them if it is hot or cold.** (hot) **Tell students it is 20°F. Ask them if it is hot or cold.** (cold)

13. **So, what do these numbers mean? Explain to students that 0-6 = acid, 7 = neutral, 8-14 = alkaline or base.**

14. **Continue recording information in the third column. Remind students that pure water measures at 7, so is it an acid, neutral, or base?** (neutral)
    → **NOTE**: Bottled water's pH varies due to the filtration process. *Absolutely pure water does not exist due to water's tendency to absorb substances from its surrounding environment.*

15. **Complete the third column of the table by asking if each drink is an acid, neutral, or base (alkaline)**

Analyze and Interpret Data

16. **Ask students to look at the information gathered from the investigation and tell you what they've learned from the data.** (All drinks are acidic except water.)

17. *Display slide 7 of the PowerPoint* **Explain that the lower the pH is, or closer to zero the pH is, the *stronger* the acid. The closer the pH is to 7, or neutral, the *weaker* the acid is.**

18. **Ask the children: Based on that information, what they can tell you about cola? Is it a strong acid or a weak acid?** (strong) **What can they tell you about milk? Is it a strong acid or a weak acid?** (weak)

19. *Display slide 8 of the PowerPoint* **Have students look at the bar graph at the bottom of the paper. Ask students what the bar graph tells them.** (The bar graph shows how many teaspoons are in a 20 oz. serving of certain drinks.)

20. **Ask students which drink has the most sugar.** (energy drink) **Which drink has the least amount of sugar?** (water)

21. **Have students recall what causes cavities** (sugar mixes with plaque and creates acid). **Ask students which drink(s) could cause a lot of damage to their teeth.** (cola, energy drink, sport drink) **Why?** (strong acid, high sugar)

22. **Ask students which drink would do the least amount of damage to their teeth.** (water) **Why?** (There is no acid or sugar in water)

Conclusion

23. **Based on the information we gathered from our investigation, which drink should you choose <u>most often</u>?** (water) **Which drinks should they choose <u>occasionally</u>?** (cola, sports drinks)
    → NOTE: Energy drinks are not recommended for children.

24. **Remind students that water should be what they drink most often, but we know they will continue to enjoy sugary drinks occasionally.** *Display slide 9 in the PowerPoint.* **Share the following tips to help keep teeth healthy:**
    - **When drinking sugary/acidic drinks, use a straw. This lessens the contact the sugar and acid has with your teeth.**
    - **After eating or drinking something containing sugar and acid, wait approximately 20 minutes and brush your teeth.**
    - **If you have finished eating or drinking something containing sugar and acid, and you don't have a toothbrush handy, drink water to help rinse away the sugar and acid.**
    - **Chewing sugarless gum can also help. Your mouth produces saliva when you chew. The saliva can help remove sugar and acid from teeth.**

EXTENSION ACTIVITIES

ACID ATTACK

Supplies
(2) Tums® tablets
(2) paper cups
Water
Vinegar

Instructions
Place a Tums® tablet in each of two paper cups. Cover one tablet with vinegar; cover the other with water. Wait five minutes and empty the liquid out of the cups. What has happened to the tablets? The one in the vinegar has dissolved much faster than the one in pain water because vinegar is an acid. Both the Tums® tablet and a tooth contain calcium, and calcium dissolves more readily in acid than in water.

Lessons Learned
Just like the Tums® tablet, your teeth's enamel dissolves more quickly when exposed to acid. That's why it is important to limit acid attacks on your teeth.

Source: https://www.mouthhealthy.org/en/resources/lesson-plans/smile-smarts

AN APPLE A D(EC)AY

Supplies
(2) Apples
(2) Paper bags
A sharpened pencil
A sharp knife

Instructions
Using a pencil, poke a hole in one of the apples. Place the apples – the punctured apple and the control apple – in separate paper bags. After letting the apples sit in the bags for at least 24 hours, remove them and use the knife to cut both of them in half. The control apple should appear normal, while the punctured apple has begun to decay.

Lessons Learned
Just like an apple's skin, enamel is an important barrier for keeping bacteria out of your teeth. When that enamel shield is broken – like when you get a cavity – it opens the door for bacteria to get inside your teeth and cause decay. That's why it's important to brush your teeth twice a day with a fluoride toothpaste to remove germs and strengthen your enamel.
Source: https://www.mouthhealthy.org/en/resources/lesson-plans/demonstrations/apple

REFERENCES

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Children's Dental Health, Centers for Disease Control and Prevention (CDC). [accessed 4/06/2020].
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HELPFUL WEBSITES

https://www.colgate.com/en-us/bright-smiles-bright-futures

https://www.deltadentalmi.com/Member/Wellness/Teaching-Tools

MouthScience® is a community service program of
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