

1. Sugary drinks



2
hours

Children take on the role of a toothpaste manufacturer liaising with a drinks manufacturer to produce a juice drink that does not increase the risk of tooth decay. The children test the effect of plaque acid on teeth, using egg shells in different concentrations of vinegar left over night.

OBJECTIVES

- Identify the different types of teeth in humans and their simple functions
- To understand that sugar can cause tooth decay.
- To understand that plaque produces a corrosive substance.
- To understand the effect of plaque acid on teeth.

RESOURCES

(Per group of 4 children unless otherwise stated)

- Activity sheets 1a-b
- Activity sheet 1c-e (per child)
- 3 containers, e.g. 250 ml beakers or yoghurt pots
- 75ml white vinegar
- 75ml water
- Eggshell (one egg for 3 – 4 groups)
- 2-4 Magnifying glasses (optional)
- Drinks packaging - detailing sugar content – optional (children collect)
- 1 plastic teaspoon
- Latex/disposable plastic gloves.

Safety note

The eggs must be boiled and the membrane removed.
Check for children's allergies.

ADVANCE PREPARATION

To prepare the egg shell, either boil and shell the eggs for each group, removing the membrane, or, shell raw eggs and then boil the shells.

Break the shells into roughly 3 equal sized pieces (approximately 1 cm²) for each group.

Each group requires three containers of liquid (approximately 50 ml). The first contains water, the second, half water and half vinegar, and the third undiluted vinegar. Depending on the class and time available, either prepare the vinegar solutions for each group beforehand, or allow the children to measure them out during the activity.

INTRODUCING THE ACTIVITY

Show the children the toothpaste manufacturer's e-mail (Activity sheet 1a), asking for advice on developing a toothpaste that will clean off the sugar left on teeth after contact with a sugary drink. Read the newspaper cuttings (Activity sheet 1b) that refer to the effect of some soft drinks on children's teeth. (Information in the cuttings is from www.bbc.co.uk)

Discuss how sugary foods and drinks cause tooth decay (see [Appendix 1](#) for background information about tooth decay).

This is an opportunity to highlight, define and discuss vocabulary to do with dental hygiene and tooth decay such as:

plaque, tooth decay, cavity, hygiene, bacteria, gum disease, tartar.

As an optional extension or homework activity, the children could complete a flow chart (Activity sheet 1c) showing the process of tooth decay using words or labelled pictures.

MAIN ACTIVITY

Ask the children to suggest how they could test the effects of sugary drinks on teeth. If they suggest dropping teeth into different kinds of drinks, ask them where they will get the teeth from. Tell them that eggshells are made of similar material to our teeth. Explain that, to make the test fair, vinegar will be used. This is not meant to be like the drink, but like the substance that is made when plaque and sugar mix together; this is called 'plaque acid'. Continue to remind the children of the connection between the effects of vinegar on eggshell, and the effect of plaque acid on teeth.

Use Activity sheet 1d to go through the investigative process and the plan to observe the effects of different strengths of vinegar on eggshell.

Children can observe the eggshells using magnifying glasses to describe their colour, texture and hardness before the investigation. They then read the plan and think about what they are going to do.

Safety note

The children should either wear plastic gloves or manipulate the eggshell with a spoon without touching it.

Children set up an investigation with the same amount of liquid in each of three containers (approximately 50 ml). The first contains water, the second, half water and half vinegar, and the third undiluted vinegar.

The children predict what they think will happen to each of the eggshells and why. Encourage them to think about the colour, texture and hardness. They could draw and label a prediction picture on the back of the sheet.

After the eggshells have been in the solutions for a few minutes, the children should be able to notice bubbles appearing on those in the vinegar solutions (more in the highest concentration of vinegar) and no bubbles on the eggshell in the water. Ask the children:

- *Why do you think bubbles are appearing on the eggshells in vinegar?*

The vinegar is doing something to the eggshell. It is changing the eggshell in some way.

After leaving for at least 1 hour (perhaps over lunch), the children observe the eggshells in the solutions. They should see that the eggshell in both concentrations of vinegar should be floating and covered in small bubbles of gas (more bubbles on the eggshell in the concentrated vinegar). However, the eggshell in the water should have no bubbles and should still be at the bottom of the container.

The children remove the eggshell samples to observe any changes in colour, hardness or texture by gently prodding, scratching and feeling the samples. This could be a discussion point, or the children record their observations on Activity Sheet 1e. They should notice that eggshells in both the vinegar solutions are weaker, more brittle (snap-able), rougher, and crumbly and that the colour can be scratched off. The eggshell in water should have no change to its colour, texture or hardness.

They then return the eggshells to their solutions and leave them overnight before the final observation where the eggshells left in the vinegar solution should be floppy and begin to disintegrate when removed from the container.

PLENARY

Draw a conclusion with the children, discussing the effect the vinegar had on the eggshell. The shell should have weakened and be much more brittle.

Make it explicit that the vinegar has damaged the eggshell in a similar way to plaque acid damaging teeth.

EXTENSION

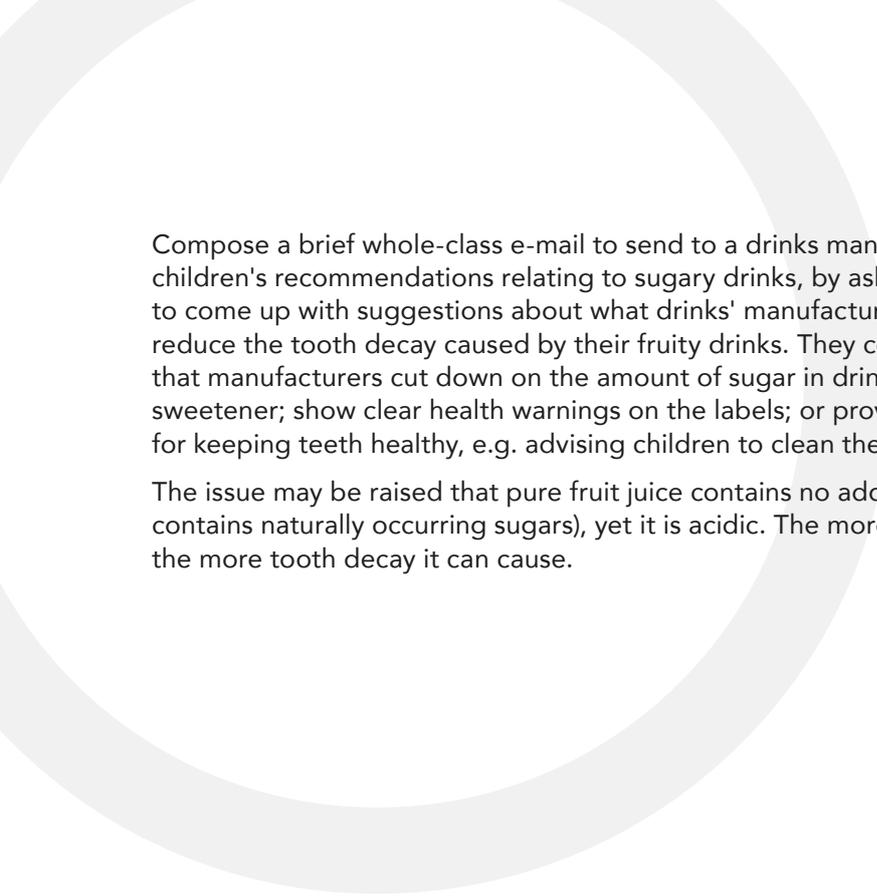
Children examine the ingredients on the drinks packaging that they have collected to identify the sugar content in different drinks and fill in the chart on Activity sheet 1f. If the amount of sugar is not listed, they could examine the ingredients that are usually listed in order of amount; largest to smallest.

Ask the question:

- *Should we never drink sugary drinks even if we really enjoy them?*

We can still eat or drink sugary foods or drinks in moderation, as long as we clean our teeth regularly after drinking them.

Re-read the e-mail and ask the children if they have found an answer to any of the problems.



Compose a brief whole-class e-mail to send to a drinks manufacturer with the children's recommendations relating to sugary drinks, by asking the children to come up with suggestions about what drinks' manufacturers should do to reduce the tooth decay caused by their fruity drinks. They could recommend that manufacturers cut down on the amount of sugar in drinks; find an alternative sweetener; show clear health warnings on the labels; or provide advice on the label for keeping teeth healthy, e.g. advising children to clean their teeth after a drink.

The issue may be raised that pure fruit juice contains no added sugar (it only contains naturally occurring sugars), yet it is acidic. The more sugar a drink contains, the more tooth decay it can cause.

Appendix 1: Tooth decay

Tooth decay is damage to the enamel of your teeth. It occurs when acids produced by bacteria in dental plaque eat away at the tooth.

HOW DO SUGARY FOODS AND DRINKS CAUSE TOOTH DECAY?

A number of micro-organisms are present in our mouths. Bacteria are the most common among them. Enzymes produced by these bacteria convert all food, especially sugar and starch, into acids. Bacteria, acid, food debris, and saliva combine in the mouth to form a sticky colourless film called plaque that adheres to the teeth.

The bacteria in the plaque consumes sugar in our mouths and produce an acidic substance as a waste product, which damages teeth, gums, and surrounding bone. Plaque forms constantly, but it can be controlled by proper brushing and flossing.

Plaque that is not removed from the teeth becomes a hard substance called tartar. Plaque and tartar irritate the gums. The acids in plaque can dissolve the enamel surface of the tooth and create holes in the tooth (cavities). Cavities are usually painless until they grow very large inside the internal structures of the tooth (the dentine and the pulp at the core) and can cause death of the nerve and blood vessels in the tooth, leading to the formation of abscess. Untreated tooth decay can result in death of the internal structures of the tooth with eventual loss of the tooth.

A dentist or physician may prescribe fluoride tablets to be taken while the teeth are developing in a young child. Daily intake of refined carbohydrates or sugars should be minimised since they promote tooth decay. If a cavity is found, the decayed tissue is removed from the tooth and replaced by a filling. A crown is used if decay of a tooth is severe. Crowns cover the tooth and minimise the risk of the tooth breaking.

HOW DOES SALIVA AFFECT TOOTH DECAY?

A primary factor in the rate of tooth decay is the chemical structure of saliva. Acid saliva causes tooth decay; and alkaline saliva causes gum disease. Acid saliva and sugar in dental plaque causes the enamel on the tooth to soften which leads to cavity formation. Alkaline saliva and sugar in dental plaque causes the plaque at the gum line to harden into calculus (tarter) causing gum disease.

Therefore, two children in the same family can eat the same amount of sugar and one child may have a lot of cavities and the other child may have no or few cavities because of the different saliva. As people get older their saliva becomes more alkaline with age. That is one reason adults have more gum disease and fewer cavities.

Thus it is important for children to brush the gums and teeth on a regular basis even though the child is not cavity prone. The gums are important too.