Toothpaste: Friend or Foe?

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This issue is important to me because I have just recently gotten my braces removed after having them on for 3 almost 4 years. I spent a lot of time and money to be able to smile proudly and I don't want to risk all that hard work by using ingredients in toothpaste that could be harmful, or that claim to whiten teeth while in fact doing very little.

Abstract

Before modern day toothpaste people tried several different things to clean their teeth such as using eggshells, ash, ground oyster shells and salt. When an American dentist Peabody added soap to his toothpaste things started to change, but did they change for the better? Modern toothpaste includes all kinds of chemicals from natural ingredients to synthetically made ingredients. These ingredients are added to help with oral health. At least that's what it's supposed to be! However, some of the ingredients may do some harm to our well-being and to our environment. For this social action project, I discuss some effects of toothpaste ingredients on personal health as well as the environment. I also conducted an experiment to test teeth whitening claims and I checked to see if there are controversial microbeads in some toothpaste brands. My proposed action is to inform people of what is in toothpaste so they can make an informed decision and I suggest healthier alternatives such as homemade toothpastes with healthier ingredients.

Introduction

With so many different types of toothpaste, there are many ingredients put together in different combinations. Toothpaste claims can be extravagant, stating that "you will have noticeably whiter teeth in 3 days." With these types of claims people assume they will receive a Hollywood white smile even though a tooth's natural color is not perfectly white. Toothpaste claiming to prevent cavities and gingivitis are considered an over-the-counter drug and are monitored by Health Canada and the Food and Drug Administration (FDA), while toothpaste claiming to whiten teeth and remove stains are considered cosmetic and are not monitored so it's questionable as to whether they are effective or even healthy. With loose regulations there are many ingredients that may affect human health as well as the environment

Student Reflections:

What I found interesting is that there is some conflicting information on triclosan due to the fact that the FDA and the Government of Canada have different opinions on this ingredient and how to regulate it. They have varying opinions on how dangerous it is.

negatively. Some of these ingredients are on the toxic substance list, and can be linked to stomach issues, damage to the liver and kidneys, and cancer.

In the past, there were other ingredients that were harmful to human health and the environment which have been banned from production (or on the list of questionable substances). Two of these ingredients are microbeads and triclosan. Microbeads are small plastic beads less than 5 micrometers in size and have been found in many waterways where they can absorb persistent organic pollutants (e.g., long-lasting toxic chemicals like pesticides, flame retardants, motor oil and more) and other industrial chemicals that move up the food chain when the toxic-coated beads are consumed by fish and other marine organisms (Perschbacher, 2016); a single microbead can be up to a million times more toxic than the water around it (Perschbacher, 2016). Microbeads were banned as of July 1, 2018.

Triclosan is an ingredient added to many consumer products intended to reduce or prevent bacterial contamination (“5 Things to Know About Triclosan”, 2019). According to one website, triclosan “does *not* provide any additional health benefits to the consumer, but it does pose risks to human health, most of which are understudied (“Beyond Pesticides, Triclosan: Health Effects”, 2019). Despite this claim, Health Canada has not banned triclosan, though it does state that this substance is harmful to the environment and suggests ways for us to limit our exposure to triclosan (“Government of Canada: Triclosan”, 2019).

Experiment

The purpose of this experiment was to test the claims of guaranteed whiteness in toothpaste brands and to see if microbeads were still present in *Crest 3D White* toothpaste. These claims of whiteness were tested by brushing nine eggs stained with coffee with different brands and types of toothpaste twice a day for seven days. The control in this experiment was an unstained egg to match to the original color and egg brushed with only water to show how much of the stain was only surface stains. To test for microbeads after brushing the Crest egg it was rinsed off into a mason jar to look for the presence of microbeads in the water under a microscope.

I predicted that the claims would be true, but not necessarily in the time claimed (e.g., guaranteed whiteness in three days!). Also, other types of toothpaste that do not claim guarantee whiteness would also whiten the eggs almost to the same amount of white as the whitening brands. It was also predicted that Crest 3D White would still contain microbeads or some abrasive material as a result of the gritty feel.

Table 1: Summary of Results BRAND of TOOTHPASTE	BEFORE BRUSHING	AFTER 7 DAYS of BRUSHING	Relative SCORE 0-5
Crest 3D White: Sodium fluoride, glycerin, hydrated silica, sodium hexametaphosphate, H ₂ O, PEG-6, trisodium phosphate, sodium lauryl sulfate, cocamidopropyl betaine, sodium saccharin, carrageenan, polyethylene oxide, xanthan gum, sucralose, mica, titanium oxide.			5
Arm & Hammer: Sodium fluoride, H ₂ O, aroma, cellulose gum, glycerin, silica gel, sodium bicarbonate, titanium oxide, sodium lauryl sarcosinate, sodium lauryl sulfate, sodium saccharin, sorbitol, tetrasodium pyrophosphate.			3
Green Beaver Natural Toothpaste: Calcium carbonate, H ₂ O, sorbitol, glycerin, hydrated silica, spearmint leaf oil, xylitol, citrus, lemon extract, xanthan gum, coco-glucoside, calcium ascorbate, tea tree leaf oil.			2
Turmeric Whitening Paste: Turmeric powder, baking soda, vitamin D3 oil, extra virgin coconut oil.			-5 (negative)
Baking Soda: H ₂ O, baking soda.			5
Water: H ₂ O.			2
CONROL EGG This is the unstained control boiled egg			NA

(Good ingredients, debatable ingredients, bad ingredients)

Student Reflections:

Figure 1: A & B are pictures of microbeads (A: 50x zoom; B: plastic microbeads on a finger) (A: "Microbeads", 2016; B: "Plastic microbeads", 2018).

Figure 2: A & B are pictures that I took under a microscope (A: 40X zoom; B: 100X zoom) (Crest 3D White toothpaste)

Discussion of Results

During this experiment I learned that some toothpaste claims may be accurate but only whiten teeth to their original color. A human's teeth are not naturally white but are within the range of light greyish-yellow shades and naturally darken with age. So, while the toothpaste may remove stains it will not give a person a Hollywood white smile. While the Crest 3D™ had the best results in whitening the eggs (relative effectiveness score of 5), its ingredient list is concerning. It should be noted that baking soda alone had the same effect (relative effectiveness score of 5) as Crest 3D™ suggesting that maybe safer alternatives could be created at home using baking soda and some other ingredients, like coconut and peppermint oils. While natural alternatives are preferred, they are not always best. Turmeric was an ingredient used in a few types of whitening paste I found while looking for healthier alternatives but, as seen in the table above (relative effectiveness score -5), it did not whiten but in fact it stained the egg, and although the paste I used caused staining another type of turmeric based toothpaste did not have the same effect. I believe that if anyone makes their own homemade toothpaste, they should research the ingredients used in it, their effects (good and bad), and if possible, how they react together. Another thing to be careful of when

using homemade is to be mindful of how much baking soda is used and how often because it is a debatable ingredient due to the fact if used constantly it could damage tooth enamel; as long as it isn't used every day baking soda may be effective. The majority of the ingredients in Crest 3D™ were either "bad" or debatable, and the polyethylene oxide ingredient needs to be investigated in more detail. Microbeads have been banned from toothpaste and polyethylene is a form of microbead polymer, though I am not sure if polyethylene is the same as polyethylene oxide, so further research is needed here. During my investigation I rinsed egg brushed with Crest 3D™ into a jar and examined the water through a microscope. I found that the sediment in the water looked like small beads, and when compared to microbead photos in Figure 1A, it looks very similar though difficult for me to make a definite conclusion if what I found are actual microbeads or something else.

The limitation of this experiment was the fact that the eggs were only stained for the initial 24 hours, while real stains are acquired for a longer period of time and teeth get stained on a daily basis, such as a person drinking coffee every day, or smoking. Another limitation is that I lack knowledge and experience to definitively say whether or not microbeads are still present within Crest 3D™ White toothpaste.

Some ways that I might improve my experiment is to stain the eggs everyday (or for longer than 24 hours). I would also test other toothpaste brands to see if they contain microbeads.

Actions

I recommend that people get informed about the ingredients used in toothpaste and the risks and benefits of each ingredient so that they can make an informed choice on which brand they use. I also recommend that natural toothpaste alternatives are used more. These alternatives are healthier. If homemade toothpastes are used more there will be less waste from corporate packaging, we know what we are putting in our mouths and what is going down the drain. After doing the research for this paper my mom and I made our own homemade toothpastes. One was made with cacao nibs grounded into powder, coconut oil, and Himalayan salt. The other was made with baking soda and strawberries but we added vitaminD3 oil, which is good for bones and teeth, to both toothpastes. We also have been using the Green Beaver Natural toothpaste and it works well, admittedly it doesn't whiten as good as the corporate brand, but it does whiten in a healthier way. The best thing I can do is to raise awareness so the public can decide if they feel that some of the ingredients used are too harmful to human health to be allowed in these products. I also created samples of homemade toothpaste as a natural alternative, especially after learning that baking soda is an effective natural ingredient to remove stains.

I chose this action because when telling my mom what I found about the ingredients used in toothpaste her first response was to look for healthier ways of keeping our teeth clean without the use of corporate toothpaste and I thought if my mom felt that way, and if an alternative solution would work the best for us, then it may work for others, too.

Student Reflections:

I wish I had the resources to definitively say whether or not microbeads are still present or not because if they are they are still getting into our lakes and oceans and are a part of mass micro plastic pollution, then this is problematic as it introduces extra toxins into marine life. As an aspiring veterinarian, I am deeply concerned about the well-being of animals and all living things.

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