

“Artificial Sweeteners: Friend or Foe to Your Microbiome”

Author: Amanda Brown
Major: B.S. in Nutritional Sciences

Microreviews in Cell and Molecular Biology

Key Words:

Microbiome, gut health, artificial sweeteners, aspartame.

2018

Department of Microbiology and Molecular Genetics, Oklahoma State University, Stillwater, OK 74078, USA

Abstract:

The gut microbiome is home to trillions of microorganisms that help regulate and balance the delicate processes performed in the body to drive metabolism and absorption of nutrients from foods consumed. Artificial sweeteners, specifically aspartame, have been named the new, and upcoming “bad guys” of the nutrition world, contributing to diseases such as obesity, diabetes, and cancer. It is advised to avoid products containing aspartame due to their reported detrimental effects to the body. Multiple studies have been conducted showing a positive correlation from the consumption of artificial sweeteners for increased obesity and raising risk of type 2 diabetes onset. An increased risk of cancer is also widely popular idea with the consumption of aspartame products, although studies have not provided strong evidence to support to these buzzing claims. In the past few years, it has become more popular for healthcare providers to suggest adding probiotics in order to aid a distressed or enhance a normal microbiome, but this may not be necessarily the long term answer to a healthy gut. A healthy diet may be the best answer to the longevity of a healthy, functioning microbiome. Overall, the recommendation to avoid the consumption of artificial sweeteners stands firm.

Introduction

There are trillions of microorganisms, including bacteria, viruses, protozoa, and fungi, located in the intestines of the human body. Most microorganisms assist with adequate digestion and absorption of vital nutrients from foods for human body function. Any acute change of diet may interrupt the habitat of these microbes in less than 24 hour if foreign foods are ingested, and in trade, takes approximately 48 hours to resume to previous microbiome normalcy¹.

Diet soda contains the following ingredients: carbonated water, caramel color, aspartame, phosphoric acid, sodium benzoate, potassium citrate, and caffeine. Many of these listed ingredients have raised alarm throughout the healthcare community due to their effects on the microbiome of the gut, and overall to a person's health, more notably, artificial sweeteners such as aspartame. Aspartame is one of the most common non-caloric artificial sweeteners and has been used in the United States since the 1980s. The make up of aspartame consists of two amino acids: aspartic acid and phenylalanine. Aspartame is easily and quickly digested in the human body. Many subjects claim that they experience diarrhea or loose stools, less frequent stools, constipation, nausea, stomach, cramps, and or abdominal bloating² after coming products that contain aspartame. There has been ongoing debates throughout the scientific community whether artificial sweeteners are indeed the culprit to health hindering effects, such concerns are increased obesity, diabetes, metabolic disorders, and other associated diseases including cancer.

Recent Progress

had an increase of their blood glucose levels over a period of time, and put them at greater risk of developing obesity and related disease such as

diabetes. The changes of the microbiome after ingesting artificial sweeteners appear to be related directly to the human bodies' metabolism. The most commonly found microbes in our gut are *Bacteroidetes* and *Firmicutes* which notably play a huge role with aid our gut metabolism. According to the study as stated, the artificial sweeteners are said to be decreasing the amount of microorganisms that are aiding our bodies' metabolism and instead enhancing the microorganisms that rob nutrients from food more intensely and create excess calories or fat. Fat is a poor source of energy for the body, and is more likely to stored in varies areas of the body rather than be used as fuel for energy. Mice were also noted to have elevated hemoglobin A1c levels and became glucose intolerant, meaning their body tissues had difficulty up taking glucose which contributed to overall obesity. Although the findings of this study may appear grim, the effects of the artificial sweeteners on the gut microbiome could be reverted back by introducing antibiotics that killed the microorganisms responsible for the significant increase in calorie production. After completing the antibiotics, the microbiome was restored to its original status as well as the blood glucose levels of the mice³.

There has also been a rising concern that aspartame closely resembles a carcinogen and is related to cancer causing agents within the human body and microbiome. One of the largest studies conducted by the NCI (National Cancer Institute) sampled 500,000 adult individuals and compared between individuals who did consume aspartame products regularly vs. those who did not, and the findings suggested that there is no strong indication that there is an increased risk of developing lymphoma, leukemia, or brain tumors in individuals consuming aspartame

¹ "Influence of diet on the gut microbiome and implications for human health", Rasnik K. Singh, *Journal of Translational Medicine*, published April 8th, 2017, page 1. <https://translational-medicine.biomedcentral.com/articles/10.1186/s12967-017-1175-y>.

² "Gastrointestinal Issues and the Gut Microbiome: How Aspartame is Digested", Calorie Control Council, *Aspartame Separating Fact From Fiction*, published 2018. <https://aspartame.org/gastrointestinal-issues-gut-microbiome/>

³ "Artificial Sweeteners May Change Our Gut Bacteria in Dangerous Ways", Ellen Ruppel Shell, *Scientific America*, published April 1st, 2015. <https://www.scientificamerican.com/article/artificial-sweeteners-may-change-our-gut-bacteria-in-dangerous-ways/>

products⁴. Most of the studies conducted in humans that consume aspartame have not provided strong evidence or support to the claim that aspartame is one of the cancer causing agents.

Healthcare providers have also attempted to create alternative methods of “fixing” a distressed microbiome by adding foods with active cultures, such as yogurt, or probiotics to an individual's diet. The concept of taking probiotics to enhance and protect our microbiome has been suggested to combat products that do cause a disruption in your microbiome, such as artificial sweeteners. Probiotics were first introduced by Elie Metchnikoff with his study suggesting longer lifespans of individuals consuming fermented milk with live microorganisms. Although probiotics may be a popular choice of prophylactic for the gut microbiota, there are some cons with daily use. Probiotics are indeed considered “active microorganisms” and may cause competition between your original microbiota and may ultimately suppress their growth⁵.

Hundreds of studies continue to be conducted in hopes of finding the true, real effects of aspartame and other artificial sweeteners on the microbiome and body in general, but progress is slow since it is an emerging science.

Discussion

These findings of the Israeli study discussed brings great relief to the artificial sweetener epidemic seeing as the microbiome of the gut is flexible in nature. It can be pushed from one end of the spectrum to another with the addition or destruction of certain microbes. Although, it is important to note that artificial sweeteners were introduced as a tactic to combat the obesity epidemic, but in fact may be contributing to the issue itself if consumed over long periods of time. Taking antibiotics in order to reverse the effects of artificial sweetener affects on the microbiome may be a successful method to revert the gut back to normal for a short period of time. Although, antibiotics are not the answer for long term regulation for individuals, especially since

antibiotics do have a significant impact on microorganism life in general. This may end up hindering a person's microorganisms in general, not just in the gut.

In terms of aspartame causing cancer, in general, there is not enough evidence to support this claim either way it is presented. It would be wise for a person who is weighing the benefits and the risks to keep in mind that artificial sweeteners are a chemical. It is better for a person to stick to a more natural diet rather than consume products with multiple chemicals that may be acutely or chronically harmful. The best way to keep your microbiome happy in general would be to follow a healthy diet. Most individuals in the United States follow a Western Diet that is high in fat which causes a rapid shift in our microbiome. Diets suggested by most healthcare providers, such as the DASH and Mediterranean diet, are plant-based that are low in carbohydrates and sodium, and packed full of fruits, vegetables, and healthy oils for taste. These diets are much more suited to keep the microbiome, and body, happy and healthy.

In conclusion, for an individual who is deciding between consuming products with artificial sweeteners as opposed to products without artificial sweeteners, it would be best to avoid aspartame and artificial sweetener consumption in general.

⁴ “Aspartame”, ACS Medical Content and News Staff, *The American Cancer Society*, published May 24th, 2014. https://www.cancer.org/cancer/cancer-causes/aspartame.html#written_by

⁵ “Effects of Probiotics on gut microbiota: mechanisms of intestinal immunomodulation and neuroendulation”, Peera Hemarajata and James Versalovic, *NCBI: PMC*, published: Jan 2013. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3539293/>