The Public Perception of Aspartame

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Jack Craddock

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On my honor as a University Student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments

Advisor

Richard D. Jacques, Ph.D., Department of Engineering and Society

Introduction

The Center for Disease Control and Prevention (CDC) defines added sugars as "Sugar and syrups that are added to foods or beverages when they are processed or prepared. Naturally occurring sugars such as those in fruit or milk are not added sugars" (CDC, 2019). The CDC goes on to say that it is very important to minimize consumption of added sugars in order to prevent conditions such as obesity, diabetes, or heart disease. A study published by the American Journal of Clinical Nutrition in 2014 found that 34.4% of added sugars consumed by Americans were from soda, sports drinks and energy drinks which is significantly more than the second highest source: 12.7% from grain desserts (Drewnowski, 2014).

On the surface it may not seem surprising that sugary beverages account for such a large percentage considering that a twelve-ounce serving typically contains about thirty-nine grams of added sugar. However, zero sugar substitutes for sugary drinks are far more attainable than zero sugar substitutes for candy or baked goods, so it seems like it would be far easier for someone to eliminate added sugar intake from sugary drinks than from any other source.

One of the main ingredients responsible for the introduction of diet sodas, diet sports drinks, and diet energy drinks is aspartame. Aspartame is an artificial sweetener which is comprised of three naturally occurring substances: aspartic acid, phenylalanine, and methanol. While aspartame had been approved by the FDA for usage as a general-purpose sweetener, aspartame has received a great deal of bad press for causing a wide variety of side effects from multiple sclerosis to brain tumors. Because of these accusations, aspartame has become the most studied substance ever approved by the FDA and, even though compelling scientifically verified evidence has never been produced, the internet and the media have managed to irreversibly spread a distrust of aspartame to the general public.

Throughout this paper, I will present the benefits of substituting sugar intake for aspartame intake, examine false claims about aspartame presented to the public, and analyze the misrepresentation of aspartame to the public.

Part I: The Benefits of Aspartame

In 1965, a scientist named James Schlatter working for Searle & Company, a pharmaceutical company, was researching peptides that could potentially tread ulcers when he licked his finger during the lab and discovered that it was covered in sweet particles. While this may not have been the best lab procedure but it produced one of the best lab discoveries of the decade. Schlatter then tested the peptide for toxicity, and it was preliminarily found that the substance now known as aspartame was entirely safe for human consumption. Searle & Company fully embraced this discovery and spent the next four years developing a patent for aspartame. In 1971, Daniel Searle, the owner of the company, expressed the belief that aspartame would become a major success since, their only competitor at the time was saccharin, which would be considered inferior due to its metallic aftertaste. Aspartame would go on to be approved by the FDA in 1974 (Stegnik, 1984). Coca-Cola would then use aspartame as the sweetener in their new product Diet Coke which first released in 1982 and PepsiCo would change the sweetener in Diet Pepsi from saccharin to aspartame in 1983.

When aspartame is digested, it is broken down rapidly and completely by enzymes into aspartic acid, phenylalanine, and methanol. It is broken down so quickly that aspartame won't be found in the blood stream as aspartame, only its individual components may be found. Aspartic acid is prevalent in the human diet through sources such as soy, eggs, and asparagus. One would have to drink over seventy twelve fluid-ounce cans or approximately 6.6 gallons of Diet Coke to ingest an equivalent amount of aspartic acid as a serving of boiled asparagus (Nast, 2018). This would seem to suggest that if aspartame is indeed causing health issues, the aspartic acid component shouldn't be the cause.

Phenylalanine is also prevalent in the human diet through sources such as soy, eggs, and shrimp. One would have to drink over twenty-seven twelve fluid ounce cans or approximately 2.6 gallons of Diet Coke to ingest an equivalent amount of phenylalanine as a serving of eggs (Nast, 2018). However, some people do have an intolerance of Phenylalanine known as Phenylketonuria (PKU) which affects about 0.01% of the population (Zeratsky, 2018). Because of this, products containing aspartame are marked with warnings to inform Phenylketonurics to avoid the product. While phenylalanine may be harmful to people with this metabolic disorder, it should not affect other people in adverse ways.

Methanol is also present in the human diet through sources such as oranges, strawberries, and tomatoes. Tomato juice contains about five times the amount of methanol on an ounce per ounce basis. Many articles critical of the safety of aspartame cite methanol as the likeliest source of negative externalities. However, there is only one fiftieth of a milliliter of methanol in a twelve-ounce can of diet soda, so in order to experience methanol poisoning, a human would have to drink around 500 twelve-ounce cans or 46.9 gallons of diet coke per day for a couple of days (Magnuson, 2008). Needleless to say, many other health concerns would arise before methanol poisoning would be a factor.

One of the main reasons that there are such small concentrations of each of these components in diet soda is that aspartame is about 200 times sweeter than sugar, which means that you need 200 times less aspartame than sugar to sweeten a diet soda (Stegnik, 1984). If aspartame were considered equally as detrimental to human health as added sugar on a gram per gram basis, diet sodas could still be considered 200 times less detrimental to our health than full-calorie sodas.

When considering the benefits of aspartame, it is important to use sugar as the primary comparison as it is intended as a substitute for sugar. While switching to water from full-calorie sodas may technically be a more desirable outcome than switching to diet soda. It should theoretically be much easier to convince a heavy soda drinker to replace 100% of their intake with diet soda than water given that diet soda tastes has a much more similar taste to full-calorie soda than water. A study by the

University of Illinois found that artificial sweeteners were extremely helpful for maintaining an appropriate diet to 72% of diabetics (Stegnik, 1984). For these reasons, the adverse effects of sugar on humans should be considered when discussing aspartame.

First, sugar is closely linked to type 2 diabetes. While sugar is not the only cause, consuming large amounts of sugar greatly increases one's chances of becoming diabetic. A Harvard study has shown that consuming just one serving of a sugary beverage daily increases one's chances of becoming diabetic by twenty-six percent (Harvard, 2019). Aspartame, on the other hand, poses no such risk. This is because aspartame actually contains negative net calories since the amount of effort that the body exerts in digesting aspartame is greater than the number of calories that are yielded by aspartame in the digestion process.

Secondly, sugar is closely linked with tooth decay. The human mouth is regularly covered with decay causing bacteria. If these bacteria come into contact with sugar, they can become highly acidic thereby causing tooth decay. Every website concerning the wellbeing of teeth has strongly warned against the consumption of sugary drinks. However, these warnings do not apply to aspartame. This is because aspartame is composed of three naturally occurring ingredients, which do not trigger the same acidic reactions to the bacteria (Umass, 1995)

Third, sugar causes weight gain. When the body receives an excess of carbohydrates, it needs to find something productive to do with them. The only thing the body can think of is to convert carbohydrates into fat and store them for later use. Since sugar is a carbohydrate, and since many people intake several times more sugar than is needed for the body to function, sugar is often directly linked to weight gain (Harvard, 2019). Aspartame, on the other hand, is not a carbohydrate and does not significantly contribute to weight gain.

Part II: Perception vs Reality

Aspartame has suffered a largely negative public perception due in no small part to several websites which publish unreliable or blatantly false information designed to decrease the demand for aspartame. One of the most high-profile attacks on aspartame was a video published by Mercola in 2013 and has since amassed in surplus of one million views at the time of writing and has virtually unanimous support in its comment section (Mercola, 2019).

Firstly, it is important to consider whether the source of this video is a trustworthy or dubious source. It appears that Mercola is clearly an unreliable source as it has a history of publishing blatantly false information. Some examples include recommending a reduction of exposure to electromagnetic fields from sources such as electric razors or wristwatches and, advising abstinence from immunization. In addition, Mercola has a history of receiving warnings from the FDA, the most blatant of which accuses him of "making deceptive claims promoting thermography as a standalone diagnostic tool for detecting cancer and other diseases and is attacking the use of mammograms" (Barrett, 2019).

While it is clear that this video comes from a dubious source, this information alone is not necessarily enough to disprove the claims of the video. In the video, Mercola directly stated that aspartame has been shown to cause seizures, brain tumors, leukemia, asthma, and multiple sclerosis just to name a few, while presenting very little evidence to support these claims. The video does cite a 2012 Harvard study which it claims supports that aspartame causes leukemia. When this study was first released it prompted headlines such as "The truth isn't sweet when it comes to artificial sweeteners." However, this study also stated in its conclusion that due to the discrepancies between women and men in the study, chance was also a reasonable explanation. Because of this Harvard issued an apology for promoting weak science and when the lead author was asked if the study proves that aspartame is dangerous, she replied: "No, it does not" (Bazell, 2012).

A more reliable way to determine whether aspartame is a carcinogen than cherry-picking a single study may be to research the American Cancer Society's analysis of all studies. The ACS states that studies dome so far have not found a link between aspartame and cancer. In addition, the European Food Safety Authority has stated "Studies do not suggest an increased risk associated with aspartame consumption for: leukemia, brain tumors or a variety of cancers, including brain, lymphatic and hematopoietic cancers" (ACS, 2019). From these statements it would seem that the video from Mercola is not meant to represent aspartame fairly as it makes no mention of the actual scientific consensus on this topic.

The claims that aspartame causes seizures has only ever been reported from individuals who already suffer from epilepsy and are entirely anecdotal. One study which is used as an attempt to prove that aspartame causes epilepsy shows an increase in seizure rate in rats. And while the study did make these findings, they also found that aspartame did not increase the seizure rate in either mice or guinea pigs which is why the study concluded that it did not show a link between aspartame and seizures. In addition to animal testing, the connection between seizures and aspartame has been heavily tested in humans as well. One 1995 study found that "aspartame is no more likely than placebo to cause seizures in individuals who reported that their seizures were provoked by aspartame consumption" (Rowan, 1995). This study is one of many which adheres to the scientific consensus that there is no link between seizures and aspartame which is supported by this statement by the FDA: "In clinical studies done in adults and children with pre-existing seizures, there was no evidence of contributing to the frequency of occurrence or severity of seizures in seizure-prone individuals" (Staff, 1999).

In addition to the claims that aspartame causes cancer and seizures, one article claimed that aspartame caused lupus, multiple sclerosis, and is deadly to diabetics stating that: "When we get people off the aspartame, those with systemic lupus usually become asymptomatic" (Staff, 1999). And "Aspartame is especially deadly for diabetics. … The aspartame keeps the blood sugar level out of

control, causing many patients to go into a coma. Unfortunately, many have died" (Staff, 1999). The FDA also responded to these allegations stating that "There is no credible evidence to suggest that aspartame elicits multiple sclerosis or systemic lupus" (Staff, 1999). In addition, the American Diabetes Association acknowledged that there is no evidence that aspartame affects those with diabetes differently than those without diabetes. In addition, aspartame can be a great tool to reduce sugar intake, which is particularly important both for diabetics and for those looking to avoid contracting diabetes (ADA, 2020).

Even though there is not enough evidence to show that aspartame is responsible for any of these health risks there is still a negative stigma about aspartame solely from the fact that there are so many accusations. It may seem curious that less healthy full-calorie sodas consistently earn higher revenues than their healthier zero-calorie counterparts when they taste practically identical. While there are many reasons why people prefer to drink full-calorie soda, such as not wanting to be viewed as being on a "diet", enjoying the taste of full-calorie soda more, or even not being aware what diet soda is, there are a surprising number of people who actively avoid drinking diet soda because of the supposed health risks entailed. This is not a particularly healthy attitude to have toward this situation. Evidence from the National Weight Control Registry shows that of people who have lost at least 30 pounds and kept the weight off for at least a year, 10% reported drinking full-calorie sugar drinks regularly while 53% reported drinking diet drinks regularly. By comparison, of the whole population 61% reported drinking full-calorie sugar drinks regularly while 15% report drinking diet drinks regularly. (Haspel, 2019)

Based off the types of websites which exhibit hostility or mistrust toward aspartame, it seems that they may be negatively disposed towards aspartame because they view it as an artificial substance. This is technically true even though aspartame is fully comprised of components which can be found naturally in many edible foods. However, these same sites don't appear to apply the same scrutiny to

substances that they consider to be natural. This is most blatantly apparent in the case of Mercola's natural dietary supplements that were objected to in at least seven instances by the FDA (Barrett, 2019).

Because this natural vs artificial distinction is the primary point of contention, there is almost an adverse ethical reaction to sodas more so because of their nature than of their nutritional value. It's a quite easy sell to most people to convince them that if their sustenance is created in a factory or contains GMOs then it is automatically inferior to natural foods, simply because humans have traditionally eaten natural foods. In addition to the purity of food, there is also an anti-corporate narrative which may compel nutritionists to prefer natural foods to artificial foods as natural foods are typically associated with authentic, cheerful farmers whereas artificial foods are typically associated with corporate sludge. These areas are where the real difference of opinion appears to be. Scientists can sit around all day stating that aspartame is perfectly safe when consumed as intended, but that won't be enough to convince a population whose biases don't allow for that belief to be valid. Thankfully, the majority of the population which is concerned about eating naturally will almost certainly not be drinking full-calorie soda either. The goal of this paper is not to convince people who don't drink soda to start drinking diet soda. Instead, the goal of this paper is to convince people who are currently drinking full-calorie soda to seriously consider switching to diet soda as a healthier alternative. A change in mentality for individuals in the nutritionist community may be paying less attention to who can be the healthiest and instead pay attention to how each person can become healthier. And for 61% of Americans, an effective and simple option to become healthier is to make the switch from a full-calorie beverage to diet beverage.

Conclusion

In conclusion, although aspartame is generally portrayed negatively on the internet, there is not sufficient evidence to suggest that aspartame is harmful to human health. It is currently accepted by the

scientific community that consumption of aspartame at recommended levels does not cause cancer, multiple sclerosis, leukemia, lupus, seizures, cardiovascular disease or diabetes. On the other hand, added sugar is known to contribute to the modern epidemic of cardiovascular disease, diabetes, and obesity. It is possible for many people to improve their health by reducing their daily intake of added sugars and aspartame can be used as a tool to facilitate a healthier lifestyle. 34.4% of added sugars in the average American's diet come from sugary drinks for which there are typically zero sugar options. This means that if all full-calorie soft drinks were replaced with zero-calorie soft drinks, the average American's daily intake of added sugars would drop from twenty-two teaspoons to fourteen teaspoons. This is a very significant difference, but it could be just the beginning. While aspartame is not the best sugar substitute for baked goods due to its baking properties, other sugar substitutes exist that are better suited for this domain, which could potentially further lower added sugar intake.

However, a change in consumer demand would also be required to achieve these results. Inaccurate and misleading information on the internet significantly reduces the demand for aspartame as could be seen when PepsiCo substituted aspartame for sucralose in its recipe for Diet Pepsi. Pepsi wasn't worried about the safety of aspartame, but they were worried that their customers were worried. Pepsi has pulled similar moves before like when it released "Pepsi Made with Real Sugar" as opposed to high fructose corn syrup. Even though pure sugar is not healthier than corn syrup, and Pepsi never made such a claim, they were able to capitalize on a consumer fear of HFCS to increase sales. (Worland, 2014)

These actions further illustrate how public perception, not scientific research, dictate reality. Misrepresentation of medical research and medical misinformation can have a very pronounced negative effect on the health of the general population, not only in the case of aspartame, but also in cases such as the anti-vax movement and the COVID-19 pandemic. In the internet age, factchecking and critical thinking skills are essential to forming opinions on any issue. Unfortunately, a large portion of

the population is either unable or unwilling to successfully exhibit these skills. As a result, many people argue that some of the channels of misinformation such as Facebook and Twitter should be censored to ensure that the public's beliefs are more consistent with reality. However, it would take an incredible amount of bandwidth for these companies to be responsible for factchecking every post on their sites, there would be a great potential for the censoring of certain topics to be biased, and any misinformation that makes it past the filter could be significantly more dangerous because users would be less wary of the potential perfidy of the post. I believe that a more affective solution has to come from the education system. I believe that students should be taught to question how they know what they know and why they believe what they believe. They should be taught how to form opinions based on evidence, how to factcheck the evidence arguments are based on, and how to identify biases inherent in different perspectives on an issue. Without these skills, public perception becomes fact, rumor becomes reality, and blind faith becomes a rational argument. It may seem like these issues and aspartame are not related, however, if aspartame can be completely harmless in the court of scientific opinion and a neurotoxin in the court of public opinion, it serves as a stark example of how susceptible modern society is to misinformation campaigns.

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