Is Aspartame really bad for your health?

Everyday, around two hundred million people consume foods that contain aspartame. Aspartame, an artificial sweetener, can be found in over six thousand food products including carbonated soft drinks, chewing gum, gelatin products, ice cream, maple syrups, nutritional bars, hard candies, cereals, yogurt, ketchup, and even in pharmaceutical products like cough candy and cough syrup. Interestingly, aspartame was discovered by accident. In 1965, Jim Schattler, a chemist at G.D. Searle, was working on a research project to discover new treatments for gastric ulcers. One of the synthetic steps in his project was to make a dipeptide intermediate, aspartyl-phenylalanine methyl ester. He accidently spilled some on his hand, and licked his fingers while picking up a piece of paper. Schattler immediately noticed the sweet taste and worked with colleagues in the next few days in testing aspartame in coffee and other foods. They confirmed that the chemical gave off sweetness. As a result, aspartame was trademarked and sold under the names nutrasweet and equal as artificial sweeteners. We see these in use everyday at home and in businesses like Starbucks, Denny’s, etc. This begs the questions - if aspartame has been used worldwide since 1965, then why are people so scared of eating it now and why hasn’t it been taken out of foods? The answer is a recent study that connected aspartame to cancer combined with Internet and social media sensationalism. Like “viral videos” or news articles, the Internet can cause a flurry of opinions and it can spread like wildfire. This paper will explain the synthesis and biochemistry of aspartame, discuss both the sides of using aspartame from scientific findings, and most importantly, whether or not aspartame is really bad for your health.

Molecularly, aspartame is comprised of three components: methyl ester, aspartic acid, and phenylalanine. This can be seen in figure 1 below:

Figure 1: molecular structure of aspartame
The synthetic process of aspartame is usually separated into two processes: fermentation and subsequent synthesis. Fermentation is the step that produces the needed amino acids: aspartic acid and phenylalanine. In the first stages of the process, phenylalanine is reacted with methanol to produce L-phenylalanine methyl ester, which can be seen below in figure 2. Aspartic acid is also reacted with certain products to give it protecting benzyl ring groups. These groups protect it from reacting with by products during the synthesis. The two amino acids are then pumped into a reactor tank for 24 hours where the temperature is increased to 149°F. The product is then crystallized, and purified with ethanol.

**Figure 2: Synthetic reaction of aspartame**

One of the major benefits of aspartame as a food product is that it is about 200 times sweeter than sugar. Thus, aspartame is a great food product for those on a diet and watching calories because it takes much less aspartame to produce a level of sweetness than sugar does. On the contrary, aspartame is unsafe for infants and children because the calorie intake does not induce growth; it is also unsafe for people with phenylketonuria because this disease prevents them from metabolizing the phenylalanine component, which accrues and can get lodged in the brain. This can cause serious health problems or mental retardation (2). Moreover, phenylalanine is one of the essential amino acids that the human body must get from their diet. It is a precursor for the synthesis of tyrosine and several neurotransmitters. Any excess phenylalanine is broken down to fumarate and acetoacetate, which are a normal part of energy metabolism (2). Aspartame has been closely studied since 1965, and has been proven to be a molecule that can be metabolized by the human body. Thus, only those who cannot metabolize aspartame, like those with phenylketonuria, should avoid consuming aspartame at all costs. So why are people so scared to eat it now and what is the research behind this?

Since its discovery, nearly two hundred scientific experiments have been conducted on humans and animals with different findings. However, it wasn’t until a study conducted in 2006, by Italian scientists at the Cesare Maltoni Cancer Research Center, which led a worldwide scare on the effects of eating aspartame. Soffritti et al.
concluded that aspartame is linked to the production of brain tumors and certain cancers. They administered aspartame in concentrations ranging from 0-100,000 ppm to 8-week-old rats until natural death (3). They discovered horrendous trends of malignant, cancerous cell growth in male and female rats. For example, in female rats administered with 50,000 ppm of aspartame, there was an increase in leukemias and lymphomas (3). When the aspartame levels were scaled up to 100,000 ppm, the rats experienced transitional cell carcinomas of the renal pelvis and ureter (3). Subsequent histopathological evaluations were performed on each rat of every experiment level and many of their findings showed cancer growth, which eventually led to the rat’s death. These results made headlines and news coverage on aspartame resulted in the public’s fear and immediate disapproval of aspartame use in food products.

Generally, people are quick to believe everything they learn and even more so when the results are backed by “scientific evidence.” However, not all scientific experiments produce sound and factual results. In refute of their claims, research scientist Ragnar E. Lofstedt of the King’s Centre for Risk Management in London provides an analysis of the Ramazzini Foundation’s aspartame study. Lofstedt states that the scientists of the Ramazzini Foundation, such as Soffritti et al., were not transparent in the way they communicated their results and instead, were used to mislead the media in sensationalizing their results. Lofstedt discusses how studies on aspartame have been highly biased. Of 90 non-industry sponsored studies, 83 identified problems with aspartame, while 74 industry sponsored studies, all 74 studies claimed no problems with aspartame (4). Nonetheless, if aspartame were really proven to cause cancer in humans, and not just rats, then the FDA would have prohibited its use in all food products by now. But this has not happened because a number of government sponsored studies to date have found that aspartame is safe to consume, and moreover, industrialists and regulators stated that it has been used for more than 30 years with no proven side affects to humans. In addition, Soffritti and et al. study were first published in their “in-house” journal the European Journal of Oncology. This journal is not technically peer reviewed like other scientific journals; instead, these are peer reviewed by “in-centre” scientists. The initial press conference given by the Ramazzini Foundation was also “in-press” and published on their website. In the academic world, this is normally not done by research groups. They do not hold press conferences after publishing a paper especially in their in-house journal. When the International Sweeteners Association and EFSA requested the core data of their research, the Ramazzini Foundation refused and continued with the conference (4). Soffritti and his colleagues also withheld raw data from the wider scientific community, which caused regulators and academic scientists to question their credibility. Lofstedt states that the Ramazzini Foundation scientists understood that their research was questionable and were not “proud” of their results, thus they actively pursued media attention via press conferences rather than releasing their data to the wider research community and publishing their findings in a leading peer-reviewed journal (4).

Aspartame has not been proven to cause cancer in humans; otherwise, there would be a worldwide ban that would make headlines. With the amount of research and studies that have been done on this sweetner, there is not reason to believe that aspartame is a cancer inducer. Aspartame is just a protein and the human body can metabolize aspartame. It is only when the human body cannot metabolize something that health problems can occur.
References


