

## The Debate around the Usage of Saccharin in the Food Industry

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### Abstract

*Over the past 100 years, Saccharin has been widely used as an alternative to natural sugar in industrial food and drinks. However, concerns have been raised regarding its safety in terms of human intake. This paper aims to explore whether Saccharin has a negative impact on the human health. The key controversial issue that is investigated in this paper is the effect of Saccharin on health, both as a carcinogenic and weight-gain substance. The USA and Canada governments' reactions toward introducing Saccharin in the food industry are also considered. Based on a range of experimental studies, this paper confirms not only the absence of the negative consequences, cancer and weight-gain, but also its positive effect on controlling or even decreasing human body-weight. This paper also concludes that different governments react differently regarding the introduction of Saccharin depending on the available studies. However, further research regarding the economic opinions could add more weight to the controversy.*

**Keywords:** Artificial food additives, cancer, health, saccharin, sweeteners

### INTRODUCTION

Artificial sweeteners as sugar alternatives have been widely used all over the world in the past 100 years due to the fact that they are both of zero calories and hundred times sweeter than natural sugar. This paper aims to shed some light on Saccharin as a major type of artificial sugar alternatives because of the fact that it has become the most popular artificial sweetener around the world soon after its origination. Saccharin has been discovered by a Russian chemist in 1878, and it has been commonly used in food industries, drinks and tablets [1].

At the time when Saccharin intake increased rapidly among people, concerns have been raised regarding the safety of consuming Saccharin on the public health [2]. Many studies and much research have been conducted to examine the extent to which Saccharin affects human bodies. The results have been controversial and

the allegations have differed among researchers in terms of whether Saccharin causes cancer in humans in addition to rats and mice. Another debatable issue is the body-weight. Many researchers claim that Saccharin intake increases the body-weight, while others state that consuming Saccharin does not only help to control the body-weight but also to lose weight. Governments have also played a major role for being responsible for the public safety. Rules of banning and allowing the usage of Saccharin in food products are made by the governments after further investigation under advanced experimental work.

The aim of this paper is to explore the debate surrounding the introduction of Saccharin into the public diet in order for Saccharin intake to be clearly defined and unambiguous. The study will be limited to the health and government perspectives due to the restrictive number of words.

After a brief background and context section in which the historical emergence of Saccharin will be provided along with the early events concerning Saccharin intake, this paper will try to discuss the main controversial issues in terms of consuming Saccharin. Firstly, the health aspect will be examined based on a wide range of experimental evidence regarding the relation between Saccharin and cancer, and Saccharin and body-weight. Then, the governmental role will also be explored, hopefully, to point towards how different countries react to the evidence provided by their experts. The response of the American and Canadian governments will be presented, and a comparison will be made in order to provide a clear picture on the safety of Saccharin intake.

## BACKGROUND

The origin of the first sweetener emerged in 1878, when Constantin Fahlberg, a Russian chemist, was working on producing sugar from chemicals [1]. By accident, he spilled his experiment mixture on his hands. Later that night, he noticed a sweet taste on his hands and that moment was the discovery of the first commercial alternative to natural sugar, Saccharin [3]. Saccharin is three hundred times sweeter than natural sugar. The new finding attracted people's attention, especially when Fahlberg started to use it in drinks, both as a sweetener and preservative. Saccharin became even more popular when it was presented in the form of powder and pills. Furthermore, it was recommended by medics to treat headaches and nausea, to name but a few [1, 4]. From 1914 onwards, the usage of Saccharin significantly increased, notably in America and Europe [1].

Despite the popularity of Saccharine at that time, people seemed to have concerns regarding whether it affects health [3]. A few years after his discovery, in 1882 to be precise, Fahlberg tested his invention. He

made it clear that Saccharine was harmless, when his body showed no side effects after 24 hours of having one dose [4]. In post-World War II, health science tried to conduct experiments on animals for longer periods of time to inspect whether Saccharin is a cancer-causing substance. The results were complex and not clear enough to judge [4]. Sometime after the war, the American lifestyle encouraged Americans to depend more on outdoor meals. Consequently, they headed towards presweetened meals in particular. Consuming large amounts of presweetened industrial food drew the attention of nutrition experts and health officials, who raised concerns about the probability of gaining weight. In 1957, these doubts directed some Americans towards criticizing their meals [4].

By 1958, the USA government started to play a guiding role in this respect. The American Congress developed the Food Additives Amendment with the assistance of the scientific community. It was at that time and place where the fear of cancer as a side effect appeared. Hence, the Congress forced the American Food and Drug Administration (FDA) to forbid using Saccharine in food [4]. Hodgins [3], Nakanishi [5] and Demers [6] state that it was in 1960 when Saccharine was suggested to cause bladder cancer in rats, and the FDA was obligated to restrict its use. A study at the University of Wisconsin also supported the fact that Saccharine causes bladder cancer among rats who consume it regularly every day. Accordingly, in 1972, the FDA prohibited the Use of Saccharine in food in America, which resulted in economic and financial issues [4]. However, 1979 witnessed an important milestone in the history of Saccharine, as 44 million people asked for the reintroduction of Saccharine in food [4]. As a result, the consumption of Saccharine was restated as harmless in 2000, when the National Institute of

Environmental Health Sciences (NIEHS) clarified that the experiments performed on rats were ‘a poor analog’ for human intake [4]. The sequence of addressing barriers and lifting them affected negatively on the popularity of Saccharine as the sole artificial sweetener, where new types emerged, for instance Aspartame and Acesulfame in the mid-1960s, and Neotame in 2002 [4].

## CRITICAL DISCUSSION

### The Effect of Consuming Saccharin on Health

The very fundamental issue regarding Saccharin consumption is the seemingly negative impact on individual’s health. The most controversial issue raised has to do with the link between the intake of Saccharin and cancer. Although many researchers have claimed that consuming Saccharin results in bladder cancer in rats [7], a great deal of evidence provided by other scientists has confirmed that it has no harmful effect on humans [1, 8]. Additionally, another concern has been presented in terms of weight-gain. Some research indicates that Saccharin causes an increase in the body weight [9]. However, later studies reveal contradicting findings; not only does Saccharin help in controlling the body weight but it also helps in decreasing it [10].

### *Saccharin as a Carcinogenic Substance*

The people consumption of Saccharin has increased according to the fact that Saccharin is present in most of their meals [4]. A great deal of intensive experimental studies has been conducted by health specialists over the past decades in order to investigate the level of safety of consuming Saccharin, and to explore whether it is a cancer-causing substance which might expose a threat on the human body. After carrying out the research results and studying the findings, the safety on consuming Saccharin have been found to be a controversial issue, where

many researchers confirm that Saccharin is safe to be consumed, while some others claim that its use should be banned or restricted for being carcinogenic. Most of the studies are based on experiments which have been conducted on rats. Although it is found to be resulting in bladder cancer in male rats, no real evidence has been provided to indicate that it is hazardous on the human organs.

Early studies [7], highlight that as long as the Food and Drug Administration labels the food which contains Saccharin with a warning statement, it indicates the probability of cancer risk. In their research, Kennedy and Winn [7] investigate the risk of Saccharin in two different methods: Animal tests and Short-term tests, from which they conclude that a risk on human can be predicted. Furthermore, Clapp [2] strongly argue that the use of Saccharin in food industries should be prohibited for many reasons. Firstly, allowing consuming Saccharin, which is defined as a substance which ‘may’ cause cancer in humans, can poses a risk of cancer to millions of people, including children, where no law is exposed to control the amount of consumption. Secondly, consuming Saccharin in rats and mice has been found to cause cancer not only in the bladder but also in the uterus and skin. Thirdly, some studies on human have also shown a relationship between consuming Saccharin and Bladder cancer. Conversely, Whysner and Williams [11] state that the experiments conducted on male rats were for a lifetime period from birth. They also bring the attention to that the doses-level is far from risk and incomparable to humans.

Despite the fact that there is much research indicating the possible hazard of consuming Saccharin in human, the mentioned studies, in addition to the aid of modern technology, criticize them and confirm the safety of Saccharin

consumption. In 2008, Dr. Ying [12] has published an article in which he states that different studies over the past decades show ‘mixed results’ where opinions have been varied whether Saccharin is carcinogenic. Ying [12] strongly confirms that no real evidence has ever been provided in order to ban or prohibit the use of Saccharin, where the previous experiments have implied hundreds of times higher-doses of Saccharin than the normal human intake, which makes them ineligible.

Another strong position is provided by Bosetti [13]. They approve in their experimental research, which has been carried out in Italy, the absence of the carcinogenic effect of Saccharin in human bodies. For a period of more than a decade, Bosetti [13] have conducted their experiment engaging 3117 individuals between incident patients with stomach, pancreas, and endometrium cancer, along with the cases of the corresponding controls. The later research provides concrete evidence and inevitable results confirming that Saccharin does not pose any threat to humans. O’Donnell and Kearsley [8] stated that ‘an equivalent rigorous and extensive safety studies’ have been conducted involving both animals and humans to ensure the safety of consuming Saccharin. The studies have resulted in the fact that the level of doses is the key for determining Saccharin’s safety-consumption, therefore, an international daily intake level of doses, in which Saccharin should be used, has been introduced [8].

To summarize, different studies on different organisms with different findings have been conducted seeking an official status regarding the relationship between Saccharin and cancer. Science and technology development over time have contributed reliable experimental work on human organs and resulted in significant

evidence. Although some researchers suggest prohibiting the use of Saccharin as an artificial sweetener in the industrial food for being cancer-causing, others confirm its safety. The major difference between the two types of studies can be contributed to the fact that the former studies are based on animal tests which do not afford realistic results, whereas the latter are relying on a wide range of experimental work including different organs of a large number of people for a long period of time.

### **Saccharin as a Weight-Gain Substance**

The consumption of Saccharin is also a controversial issue in terms of weight gain. Although many studies claim that Saccharin usage should be banned or prohibited in food industries, others have confirmed not only its safe impact on health but also its benefits in losing and controlling body weight. However, Saccharin has been verified to have a favorable impact on human bodies. Early studies have reported that Saccharin might have reverse metabolic impact [14]. Only two out of seven studies on animals have shown an increase in the blood glucose after the intake of Saccharin, however, soon after, another study confirmed that in the in the case of the two contradictory studies the results were observed when only the rats were subjected to Saccharin consumption over a long period of time.

After reviewing other research, Rosenman [14] strongly underlines the implications of banning Saccharin on health. He came with the idea that prohibiting Saccharin can negatively affect the consumers who may substitute their diet soda, which contains Saccharin, with drinks with natural sugar resulting in 36 more pounds for the individual per year. The main conclusion to be drawn from this study is that Saccharin has no adverse effects on dietary adherence. According to Rogers [15], Saccharin can be distinguished from

other artificial sweeteners for the fact that it passes through the body unchanged (a non-metabolized substance). For Saccharin to be labeled as a safe substance to consume, it is referred to this characteristic. When the substance leaves no traces in the body it means that it does not increase the person's weight, especially when this substance is of zero calories per 145 mg [15].

In the later years many studies and much research have been carried out to further investigate the concern. A 10 weeks long-term epidemiologic study by Raben [9] suggests that a strong link has been found relating the increase in weight in adults to the intake of Saccharin. Moreover, in the consort with Reban [9], the specialists in the neuroscience branch in Yale journal of biology and medicine have published an article in 2010 in which they assume that Saccharin is likely to cause weight problems by referring to another study where 31,940 women have suffered of eight-year weight gain during consuming Saccharin. Another statement has been released suggests that consuming Saccharin increases the motivation to eat due to the fact that it leaves a sweet taste after the intake and raises the energy level, the conclusion was drawn based on an experimental study on rats [9]. No further studies have been conducted in terms of the implications of the sweet taste of Saccharin.

In order to justify its sponsorship, the Calorie Control Council (CCC) [16] has published an article in which it refers to the benefits of Saccharin in different aspects. What has been written in the article can be summarized in four points, firstly, Saccharin has been recommended to be consumed for those who try to lose or preserve their body weight to the fact that it contains no calories. Secondly, it seems that dietetic professionals used to recommend Saccharin intake to the

patients who are facing diabetes, as a result of being free from both calorie and carbohydrate. Thirdly, it draws the attention to the fact that Saccharin has safe use reports on humans over the past 100 years. Lastly, and as Rogers [15] states, the CCC has also pointed out to the non-digestive features of Saccharin to indicate that it does not add calories to the diet. Although the CCC is a Saccharin sponsor, it conveys facts that other studies agree with.

Hedrick [10], who seems to agree with the CCC study, highlights the main reasons which the CCC believes that they are 'serious limitations' for the contrast studies. Examples of the serious disagreements can be summarized as the followings: Firstly, the counter studies have been found to be illogical. The rats which have been eaten meals supplemented with Saccharin appear to give the same increase in weight when they are being fed a high fat food. Secondly, copious studies in human have been shown the positive effects of consuming Saccharin in terms of losing and preserving body weight. Thirdly, the CCC accuses the counter studies for not providing appropriate statistical analysis and it accuses the authors for misleading the readers. After viewing both the argument and counter argument, the main conclusion to be drawn is that introducing Saccharin in diets can affect positively on the body-weight by either controlling or decreasing it.

### **THE GOVERNMENTAL ROLE IN REGULATING THE USE OF SACCHARIN**

The government intervention has also played a vital role in deciding the extent to which Saccharin should be used. Over the past forty years, many governments, for instance, have adopted the law of banning the use of Saccharin in various food products, followed by the law of re-



allocating it. In 1977, according to the International Food Information Council Foundation (IFICF) [17], the American FDA proposed to ban the use of Saccharin owing to the experimental evidence which shows that the consumption of Saccharin leads to cause bladder cancer in rats. As a result of this strong evidence, the US government passed a law to ban the usage of Saccharin in the same year [18]. Added investigation into the advanced experimental evidence has confirmed the safety of Saccharin intake in which it shows no association between bladder cancer in rats and humans, and therefore Saccharin was brought back to the market by 2001 [17].

In Canada, prior to the USA, Saccharin was banned due to the claims which strongly state the severe damaging effects of Saccharin intake in the human body [19]. Health Canada [20], attempting to re-list Saccharin in its food production, has further evaluated the evidence, resulting in a conclusion that Saccharin safety status for human consumption is not absolute. Unlike the USA, Saccharin is still banned by the Canadian government until the Health Canada provides clear-cut evidence on the safety of consuming Saccharin followed by a period of time for the consumer feedback. If no health concerns arise, Saccharin will be used again as a food artificial sweetener.

Although, recently, clear evidence has been provided, and there are more than ninety countries officially permitting the consumption of Saccharin up to a dose of 0-5 mg Saccharin/kg body weight [21], other governments still ban the usage of Saccharin. In the main, it is very important to evaluate the overall process under the conditions of the unusual circumstances (like a daily intake of high doses) before announcing the safety of consuming such a controversial chemical substance, especially when it is the responsibility of

the governments which cannot afford to take risks when people's lives are at stake.

## CONCLUSION

The decision whether to introduce Saccharin into public food and drinks has been of considerable debate over the past century. The present study has been designed to determine the effect of Saccharin intake on human bodies from two different perspectives: Health and the governmental role. Regarding the health aspect, this paper has discussed two major issues presented by the relation between Saccharin and cancer, and Saccharin and body-weight. In terms of Saccharin as a carcinogenic substance it has been concluded that although Saccharin might cause bladder cancer in rats, strong advanced experimental studies have confirmed that these findings cannot be extrapolated to humans. With regard to the body-weight, it has been often invoked that Saccharin causes an increase in weight for those who consume it. However, recent extensive studies have indicated the contrary. Saccharin intake does not only help in preserving weight, but also in losing it due to the fact that it is zero calories.

The governmental position towards the usage of Saccharin in the public industrial food and drinks has also been found to be a highly controversial matter. Formerly, around 1977 Saccharin was banned in many countries. Currently, after re-examining the issue using the technological methods, some countries, the USA for instance, have re-listed Saccharin as a safe substance for the human intake, while others, like Canada, have not declared a final status clarifying the safety of Saccharin consumption. For such responsibility, governments, with the aid of experts, should conduct further research and go through many steps before announcing or giving a declaration upon such debatable substance, especially when

it is associated with the public health. Presently, more than 90 countries allow the usage of Saccharin under limited doses.

The implications upon banning or prohibiting the usage of Saccharin in human diet could negatively affect the human health because of the fact that natural sugar contains high calories in comparison to Saccharin, thus consuming natural sugar can lead to an increase in the body-weight, which in turn may result in heart diseases when the consumption reaches high doses and on a daily bases. Finally, it is worth mentioning that this paper has only examined two aspects, whereas many others are also important and play a vital role in terms of introducing Saccharin for the public. Further studies could be carried out to investigate the rational of promoting or banning the use of this substance from an economic perspective.

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