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Popular Article

Acrylamide: The unknown toxin in food

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Abstract

An industrial chemical called acrylamide is used to make polyacrylamides, and it has also been found in a variety of foods at relatively high concentrations. It develops when a variety of foods are cooked, roasted, or baked, especially starchy meals like potatoes and cereal products. The International Agency for Research on Cancer has classed acrylamide as a group 2A human carcinogen based on evidence of its ability to cause cancer in animals. The common Maillard reaction, which occurs when reducing sugars like fructose and glucose react with the amino acid asparagine, produces acrylamide as a byproduct.

Keywords: Acrylamides, Cancer, Maillard browning

Introduction

Acrylamide, produced as a byproduct of the cooking process. When reducing sugars (glucose or fructose) and the amino acid asparagine interact to cause the Maillard reaction, which is responsible for the browning of food during baking, frying, and roasting. Thus, elements including cooking temperature, cooking duration, moisture content, and the amount of reducing sugar and asparagine in raw foods all have an impact on the levels of acrylamide in cooked foods (Elmore *et al*., 2005).

Numerous epidemiological studies have looked at the probable link between acrylamide and cancers of numerous organs including the brain, kidney, lung, and reproductive systems since the discovery of acrylamide in commonly consumed foods. In all nations, coffee, fried/baked potatoes, and baked foods continue to rank among the most popular sources of acrylamides (Mucci and Wilson, 2008).

Acrylamide Toxicity

The biggest issues with acrylamide's potential health impacts on humans are its genotoxicity and carcinogenicity (actions that damage DNA). Since its discovery in food, extensive research has been done to determine whether it causes cancer in humans. However, there is currently no conclusive evidence to support this claim. It causes tumors in laboratory rats. However, the International Agency for Research into Cancer (IARC) has classed it as a possible human carcinogen.

In humans, it has also been demonstrated to be neurotoxic, and it may harm reproductive functions. Numerous international organizations, including the European Food Safety Authority, the Food and Agriculture Organisation (FAO) of the United Nations, and the World Health Organization (WHO), have evaluated the hazards that acrylamide in food poses to consumers' health. These organisations have all come to the conclusion that efforts should be made to lower acrylamide quantities in food due to its toxicity (Becalski *et al*., 2002).

Exposure of Acrylamide

Numerous fried, baked, or roasted meals have been found to contain acrylamide. This includes both commercially processed foods and dishes prepared at home. Despite the fact that acrylamide's existence in food was just recently found, it has likely been there for a very long time because staple foods make up a sizable portion of the average person's diet. Foods that are neither fried or baked, such as boiling potatoes, have not been shown to contain acrylamide.

The Food Safety Authority of Ireland (FSAI) has determined that the average dietary exposure to acrylamide for the adult population of Ireland is roughly 0.6 micrograms (g) per kilogramme body weight per day, with high-level consumers being exposed to about 1.75 g/kg bw/day. These estimates of Irish consumers' acrylamide exposure correspond favorably to those provided by the Joint FAO/WHO Expert Committee on Food Additives (JECFA), which indicated that average consumers' acrylamide exposure varied from 0.3 to 2.0 g/kg bw/day and high consumers' exposure ranged from 0.6 to 3.5 g/kg bw/day. Although coffee also contributes to exposure, the FSAI exposure analysis revealed that consumption of potatoes and potato products accounts for the biggest share of dietary intake of acrylamide, followed by consumption of bread and biscuits (Mills *et al*., 2008). Contribution of specific food types to acrylamide in % is given in table 1.

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Table1: Contribution of specific food types to acrylamide in %.

Food product	Percentage contribution to acrylamide
Biscuits	10%
Coffee	25%
Bread	34%
Breakfast Cereals	5%
Cocoa products	1%
Potatoes & products	48%

Identifying a Starting Point for Controlling Acrylamide Formation

- Free asparagine- You can reduce the amount of this amino acid in a product by choosing flour that contains less free asparagine, such as wheat instead of rye, flour with a low extraction rate during milling, or by removing the inclusion of potato flakes.
- Baking agent: Ammonium hydrogen carbonate, a baking agent, and reducing sugar all play crucial roles. By substituting NaHCO3 for the baking agent, the amount of acrylamide in food will be reduced. This baking agent greatly promotes the development of acrylamide.
- Reducing sugars: A significant reduction in the level of acrylamide is achieved by replacing the primary source of reducing sugar with a solution of sucrose with an equivalent concentration.
- Special additions (organic acid): By adding organic and inorganic acids to dough for a heating product, which lowers the pH of the medium, acrylamide production is reduced.
- Baking - A shorter baking period at a higher temperature resulted in a longer baking period at a lower temperature and a lower acrylamide content. For instance, gingerbread baked at 160°C for 20 minutes will bake at 200°C and require 10 minutes less time. the modification of the baking profile or the lowering of temperature as baking progresses.

Conclusion

Arylamide is considered as a toxin which is carcinogenic in humans. Its presence in processed foods especially in starchy foods like potatoes and its products are serious issue nowadays. The greatest worry surrounding the potential health effects of acrylamide in food has been its carcinogenicity and geno-toxicity (DNA-damaging effects). Although there is no proof that acrylamide exposure causes cancer in people, it induces tumours in experimental rats.

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