



How Ultra-Processed Foods Increase the Risk of Gastrointestinal Cancers

Yuvanah Vignesh

Abstract:

Gastrointestinal cancer cases are becoming major problems globally and affect public health. Of the 1 million new cancer cases that occur in the United States each year, gastrointestinal cancers are the leading cause of death. There is still more research needing to be done to find a definite link between processed foods and the risk of cancer. Therefore, this project is providing an overview of certain studies that prove a connection between ultra-processed foods and the risk of gastrointestinal cancer. This review paper will focus on how ultra-processed foods and the chemicals involved affect the overall risk of gastrointestinal cancer, with the goal of finding how different chemicals are related or potentially cause the disease. Gastrointestinal cancer includes mouth, esophageal, stomach, bowel, and colon cancer. I will analyze several articles to draw conclusions and report on this topic. In this paper, I will find my information on the internet by using PubMed, Google Scholar, and other trusted sites to provide a comprehensive review. I will look into information about specific processed foods associated with certain types of gastrointestinal cancer. The results of my literature review indicate chemicals like Nitroso Compounds, Carrageenan-Kappa, and Acrylamide, found in ultra processed foods that are potentially carcinogenic. A high-fat diet, which frequently consists of numerous ultra-processed foods, is a known risk factor for obesity. Since obesity is also a major risk factor for gastrointestinal cancer, the rising concern of obesity rates may also play a role in the amount of gastric cancer cases.

Introduction:

Gastrointestinal cancer is a general term describing cancers that affect the digestive system. It can be found in the esophagus, stomach, pancreas, small intestine, large intestine, and the liver. Symptoms of gastrointestinal cancer include abdominal pain or discomfort, change in bowel habits, loss of appetite, bloating, fatigue, nausea, vomiting, and accidental weight loss.¹ Current treatment options include chemotherapy, surgery, radiation therapy, and targeted therapies like Imatinib and Trastuzumab.¹ Gastrointestinal cancer is the fifth most common and second most fatal cancer worldwide.² According to researchers in China, “[in 2020] 1,806,590 new cancer cases and 606,520 cancer deaths occurred in the United States each year, with gastrointestinal cancer being one of the leading causes of death.”³ Risk factors for gastric cancer include; old age, smoking, family history, tobacco, obesity, and being male.⁴

The human body, including the gut microbiome, can be impacted greatly through a high consumption of ultra-processed foods that contain potential carcinogen chemicals or food additives.^{7,9} A high intake of ultra-processed foods can result in inflammation and damage to the small intestine, as well as a potential link to cancer.⁹

Since gastrointestinal cancer is a global health threat, it is important to study and understand the risk factors to improve the overall health of the world. In the following review, I will go over the definition of ultra-processed foods, how they affect the human body, and any potential connections to cancer.

Ultra-processed foods

Ultra-processed foods are mostly composed of substances obtained from food like fats, starches, and sugars, as well as additives like artificial colors, flavors, or stabilizers.⁵ All these inclusions result in a longer shelf life, makes the food last longer and gives off a more pleasing taste.⁵ Additives also lower production costs by using cheaper ingredients like starches and preservatives for manufacturers.⁵ Examples of ultra-processed foods are soft drinks, frozen meals, packaged soups, chips, sweetened cereals, etc. In the NOVA Classification system, as shown below (Figure 1), foods are categorized into four levels, ranging from minimally and unprocessed foods to ultra-processed foods.⁵

Figure 1: NOVA Food Classification System⁵

Category	Group 1: Minimally processed foods and unprocessed foods	Group 2: Processed culinary ingredients	Group 3: Processed foods	Group 4: Ultra-processed foods
Definition	Directly obtained from plants or animals or only lightly processed to help preserve them.	Ingredients extracted from natural sources or Group 1 foods	Adding ingredients from group 2 to foods in group 1	Created mostly or entirely from substances in groups 2 and 3
Examples	Fresh, frozen, chopped or dried produce Pasteurized milk Powdered milk Spices Unsalted nuts Eggs Potatoes	Sea salt Cane sugar Honey Maple syrup Butter Lard Vegetable oils Vinegar Corn starch	Canned fruit, vegetables Salted nuts Smoked meat Cured meat Canned tuna Cheese	Ice cream Many snack foods such as potato chips Fish sticks Soft drinks Breakfast cereals and bars Alcohol Commercially baked goods such as cookies and doughnuts

Chemicals used to process foods and their effect on health

As ultra-processed foods become more common in the world today, chemicals, such as additives, can affect the human body greatly. Ultra-processed foods take a toll on the body's gut, like its microbiome.⁷ The gut microbiome contains microscopic organisms, like bacteria, viruses, fungi, and is affected by the exposure to the environment and diet.⁸ Studies in animals have shown that food additives, like artificial sweeteners, can negatively impact colonic and cardiovascular health by altering the gut microbiome and the mucus layer of the stomach, leading to inflammation and damage to the lining of the small intestine.⁹

The packaging used to contain ultra-processed foods may potentially carry harmful substances, like bisphenol A, which is suspected to be carcinogenic and can disrupt hormones.⁶ Bisphenol A is found in plastic food containers, fast-food wrappers, and sometimes metal cans and bottle tops.⁵ Ultra-processed foods also carry approved additives such as titanium dioxide and sodium nitrite, found in processed meat.⁶ Both titanium dioxide and sodium nitrite have been associated with cancer, found through animal models.⁶

Chemicals like N-nitroso-compounds are found in ultra-processed foods as well.⁵ Nitroso compounds (NOCs) can promote cancer in 40 animal species and humans, such as gastric, esophageal, and colon cancers.¹⁰ Exposure to pre-formed NOCs from tobacco, diet, and drugs contributes to cancer risk as well.¹⁰

A chemical, Carrageenan-Kappa, is found in dairy and meat products, and is thought to be potentially cancerous, but more studies need to be done because there is a limited amount of information on this topic.¹¹ In Figure 1, carrageenans fall under group 4: Ultra-processed foods.

Another chemical, called Acrylamide, is classified as a potential carcinogen (a cancer promoting agent) and has been linked to genotoxicity, neurotoxicity, and reproductive and developmental toxicity.¹² Acrylamide forms under high heat (greater than 120 degrees) and in low-moisture conditions.¹² Acrylamide has been identified in foods including fried foods, coffee, cookies, potato chips, sweet cereals, and cookies, many of which fall under the ultra-processed group in the NOVA Classification System (Figure 1).^{5,12}

Processed foods and a High Fat Diet

A high intake of ultra-processed foods is not only a concern for potential cancer risks, but it can also lead to obesity and diabetes.⁵ Chemicals in ultra-processed foods may have far reaching consequences by disrupting hormones like estrogen and insulin.⁵

A high consumption of ultra-processed foods can indirectly affect cancer through obesity.³ In a recent article in *Theranostics* it claims, “Obesity is a risk factor for gastrointestinal cancer, and the main cause of obesity is a high fat diet. It contains high amounts of fatty acids, but low amounts of fiber, vitamins and minerals.”³ The article also expresses the concern for obesity as a global health problem as the world continues to evolve and grow in economic aspects.³ Research predicts that by 2025 the global obesity rate for men will ascend from 14% to 18%, while the global obesity rate for women will ascend from 18.5% to 21%, resulting in a possible increased risk of gastrointestinal cancer on a global scale.³ The rising rates of obesity are due to a high fat diet, which commonly correlates to ultra-processed foods (see Figure 1).⁵ This likely contributes to an increased risk of the existence and the development of gastrointestinal tumors.³

Studies on chemicals/processed foods and cancer:

In a study on 104,980 (22,821 men and 82,159 women) individuals aged 18 years and older, participants submitted dietary records for over two years.⁶ Dietary records were taken every 24 hours and the food was classified through the NOVA classification system.⁶ After adjusting for factors, including diet, smoking, and lifestyle habits, a correlation was found between an increased cancer risk and ultra processed foods.⁶ It revealed that a 10% increase in the consumption of ultra-processed foods in one’s diet was linked with a 10% increase in all cancers.⁶

The study found that a higher intake of ultra-processed foods was connected to an increased risk of overall cancer.⁶

In a study, including 3628 cases, dietary NOC intake was found to be significantly related with an elevated risk of cancer in both men and women.¹⁰ When the highest NDMA(a type of carcinogenic NOC) intake was compared to the lowest, age- and sex-adjusted factors, it showed a higher risk of cancer, specifically more in males.¹⁰ In more thorough studies, this connection was weaker.¹⁰ Consuming NOC’s has also been potentially linked to an increased risk of gastrointestinal cancer, especially rectal cancer, which is a type of gastric cancer.¹⁰ The study also found a significant correlation between dietary NDMA and plasma vitamin C levels, finding that it may influence how NOC intake affects overall cancer risk, with higher vitamin C levels potentially reducing the risk of gastric cancer.¹⁰

This study found dietary NOC intake to be correlated with an increased risk of gastrointestinal cancer.¹⁰



Discussion/Conclusion:

Gastrointestinal cancer affects the digestive system and is one of the leading causes of cancer deaths in the United States every year.³ Ultra-processed foods are classified into four different categories in the NOVA Classification System.⁵ As the intake of ultra-processed food increases globally, chemicals, like Nitroso Compounds, Carrageenan-Kappa, and Acrylamide found in ultra-processed foods are discovered to be potentially carcinogenic.¹⁰⁻¹² To conclude, there is evidence of a connection between an increased risk of gastrointestinal cancer and a high consumption of ultra-processed foods.⁶ A high fat diet consists of many ultra-processed foods, which is a risk factor for obesity.³ Obesity is also a high risk factor for gastrointestinal cancer, reinforcing the link between health and diet.³ As obesity rates rise, the risk for gastrointestinal cancer may increase as well.

Taken together, the results from these studies show that there is a link between gastrointestinal cancer and a high consumption of ultra-processed foods. However, there are limited studies that can directly prove this link and explain the underlying mechanism of how chemicals in ultra-processed foods cause cancer. Thus, more research needs to be done, to provide a comprehensive understanding. In the future, a more careful examination of how the chemicals in our food affect global health is paramount.

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