Volume 11, Issue 8, August– 2026 International Journal of Innovative Science and Research Technology
ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/26aug441

Public Health Challenges of Modern Diet: The Influence of Processed Foods

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Publication Date: 2026/08/17

Abstract: The widespread use of modern technology and changes in eating habits have led to a significant increase in highly processed foods over the past few decades. This has raised concerns about the potential impact on public health. These ultra-processed foods are typically high in added sugar, unhealthy fats, salts, and various additives, making them very appealing and extending their shelf life. They undergo extensive processing in industrial settings, transforming the original ingredients into a final product designed to be highly palatable and have a longer storage life. The objective of the research paper is to explore the various ways in which highly processed foods affect human health. The research aims to provide a comprehensive understanding of the public health implications of highly processed foods by examining their nutritional deficiencies, the presence of harmful additives, and the socioeconomic factors that contribute to their usage.

Keywords: *Highly Processed Food (HPF), Ultra Processed Food (UPFs), Modern Diet, Hyper-Palatable, Dietary Modifications, Dietary Patterns, Nutritional Inadequacies, Monoculture Crops, Chemical Runoff, Industrial Farming, Antibiotic Resistance, Inflammatory Bowel Disease.*

How to Cite: Dr. Gunjan Meena (2026) Public Health Challenges of Modern Diet: The Influence of Processed Foods. *International Journal of Innovative Science and Research Technology*, 11(8), 610-614. https://doi.org/10.38124/ijisrt/26aug441

I. INTRODUCTION

Ultra-processed foods (UPFs), also known as highly processed foods, are industrial formulations that undergo multiple stages of processing and are prepared primarily or entirely from ingredients extracted from food (such as sugar, starch, proteins, oils, and fats), derived from food ingredients (such as hydrogenated fats and modified starch), or synthesized in labs from food substrates or other organic sources (such as flavour enhancers, colours, and preservatives). These foods are typically designed to improve their palatability. They are known for being convenient and having a long shelf life, which makes them appealing and less time-consuming in today's fast-paced society.

Highly processed foods are engineered and altered to be hyper-palatable, which means they taste different and good, which can lead to overconsumption of the food. These foods often contain high levels of sugar, salt, and unhealthy fats while being low in essential nutrients such as fiber, vitamins, and minerals [1]. Prepackaged, highly processed foods require less time to cook and are generally highly palatable, which is why people often crave them. The modern diet, combined with a sedentary lifestyle, has been linked to chronic metabolic inflammation, leading to prevalent non-communicable diseases such as diabetes, obesity, cardiovascular disease (CVD), and cancer [2] This nutritional imbalance can cause different problems, such as poor dietary patterns, as these foods can displace healthier options in the diet.

The consumption of highly processed foods (HPFs) in today's modern diet has increased so rapidly over the past few decades, paralleling significant the increase in the diseases such as obesity, cardiovascular diseases, and type 2 diabetes. This shift in dietary patterns warrants critical examination due to its profound public health implications. Understanding the specific health impacts of HPFs is essential for developing effective public health strategies and policies aimed at mitigating these adverse effects. Previous research has consistently demonstrated that HPFs contribute to poor dietary quality and increased disease risk, making this an urgent area of study [3].

II. NUTRITIONAL CONTENT OF PROCESSED FOOD

UPFs are frequently loaded with added sugars, which contribute to excessive calorie intake without providing essential nutrients. High sugar consumption is linked to numerous health issues, including obesity, type 2 diabetes, and dental caries [4]. Similarly, these foods often contain high levels of salt to enhance flavour and preserve shelf life, which is associated with increased risks of hypertension and cardiovascular diseases [5]. Despite their high energy density, UPFs are typically low in dietary fiber, vitamins, and minerals. Fiber is crucial for digestive health and helps regulate blood sugar levels, yet it is often stripped away during the extensive processing of UPFs [6].

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/26aug441

The nutrient-poor profile of UPFs is associated with an increased risk of chronic diseases. Low dietary fiber intake is linked to a higher risk of colorectal cancer, while inadequate levels of vitamins and minerals can contribute to cardiovascular diseases and osteoporosis. For example, low potassium and high sodium levels, typical in many UPFs, can lead to hypertension and other cardiovascular issues [7]. Some components of UPFs, such as certain preservatives and additives, have been linked to an increased risk of cancer. For example, nitrates and nitrites, commonly used in processed meats, can form carcinogenic compounds called nitrosamines in the body. Furthermore, the high sugar content in UPFs can promote the growth of cancer cells by providing them with an abundant energy source. Due to their high levels of sugar, there is an increase in the glycaemic index and a lack of fiber due to changes in the food-making process and the addition of substitutes, which can impair insulin sensitivity and glucose metabolism. [8]. The displacement of 'real food' by ultra-processed foods is also a cause of social, cultural, economic, political and environmental disruption and crises [9].

III. PROCESSED FOOD AND CHRONIC DISEASE

Due to the increase in demand and consumption of UPFs, it has been linked to various chronic diseases due to the added sugar, fats, preservatives, and various additives, due to which food lost its nutritive qualities such as fibers, vitamins, and other minerals, which have a negative impact on health.

➢ *Obesity:*

Obesity and overweight are two prevalent public health problems caused by multifactorial and complex processes that influence countries of various economic conditions [10]. UPFs are high in fats and sugar, which increase the calorie intake, and due to the absence of essential nutrients such as fibers, vitamins, and minerals, it leads to an imbalance in the diet and causes obesity [11]. Obesity and overweight are two prevalent public health problems caused by multifactorial factors and complex processes that effect countries of various economic conditions [12-16].

➢ *Cardiovascular Disease:*

UPFs contain high sodium content which is one of the contributing risk factors for hypertension, an important for developing cardiovascular disease [17].

High levels of sugar content, which are present in HPFs, particularly in sugary beverages and snacks, can lead to obesity, insulin resistance, and type 2 diabetes, and all these factors can contribute to CVDs.[18]

➢ *Type 2 Diabetes:*

Due to the high glycemic index of UPFs, there are rapid spikes in blood sugar levels, which leads to insulin resistance over a period of time if we consume UPFs on a regular basis. Additionally, fibers cause impairment in the glucose metabolism [19].

- Cancer: Due to the presence of potential carcinogenic additives, contaminants, and an overall poor nutrient profile, UPFs increase the risk of cancer. High consumption of these foods has been linked to an increased risk of various types of cancer, such as breast and colorectal cancer [20].
- Gastrointestinal disorder: UPFs often lack dietary fiber and contain emulsifiers that can negatively affect gut health. This can lead to conditions such as irritable bowel syndrome (IBS) and inflammatory bowel disease (IBD) [21].

IV. ENVIRONMENTAL IMPACT OF PROCESSED FOOD

➢ *Resource-Intensive Production*

For the production of UPFs, companies require extensive resources such as water, energy, and raw materials for packaging and transportation. This contributes to the higher carbon footprints when we compare them with whole, minimally processed food. This ultimately causes an increase in greenhouse gas emissions, which contributes to climate change, which ultimately affects food security and public health [22].

➢ *Deforestation and Biodiversity Loss*

For the production of UPFs, there is a requirement for monoculture crops such as soy, corn, and palm oil, and these crops lead to disturbance in the agriculture practice and cause disturbance in the biodiversity. They reduce the availability of medicinal plants, affecting human health [23].

➢ *Pollution and Waste*

HPFs generate a large amount of plastic pollution and chemical runoff in the manufacturing and packaging of processed foods, which contaminate air, water, and soil. Exposure to these pollutants can lead to respiratory problems, waterborne disease, and other health issues in humans [24].

➢ *Antibiotic Resistance*

Industrial farming practices often involve the use of antibiotics for the better development of crops, but excessive use of these antibiotics leads to the development of antibiotic-resistant bacteria [25]. This has a health impact on human health by making infections harder to treat and increasing the mortality rate.

V. SOCIOECNOMIC FACTORS

Socioeconomic factors significantly play an important role in the consumption of UPFs, and they have a direct effect on public health. These factors include income, education, accessibility, and marketing strategies. Together, they shape the dietary patterns of people and contribute to the prevalence of chronic diseases.

➢ *Income and Food Prices*

Generally, UPFs are cheaper and more accessible than fresh, minimally processed food. Due to this cost disparity between healthy and unhealthy food, lower-income households often rely on UPFs due to their affordability and

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/26aug441

cheaper prices. Due to this, an increase in the consumption of UPFs in low-income populations contributes to higher rates of obesity, diabetes, and other diet-related diseases [26]. This economic pressure leads to higher consumption of UPFs, contributing to increased rates of obesity, diabetes, and other dietrelated chronic diseases among lower-income groups. This economic pressure leads to higher consumption of UPFs, contributing to increased rates of obesity, diabetes, and other dietrelated chronic diseases among lower-income groups.[27].

➢ *Education and Nutritional Knowledge*

Education also plays an important role in the consumption of UPFs. Due to the lack of knowledge about nutrition and dietary habits in poorly developed areas, they are unaware of or less likely to understand the effects of health risks associated with UPFs. Lower education levels are associated with higher consumption of UPFs and a greater prevalence of chronic diseases such as cardiovascular disease and type 2 diabetes [28].

➢ *Marketing and Advertising*

Aggressive marketing and advertising of UPFs, especially targeted at children and lowincome populations, influence dietary choices. These foods are often promoted as convenient, tasty, and affordable. The pervasive advertising of UPFs contributes to unhealthy eating habits and the rising prevalence of diet-related chronic diseases [29].

➢ *Accessibility of HPDs*

Accessibility to fresh, minimally processed food is often limited in certain urban and rural areas due to the rise of convenience stores and fast-food outlets, which lack supermarkets that offer fresh or minimally processed food [30].

Socioeconomic factors are deeply intertwined with the consumption of UPFs. Lower income, limited education, poor accessibility, and pervasive marketing create an environment where UPFs become a staple in the diet of disadvantaged populations [31].

VI. ENVIRONMENTAL IMPACT

➢ *Greenhouse Gas Emissions*

The production and distribution of UPFs, industrial agriculture practices, extensive processing, and long supply chains involved in the production of UPFs are the major sources of carbon emissions. As compared to fresh and minimally processed food, UPFs require a large carbon footprint. The energy-intensive process and the use of fossil fuels in transportation contribute to climate change [32].

➢ *Resources Used in the Production of UPFs*

The industrial processes required to manufacture the UPFs are resource-intensive, and the production of these foods involves extensive use of natural resources, including water, land, and energy, which can lead to significant environmental degradation. The cultivation of raw materials for the use of UPFs, such as palm oil, soy, and corn, often leads to deforestation and soil degradation [33].

➢ *Waste Production*

The consumption of UPFs generates a significant amount of waste, particularly plastic packaging. The convenience factor of UPFs often comes with excessive packaging, which contributes to environmental pollution. The packaging waste from UPFs is a major environmental concern. Plastics and other non-biodegradable materials used in UPF packaging contribute to land and marine pollution, posing threats to wildlife and ecosystem [34].

➢ *Water Usage and Pollution*

UPF production is water-intensive and contributes to water pollution through the use of fertilizers and pesticides in agriculture. At different levels of processing, they consume a large amount of water and generate wastewater. Parallelly, agriculture runoff from UPF ingredient production pollutes water bodies, harming aquatic life and affecting water quality [35].

VII. CASE STUDY: THE IMPACT OF ULTRA-PROCESSED FOODS ON OBESITY

This case study examines this relationship using data from the National Health and Nutrition Examination Survey (NHANES). The rising consumption of ultra-processed foods (UPFs) is linked to increasing obesity rates.

Obesity affects over one-third of U.S. adults. Dietary shifts toward UPFs, which are high in sugars, fats, and salts but low in essential nutrients, are a significant factor in this trend [36].

➢ *Study Design.*

Data from NHANES 2009-2010 was analysed to assess the correlation between UPF consumption and body mass index (BMI) in American adults.

➢ *Key Findings:*

- High UPF Consumption: UPFs comprised about 58% of total energy intake among American adults [37].
- Association with Obesity: Higher UPF consumption was significantly correlated with higher BMI and obesity prevalence [38].
- Nutritional Quality: UPF are energy-dense and nutritionally poor, promoting excessive calorie intake and weight gain. [39,40]
- Socioeconomic Disparities: Lower-income groups consumed more UPFs, leading to higher obesity rates among these population [41,42].

➢ *Implications:*

- High Energy Density: UPFs promote weight gain due to their high calorie content and low nutritional value.
- Marketing and Accessibility: Widespread marketing and accessibility make UPFs a common choice, especially for lower-income individuals.
- Behavioural Factors: The palatability and addictive properties of UPFs lead to overconsumption.

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/26aug441

➢ *Recommendations:*

Reducing UPF consumption is crucial for combating obesity. Strategies include nutritional education, policy measures to limit UPF availability, and improving access to healthy foods.

VIII. CONCLUSION

The extensive research on ultra-processed foods (UPFs) reveals their significant negative impact on human health. High consumption of UPFs is associated with an increased risk of chronic diseases such as obesity, cardiovascular diseases, type 2 diabetes, and certain cancers. Additionally, diets rich in UPFs contribute to mental health issues like depression and anxiety due to their poor nutritional quality and presence of unhealthy ingredients.

Socioeconomic factors play a crucial role in UPF consumption, with lower-income and lesseducated populations more likely to rely on these foods due to their affordability, convenience, and aggressive marketing. This exacerbates health disparities and leads to higher rates of diet-related diseases in these groups.

To mitigate these adverse effects, it is essential to implement policies that make healthy foods more affordable and accessible, enhance public education on nutrition, and regulate the marketing of UPFs. Promoting dietary patterns that prioritize whole, minimally processed foods is crucial for improving public health globally.

By addressing the root causes and promoting healthier dietary choices, it is possible to reduce the consumption of UPFs and improve public health on a global scale.

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ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/26aug441

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