Relationship between Ultra-processed Food Consumption and Obesity in Low-income Populations

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Abstract. Background: In recent years, the consumption of ultra-processed foods (UFPs) has increased rapidly in various countries, and based on this, various health problems such as chronic diseases such as obesity are common, especially in the consumption patterns of low-income groups. This is not only a serious threat to individual health but also causes various pressures on the public health system. Therefore, it is of great practical significance to study the consumption behavior of low-income people on UFPs and its impact on health. Results: Data analysis showed that after adjusting for confounding factors, we found that the population with high frequency of consumption of super industrial food had a higher risk of obesity than the population with low frequency of consumption of UFPs. This food is usually high in sugar and fat, in addition, long-term artificial sweeteners may increase people's desire for sweets, so low-income people are easy to develop dependence on UFPs, which increases the risk of obesity. Conclusion: This study shows that there is a strong direct relationship between excessive consumption of UFPs and obesity, especially in low-income populations. This leads to a significant increase in the prevalence of obesity and related chronic diseases. Therefore, the results of this study provide direct and important reference materials for public health workers and policymakers, thereby reducing the enormous pressure on social health caused by UFPs, raising public awareness of its harmful effects, and improving the eating patterns of low-income populations. This research has important theoretical significance and practical value.

Keywords: Ultra-processed food, low-income populations, obesity.

1. Introduction

In recent years, with the acceleration of globalization and urbanization, the consumption of ultra-processed foods (UPFs) has grown rapidly in various countries. UFPs refers to foods produced through a series of complex industrial processing methods (such as hydrogenation, putrefaction, etc.), which usually add many sensory irritating additives, such as high content of sugar, salt, unsaturated fat, as well as preservatives, emulsifiers, colors and thickeners. UFPs are designed to appeal to consumers by enhancing the taste experience, improving appearance, increasing aroma and extending shelf life. Due to its low price and easy access, UFPs have gained widespread popularity worldwide, especially among low-income people.

However, along with the increase in UFPs consumption, various health problems have come with it. Many studies have confirmed that the high intake rate of UFPs is closely related to the occurrence of a variety of chronic diseases, of which obesity is particularly prominent [1]. According to the results published on the official website of the World Health Organization, the latest study published by the Lancet shows that the global obesity population is as high as 1 billion people in 2022. Since 1990, obesity worldwide has more than doubled in adults and tripled in children and adolescents (ages 5 to 19). The data also shows that 43% of adults will be overweight in 2022. Obesity is not only a serious threat to individual health, such as increasing the risk of cardiovascular disease, diabetes and other diseases, but also puts enormous economic and resource pressure on the public health system. In China, the obesity rate has continued to rise in recent years, especially among low-income people, and the obesity problem is more prominent and complex. This phenomenon is closely related to the popularity and high consumption of UFPs and deserves great attention. In this context, it is of great

practical significance to study the consumption behavior of low-income people on UFPs and their impact on health. By in-depth analysis of the dietary structure and nutrient intake patterns of this group, we can better understand the impact of UFPs in the obesity epidemic. In addition, exploring the socioeconomic circumstances and food choices of low-income people can help identify the root causes of health inequalities and provide a scientific basis for targeted public health policies.

2. UFPs Consumption Preference of Low-income Groups

2.1. Low-income Groups

Low-income people generally refer to people at the lower end of the economic spectrum whose income level is not sufficient to meet basic needs or meet socially accepted standards of economic security. The National Bureau of Statistics (NBS) classifies all surveyed households into five equal income groups according to their per capita income level, from low to high, and divides them into five equal groups on average. Households with the lowest 20% income are classified as low-income groups. Generally, family income, financial status, living standards and consumption power are the main basis to measure whether they are low-income people. Low-income groups include but are not limited to recipients of subsistence allowances, people in extreme poverty, families on the edge of subsistence allowances, families with spending difficulties and other low-income populations.

2.2. UFPs

UPFs refer to foods that have been highly industrially processed and often contain a variety of additives, such as preservatives, colors, sweeteners and flavorings, to enhance taste, extend shelf life or improve appearance. Common UFPs include ready-to-eat foods, sweets, sweet drinks, packaged snacks, processed meat products, etc. These foods tend to be nutritionally unbalanced, often high in sugar, fat, salt and artificial additives, and relatively low in dietary fiber, protein and micronutrients. Monteiro, C.'s study proposes a definition of ultra-processed foods and describes the high sugar, fat, and nutrient content of these foods, as well as their negative health effects, such as the association between obesity and cardiovascular disease [1].

2.3. UFPs Preference of Low-income Groups

Low-income people often choose lower-priced food because of financial pressure. UFPs tend to be less costly through mass production and processing, and thus can be offered to consumers at a lower price, making UFPs often an option for low-income people. At the same time, low-income groups generally have long working hours and fast pace of life, so they are more inclined to choose convenient and quick UFPs to meet their daily energy needs. The study of Darmon, N., & Drewnowski, A. pointed out that low-income people tend to choose cheaper but less nutritious foods due to economic constraints, and ultra-processed foods have become the main choice for low-income families due to their low prices. These foods tend to be high in energy density but lack essential micronutrients [1].

There is a study found that low-income people consume a higher proportion of ultra-processed foods, and these foods are high in energy density and low in nutritional value, resulting in a significant increase in calories consumed and the risk of obesity [2].

According to a study, the fast pace of life and high time pressure also encourage low-income people to choose ultra-processed foods. Research shows that economic pressures and long working hours have led to an increase in the demand for quick and convenient foods, and ultra-processed foods can meet this demand [1].

3. UFPs and Obesity

3.1. Obesity

Obesity is a health condition caused by the accumulation of excess fat in the body, usually by body mass index (BMI) measure. Obesity is generally defined as a BMI of 30 or more. Obesity not only affects appearance, it is also strongly linked to multiple health problems, including cardiovascular disease, diabetes, high blood pressure and some types of cancer. Obesity usually occurs because of chronic energy intake exceeding energy expenditure, and this imbalance is often associated with unhealthy eating habits and lack of physical activity.

3.2. Study on Correlation between Ufps and Obesity

There are limited survey data on the impact of UFPs on obesity in China, but there have been several studies abroad showing the association between UFPs consumption and obesity.

A cross-sectional study evaluated the association between UFPs consumption and obesity in the Canadian population [1]. 19, 363 adults aged 18 years or older from Cycle 2.2 of the 2004 Canadian Community Health Survey. UFPs intake is the daily relative energy intake using UFPs based on data obtained from a 24-hour food review (As a percentage of total energy intake) to estimate. Use body mass index (BMI ≥ 30 kg/m 2) assess obesity. Univariate and multivariate linear regressions were performed to describe UFPs consumption based on socioeconomic and demographic variables, and multivariate logistic regression was performed to validate the association between UFPs consumption and obesity, adjusting for potential confounders including sociodemographic factors, physical activity, smoking, immigration status, place of residence, and measured and self-reported weight and height. UPF intake is positively associated with the prevalence of adult obesity, Adjusted odds ratio (OR) is 1.32 [95 % confidence interval (CI)= 1.05~1.57].

The results showed that UFPs consumption was positively correlated with obesity. After adjusting for confounding factors, people in the top fifth of UFPs consumption were 32 percent more likely to be obese than those in the top fifth.

Another cohort study looked at middle-aged Spanish college graduates who were not initially overweight or obese and followed them for a median of 8.9 years. The association between UFPs consumption and the risk of overweight and obesity in cohort studies was evaluated. UFPs consumption was assessed using a validated semi-quantitative 136-item food frequency questionnaire. A total of 1,939 cases of overweight and obesity were identified during the follow-up period. After adjusting for potential confounding factors, participants in the highest quartile of UFPs consumption had a higher risk of being overweight or obese than those with the lowest consumption of the quartile of participants [2].

3.3. Additives in UFPs and Their Mechanisms of Influence on Obesity and Metabolic Health

For the normal population, long-term artificial consumption of sweeteners may increase people's desire for sweets, which can lead to obesity. Most studies have found that ingesting aspartame or sucralose has no effect on blood sugar, insulin, or gut hormone concentrations, but related human experiments suggest that long-term ingestion of aspartame may increase the risk of adipose tissue deposition and obesity in visceral and skeletal muscle [3].

A new study published in the journal Nature suggests that the artificial preservatives used in many processed foods may increase the risk of inflammatory bowel disease and metabolic disorders. In a mouse experiment, the researchers found that chemicals such as emulsifiers can change the composition of bacteria in the colon. This is the first time such additives have been shown to directly affect health. After feeding mice the common emulsifiers carboxymethyl cellulose and polyssorbate-80, healthy mice that drank the emulsifier gradually became obese and developed metabolic problems such as glucose intolerance, despite no other changes in their diet [4].

Taking food coloring as an example, since the 1980s in the world, many synthetic pigments have been pointed out after toxicological studies that they have certain toxicity, and have been prescribed

the scope and amount of use, such as amaranth, carmine, lemon yellow, of which carmine is still not allowed to be added to food in the United States. In addition, in the process of chemical synthesis, its raw materials often need coal tar, but its metabolism in the body will generate some carcinogens with genetic risks [4].

UFPs typically contain high levels of added sugars and unhealthy fats, which are significantly associated with obesity risk. According to the study of Brazilian dietary patterns by Monteiro et al., UFPs are playing an increasingly important role in the modern diet, and the high sugar and fat characteristics of this type of food make it a major choice for low-income people [5].

Specifically, studies have shown that diets high in sugar have been widely recognized as an important contributor to obesity. A systematic review of randomized trials and cohort studies by Te Morenga et al. showed a significant positive correlation between increased sugar intake and weight gain [6]. In addition, Malik and Hu point out that excessive intake of added sugars such as fructose not only affects body weight but may also lead to other metabolic health problems, especially in groups with frequent consumption of high-sugar beverages [7].

Similarly, high-fat diets have also been shown to be strongly associated with obesity. Friedman emphasized in his study that the intake of high-fat foods promotes fat storage and leads to weight gain [8,9]. These studies suggest that UFPs significantly increase the risk of obesity due to their high-sugar and high-fat properties, especially in low-income populations, suggesting that policymakers should pay attention to the dietary choices of these groups.

4. Conclusion

This paper examines the dependence of low-income populations on ultra-processed foods and analyzes the relationship between this dietary preference and chronic diseases represented by obesity. By assessing the long-term health effects of these foods, we aim to promote specific policy recommendations to help prevent and control obesity and improve the nutritional status and overall health of low-income populations. At a time when the negative effects of ultra-processed foods are becoming increasingly prominent, the findings of this paper will provide important references for policy makers and public health workers to develop more effective interventions to mitigate the enormous health challenges posed by ultra-processed foods in society.

Through this study, we hope to not only provide a scientific explanation for the health problems of low-income people but also provide a basis for the whole society to reflect on the consumption of ultra-processed food and policy adjustments. Only through multi-party collaboration, scientific guidance and policy intervention can we effectively curb the development of public health crises such as obesity and improve the health level of the whole society.

Authors Contribution

All the authors contributed equally and their names were listed in alphabetical order.

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