

# The Effects of Ultra-processed Foods on Food Addiction in Adolescents and the Mechanism of Prevention

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**Abstract.** Adolescent obesity is a chronic metabolic disease caused by a combination of environmental, genetic and other factors, and it poses a serious threat to adolescent health both physically and psychologically. Even worse, the negative effects can carry over into adulthood, increasing the risk of a range of cardiovascular and cerebrovascular diseases. The rising incidence of obesity among teenagers over the past few years is directly linked to the food industry's explosive growth. Meanwhile, Overindulgence in highly processed meals can result in the development of food addiction. As one of the causes of the obesity epidemic, the psychophysiological damage caused by food addiction to adolescents has increasingly received attention from all sectors of society. This paper reviews the research progress on food addiction among adolescents at home and abroad, and describes the assessment methods, occurrence mechanisms, and related preventive measures of food addiction among adolescents. It provides guidance for the prevention of adolescent food addiction and the protection of adolescent dietary health.

**Keywords:** Food addiction; ultra-processed foods; prevention; assessment.

## 1. Introduction

Food addiction is a long-term, recurrent mental illness brought on by a number of underlying causes, mostly the overindulgence in food to the point of extreme pleasure or euphoria[1]. Food addiction can lead to overeating and obesity in minors, and more seriously, the negative effects can be carried over into adulthood, increasing the risk of a range of cardiovascular and cerebrovascular diseases.

In recent years, issues relating to food addiction have received increasing attention from a wide range of sectors of society. A survey of a range of food addicts has shown that most of the foods that cause food addiction are high in fat and sugar, and this combination is often found in ultra-processed foods. Ultra-processed foods are extremely dependent on food additives, which means that they frequently have more fat, saturated fatty acid, and added sugar content than conventional foods [2].

First proposed by Monteiro et al. in 2009, ultra-processed foods usually refer to foods that are reprocessed on top of what has already been processed, such as carbonated beverages, packaged breads, and frozen convenience foods [3]. Ultra-processed foods have gradually dominated the global food supply by virtue of their advantages of being cheap, convenient and ready-to-eat, and tasty. Especially with the active promotion of fast-food chains and the rapid development of the food industry, ultra-processed foods dominate the daily diets of many adolescents, and are even able to replace traditional cooked foods. According to the China Child Development Report (2021), the overweight and obesity rate among 12-15 year olds in China has reached 23.1% [4]. The key root cause of the obesity epidemic is over-eating, and a large number of clinical and pre-clinical studies have shown that most obesity in minors due to over-eating is characterised by symptoms of food addiction. However, there is relatively little contemporary research on the association or mechanisms between ultra-processed foods and food addiction in adolescents. Therefore, this paper explains the assessment method of adolescent food addiction from the adolescent perspective and explores the influencing factors in ultra-processed foods that make adolescent food addiction occur, aiming to provide some theoretical basis and suggestions for preventing and reducing the incidence of adolescent food addiction problems.

## 2. The Concept of Food Addiction

The term "food addiction" was first coined by Randolph, describing it as "a condition in which the regular consumption of a particular food (e.g., corn, wheat, coffee, milk, eggs, potatoes, etc.) produces specific adaptations in the consumer, which result in symptoms similar to those of an addictive process". With the progress of research, this view has changed, and its main manifestation is that the consuming person consumes a certain food for a long period of time and becomes dependent on it, and once he stops consuming it, negative emotions such as cravings and anxiety appear, and when it is re-acquired, he keeps over-consuming it under the double stress of physiology and psychology and develops a tolerance, and bingeing and other behaviours in order to obtain an extremely euphoric and pleasurable sensation or to discharge certain negative emotions, so that the As the cycle repeats, the dependence on the food becomes more and more serious, resulting in the symptoms of food addiction[1]. Food addiction is common in all groups, and the incidence can be as high as 10 per cent in people with normal body mass index [5]. It is not only harmful to people in terms of the range of illnesses caused by overeating, but also in terms of the mental harm it can cause. The high prevalence of food addiction is therefore cause for alarm.

## 3. Adolescent Food Addiction Assessment Methods

### 3.1. The Yale Food Addiction Scale Method

The Yale Food Addiction Scale is currently used to diagnose substance dependence in relation to eating behaviors, and this serves as the basis for official evaluations of food addiction. In order to determine whether compulsive eating is clinically important, these comprise two entries and seven diagnostic criteria. The Yale Children's Food Addiction Scale was created by Gearhardt et al. based on the Diagnostic and Statistical Manual of Mental Disorders (Fourth Edition), which altered the YFAS and decreased the needed reading level. There was a creation of the Yale Food Addiction Scale for Children [6]. The following are some of its primary areas: 1) I find it difficult to stop eating after I've eaten; 2) I make every effort to locate what I want to eat, whether it be by asking a buddy to buy it for me, searching for a vending machine, or stealing it while no one else is there. 3) After overindulging in food, I feel guilty; 4) When I avoid certain foods, I get upset or queasy; 5) I eat in a way that upsets me; 6) My eating habits lead to a lot of problems; 7) I wish I could cut back on or quit eating certain foods; 8) I eat improperly; and 9) I feel that I need to eat more food in order to feel content and at ease. The seven DSM-IV-TR diagnostic criteria for substance dependency connected to eating behaviors are reflected in these questions: (1) Forbearance (2) abstinence (3) loss of self-control (4) incapacity to cut back on sporadic drug use (6) abandoning significant activities like socializing, leisure, etc. because of substance misuse; and (7) abusing the substance while continuing to use it even though it is producing psychological or bodily problems; Pretlow and associates [7]. examined food addiction in kids using the DSM-IV-TR diagnostic criteria for drug abuse and found that eating behaviors resembling addiction were more common in minors than in adults.

### 3.2. Blood Component Assessment

Regarding the completion of the scale, it may be somewhat subjective and to some extent may cause bias in the test results. Therefore, other indicators can be explored to assess food addiction. The connection between hormones, blood biomarkers, and food addiction was examined by Stephanie Sophie Romer et al. [8]. There is a correlation between blood cortisol, TSH, and triglycerides and food addiction symptoms, according to 16 studies. If specific hormones or blood biomarkers can be examined clinically to determine the presence or likelihood of food addiction disorders, it may be able to provide an adjunct to the results of the Yale Food Scale method.

## 4. The Cause of Food Addiction in Ultra-processed Food

Adolescent food addiction is mediated by a long-term interaction between multiple factors. These include genetic and neurobiological factors. Genetic factors determine the susceptibility of adolescents to food addiction, and neurobiological factors and addictive additive components in ultra-processed foods work together to regulate the development of food addiction. Exploring these mechanisms can provide a theoretical basis for preventing food addiction in adolescents, thereby reducing their risk of obesity-related diseases in adulthood.

### 4.1. Hereditary Factor

Data indicates that the offspring of the group with the highest maternal consumption of ultra-processed foods (12.1 servings/day) had a 26% higher risk of obesity than those of the group with the lowest consumption (3.4 servings/day) [9]. Mothers who consume ultra-processed foods during pregnancy have been found to increase their offspring's risk of being overweight or obese. The reason for this is mainly due to the influence of factors such as nutritional and energy status in the mother's perinatal body on the DNA methylation patterns associated with eating disorders in the offspring. Maternal high-fat diets alter DNA methylation patterns associated with eating disorders in offspring and have an effect on the expression of dopamine and opioid genes (neural mechanisms associated with reward and affecting food preferences in animals) in the midbrain limbic reward circuitry and hypothalamus of the offspring. Opioids increase food preferences by increasing the pleasure of the reward.

### 4.2. Neurobiological Influence

The mechanisms of food addiction are based on certain neurophysiological foundations that are similar to those of drug addiction. Animal experiments have shown that the mediators that cause withdrawal-like symptoms when rats are deprived of high-fat food are the same as those that mediate drug withdrawal symptoms. The biggest commonality is their ability to activate the dopamine connection response in the brain's reward circuit. Another study, using intracerebral scans of addicts, found that parts of the caudate nucleus, hippocampal gyrus, and insula in addicts were able to release endogenous dopamine when activated by food, resulting in euphoric and pleasurable sensations. This is due to the fact that memories from high-calorie foods are more easily encoded by the brain's memory system, and when odours, vision, location, etc. are already encoded in the same way as high-calorie foods, it will be easier to activate the limbic dopamine system, releasing endogenous dopamine and enhancing the motivation to seek out these foods [10]. However, prolonged intake of such substances can lead to downregulation of dopamine D2 receptors in the brain as well as reduced dopamine binding to these receptors, resulting in insufficient dopamine in the brain. When the brain is low on dopamine, it causes withdrawal. This withdrawal causes the sugary substance to continue to be ingested, ultimately leading to addiction.

### 4.3. Addictive Food Components

A number of animal models have demonstrated the link between eating behaviors akin to addiction and highly processed food intake. Studies have demonstrated that when mice are made to seek for highly processed foods even after receiving electric shocks to the soles of their feet, these foods are most likely to be linked to addictive eating practices. Based on the responses from study participants who completed a Yes questionnaire and were required to complete a multiple-choice task, Schulte, Avena, and Gearhardt came to the conclusion that processed foods high in fat and refined carbohydrates are the most likely to be linked to addictive eating patterns [11]. This is due to the fact that ultra-processed foods high in fat and sugar, i.e., high-calorie foods, stimulate the reward and motivation systems as well as endogenous opioids in the brain and limbic dopaminergic pathways in the midbrain, which enhances the reward effect and results in a euphoric and pleasurable sensation.

Studies have indicated that children are more vulnerable than adults to the harmful effects of addictive dietary additives.

## **5. Preventive Measures Against Addiction to Ultra-processed Foods**

Food addiction is different from the prevention of drug or substance addiction, people can't stay away from food as much as they can stay away from tobacco or drugs, food is an essential presence in everyday life, but one can choose the right way to prevent food addiction from occurring.

### **5.1. Raising Awareness of Food Addiction among Adolescents and Parents**

Raising awareness of the concepts related to food addiction is extremely necessary. This will enable people to pay more attention to what they eat and to control their behaviour subconsciously when they are aware of their tendency to suffer from food addiction symptoms. However, popularising the concepts related to food addiction is not enough for the adolescent group, who have less self-control, and parental supervision is also needed. Therefore, it is necessary to improve the dietary environment of the family, rationally prepare meals to ensure that adolescents have sufficient and comprehensive nutritional intake, and at the same time, control the intake of ultra-processed foods by adolescents. Brown et al showed that adolescent dietary behaviours are greatly influenced by the dietary behaviours of their parents, and that adolescents' preference for french fries and other junk foods is found in their parents' diets [12]. This would go a long way in reducing the problem of food addiction.

### **5.2. Food Addiction on a Daily Basis**

It is possible to prevent food addiction in daily life. First of all, in daily diet, do not let the body be in a state of excessive hunger. Some studies have shown that excessive hunger in humans can lead to the phenomenon of food addiction under certain circumstances. Therefore, in daily life, we should maintain a regular intake of three meals a day, in addition, each meal should be balanced intake of various nutrients, to avoid the body for a long-term lack of certain elements of the state, at the same time, each meal to eat to the eighth full enough. Excessive eating is likely to cause damage to other organs of the body.

### **5.3. Improvement of Psychological Factors**

Since diet can reduce stress to some extent, people can't help but increase their dietary intake when they are under a lot of stress, but this is not a scientific approach. It has been proven that there are many other activities in life that can relieve stress, such as exercise, which can also increase dopamine secretion in the brain, similar to the effect of consuming high-calorie food intake. People should choose healthy ways to relieve stress that suit them.

## **6. Conclusion**

According to the currently available research, there are more studies on food addiction but less studies on food addiction in adolescents. Future studies on adolescent food addiction are required. Furthermore, the Food Addiction Scale serves as the basis for the current definition of food addiction in teenagers. However, because the scale is subjective, further research is required to find meaningful biological indicators that may reliably diagnose food addiction disorders. In conclusion, integrating environmental and physiological factors, strengthening publicity and education on food addiction among adolescents, and encouraging adolescents to reduce their intake of ultra-processed foods are of great significance in safeguarding adolescents' physical health.

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