

The Role of Plant-Based Diet in Adolescent Obesity Rates and Its Potential as A Solution

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Abstract:

s. This study examined the impact of plant-based diets on obesity rates among adolescents, described their potential positive impact on adolescent obesity, including how they can help adolescents improve their weight management and overall health by providing low-calorie, high-fiber food options. An in-depth discussion of the dual effects of adolescent obesity on physical health and psychosocial well-being was provided, including the increased risk of chronic disease and the psychosocial disorders that can result. It also analyzed the health benefits of plant-based diets from a nutritional perspective, discussed their short- and long-term health effects, and identified challenges that may be faced when implementing plant-based diets, such as nutritional imbalances, acceptance and adaptation issues, and lack of education and information. To address these issues, this paper proposed a range of solutions including providing nutrition education and guidance at the school and community levels, enhancing diet acceptance through media and public policy, and government support and incentives. These strategies aim to promote the popularization of plant-based diets and improve eating habits among adolescents, thereby effectively managing and reducing obesity rates.

Keywords: Plant-Based Diet; Adolescent Obesity; Nutrition Education; Health Management.

1. Introduction

In recent years, the rapid rise of obesity among Chinese adolescents has become a public health problem that cannot be ignored. According to relevant studies, the rate of obesity among adolescents continues to grow, which is closely related to unhealthy eating habits, lack of sufficient physical activity and socio-economic factors[1]. Obesity not only affects the physical health of adolescents, such as increasing the risk of chronic diseases like heart disease and diabetes, but also negatively affects their psychological and social development. In view of this situation, finding effective strategies to prevent and control obesity among adolescents has become an urgent issue.

Among the many possible solutions, the plant-based diet is considered to be a dietary approach that can help prevent and treat obesity due to its low calorie, high fiber, and micronutrient-rich composition. Plant-based diets, which emphasize the use of plants as the main food source and the reduction of animal food intake, have become increasingly popular in Western countries and have been shown to have multiple health benefits. This study aims to explore the application of plant-based diets in adolescents, evaluate their potential effects on controlling adolescent obesity, and propose practical strategies for their promo-

tion. Through the in-depth study of the relationship between plant-based diets and adolescent obesity, this paper hopes to provide a scientific basis and practical guidelines for alleviating the problem of adolescent obesity in China.

2. Health Effects of Adolescent Obesity

2.1 Physical Health Effects

Obesity has become a major threat to the health of adolescents worldwide, with the strong link to type 2 diabetes of particular concern. In adolescents, excess weight directly contributes to the body's decreased sensitivity to insulin, which in turn causes insulin resistance[2]. Insulin is a key hormone that regulates blood glucose levels, and insulin resistance means that the body's cells are unable to efficiently utilize insulin, thus failing to convert sugar in the bloodstream into energy. Prolonged hyperglycemia not only affects the normal functioning of all body systems, but also accelerates the development of diabetes-related complications, such as retinopathy and nephropathy, which can have a serious impact on a young person's long-term health.

With the increase in adipose tissue in the body, the demand for blood supply increases and the heart needs to pump more blood to meet the body's needs, which di-

rectly leads to a heavier burden on the heart and higher blood pressure. High blood pressure in adolescents not only poses a threat to heart health, but may also damage other organs, such as the kidneys and brain. High blood pressure, if left unchecked, can develop into more serious cardiovascular disease in the long term, posing a serious threat to adolescents' health and future quality of life. Obesity not only leads to elevated blood pressure, but is often accompanied by dyslipidemia, such as high cholesterol and high triglycerides, all of which can damage the walls of blood vessels and accelerate the process of atherosclerosis. Atherosclerosis is the leading cause of cardiovascular disease, which leads to reduced elasticity and narrowing of blood vessels, thereby increasing the risk of heart disease and stroke. Obesity can plant the seeds of cardiovascular disease in adolescence, affecting their health throughout adulthood. This early exacerbation of cardiovascular risk suggests that early intervention and management of adolescent obesity is key to preventing future cardiovascular disease.

2.2 Psychosocial Influences

Obese adolescents face multiple psychological and social challenges during a critical period of psychological development. During adolescence, individuals are often very sensitive to their body image, and obesity may trigger serious problems with self-image. Peer evaluations and acceptance during this stage can have a tremendous impact on the development of self-esteem[3]. Obese adolescents may be ridiculed or ostracized by their peers because of their size, and this negative social feedback may lead to damaged self-esteem and a feeling that they are not appreciated or accepted by others. This dissatisfaction and shame about their appearance can gradually evolve into deeper self-identity issues, affecting their overall mental health and development.

As self-esteem declines, obese teens may exhibit avoidant and closed-off behaviors at social events[4]. This social impairment can make it more difficult for them to establish and maintain friendships and reduce opportunities for social interaction. On campus and in everyday life, they may avoid participating in any activities that may reveal their body size, such as sports or any public performances. This avoidance behavior not only limits their social life, but may also affect their participation in studies and other normal activities, further exacerbating feelings of isolation and exclusion. Prolonged social difficulties and a low sense of self-worth may lead to more serious psychological problems, such as depressive tendencies. Depression not only affects adolescents' emotional state, but also interferes with their daily functioning, including academic performance and relationships. Depressed teens

may experience symptoms such as sleep problems, difficulty concentrating, and lack of motivation. In addition, to cope with these negative emotions, they may resort to unhealthy behaviors to seek solace, such as overeating and drinking, which can create a vicious cycle and aggravate obesity.

3. Plant-Based Diet

3.1 Definition and Characteristics of Plant-Based Diets

The plant-based diet, a diet that is receiving increasing attention, is mainly characterized by an emphasis on the intake of plant-based foods while reducing or avoiding the consumption of animal-based foods. This diet is not only recognized as contributing to improved personal health, but also as having a positive impact on environmental protection.

A plant-based diet primarily refers to the use of plant-based foods as the primary source of your daily diet[5]. Specifically, this dietary pattern emphasizes the consumption of large amounts of whole grains, legumes, vegetables, fruits, nuts, and seeds, while limiting or completely avoiding meat, dairy, and other animal-derived products. A plant-based diet does not necessarily imply a complete vegetarian or vegan diet, but rather promotes plants as the mainstay of food intake[6].

The main components of a plant-based diet include whole grains such as brown rice, whole wheat flour, oats and quinoa [7]. Whole grains retain all of the natural components of grains, including the nutrient-rich germ and outer layers of fiber, which help maintain satiety for longer periods of time while providing essential B vitamins and minerals. Legumes include a variety of beans such as black beans, red beans, green beans, tofu and soy milk[8]. Legumes are an important source of protein in a plant-based diet and also provide nutrients such as fiber, iron and calcium. Vegetables and fruits emphasize variety and colorful, they are rich in vitamins, minerals, antioxidants and phytochemicals, which are important in the fight against chronic diseases. Nuts and seeds such as walnuts, almonds, flaxseeds and chia seeds, they are a good source of healthy fats, protein, and Omega-3 fatty acids. Other plant-based foods such as kelp and mushrooms are also part of a plant-based diet, and they provide additional nutrients and flavor to the diet[9].

The biggest difference in plant-based diets compared to traditional diets is the greatly reduced intake of animal products and the increased proportion of plant-based foods[10]. Whereas meat, poultry and seafood tend to dominate many traditional diets, in plant-based diets these foods are replaced by plant-based foods such as whole

grains, legumes, vegetables and fruits. This substitution not only affects the proportion of nutrients in the diet, such as increasing dietary fiber intake and lowering saturated fat and cholesterol intake, but may also result in lower calorie intake, which aids in weight control and health management.

The health benefits of a plant-based diet have been confirmed by numerous studies. For example, it reduces the risk of heart disease, high blood pressure, diabetes and certain types of cancer. A high fiber intake helps improve the functioning of the digestive system and helps maintain a healthy weight. In addition, the antioxidants and phytochemicals rich in a plant-based diet can reduce the body's inflammatory response and boost immunity.

Plant-based diets are not only good for personal health, but also have a positive impact on the environment. Compared to traditional meat-based diets, plant-based diets require less land, water and energy consumption in their production. In addition, reducing the consumption of animal products also reduces greenhouse gas emissions, particularly methane and carbon dioxide, which can help mitigate global warming.

3.2 Effect of Plant-Based Diets on Health

3.2.1 Reduce the risk of heart disease

Plant-based diets significantly contribute to reducing the risk of heart disease through their specific nutritional composition, especially by reducing the intake of saturated fat and increasing the consumption of dietary fiber. Saturated fats are primarily derived from animal foods, such as red meat and full-fat dairy products, which figure prominently in traditional diets. In contrast, a plant-based diet emphasizes foods such as legumes, nuts, whole grains, and lots of fruits and vegetables that are low in saturated fat and high in unsaturated fat, a fatty acid composition that helps lower plasma levels of low-density lipoprotein (LDL), or so-called „bad“ cholesterol, which is a major risk factor for the development of heart disease [11]. In addition, a plant-based diet rich in complex carbohydrates and high in fiber is particularly beneficial to heart health. Whole grains such as oats, brown rice and wheat germ are rich in soluble and insoluble fiber. Soluble fiber has been shown to directly lower blood cholesterol levels by forming a gel-like substance that traps cholesterol and prevents it from being absorbed into the bloodstream. Insoluble fiber, on the other hand, helps promote intestinal health, maintains stable blood sugar, and indirectly reduces the risk of heart disease. Studies have shown a direct positive correlation between a high-fiber diet and a reduced risk of heart disease.

A plant-based diet is also rich in a variety of plant sterols

and micronutrients, all of which have positive effects on cardiovascular health. Plant sterols are structurally similar to cholesterol and can compete with cholesterol for the same absorption pathway during digestion, thus reducing the total amount of cholesterol in the body. In addition, many plant-based foods contain antioxidants such as vitamins C and E, selenium, and beta-carotene, which protect the body's cells from free radical damage and reduce inflammation, all of which are key contributors to cardiovascular disease. Thus, a plant-based diet not only promotes heart health by directly lowering harmful cholesterol and blood pressure, but also indirectly by providing an abundance of antioxidants, which is an important health investment at any age.

3.2.2 Improving glycemic control

Plant-based diets play a key role in improving glycemic control by providing high-fiber, low-glycemic-index (GI) foods, which are extremely important for the prevention and management of type 2 diabetes[12]. Foods such as whole grains, legumes, vegetables and certain fruits in a plant-based diet are rich in dietary fiber. Dietary fibers are vital for controlling blood sugar levels because they not only slow down the digestion of food, which helps release sugar into the bloodstream more smoothly, but they also improve insulin sensitivity. This slow digestion process means that blood sugar levels don't rise as quickly after a meal, thus helping to maintain stable blood sugar for longer periods of time and reducing the need for insulin. Legumes and other low GI foods in a plant-based diet play a vital role in maintaining blood sugar balance. The glycemic index is a measure of how quickly blood sugar rises after food intake, and low-GI foods release sugar more slowly during digestion, thus avoiding sharp swings in blood sugar levels. For example, the complex carbohydrates and proteins in beans help stabilize blood sugar, while their high fiber content helps slow digestion and further stabilize blood sugar. This is especially important in preventing the development of type 2 diabetes and its complications, as sustained high blood sugar levels are a major driver of this disease. Plant-based diets indirectly help control blood sugar levels by promoting the maintenance of a healthy weight. Obesity is a major risk factor for type 2 diabetes, and the low-calorie, high-fiber foods in a plant-based diet help with weight management, thereby reducing the risk of obesity. Maintaining a healthy weight not only helps to improve the body's response to insulin, but also reduces the likelihood of the pre-diabetic state shifting to full-blown diabetes. Through these mechanisms, the plant-based diet becomes an effective strategy for preventing and controlling blood sugar-related health problems, especially during the critical growth and devel-

opmental stage of adolescence.

3.2.3 Weight reduction

Plant-based diets significantly contribute to weight management and weight loss through a combination of high-fiber and low-fat foods[13]. The importance of fiber in a plant-based diet lies not only in its nutritional value, but also in its positive impact on weight management. High-fiber foods such as legumes, whole grains, vegetables, and fruits take longer to break down during digestion, thus prolonging satiety and avoiding the need to eat frequently. Fiber absorbs and retains water and takes up more space in the stomach when it increases in size, which directly increases the feeling of fullness. In this way, the high intake of fiber helps to reduce overall food intake, and the calorie intake naturally decreases.

The low-fat nature of plant-based diets is also a key factor in their ability to help with weight loss. Compared to high-fat animal products, plant-based foods typically contain lower amounts of saturated and total fat, which helps to lower calorie intake. For example, a legume- or vegetable-based plate has a much lower fat content than a meat-based plate. Reducing saturated fat intake not only helps control calories, but also improves cardiovascular health, resulting in an overall health-promoting eating pattern. By eating this way, consumers are able to effectively control their calorie intake, which in turn promotes weight loss. Developing healthy eating habits during adolescence has long-term benefits in preventing future obesity and related chronic diseases. By implementing a plant-based diet, adolescents not only learn how to make nutrient-dense, low-calorie food choices, but they are also able to develop a consistent pattern of healthy eating. Such eating habits help them maintain a normal body weight and avoid overconsumption of useless, high-calorie foods, thus building a solid foundation for a healthy life during a critical period of growth.

4. Effects of Plant-Based Diets on Adolescents Health

4.1 Nutritional Perspective

A plant-based diet, with its rich nutrient composition, has a significant role to play in the maintenance and promotion of health, especially during this critical period of growth and development in adolescents. First and foremost, vegetables, fruits, whole grains, legumes, nuts and seeds in a plant-based diet are all excellent sources of dietary fiber. Dietary fiber intake is vital to health; not only does it help maintain a healthy digestive system and prevent constipation, but it also increases the volume of food during digestion, which leads to an enhanced feel-

ing of fullness. This enhanced feeling of fullness helps control the amount of food eaten and indirectly reduces the total calorie intake, which has a direct positive impact on weight management and obesity prevention. In addition, the abundance of vitamins and minerals in a plant-based diet is a valuable resource for adolescent growth and development. For example, vitamins C and E are both powerful antioxidants that protect the body's cells from free radical damage and help reduce the risk of chronic disease. Minerals such as potassium and magnesium are especially important for heart health, as they help regulate heart function and blood pressure. Potassium also helps regulate water balance and electrolyte balance in the body, while magnesium is a key element for bone and muscle function and is important for promoting bone health and muscle development in teens.

4.2 Short-Term Health Effects

The short-term health effects of plant-based diets on adolescents are primarily in the form of increased satiety and control of energy intake. Since high-fiber foods absorb and retain large amounts of water during digestion, this causes the fiber to expand in the stomach, increasing the volume of food, which can significantly prolong satiety[14]. This physical state of fullness can effectively reduce the frequency of eating and the amount of food consumed at each meal in adolescents, thus helping to control total caloric intake, which is particularly important for weight management and obesity prevention. In addition, the complex carbohydrates abundant in plant-based diets are more difficult to break down than refined carbohydrates, which helps to smooth out blood glucose levels, avoiding sharp rises and falls in blood glucose after meals, thus helping to maintain a steady release of energy and avoiding the feelings of fatigue and hunger that result from fluctuations in blood glucose.

Implementing a plant-based diet in the short term can also help improve the overall nutritional status and metabolic health of adolescents. Due to the low-sugar, low-fat nature of a plant-based diet, it helps to reduce the accumulation of unhealthy body fat in adolescents while reducing the risk of hyperglycemia, which is critical for the prevention of diabetes and other metabolic syndromes. Thus, plant-based diets not only help teens control their weight in the short term, but also enhance their quality of life and health on a broader scale.

4.3 Long-Term Health Effects

The long-term health effects of a plant-based diet are manifested in a number of ways, particularly in the significant benefits in reducing the risk of many chronic diseases[15]. Long-term adherence to a diet based on plant-

based foods, such as vegetables, fruits, whole grains, and legumes, can be effective in reducing the risk of heart disease, high blood pressure, and diabetes. The high levels of antioxidants and anti-inflammatory components such as vitamin C, vitamin E, beta-carotene, and a variety of phytochemicals enriched in these foods reduce oxidative stress and chronic inflammatory conditions in the body. These conditions are widely recognized as core drivers in the development of chronic diseases such as cardiovascular disease and diabetes. For example, whole grains can improve blood lipid levels, beans are rich in soluble fiber that helps lower cholesterol, and antioxidants in fruits and vegetables can prevent cell damage from free radicals, thereby reducing the risk of cancer.

A plant-based diet also plays an important role in maintaining a healthy body weight and body fat percentage. Long-term adoption of a low-fat, high-fiber dietary pattern not only helps to reduce and control body weight, but also optimizes body fat distribution and reduces the accumulation of abdominal fat, thus further reducing the risk of cardiovascular disease and diabetes. Healthy weight management also reduces joint burden and prevents obesity-related bone and joint problems such as osteoarthritis. In summary, following a plant-based diet over the long term not only improves quality of life, but also effectively extends healthy lifespan and reduces the burden of chronic disease, with far-reaching positive effects on both individuals and society.

5. Problems in the Application of Plant-Based Diets

5.1 Inadequate Intake of Nutrients

While plant-based diets offer a variety of health benefits for teens, they can also lead to inadequate intake of certain nutrients, especially key nutrients such as protein, iron, and vitamin B12, if the diet is not planned properly. Protein is an important part of the body, especially during the critical period of adolescent growth and development. Although plant foods can provide protein, the bioavailability of plant proteins and the completeness of the essential amino acids they contain are usually not as good as animal proteins[16]. As a result, if a comprehensive protein intake is not ensured through a judicious mix of a variety of plant-based foods, adolescents may face inadequate protein quality, affecting their muscle development and overall health.

Iron and vitamin B12 deficiencies are also common nutritional problems in plant-based diets. Iron is a key component in the production of red blood cells, and the iron found in plants (non-heme iron) is more difficult for the body to absorb than the iron found in animal prod-

ucts (heme iron). Adolescents have a high need for iron during their growth spurts, and iron deficiencies can lead to anemia and related fatigue and concentration problems. Vitamin B12, on the other hand, comes almost exclusively from animal foods and is essential for maintaining nervous system health and red blood cell production. A plant-based diet that does not address sources of vitamin B12 through supplements or fortified foods may lead to vitamin B12 deficiency, and long-term deficiency may also lead to permanent damage to the nervous system.

5.2 Acceptance and Adaptation Weaker

An important issue facing plant-based diets in adolescent obesity management is acceptance and adaptation, which is largely influenced by taste preferences, and cultural habits[17]. Adolescents often have clear preferences for the taste and texture of foods, and the flavors and ingredients of plant-based diets may differ significantly from what they are used to. For example, adolescents accustomed to meat and high-fat foods may find plant-based foods less flavorful and satisfying. In addition, dietary habits are strongly influenced by cultural contexts; in some regions, animal products dominate the food culture, and adolescents are exposed to and accustomed to such dietary patterns from an early age, and there are cultural and emotional barriers that need to be overcome in order to change these dietary habits. In many cases, especially in developing regions, plant-based foods (such as certain fresh vegetables, fruits and vegetables, and selected whole grains) may be more expensive than traditional meat and processed foods. This may make the diet unaffordable for adolescents from low-income families, and access to and storage of plant-based foods may also be problematic, especially in those areas where plant-based foods are in short supply.

5.3 Inadequate Education and Information

One of the implementation challenges of plant-based diets in managing adolescent obesity is the lack of public awareness. Although the health benefits of plant-based diets have been supported by several studies, in practice, many families, educational institutions, and even health-care providers still do not have a good understanding of how to effectively implement plant-based diets[18]. This lack of knowledge is particularly evident among adolescents and their parents, who may not be aware of the specific health benefits that plant-based diets can provide, how to balance their diets to prevent nutritional deficiencies, and how to incorporate plant-based foods into their daily diets. Lacking this basic knowledge, adolescents and their parents may have reservations about shifting their diets, fearing that plant-based diets may not meet the

nutritional needs of daily life, especially for growing adolescents. In addition, promotion and education of plant-based diets is inadequate in many areas. Schools and communities often lack a systematic strategy for integrating plant-based diets into health education curricula, and public health promotion rarely addresses specific ways to implement plant-based diets. This makes it difficult for adolescents to receive practical guidance on how to choose and prepare plant-based foods in school or community settings.

6. Public Strategies to Promote Plant-Based Diets

Addressing adolescent obesity, particularly through the promotion of plant-based diets, requires comprehensive nutrition education and guidance at the school and community levels. Schools can incorporate content on plant-based diets into their curricula to educate students about the nutritional value of various plant foods and their health benefits. Community centers can organize regular seminars and workshops on healthy eating and invite nutrition experts to explain the benefits of plant-based diets and strategies for implementation. These activities can provide a platform for parents and youth to learn and exchange ideas, enhance their knowledge and interest in plant-based diets, and provide families with the motivation and means to change their eating habits. School food service should also incorporate the concept of a plant-based diet by offering healthier, nutrient-dense plant-based meal options. This requires school food service administrators to work closely with dietitians to ensure that the food offered meets both nutritional needs and student tastes.

Policy support and incentives are important tools for promoting plant-based diets and managing youth obesity[19]. Governments can help change public eating habits and promote public health by formulating specific policies to encourage the production and consumption of plant-based foods. For example, the government can provide tax incentives to companies that produce and sell plant-based foods. The government can also support the research and development and promotion of plant-based foods by providing subsidies. These subsidies can be used to support research institutes and universities to conduct in-depth studies on the nutritional value of plant-based foods, or to assist small and medium-sized enterprises to develop new plant-based products, improve processing technology, and enhance product quality and taste so that they are more in line with the tastes of adolescents. The Government can also subsidize public health promotion campaigns to increase awareness and acceptance of plant-based diets in the community at large by educating the public, especially

youth and parents, about the health benefits of plant-based diets. Through such a series of comprehensive policy support and incentives, the popularization of plant-based diets among adolescents can be effectively promoted, providing strong support for controlling or even reversing the rate of adolescent obesity.

7. Conclusion

This study provided insight into the impact of plant-based diets on obesity rates and their solutions in Chinese adolescents. This paper clarified the definition and characteristics of plant-based diets and assessed their significance on adolescent obesity, including their direct health impacts and socio-environmental effects. Plant-based diets are rich in fiber, vitamins, and minerals, have both short- and long-term health benefits, and are effective in preventing and managing adolescent obesity and its associated complications. From a health perspective, adolescent obesity is not only related to physical health, such as increased risk of diabetes, hypertension and cardiovascular disease, but also has serious impacts on psychosocial health, including self-esteem issues, social disorders and depressive tendencies. Plant-based diets help adolescents improve their weight management by providing healthy dietary choices, which indirectly improves their social functioning and mental health. However, plant-based diets face a number of challenges in their implementation, mainly including the risk of nutritional imbalance, acceptance and adaptation issues, and inadequate education and information. These issues need to be addressed through effective strategies, such as enhancing the social acceptance of plant-based diets through targeted nutrition education and guidance in schools and communities, and promoting the production and consumption of plant-based foods through government policy support and incentives.

In summary, plant-based diets have the potential to reduce obesity rates among adolescents, but their successful implementation requires the support of multiple parties, including the joint efforts of families, schools, communities, and the government. Through these comprehensive measures, plant-based diets can be more effectively promoted to help adolescents establish healthy lifestyles, thereby improving their health and quality of life in the long run.

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