

The Effects of Dietary Nutrients on Obesity

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Abstract. Obesity is a major public health problem affecting people of all ages, genders and ethnicities around the world. It is characterized by an abnormal or disproportionate amount of fat that can be detrimental to people's health. There are many factors relating to obesity, such as pressure, sedentary life, dietary and so on. One of the most relevant factors in people's lives is their daily diet. The objective of this paper is to analyze the repeatedly observed link between obesity and carbohydrate, low vitamin D levels and protein intake. Besides, this paper also focuses on how dietary nutrients affect people's obesity. Upon ingestion of these three nutrients by the human body, a potential mechanism of digestion and subsequent metabolic processes can be elucidated. Subsequent to digestion, the effects on the human body can be observed. Thus, a thorough understanding of the potential mechanisms and their resulting effects can be achieved. This article provides important insight into the effects of carbohydrate, vitamin D and protein on obesity. It also provides a valuable contribution to the understanding of the complex relationship between nutrition and obesity.

Keywords: Obesity, Carbohydrate, Vitamin D, Protein.

1. Introduction

Obesity is a growing global epidemic, with more than 2 billion people worldwide affected by overweight or obesity. In 2016, the percentage of adults aged 18 and over who were overweight was 39%, and the percentage of adults who were obese was 13%. The prevalence of obesity is highest in the Americas, followed by Europe and the Western Pacific. In America, it is estimated that roughly one third of the population is obese. Additionally, a variety of health problems like type 2 diabetes, hypertension, and cardiovascular disease are linked to obesity. These health risks can lead to premature death and disability, making it a serious public health concern. Obesity is also associated with numerous mental health issues, including depression, anxiety, and lower self-esteem. Furthermore, the economic burden of obesity is substantial, as healthcare costs for treating obesity-related diseases continue to rise. Numerous initiatives have been implemented to address the growing prevalence of obesity, including public health campaigns, nutrition education, and policy changes. These efforts aim to empower individuals to make healthier lifestyle choices and, ultimately, reduce the burden of obesity.

Obesity is a complex medical condition that is caused by a combination of several factors. Imbalances between energy intake and energy expenditure, physical inactivity, unhealthy eating patterns, heredity, specific medical circumstances, and particular medications can all be contributing factors. Poor dietary choices, such as consuming excessive amounts of processed foods or foods high in saturated fat, sugar, and salt, can lead to an energy imbalance and weight gain. Not only that, but poor dietary choices can lead to numerous other health issues, such as high cholesterol, diabetes, and heart disease. Therefore, it is critical to maintain a balanced diet in order to avoid obesity. To achieve optimal health, it is essential to have a balanced diet. This includes consuming plenty of fruits, vegetables, and whole grains. Besides, limiting the intake of processed and sugary foods is essential. Eating a variety of healthy foods will provide the body with the necessary nutrients and energy needed. Additionally, regular physical activity is also recommended to help maintain a healthy weight.

The purpose of this article is to briefly examine the consequences of carbohydrate, vitamin D and protein intake on obesity, as well as to delve into the mechanisms of action of these three nutrients. There is evidence that these nutrients can act to modulate appetite, satiety and energy expenditure. The discussion centers around the capability of these nutrients to decrease obesity and its related

health hazards, as well as the significance of evaluating the quality and amount of the nutrients taken in.

2. Three dietary nutrients associated with obesity

2.1. Carbohydrate

Since the early 1990s, there has been a dramatic increase in obesity rates globally. At the same time, the number of processed foods that contain fructose has increased, because fructose is a cheaper alternative to sucrose [1]. It is obvious that carbohydrate-containing foods can have different effects on blood sugar, even if they have similar amounts of carbohydrate. Jenkins et al. [2] developed the glycemic index in 1981, which is a tool that can be used to help people with diabetes select foods that will not cause a large spike in their blood sugar levels. The index is based on the concept that different carbohydrates affect blood sugar differently and assigns each food a numerical value between 0 and 10. This value indicates how quickly the carbohydrate in the food is absorbed into the bloodstream and how much it raises blood sugar levels. The glycemic index can be a valuable tool for people with diabetes, as it can help them to maintain their blood sugar levels within a safe range. Fructose is a type of sugar that is found in many foods. Unlike other sweeteners, fructose is digested at a slower rate in the intestine and its metabolic process is centered in the liver, which is then changed to glucose and kept as glycogen. Because of its unique metabolism, fructose does not have the same effect on blood sugar and insulin levels as other types of sugar. For this reason, fructose-containing foods are considered "low glycemic". However, recent studies have shown that the two sugars have very different effects. This may shed light on the relationship between obesity and fructose consumption. A problem with the GI is that it only assesses the glucose reaction. Today's diet is characterized by a significant amount of carbohydrate derived from high-fructose corn syrup and added sugar, such as sucrose. This sugar consists of 50% fructose, a type of sugar naturally found in many fruits and vegetables. Fructose is metabolized differently than glucose, bypassing some of the key steps in liver function [1]. The discrepancy in metabolic rate might account for why fructose is connected with a higher likelihood of becoming obese and suffering from other chronic diseases.

In general, the hormone response to fructose is the inverse of what is seen with glucose. Fructose consumption doesn't result in increased insulin levels, reduced leptin, or suppressed ghrelin [3]. Leptin generally falls when people doesn't eat, rises when they do eat, and is thought to play a role in controlling how much people wants to eat. It is reported that ghrelin is a hormone that has been linked to hunger and appetite [3]. Studies have shown that ghrelin levels generally rise when a person is fasting, which may explain why people who are fasting may feel hungrier than usual. Ghrelin has also been shown to stimulate appetite, which may lead to people eating more than they normally would. Ghrelin remains low after a meal when glucose is administered or when a high-carbohydrate meal is consumed. The short-term satisfaction of hunger that carbohydrates provide is well-known, and it has been theorized that the hormone ghrelin may play a role in this effect. In comparison to other nutrients, fructose has a much-reduced impact on ghrelin suppression. When a person consumes fructose instead of glucose, it can have an impact on the processes controlled by the hormones leptin, ghrelin, and insulin, which are all thought to play significant roles in controlling how much food a person eats.

The presence of fructose in the liver has been observed to significantly increase the production of lipids, ranging from a three to fifteen times increase compared to the relatively small amount of lipid production that results from the presence of glucose [1]. Teff et al. discovered that the ingestion of high-fructose drinks during meals caused an elevation in triglyceride levels [3]. They hypothesized that this could be attributed to fructose's influence on leptin concentrations. Leptin causes an increase in fat use, and fructose is processed differently in the liver than other nutrients. The increased levels of triacylglycerol due to sucrose consumption could be a result of the fructose present in sucrose, something that has been corroborated by human studies [1]. Furthermore, individuals with type 2

diabetes who supplemented their high-fiber, high-carbohydrate, low-fat diet with fructose observed an increase in their glucose levels, however they experienced an increase in their weight as well [4]. In conclusion, fructose is a simple sugar that can contribute to weight gain and obesity. Consuming too much fructose can lead to insulin resistance and type 2 diabetes. To prevent obesity, it is important to limit your fructose intake.

2.2. Vitamin D

More and more evidence is showing that people with a higher BMI tend to have lower levels of vitamin D. According to some research projects, obesity is related to low intake of vitamin D [5]. Therefore, a clear link between lower levels of vitamin D and obesity appeared. This section aims to provide a synopsis of the implications of vitamin D on obesity. Fat mass in apparently healthy adults aged 20–40 years and ≥ 64 years. Building upon the information from Cashman et al [6]. A healthy weight is determined by a BMI of 24.9 or less, being overweight is denoted by a BMI between 25.0 and 29.9, and obesity is classified by a BMI of 30.0 or higher.

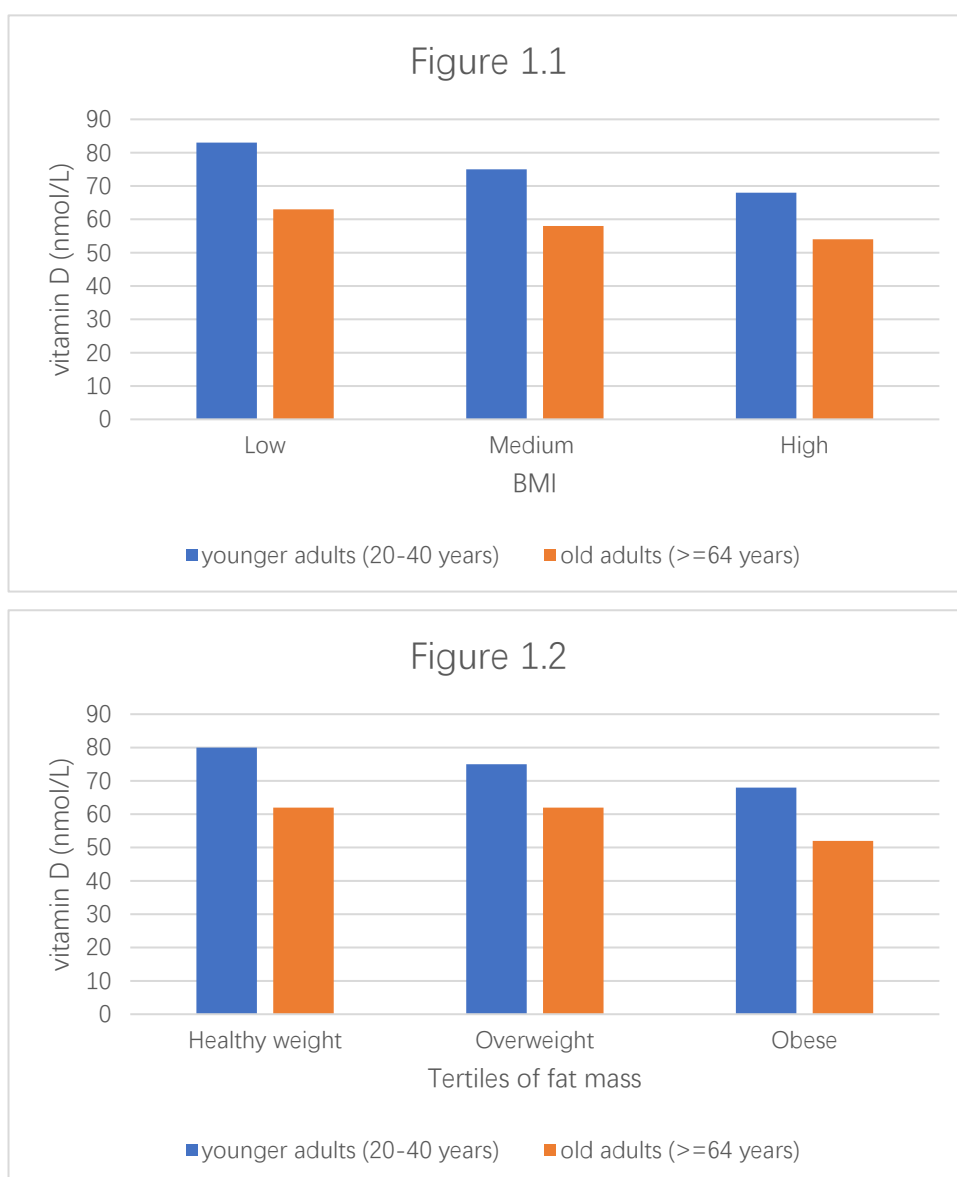


Figure 1. Association between serum 25-hydroxy vitamin D and BMI categories

Using data from two studies related to vitamin D, researchers can investigate the association between health conditions (BMI) and 25(OH)D concentrations which can represent vitamin D in two types of people, the younger and the older [6]. In addition to BMI, a more accurate measure of body

composition was taken through four-site skinfold thickness measurements of fat mass (FM). Therefore, according to Figure 1, the association is evident in younger and older adults, and suggests that 25(OH)D may play a role in the development of FM. There is a trend in the two age groups where older adults have lower vitamin D level than younger ones. However, this is only statistically significant in the obese category, with a BMI > 30 kg/m². Those who are obese have lower vitamin D levels than those who are healthy and overweight. When looking at the tertiles of FM, it was clear that a similar pattern existed. The pattern was particularly notable among the elderly and those with the highest FM scores. This means that obese people are more likely to be deficient in vitamin D, resulting in potential health issues. Obesity is a major health problem, and it is important that obese individuals get their vitamin D levels checked to make sure they are taking care of their health.

Besides, the internal causes between obesity and low vitamin D intake need to be explained. There are several mechanisms by which vitamin D deficiency can occur in obese patients. First, obese patients are more likely to have a sedentary lifestyle, with less outdoor activity and less exposure to sunlight. This can lead to a decrease in vitamin D production. Second, obese patients are more likely to have a high body fat percentage, which can lead to vitamin D storage in adipose tissue and a decrease in circulating levels of vitamin D. Third, obese patients are more likely to have insulin resistance, which can lead to decreased vitamin D absorption. Fourth, obese patients are more likely to have chronic inflammation, which can lead to vitamin D depletion. Finally, obese patients are more likely to have a higher risk of renal dysfunction, which can lead to vitamin D excretion. Obesity is now known to be a form of chronic, low-grade inflammation of the body, with fat cells shown to produce a number of inflammatory molecules. There are also other cells present in the adipose tissue, for example, preadipocytes, macrophages and mast cells, which also contribute to the inflammation [7]. The release of cytokines and other inflammatory mediators is a result of obesity causing an increase of inflammatory cells in the tissue. These mediators then stimulate the release of more inflammatory cells from the blood, which further amplifies the inflammatory response. It is evident that obesity is linked to an increase in pro-inflammatory molecules. Obesity can be a contributing factor to a higher risk of developing inflammatory conditions. Besides, obesity has been linked to a decrease in the production of anti-inflammatory molecules. This means that obesity can lead to an increase in the risk of chronic inflammation, which is a major contributor to many chronic health conditions. In addition, it has been proven through different studies that lowering obesity-related inflammation markers is possible through weight loss.

It has been hypothesized that raising vitamin D levels may heighten the efficacy of weight loss. This hypothesis is supported by data from obese individuals who are metabolically healthy. People who are obese but have a healthy metabolism are healthier than those who are obese and have an unhealthy metabolism. A recent research project revealed that vitamin D may be instrumental in sustaining a healthy weight for individuals. Esteghamati et al. conducted an investigation on a collective of 4391 obese adults and discovered that their vitamin D levels were superior to those of the metabolically unhealthy obese group [8]. It would be helpful to do additional research to verify this discovery and to gain a deeper understanding of other potential mechanisms that might explain vitamin D's effect among obese individuals.

2.3. Protein

So far, a lot of research has been done on the consequences of a high protein diet. A high-protein diet is one that includes a large amount of protein-rich foods. A very-high-protein diet is one that includes an even larger amount of protein-rich foods. People turn to high-protein diets because they believe that the extra protein will help them to lose weight. The study by Skov et al. found that obese adults who followed a higher protein diet for six months had better results than those who followed a standard protein diet [9]. In spite of having protein consumption strictly regulated, the participants were allowed to eat as they pleased. During a six month period, it was apparent that the higher protein dieters lost more weight than the group with the standard protein diet. According to this research, protein can have a positive effect on losing weight.

Proteins play an integral role in bodily functions. They are the building blocks of muscles, tissues, and organs. Amino acids, which form the building blocks of proteins, are connected by peptide bonds. There are 20 different types of proteins in the human body. Some proteins are important for growth and development, while others help to protect the body from damage. The average amount of protein available to Americans is 102 grams per day. Male protein consumption typically falls between 88 and 92 grams, while females consume an average of 63 to 66 grams [10]. Some people with kidney or liver problems may be advised to follow a low protein diet, which would include 10% of their daily caloric intake from protein. The most important point is that people often turn to high-protein diets and very-high-protein diets when they want to lose weight. If people want to lose weight, they have to create a calorie deficit by eating less than they are burning. Unless the macronutrient composition of the diet affects caloric intake, it has little effect on weight loss in obese individuals over the short term. However, the caloric intake largely depends on how appetizing the food is and how full it makes people feel. Therefore, protein is a key nutrient for weight loss, as it helps to maintain muscle mass and keep people feeling full. At present, Americans consume between 12 and 16 percent of their daily calories from protein, 34 percent from fat, and 49 percent from carbohydrate. The focus of many dietary recommendations has been on fat because it has more calories per gram than protein or carbohydrates. However, people prefer protein because of its palatability and essentiality.

Diets that are high in protein and fat can lead to ketosis, which may be appealing because it can help lose weight quickly. This weight loss may result from low carbohydrate intake, the loss of glycogen, ketosis, sodium and water. The lack of appetite caused by ketosis makes this diet easier to stick to, as total calories consumed are less. In fact, a high protein diet can also have negative consequences because it restricts the types and amount of food people can eat. The meal plan is very strict and only allows for certain foods to be eaten at specific times. This lack of flexibility may be appealing to some people at first. These characteristics may help to reduce the amount of calories consumed and could be the reason for weight loss. To sum up, while protein is an essential macronutrient, it is not necessary to consume large amounts of it in order to meet one's needs. In fact, consuming too much protein can actually be detrimental to one's health. Nevertheless, the appeal of a high-protein diet is often difficult to resist.

3. Conclusion

This paper seeks to explore the potential impact of three key nutrients on the prevalence of obesity. For starters, by reducing the amount of fructose in the diet, people can promote weight loss and overall health. It is important to note that while reducing fructose intake can be beneficial, it should not be done as a sole weight-loss strategy. To promote healthy weight loss, a combination of healthy eating habits and physical activity remains the most effective approach. Moreover, the relationship between decreased concentrations of Vitamin D and obesity is well documented in scientific literature. This association is of particular importance as Vitamin D deficiency has been linked to an increased risk of obesity and other metabolic disorders. Therefore, it is imperative to keep sufficient Vitamin D levels in order to avoid the occurrence of obesity and other health problems. Besides, by consuming a diet that has 25-30% of its calories coming from protein, there is an observable increase in body weight management, as energy intake is reduced, leading to weight loss and a better overall body composition. The mechanism functions in part due to the enhancement of appetite control and satiety. Finally, it is likely that a comprehensive approach to obesity prevention, including dietary modifications and lifestyle changes, will be necessary to reduce the prevalence of obesity in the future.

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