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Review Article

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The Glycemic Index as a Predictor of Obesity and Type-2 Diabetes: Current Evidence

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Abstract

The worldwide occurrence of obesity and diabetes has reached alarming heights, leading to major public health issues. The glycemic index (GI) significantly affects various health issues such as obesity, type-2 diabetes, heart disease and metabolic syndrome. High-GI diets causes rapid rises in blood glucose and insulin, lead to insulin resistance, weight gain and increased risk of chronic illnesses. In comparison, low-GI diets have been demonstrated to enhance glycemic regulation, increase insulin sensitivity, lower inflammation and support weight loss. Also, Low-GI foods in the diet could be a helpful for preventing and controlling obesity, diabetes and various metabolic disorders. Long-term research is necessary to understand the complete range of advantages of low-GI diets and to enhance dietary guidelines for various groups. Obesity serves as a significant risk factor for the onset of type-2 diabetes. A dietary element that influences blood glucose control and weight management is the glycemic index of various foods. High-GI foods are quickly broken down and absorbed, resulting in a fast and significant increase in blood sugar levels and subsequent insulin release. This instant rise in glycaemia may lead to various negative metabolic consequences, such as insulin resistance, diminished glucose tolerance, heightened lipogenesis fat accumulation and ongoing inflammation.

Keywords: Glycemic index, obesity, type-2 diabetes, glucose.

Introduction

The worldwide rates of obesity and diabetes have attained alarming heights, leading to major public health issues. These conditions are frequently interconnected; obesity is a significant risk factor for development of type-2 diabetes. Glycemic index of various foods influences blood glucose control and weight management. The GI indicates the speed at which carbohydrates in food elevate blood sugar levels in comparison to pure glucose. Foods that have a high-GI lead to quick spikes in blood sugar, while those with a low GI produce a slower, more gradual increase in glucose levels. The link between the GI of foods, obesity, and diabetes is crucial for creating dietary strategies that may assist in preventing and managing these issues. The glycemic index is a numerical scale that assesses the speed at which a carbohydrate-rich food elevates blood sugar levels. The GI of a food is established by measuring the rise in blood glucose levels after eating it and comparing it to the response caused by pure glucose, which has a GI of 100. Foods that have a high GI (over 70) result in quick spikes in blood sugar, whereas those with a low GI (under 55) contribute to a slower and gradual rise in blood glucose levels (Jenkins et al., 1981). This review seeks to offer a thorough summary of the existing evidence concerning the involvement of the GI in the emergence, prevention and control of obesity and type-2 diabetes.

Methodology

A review paper on glycemic index, obesity, and diabetes is a systematic approach to gather and evaluate existing research. Human Studies published in peer-reviewed journals were included but animal studies were excluded. Studies not published in English language, editorials, letters and conference abstracts were excluded from the review study. Studies focusing solely on type-1 diabetes or other specific conditions unrelated to the core topic were also excluded. By following this rigorous methodology, a review paper can provide a comprehensive and reliable summary of the evidence regarding the relationship between glycemic index, obesity and diabetes.

Results and Discussion

Obesity is defined by an accumulation of body fat and linked to several metabolic disorders such as insulin resistance, which can lead to type-2 diabetes. The global rise in obesity rates results in a higher incidence of diabetes. As per the International Diabetes Federation (IDF), approximately 537 million adults globally were affected by diabetes in 2019, and this figure is projected to increase substantially by 2030 (IDF, 2019). Controlling blood glucose levels is essential for preventing diabetes. Studies have shown that eating foods with a low glycemic index can positively impact body weight and glycemic regulation, establishing GI as an essential element in addressing obesity and diabetes. Research has shown that low-GI diets correlate with enhanced insulin sensitivity, lower fasting blood glucose levels and improved overall weight control (Brand-Miller et al., 2003; Ludwig, 2002). Low-GI diets have been demonstrated to lower the risk of type-2 diabetes in those at high risk (Jenkins et al., 2008) and these diets are frequently advised as a component of weight-loss programs because they improve feelings of fullness and decrease total caloric consumption (Slabber et al., 2005). Conversely, diets rich in GI, marked by rapid rises in blood glucose and insulin levels, have been associated with the onset of obesity and insulin resistance. Foods with a high glycemic index cause regular insulin surges, which may encourage fat storage and result in increased abdominal fat—a significant risk factor for metabolic syndrome and type-2 diabetes (Haug et al., 2009). The link between high-GI diets and insulin resistance highlights the significance of dietary habits in preventing and managing diseases related to obesity. The glycemic index indicates how quickly carbohydrates are digested and absorbed in the digestive system. Foods that have a high-GI, including refined sugars and white bread, are rapidly digested, causing a sudden increase in blood glucose and insulin levels. Conversely, low-GI foods like whole grains, legumes and non-starchy vegetables are metabolized gradually, resulting in a slower increase in blood glucose levels (Ludwig, 2002). The gradual uptake of carbohydrates from low-GI foods facilitates improved blood sugar management and may lead to increased feelings of fullness, decreased appetite and better metabolic regulation (Slabber et al., 2005).

The GI scale categorizes foods into three groups:

• Foods with a low GI (GI ≤ 55): Examples consist of whole grains, fruits, vegetables and legumes. These foods are linked to improved glycemic regulation and a lower risk of chronic conditions like type-2 diabetes and obesity.

• Foods with a medium GI (GI 56–69): Brown rice, sweet corn and whole-wheat bread lead to a slight rise in blood glucose levels.

• High-GI foods (GI ≥ 70): White bread and white rice lead to a high rise in blood glucose levels.

High-GI foods cause a quick spike in blood glucose levels and are associated with a higher risk of metabolic issues, including obesity, insulin resistance and type-2 diabetes (Jenkins et al., 2002).

Eating foods with a high glycemic index leads to regular insulin spikes which may lead to insulin resistance, a precursor of type-2 diabetes (Liu et al., 2000). Moreover, high-GI foods may contribute to weight gain by enhancing fat storage and boosting appetite due to instant changes in blood sugar levels. Conversely, low-GI foods aid in weight management and enhance metabolic health. Research has shown that low-GI diets can increase insulin sensitivity, better lipid profiles and lower the risk of obesity and type -2 diabetes (Ludwig, 2002). The rising global rates of obesity and type-2 diabetes mellitus (T2DM) represent a major danger to public health. The glycemic index a biological metric indicating how foods rich in carbohydrates affect blood sugar levels, has become an essential dietary principle in comprehending the connection among diet, obesity, and diabetes. The GI evaluates foods on a scale from 0

to 100, where higher scores signify a more significant and rapid increase in blood glucose after eating. High-GI foods are quickly processed and absorbed, resulting in significant increases in blood sugar and insulin levels. With time, regular intake of these foods might lead to insulin resistance, poor glucose metabolism, enhanced fat storage and eventually, a higher risk of obesity.Obesity poses a considerable risk for insulin resistance, a state in which the body's cells are less responsive to insulin resulting in elevated blood glucose levels and the possible onset of type-2 diabetes. On the other hand, low-GI foods are processed and taken in at a slower pace, leading to a steady increase in blood glucose levels and a reduced insulin reaction. It is believed that these metabolic effects provide protective advantages against obesity and T2DM. The worldwide occurrence of obesity and type-2 diabetes mellitus (T2DM) has reached concerning levels, creating major challenges for public health systems globally. Dietary elements, especially the quality and amount of carbohydrates ingested, are essential in the development and management of these metabolic diseases. The glycemic index has become an important concept in nutritional science and a possible dietary approach to reduce the risks linked to obesity and type-2 diabetes mellitus. This review will examine the existing scientific evidence concerning the effect of the GI on obesity and T2DM and seeks to offer a thorough understanding of the role of GI in preventing and managing obesity and T2DM by critically assessing the current literature. The worldwide impact of obesity and type-2 diabetes mellitus (T2DM) has attained pandemic levels and presented major health and economic issues across the globe (World Health Organization, 2021). Kind and quantity of carbohydrates ingested are always linked metabolic conditions. The glycemic index, established by Jenkins and colleagues in 1981, serves as a physiological indicator of the post-meal glycemic reaction to foods containing carbohydrates, presenting an important resource for grasping the relationship between diet, obesity and type-2 diabetes mellitus. High-GI diets have been demonstrated to worsen insulin resistance by triggering frequent and rapid increases in blood glucose and insulin levels. These insulin surges can encourage fat accumulation especially in the abdominal area which is strongly associated with metabolic issues (Haug et al., 2009). Additionally, insulin resistance promotes greater fat accumulation because of the raised insulin levels, which function as a lipogenic hormone (Zhao et al., 2014). Although the theoretical mechanisms indicate a connection between high-GI and obesity via heightened insulin secretion and lowered satiety (Ludwig, 2002). Certain observational studies have associated the high-GI diets with a heightened risk of overweight and obesity (Willett et al., 2002). Nevertheless, these studies are frequently complicated by various dietary and lifestyle elements. Randomized Controlled Trials (RCTs) that assess low-GI versus high-GI diets for weight loss have produced varied outcomes. Several studies have noted slight advantages of low-GI diets for weight loss, especially in the short term (Brand-Miller et al., 2003). Nonetheless, additional research has indicated no meaningful difference between the two dietary methods when calorie consumption is regulated (Thomas & Elliott, 2007). Consequently, the overall eating pattern, which encompasses total calorie consumption, macronutrient allocation and fibre levels, probably has a greater influence on weight control than GI by itself. The evidence robustly indicates the positive impact of low-GI diets in preventing and managing T2DM. Many observational studies have repeatedly demonstrated a link between high-GI/glycemic load (GL) diets and a heightened risk of T2DM (Willett et al., 2002). GL takes into account the GI of a food along with the carbohydrate quantity eaten, offering a more applicable assessment of the glycemic effect of an average portion (Brand-Miller et al., 2003). RCTs have shown that low-GI diets can enhance glycemic regulation in people with T2DM, indicated by decreases in HbA1c, fasting glucose and postprandial glucose values (Brand-Miller et al., 2003). Meta-analyses of these studies have reinforced this finding (Livesey, 2003). Research conducted by Liu et al. (2000) showed that people who ingested high-GI foods faced an increased risk of developing type-2 diabetes over a 12-year span compared to those who ate lower-GI foods. The prolonged impact of high-GI foods on blood sugar management could worsen insulin resistance and hasten the development of diabetes. In a similar manner, a significant cohort study from the Nurses' Health Study discovered that elevated GI scores correlated positively with a heightened risk of diabetes, indicating that dietary modifications aimed at reducing GI may notably lower diabetes incidence (Salmerón et al., 1997). On the other hand, low-GI diets have been demonstrated to enhance glycemic control in people with type-2 diabetes. A study conducted by Brand-Miller et al. (2003) revealed that diabetes patients who followed a low-GI diet had better fasting blood glucose readings, lower HbA1c levels (an indicator of long-term glucose management) and improved insulin sensitivity. Foods with a low

glycemic index like whole grains, legumes and non-starchy vegetables lead to a gradual increase in blood glucose aiding in the maintenance of stable blood sugar levels during the day. These impacts are especially significant in managing type-2 diabetes as controlling blood sugar is essential for avoiding complications. The physiological processes through which GI affects obesity and diabetes are varied and numerous. A key mechanism is the influence of GI on blood glucose and insulin levels after eating. Foods with a high glycemic index lead to a immediate increase in blood sugar levels, which subsequently prompts a quick insulin reaction. Frequent insulin surges can result in insulin resistance, thereby raising the likelihood of obesity and diabetes. Insulin resistance hinders cells from absorbing glucose leading to elevated blood sugar levels and greater fat accumulation (Haug et al., 2009).

Conclusion

Although the effect of GI on obesity is still somewhat unclear, substantial evidence confirms the advantages of low-GI diets for preventing and managing type 2 diabetes. Dietary guidelines must take into account the overall eating pattern alongside GI, encompassing GL, fibre consumption and other nutritional elements. This is not a comprehensive list but offers a strong basis for grasping the significance of GI in obesity and diabetes. Additional studies, especially long-term intervention research studies are required to clarify the intricate connection between GI, obesity and associated metabolic disorders.

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