



Obesity: A Major Factor in Diabetes

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Abstract

Obesity is currently recognized as a significant risk factor contributing to the onset of diabetes, presenting a substantial challenge to public health worldwide. This abstract provides a concise overview of the intricate relationship between obesity and diabetes, with a specific focus on the impact of excess body weight on insulin resistance and beta-cell dysfunction. These two mechanisms serve as the primary contributors to the development of diabetes. The abstract delves into the complex interplay between adipose tissue, insulin signaling, and inflammation, elucidating the underlying mechanisms by which obesity exacerbates insulin resistance. Additionally, the role of visceral adiposity, genetic factors, and lifestyle modifications are explored within the context of obesity-related diabetes.

The abstract also highlights the adverse health consequences associated with obesity-related diabetes, particularly the heightened risk of cardiovascular disease and other comorbidities. Acknowledging these detrimental effects strengthens the urgency in addressing this widespread issue. Consequently, the abstract briefly outlines the various effective management strategies available to combat obesity-related diabetes, including weight loss interventions, pharmacotherapy, and bariatric surgery.

In conclusion, the abstract underscores the necessity of adopting a comprehensive and multidisciplinary approach in tackling both obesity and diabetes. Prevention measures are emphasized as a crucial component in alleviating the burden posed by these two interrelated health conditions. By implementing proactive strategies, it is possible to mitigate the escalating prevalence of obesity-related diabetes and enhance public health outcomes.

Keywords: Obesity; Diabetes; Insulin Resistance; Beta-Cell Dysfunction; Adipose Tissue; Insulin Signaling; Cardiovascular Disease; Prevention; GLP-1 Receptor; SGLT-2 Inhibitors

Abbreviations: T2D: Type 2 Diabetes; IR: Insulin Resistance; WHO: World Health Organization.

Introduction

Obesity is a condition characterized by excessive accumulation of fat in the body, which occurs when

calorie intake exceeds the energy expenditure over a prolonged period of time. It has become a global epidemic in recent decades, affecting people of all age groups and socioeconomic backgrounds. The World Health Organization (WHO) estimates that over 1.9 billion adults worldwide are overweight, and of these, over 650 million are obese [1].

Obesity is known to be a major risk factor for various health problems, including cardiovascular disease, certain types of cancer, and musculoskeletal disorders. However, one of the most concerning complications associated with obesity is the increased likelihood of developing type 2 diabetes.

Type 2 diabetes is a chronic metabolic disorder characterized by high blood sugar levels due to insulin resistance and inadequate insulin production by the pancreas. Insulin is a hormone responsible for regulating glucose (sugar) levels in the blood. In obese individuals, excess body fat can disrupt the normal functioning of insulin, leading to insulin resistance. This means that the body's cells become less responsive to the hormone, making it difficult for glucose to enter the cells and causing a buildup of sugar in the blood.

The exact mechanisms linking obesity and type 2 diabetes are complex and not yet fully understood. However, several factors contribute to this close association. Firstly, obesity induces chronic low-grade inflammation, which disrupts the normal insulin signaling pathways and impairs glucose metabolism. Adipose (fat) tissue secretes various pro-inflammatory substances called adipokines, which can interfere with insulin action and contribute to insulin resistance [2,3].

Secondly, obesity is often accompanied by dyslipidemia, a condition characterized by abnormal levels of lipids (cholesterol and triglycerides) in the blood. Dyslipidemia can lead to the deposition of fat in vital organs, including the liver and pancreas, impairing their function and further worsening insulin resistance.

Moreover, excess weight puts an increased workload on the pancreas, the organ responsible for producing insulin. Over time, this can lead to the deterioration of pancreatic beta cells, which produce insulin, resulting in reduced insulin secretion and further exacerbating the development of diabetes.

Genetic factors, physical inactivity, unhealthy dietary habits (high in calories, saturated fats, and sugar), and socioeconomic factors also play a role in the obesity-diabetes relationship. Additionally, central obesity, characterized by excess fat accumulation in the abdominal region, is particularly associated with a higher risk of diabetes compared to generalized obesity.

Addressing the worldwide obesity epidemic requires a comprehensive approach involving education, lifestyle modifications, and public health interventions. Promoting healthy eating habits, regular physical activity, and weight management can help mitigate the risk of obesity and

subsequently reduce the incidence of type 2 diabetes. Healthcare professionals play a crucial role in raising awareness, providing counselling, and offering appropriate treatment options to individuals struggling with obesity and its associated complications.

Obesity as a Risk Factor

Obesity serves as a powerful risk factor for the development of diabetes. Excess weight, particularly in the form of body fat, impairs insulin sensitivity and disrupts glucose metabolism. Adipose tissue, especially around the abdomen, secretes pro-inflammatory molecules and hormones that contribute to insulin resistance, a key factor in the progression of Type 2 diabetes (T2D).

Impact on Insulin Resistance (IR)

Insulin resistance occurs when the body's cells become less responsive to the hormone insulin, which is responsible for regulating blood sugar levels. As body fat increases, adipocytes release higher levels of fatty acids that interact with muscle and liver cells, hampering normal insulin signalling. This insulin resistance reduces the body's ability to effectively utilize glucose, leading to higher blood sugar levels and ultimately contributing to the development of diabetes [4].

Sirtuin 1 and Obesity-Related Diabetes

Sirtuin 1, an anti-aging gene, plays a critical role in preventing insulin resistance and preserving beta-cell function, both of which are pivotal in the development of diabetes. Activation of Sirtuin 1 has been highlighted as a key preventative measure against the progression of obesity-related diabetes, underscoring the importance of dietary components that facilitate its activation [5].

Dysregulated Hormonal Balance

Obesity creates a state of hormonal dysregulation, exacerbating the risk of diabetes. Adipose tissue secretes various hormones, such as leptin and adiponectin, which play crucial roles in appetite regulation, energy balance, and glucose metabolism. However, in obesity, these hormones become imbalanced, leading to leptin resistance and decreased adiponectin levels. This imbalance further contributes to insulin resistance and promotes the progression of diabetes.

Progression to Type 2 Diabetes

The strong association between obesity and Type 2 diabetes (T2D) is well-established. As obesity rates rise, so

does the incidence of Type 2 diabetes. Persistent insulin resistance, combined with the gradual decline in pancreatic beta-cell function, ultimately leads to impaired glucose regulation and the onset of diabetes. Furthermore, obesity-related diabetes poses a greater risk for other health complications, such as cardiovascular diseases, kidney problems, and neuropathy [6-8].

Role of Drug Therapy in Preventing Obesity-Related Diabetes

- Regulating Blood Glucose Levels and Improving Insulin Sensitivity Drug therapy plays a vital role in preventing obesity-related diabetes by aiming to regulate blood glucose levels and improve insulin sensitivity. Medications like metformin can target glucose production in the liver and enhance insulin sensitivity. By controlling blood glucose levels, these drugs reduce strain on pancreatic beta cells responsible for insulin production.
- Targeting GLP-1 Receptors to Control Blood Glucose and Reduce Obesity GLP-1 receptor agonists, such as liraglutide and exenatide, are effective in preventing diabetes in individuals with obesity. These drugs work by increasing insulin secretion, slowing down gastric emptying, and reducing appetite. By promoting weight loss, GLP-1 receptor agonists help reduce obesity and subsequently decrease the risk of developing diabetes.
- Inhibiting Glucose Reabsorption through SGLT-2 Inhibitors offer a newer approach for diabetes prevention in individuals with obesity. These medications act on the kidneys to inhibit glucose reabsorption, resulting in increased glucose excretion through urine. By lowering blood glucose levels, SGLT-2 inhibitors help reduce the risk of developing diabetes in individuals with obesity.
- Synergistic Effects with Lifestyle Modifications While drug therapy is important in preventing obesity-related diabetes, it is crucial to combine it with lifestyle modifications for optimal results. Lifestyle changes, including a healthy diet and regular exercise, can enhance the effectiveness of drug therapy. This comprehensive approach maximizes the potential for delaying or preventing the onset of obesity-related diabetes [9-12].

Here are Some Preventive Measures for Obese Individuals to Prevent Diabetes

- i. **Maintain a healthy weight:** Losing weight and maintaining a healthy weight is crucial in preventing diabetes. If you are obese, work on gradually losing weight through a combination of healthy eating and regular physical activity [13].
- ii. **Follow a balanced diet:** Incorporate a balanced diet that consists of whole grains, lean proteins, fruits,

vegetables, and healthy fats. Limit your intake of sugary foods, processed foods, and unhealthy fats [14-16].

- iii. **Portion control:** Be mindful of your portion sizes to avoid overeating. Use smaller plates, bowls, and cups to help control your portions.
- iv. **Stay physically active:** Engage in regular physical activity for at least 150 minutes per week. Consider activities like brisk walking, swimming, cycling, or any form of exercise that you enjoy and can be sustained long-term [17].
- v. **Limit sedentary behaviour:** Minimize time spent sitting or lying down for extended periods. Take breaks, stand up, and move around as often as possible throughout the day.
- vi. **Drink plenty of water:** Replace sugary beverages with water or unsweetened drinks to stay hydrated and reduce calorie intake.
- vii. **Control stress levels:** High levels of stress can contribute to weight gain and the risk of developing diabetes. Engage in stress-management techniques such as deep breathing exercises, meditation, yoga, or any activities that help you relax.
- viii. **Get enough sleep:** Aim for 7-9 hours of quality sleep each night. Poor sleep can affect hunger hormones and lead to weight gain or difficulties in maintaining a healthy weight [18].
- ix. **Regular health check-ups:** Visit your healthcare provider regularly for check-ups, including monitoring your blood sugar levels, cholesterol levels, and blood pressure. This will help you detect any potential problems early on and take appropriate actions.
- x. **Seek support:** Consider joining support groups or seeking professional help to maintain motivation, receive guidance, and share experiences with others who are on a similar path towards a healthier lifestyle [19,20].

Discussion

This review discusses the strong correlation between obesity and diabetes, focusing on the impact of excess body weight on insulin resistance and beta-cell dysfunction. It emphasizes that obesity is a significant risk factor for the development of diabetes and poses a substantial challenge to public health globally.

The article explains that obesity impairs insulin sensitivity and disrupts glucose metabolism. Adipose tissue, particularly around the abdomen, secretes pro-inflammatory molecules and hormones that contribute to insulin resistance, playing a key role in the progression of Type 2 diabetes (T2D). As body fat increases, higher levels of fatty acids are released, which interact with muscle and liver cells, hampering normal insulin signalling and reducing the body's ability to effectively utilize glucose.

Hormonal dysregulation is another consequence of obesity highlighted in the article, with imbalances in hormones like leptin and adiponectin. This imbalance further contributes to insulin resistance and promotes the progression of diabetes.

Also stresses that obesity-related diabetes increases the risk of cardiovascular disease and other comorbidities. Acknowledging these adverse health consequences emphasizes the urgency in addressing obesity and diabetes.

Briefly outlines effective management strategies for obesity-related diabetes, including weight loss interventions, pharmacotherapy, and bariatric surgery. However, it emphasizes the necessity of adopting a comprehensive and multidisciplinary approach to tackle both obesity and diabetes. Prevention measures are highlighted as crucial components in alleviating the burden posed by these two interrelated health conditions.

It concludes by providing preventive measures for obese individuals to prevent diabetes, such as maintaining a healthy weight, following a balanced diet, staying physically active, limiting sedentary behavior, and seeking regular health check-ups. It also suggests controlling stress levels, getting enough sleep, drinking plenty of water, and seeking support from support groups or professionals.

Overall, the review underscores the importance of understanding and addressing the intricate relationship between obesity and diabetes to enhance public health outcomes and mitigate the increasing prevalence of obesity-related diabetes. Obesity has reached epidemic proportions in recent years, posing significant health challenges worldwide. Among the various complications associated with obesity, one of the most prevalent and alarming is the increased risk of developing diabetes. This review aims to highlight the strong correlation between obesity and diabetes, providing insight into the mechanisms and consequences of this relationship.

Conclusion

Obesity is when someone has too much body fat, and it greatly increases the chances of developing diabetes. The connection between obesity and diabetes is that the excess fat makes it difficult for the body to respond to insulin and process glucose properly.

Insulin is a hormone made by the pancreas that helps control sugar levels in the blood. In people who are obese, the fat cells release substances called adipokines that make it harder for insulin to lower blood sugar levels. This is called insulin resistance and leads to higher blood sugar levels because the body's cells don't respond well to insulin.

Obesity also affects how the body processes glucose. The extra fat can interfere with the function of different cells and organs involved in glucose metabolism, like the liver, muscles, and pancreas. These changes disrupt the normal balance of glucose regulation and make diabetes more likely.

The goal of this review is to show how excessive body fat is a key factor in the development of diabetes. By raising awareness about this connection, it wants to highlight the importance of finding effective ways to prevent and treat diabetes related to obesity.

To prevent diabetes related to obesity, using medication to regulate blood sugar levels, improve insulin sensitivity, and promote weight loss can be helpful. Medications like metformin, GLP-1 receptor agonists, and SGLT-2 inhibitors are important for reducing the risk of developing diabetes in people with obesity. But it's also important to make lifestyle changes alongside taking medication. Healthcare professionals can help determine the best medication and lifestyle plan for each individual.

Addressing obesity comprehensively is crucial for reducing the risk of diabetes and its complications. Encouraging healthy habits is an important part of this. Regular exercise helps burn calories, reduce body fat, and improve insulin sensitivity. Engaging in aerobic activities, strength training, or other forms of physical activity can lead to weight loss and better metabolic health.

In addition to exercise, having a balanced diet is key in preventing obesity and managing the risk of diabetes. A diet that includes plenty of fruits, vegetables, whole grains, lean proteins, and healthy fats helps control weight and stabilize blood sugar levels. On the other hand, it's important to limit high-calorie, sugary, and processed foods because they can lead to weight gain and worsen insulin resistance.

By focusing on these lifestyle factors, individuals can greatly reduce their risk of obesity-related diabetes and its complications. Public health initiatives, education efforts, and policy changes that promote healthy eating, physical activity, and weight management are necessary to address the increasing prevalence of diabetes. By comprehensively addressing obesity, we can improve people's overall health and lessen the impact of diabetes on society.

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