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The Impact of Sucralose on Blood Glucose Levels in Diabetic Patients

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Abstract: The objective of this study was to comprehensively and scientifically evaluate the relationship between sucralose, a popular artificial sweetener, and the rise and fall of blood sugar levels in diabetic patients. This paper adopts the literature research method and integrates a large number of relevant authoritative literature to explore the possible effects of sucralose on diabetes patients in two aspects: long-term and short-term. Although the safety of sucralose is widely recognized, this study focuses on its potential effects on insulin sensitivity. The results of this study point to the importance of the dose of sucralose intake in diabetic patients and look forward to further research on the metabolism of sucralose.

Keywords: Sucralose, Blood Sugar, Insulin, Diabetes, Sweeteners.

1. Introduction

1.1. Background

Diabetes, especially type 2 diabetes, is an increasingly common chronic metabolic disease, which poses a major challenge to normal human metabolism. Lack of insulin or insulin resistance can lead to high blood sugar, which can lead to diabetes. Recently, there are a large number of people with diabetes worldwide. There is also a significant increase in diabetes in China (Li et al., 2020). Controlling blood sugar levels is a key part of preventing diabetes and its associated complications.

1.2. The importance of dietary intervention in the treatment and control of diabetes

In diabetes care, effective control is a very important step. Specifically, keep your sugar intake low. At present, the common practice is to use sucralose instead of ordinary sugar to flavor the diet of diabetic patients. Sucralose has no sufficient carbohydrates, zero calories, and is nearly 600 times sweeter than regular table sugar, making it a very good sugar substitute in the diet industry (Renwick et al., 2000).

1.3. Research Objective

This study aims to scientifically evaluate the relationship between sucralose and the rise and fall of blood glucose levels in diabetic patients, and to further explore whether it is effective and safe as a sugar substitute in the diet of diabetic patients.

2. Literature Review

2.1. Chemistry and Metabolism of Sucralose

Sucralose is a chlorinated derivative of sucrose characterized by the substitution of chlorine atoms for three hydroxyl groups making it non-caloric and metabolically inert(Roberts et al., 2000). The absorption rate of sucralose by the human body is only about 15%, and the remaining sucralose will be excreted from the body through excretion, and the absorbed part will be excreted quickly with the urine(Renwick et al., 2000).

2.2. Safety and Regulatory Approval

The safety of sucralose has been widely recognized by the World Health Organization (WHO) and the United States Food and Drug Administration (FDA)(JECFA, 1989). A large number of scientific research results have consistently proven that sucralose is generally safe for the human body, and this is also true for diabetic patients.

2.3. Impact on Blood Glucose Levels

The effects of sucralose on blood levels have been studied several times. According to Baird et al. (2000), there was no significant change in blood sugar or insulin levels in healthy people who ingested sucralose. Similarly, Grotz et al. (2017) also conducted a three-month randomized clinical trial, and determined that sucralose did not disrupt glucose homeostasis in healthy individuals. These results indicate that blood glucose regulation in healthy people may not be affected by sucralose.

Although a lot of people think that sucralose is safe, some researchers suggest that insulin sensitivity may be affected by it. Pepino et al. (2013) found that the body's glucose response potentially is changed by sucralose, affecting the sensitivity of Insulin. Moreover, Romo et al. (2018) further raised some concerns suggesting that high doses may reduce the sensitivity of Insulin in the average person. They conducted some randomized controlled trials to investigate the effects of sucralose intake on healthy subjects with no complications and less exposure to non-nutritive sweeteners. Glucose metabolism could be affected by sucralose. Hasan, H. M. (2022) did a randomized controlled trial where Participants were categorized based on their daily intake of saccharin and cyclamate and the duration of their consumption, followed by measurement of various biochemical markers. Long-term intake of cyclamate and saccharin can increase the stress of oxidative and altered biochemical markers related to metabolic functions in both people with type 2 diabetes and healthy people. Saccharin and cyclamate intake elevated levels of Malondialdehyde, an indicator of oxidative stress, and altered the profile of blood lipids including LDL cholesterol and triglycerides. These changes suggested that these sweeteners could exacerbate metabolic dysfunction and oxidative damage through increased oxidative stress and lipid

peroxidation. Therefore, it should be used carefully in diabetic patients.

2.4. Long-Term Effects and Controversies

Current research on sucralose shows that its long-term effects are still unclear. Some studies have shown that sucralose may interfere with the signaling of insulin, mainly in terms of reducing the sensitivity of insulin (Nakagawa et al., 2013). At the same time, long-term use of sucralose can also be harmful to people's metabolic function, causing fluctuations in body weight and blood sugar (Pang et al., 2021). Given these concerns, sucralose should be used with caution.

3. Methodology

We collected and collated the literature on the effects of sucralose on blood glucose levels and insulin sensitivity based on criteria such as topic relevance, the scientific rigor of the studies, and fit with study subjects (i.e., people with diabetes).

Based on these literatures, we conducted a meta-analysis to more fully understand the effects of short-term and long-term sucralose intake on diabetic patients.

Our research focuses on how sucralose affects blood sugar levels and insulin sensitivity in people with diabetes. In order to ensure the scientific results of the statistics, and to correctly assess the effects of sucralose on metabolic levels, we took into account as many relevant influencing factors as possible, including the dose and time of use, and the health of the participants.

4. Results

The results of the comprehensive study analysis proved that the blood sugar of diabetic patients did not increase significantly in the short time after the intake of sucralose. The results are consistent with studies of healthy people. There was no significant change in blood sugar or insulin levels (Baird et al., 2000).

Long-term studies, however, tell a different story. Although Grotz et al. (2017) reported little difference in long-term outcomes, Romo et al. (2018) found that long-term use of sucralose affected glucose homeostasia while reducing insulin sensitivity. The higher the dose, the greater the effect. These findings call for careful choices about whether to take sucralose long-term.

In other words, if you intend to take sucralose for a long time or take more doses, you should pay special attention to its safety. Even if sucralose is approved, this situation may still change in diabetic patients who are prone to metabolic disorders. The potential of sucralose to reduce insulin sensitivity still needs further study.

5. Discussion

Sucralose in moderation is helpful in controlling blood sugar in people with diabetes. However, overdosing or prolonged use still raises concerns that it may reduce insulin sensitivity.

Although this study repeatedly mentions that sucralose may reduce insulin sensitivity and impact metabolic health, this study actually has inherent limitations in the study methodology and study subjects. Further, more thorough studies are needed to assess the long-term effects of sucralose in order to make the results more conclusive.

Therefore, follow-up research should focus on extensive and long-term clinical trial studies to truly assess the effects of sucralose. In order to better understand the possible effects of sucralose on diabetic patients, it is necessary to focus on exploring the effects of sucralose on insulin and the pathways by which it affects glucose metabolism.

6. Conclusion

In summary, although sucralose appears to offer a safe and efficacious short-term alternative for diabetic patients, long-term use should be cautious, after all, it still has the potential to affect insulin sensitivity. Future research should focus on assessing the effects of long-term sucralose consumption, and it is crucial to develop recommended guidelines for sucralose consumption in people with diabetes.

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