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Question: In patients with type 2 diabetes, does diet soda consumption contribute to decline in blood sugar control?

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SUMMARY OF THE ISSUES

Physicians often recommend switching to diet soda when providing dietary counseling for type 2 diabetes. However, while consumption of sugar-sweetened beverages (SSBs) has a decidedly negative impact on glycemic control, the effect of artificially sweetened beverages (ASBs) is less clear. Theoretical concerns about ASB's effect on metabolic regulation include alterations of the composition of intestinal bacteria, reconditioning of the brain when faced with ASBs that are 200 times sweeter than sugar, and hypoglycemia caused by discordant insulin secretion when a sweet taste is present without a corresponding increase in serum glucose.[1,2] Scientific studies about ASBs are often limited by reverse causality; patients who are predisposed to gaining weight and who are facing increasing insulin resistance frequently will increase their consumption of ASBs to help manage these issues.[3]

SUMMARY OF THE EVIDENCE

As the effectiveness of substituting ASBs for SSBs for weight loss and improvement of glucose control in type 2 diabetics has been called into debate, the obvious question arises: could these compounds have the opposite of their intended effect and actually negatively influence blood sugar control? Relatively few high powered randomized controlled studies have been done to study this. Hence, the most reliable articles tend to be meta-analyses.

According to a 2014 meta-analysis by Christopher Gardener et al, the body of evidence for the direct effects of ASBs on glycemic control is severely limited.[4] Many studies have compared Non-nutritive Sweeteners (NNS) to placebo looking for any ill effect on glycemic control with null results. However, these studies fail to address the potential effect of replacing SSBs with ASBs in the diet. The studies that directly compare NNS to sugars are limited by low sample size and other potential confounders.

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Although weight does not directly affect glucose control in diabetics, it is commonly accepted that a decreased BMI is correlated with a lower HgbA1C. A meta-analysis (by Paige E Miller et al) of 15 randomized controlled trials evaluated weighted mean differences in body weight and body composition between a study group using low-calorie sweeteners (LCS) such as aspartame, saccharin, steviol glycosides, or sucralose in experimental groups and full-calorie control groups. The differences were consistent with the conclusion that substituting LCS for sugar (full-calorie) resulted in a modest decrease in body weight (−0.80 kg; 95% CI: −1.17, −0.43) and may be useful in weight management.[5] LCSs were also correlated with modest improvements in BMI, fat mass, and waist circumference.

A double-blind cross-over study by A. Temizkan et al compared the glycemic effect of the NNS sucralose, commonly known as Splenda, with cellulose placebo. Plasma glucose and serum C-peptide levels were measured for four hours after administration among insulin-dependent and non-insulin-dependent diabetics. These researchers found no significant differences between the control and experimental groups for either of the above measurements.[6] Another 2008 randomized, double-blind, placebo-controlled study by Luis A. Barriocanal followed type 2 diabetics who consumed 250mg of Steviol TID, commonly known as Stevia. Their control counterparts consumed cellulose placebo TID. There was no significant difference in HgbA1C over the course of the study between the two groups.[7] Unfortunately, as with most of these studies in diabetic patients, they were both very low power; there were a mere 26 and 30 patients enrolled, respectively, in the control and experimental groups.

Another possible alternative to glucose or hemoglobin A1C measurement for conceptualizing glucose control, albeit indirectly, is GLP-1 secretion. When stimulated by glucose ingestion, this gut hormone causes secretion of insulin and suppression of glucagon, thus lowering blood sugar. In a 2012 study by Brown et al., the authors hypothesized that diet soda could increase GLP-1 secretion, and presumably insulin secretion, by binding to sweet taste receptors on the tongue. In the study, diet soda ingestion increased the level of GLP-1 in healthy subjects by 34% and in type 1 diabetics by 43%, but it did not increase GLP-1 in type 2 diabetics.[8] The study measured the change in GLP-1 when the participants drank a combination of diet soda and glucose, as compared to when they drank a combination of carbonated water and glucose. However, “[serum] glucose… [was] not statistically different between the two conditions in any group.”[8]

COMMENTS

In conclusion, there is insufficient evidence to support or refute claims that ASBs or NNSs contribute to poor glycemic control in diabetics. Unfortunately, the existing evidence is fraught with confounders such as reverse causality, as explained above, or compensation for the use of a low calorie sweetener by increasing caloric intake later in the day. Of the remaining studies, there are few randomized control trials with adequate power to make any clinically applicable conclusions. More randomized controlled trials with sufficient power are needed to justify non-nutritive sweetener use in improving the health of type 2 diabetic patients.

SEARCH TERMS

DM2, non-nutritive sweeteners, glycemic control, blood glucose, hemoglobin A1C

References

1. Tandel KR. Sugar substitutes: health controversy over perceived benefits. J Pharmacol Pharmacother. 2011 Oct-Dec;2(4):236–243. [PubMed: 22025850]
2. New concerns about diet sodas. Harvard Health Letter; 2015 May. www.health.harvard.edu [Accessed March 25, 2016]
3. Pereira MA. Diet beverages and the risk of obesity, diabetes, and cardiovascular disease: a review of the evidence. Nutr Rev. 2013 Jul; 71(7):433–40. [PubMed: 23815142]
4. Gardner, Christopher. Non-nutritive sweeteners: evidence for benefit vs. risk. 2014 Feb; 25(1):80–84.
5. Miller, Paige E; Perez, Vanessa. Low-calorie sweeteners and body weight and composition: a meta-analysis of randomized controlled trials and prospective cohort studies. AJCN. 2014; doi: 10.3945/ajcn.113.082826
6. Temizkan A, et al. Sucralose enhances GLP-1 release and lowers blood glucose in the presence of carbohydrate in healthy subjects but not in patients with type 2 diabetes. European Journal of Clinical Nutrition. 2015; 69:162–166. [PubMed: 25271009]
7. Barriocanal, Luis A; , et al. Apparent lack of pharmacological effect of steviol glycosides used as sweeteners in humans. A pilot study of repeated exposures in some normotensive and hypotensive individuals and in Type 1 and Type 2 diabetics. Regulatory Toxicology and Pharmacology.
8. Brown RJ, Walter M, Rother KI. Effects of diet soda on gut hormones in youths with diabetes. Diabetes Care. 2012 May; 35(5):959–64. DOI: 10.2337/dc11-2424 [PubMed: 22410815]