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A Principal Driver of Type 2 Diabetes Mellitus and Its Consequences

Data from animal experiments and human studies implicate added sugars (eg, sucrose and high-fructose corn syrup) in the development of diabetes mellitus and related metabolic derangements that raise cardiovascular (CV) risk.

Intake of added fructose at such high levels would undoubtedly worsen rates of diabetes and its complications. There is no need for added fructose or any added sugars in the diet; reducing intake to 5% of total calories (the level now suggested by the World Health Organization) has been shown to improve glucose tolerance in humans and decrease the prevalence of diabetes and the metabolic derangements that often precede and accompany it. Reducing the intake of added sugars could translate to reduced diabetes-related morbidity and premature mortality for populations.

Given substantial risks in terms of morbidity and mortality, there is great interest in diabetes prevention and treatment. Key to both of these issues is dietary intake, specifically the consumption of added sugars—one of the most fundamental determinants of glucose metabolism. Of the added sugars, fructose appears to be particularly pernicious with regard to glucose metabolism. There is a considerable body of basic science evidence, observational data, and clinical trial findings to suggest added fructose—even relative to other sugars—is a primary driver of diabetes development and consequences.

Basic Science Data

At a molecular level, fructose is a monosaccharide that when combined with the monosaccharide glucose forms the disaccharide sucrose, otherwise known as table sugar or simply “sugar”. Sucrose is commonly used in processed foods and beverages; however, its predominance in processed items has gradually been surpassed by another sweetener—high-fructose corn syrup (HFCS). Whereas sucrose contains 50% fructose (and 50% glucose), HFCS (particularly as found in soft drinks) commonly contains up to

65% fructose. The fructose in HFCS represents nearly 50% of the sweetener's weight. By comparison, the fructose in a fresh peach represents only about 1% of the sweet fruit's weight.
The net result of excess consumption of added fructose is derangement of both hepatic and systemic metabolism and global insulin resistance. Other dietary sugars not containing fructose have been found to be less detrimental in these respects.
Fructose consumption—as from sucrose or HFCS—has been linked not only to diabetes-related metabolic abnormalities but also to end-organ damage and diabetic complications. Isolated fructose causes renal injury in animals and fructose consumption from soft drinks (i.e., HFCS) is associated with kidney disease in humans.

Observational Data

Although fructose is found naturally in some whole foods, such as fruits and vegetables, consumption of these foods poses no problem for human health and indeed may be protective against diabetes and broader cardiometabolic dysfunction. Moreover, consumption of whole fruits and vegetables is associated with reduced premature mortality. The difference may be a matter of dose and context; fructose in natural foods exists in lower concentrations (eg, the peach example from earlier) and is accompanied by water, fiber, antioxidants, and other whole-food constituents.

Conclusion

There is no biological need for any added sugars in the diet, particularly those containing fructose (eg, sucrose and HFCS). Dietary guidelines should encourage individuals to replace processed foods with whole foods, such as fruits and vegetables, and should incentivize industry to add less sugar, especially fructose-containing varieties, to food and beverage products. The existing basic science evidence, observational data, and clinic trial findings suggest that reducing consumption of added sugars, particularly added fructose, could translate to reduced diabetes-related morbidity and potentially premature mortality. At an individual level, limiting consumption of foods and beverages that contain added sugars, particularly added fructose, may be one of the most effective strategies for ensuring one's robust future health.

Vocabulary:

A Principal Driver of Type 2 Diabetes Mellitus and Its Consequences

Intake: ingesta

Added: añadido(a)

Syrup: jarabe

Derangements: transtornos

Whole: integral/completo

Improve: mejorar

Detrimental: perjudicial

Sweetener: edulcorante

Guidelines: pautas

Indeed: incluso