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Current Intake and Demographic Disparities in the Association of Fructose-Rich Foods and Metabolic Syndrome

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Since the 1970s, when high fructose corn syrup (HFCS) began to replace sucrose in soft drinks, added fructose intake has increased to a mean of approximately 7.5% of total energy intake.[1] For comparison, the 2015-2020 Dietary Guidelines for Americans recommend that less than 10% of energy in the diet come from total added sugars. Added sugar intake has been decreasing in recent years, but in 2016, US adults consumed 14.4% of energy as added sugar.[2]

In 2004, a commentary by Bray et al[3] observed that as HFCS consumption increased in the US, prevalence of obesity also increased. They,[3] and subsequent authors,[4] found that aspects of fructose metabolism could influence metabolic syndrome (MetS) risk factors, including fatty acid synthesis, obesity, and insulin sensitivity. Although Bray et al[3] presented their data as a hypothesis, the article sparked a controversy about fructose consumption and risk of chronic diseases, including MetS, compared with glucose and sucrose, even though HFCS has the same composition of fructose and glucose as sucrose. Despite the ongoing discussion about whether one type of sweetener is worse for health than another, it is helpful to determine any differences in the risks of consuming these simple sugars to provide the best guidance to consumers and to advocate for a healthful food supply.

Most studies on fructose consumption and the association with MetS and related diseases have focused on sugar sweetened beverage (SSB) intake, which accounts for the largest proportion of fructose intake in the US (46%).[1] As shown in the systematic review and meta-analysis by Semnani-Azad et al,[5] there seems to be a clear positive association between SSB consumption and MetS. However, it is important to consider other sources of fructose and whether they have the same association with MetS. Grain products account for 17.3% of fructose consumption, fruit and fruit products account for 13.4%, sugars and sweets account for 10.3%, milk and milk products account for 7.1%, and vegetables and vegetable products account for 2.7%.[1] This study is an important contribution to the literature because it analyzed the limited data available about other fructose-rich foods to determine dose responses and identified nonlinear associations.

Although many studies have investigated the association of nutrients and other components of food with health, people consume foods, not nutrients. In recent years, guidance has largely moved from nutrient-based recommendations to food-based recommendations.[6] This systematic review and meta-analysis found that there is not just one association of fructose with MetS; it depends on the food.[5] In contrast to the SSB findings, mixed fruit juice and 100% fruit juice had a U-shaped association, and yogurt and whole fruits had a positive association. It makes sense that other nutrients and phytochemicals in these foods could have a protective effect. For fruit juice, the beneficial effects occur up to the amount in a 6-oz juice glass. US adults drink a mean of one-third cup of 100% fruit juice, which is less than half of the juice glass.[7] Although the guidance is to consume mostly whole fruit, 100% fruit juice in moderation is still part of a healthy diet.[6] The benefit of yogurt consumption in this study was at approximately half a standard container (75 g).[5] Yogurt has benefits beyond this association with MetS, but it accounts for only 2.6% of dairy consumption among US adults,[6] which translates to a mean consumption of 17 g of yogurt.[7] This finding suggests that most people are not benefitting from the potentially MetS-protective effects of fruit juice or yogurt consumption. In the case of whole fruit, the most beneficial amount determined by this analysis was more than the current recommendation of 2 cup-equivalents.[6] US adults currently consume less than 1 cup-equivalent of whole fruit.[7]

Data are lacking for honey, ice cream, and confectionary, and Semnani-Azad et al[5] found that the evidence for these foods was low in quality. Although the authors of the review state that the adverse association of SSB with MetS does not extend to other sources of fructose, there does not seem to be enough evidence to determine whether the association extends to these foods or not. This lack of evidence suggests that the ability to draw conclusions about their association with MetS is extremely limited.

In considering the results of this meta-analysis, it is important to recognize which populations in the US are most affected by the associations of these fructose-rich foods and MetS. For example, people with lower socioeconomic status (SES) and African American women have higher rates of MetS compared with other groups,[8] and lower-SES groups and African American people have higher prevalence of related diseases, including obesity, hypertension, and diabetes. Not only are they more at risk for MetS, but they are also more likely to have intakes of these fructose-rich foods that are counter to the dietary advice that can be gleaned from the work of Semnani-Azad et al.[5] Both low-SES groups and African American people consume more SSBs and fruit juice and fewer servings of whole fruits and yogurt than non-Hispanic white people.[7] Consuming more fruit juice, although potentially beneficial, puts them a higher risk of experiencing harm from fruit juice consumption.

In summary, this study supports current dietary guidance. More studies are needed that examine fructose-rich foods and MetS in general and especially in low-SES and diverse populations. In addition, more interventions are needed to identify efficacious methods of motivating Americans to adopt dietary patterns that reflect recommendations. Future studies should also take into account factors that could limit at-risk populations' ability to purchase the protective foods mentioned in this study, such as availability and affordability.

ARTICLE INFORMATION

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