LETTER

Positive association between artificially sweetened beverage consumption and incidence of diabetes. Reply to Sylvetsky Meni AC, Swithers SE, Rother KI [letter]

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Abbreviations

ASB Artificially sweetened beverages

SSB Sugar-sweetened beverages

To the Editor: We appreciate the positive comments from Sylvetsky Meni et al [1] about our work on consumption of sweet beverages and incidence of type 2 diabetes [2]. However, they question our interpretation of reverse causality as the possible explanation for the attenuation of the significant association between consumption of artificially sweetened beverages (ASB) and incidence of diabetes after adjustment for obesity, proposing that alternative explanations are more likely. In particular, they argue for a direct detrimental effect of artificial sweeteners on metabolic health, rather than our rationale that obese individuals tend to consume ASB preferentially as part of weight management strategies. They also suggest that our approach of adjusting for BMI in our analysis of ASB was inappropriate, because consumption of ASB causes greater adiposity and insulin resistance.

Sylvetsky Meni et al cite several studies to support the argument that artificial sweeteners may have direct adverse

metabolic effects. However, the evidence is far from conclusive. For example, the dose of saccharin used in experiments in rats [3] and in seven human volunteers [4] was in supraphysiological doses, several-fold higher than typical human consumption of saccharin (8 mg per 340 ml or 12 oz) [5]. We estimate that approximately 40 cans/day of a 12 oz ASB drink with saccharin would have to be consumed to achieve that daily dose of saccharin. Their citation of studies of a pancreatic beta cell line [6] or of 17 morbidly obese adults with mean BMI of 41.0 kg/m² [7] have limited generalisability, and such assertions should be tested for comparison with observations, including ours, in a free-living setting. Moreover, the observational studies from a single cohort [8, 9] cited by Sylvetsky Meni et al did not show any causal effects of ASB on increased body weight or adiposity, being limited by the possibility that individuals with greater weight or weight gain might have preferentially consumed ASB or that ASB consumers may have consumed food with a high energy content to compensate for a low energy intake by consuming ASB.

In contrast, though not cited by Sylvetsky Meni et al, there is convincing evidence from randomised controlled trials that ASB can play an important part in weight control and obesity prevention. For example, Maersk et al reported a 6 month intervention study comparing water, milk, sugar-sweetened beverages (SSB), and ASB sweetened with aspartame [10]. Among 47 adults, SSB consumers showed trends toward greater fat mass in adipose tissue, muscle and liver than other groups, whereas there was no difference in fat mass in adipose, muscle or liver tissues when comparing ASB consumers with consumers of water or milk. Tate et al conducted a 6 month trial ($n=318$ overweight and obese individuals) comparing groups of no intervention, substituting water for SSB, and substituting ASB for SSB, and demonstrated significant weight loss by the groups that consumed ASB or water, and reported no difference between ASB and water consumption

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[11]. These trials indicate that an obesogenic effect of ASB is absent or negligible. Moreover, although Sylvetsky Meni et al express concern about the increasing use of diet and low-energy beverages in place of SSB among children, trial evidence indicates reduced weight gain and lower fat accumulation with such replacement [12]. Given the trial evidence, a correlation between ASB consumption and obesity status is likely to reflect that obesity status alters ASB consumption. Although no trial to date has randomised participants by obesity status or health consciousness and examined behavioural changes, we consider that our approach of adjusting for obesity status in analysis of ASB is valid. Without the adjustment, the result would reflect a portion of the established effect of obesity on the development of diabetes. Indeed, we deliberately provided our results both without and with adjustment for obesity for greatest clarity.

We acknowledge that it is important to further understand the complex relationships between types of beverages, adiposity, weight change and metabolic risk, and to explore mechanisms underlying associations, and to this end, further research is warranted. As we could not examine the effects of ASB consumption on weight gain or insulin resistance without confounding by obesity status, we echo here the arguments, written by a co-author of this letter (by Sylvetsky Meni et al) that ‘it is possible that consumption of artificial sweeteners may be beneficial in limiting weight gain’ and ‘more studies evaluating the effect of artificial sweeteners on hormonal and metabolic response and on sweet craving must be conducted’ [13]. Until we have further evidence otherwise, ASB intake in place of sugary beverages remains a part of weight management strategies. We also further re-endorse our findings that consumption of drinking water and of unsweetened tea or coffee in place of SSB can help in the prevention of type 2 diabetes alongside other healthy lifestyle behaviours.

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