

Honey and fruit for weight management¹

Honey and fruit were associated with lower body weight, while fructose-sweetened beverages increased body weight, based on a systematic review and meta-analysis.

Study Overview: This comprehensive review of the totality of evidence available shows that the hypothesized relationship between beverages sweetened with fructose depends on the amount consumed. And moreover, when it comes to other fructose-containing foods, the relationship with body weight and adiposity may be quite different compared to beverage form. A comprehensive systematic evidence review funded by the American Society for Nutrition and published in the *American Journal of Clinical Nutrition*, considered the totality of evidence from randomized clinical studies on body weight and adiposity, in which fructose containing foods were fed at varying levels of intake.

Method in Brief: A systematic evidence review of controlled human feeding trials of ≥ 2 weeks duration, published through April 2022, assessed the relationship between body weight and consumption of various fructose containing foods at differing intake levels. Secondary outcomes included measures of adiposity. In total, 169 trials of 255 comparisons met review criteria for inclusion. Results were considered separately depending on how fructose calories were incorporated into the diet relative to the comparator, namely substituted (energy-matched replacement of sugars), added (energy from sugars added), subtracted (energy from sugars subtracted), or ad libitum (energy from sugars freely replaced by subjects).

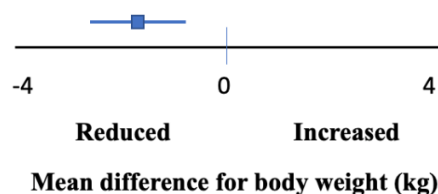
Findings: As expected when calories increase, combining all fructose-containing sugars together showed increased body weight when added to the diet without adjustment for the extra calories and decreased body weight when subtracted without adjusting total energy intake. There was overall no association with body weight when substituted into the diet or when subjects ate ad libitum diets.

However, subgroup analysis showed important differences based on the amount and the source of fructose fed:

1. **Sugar sweetened beverages** added without reducing calories, led to increases in body weight and BMI in a linear dose response. When the data were analyzed for dose-response, for each incremental 8% of total energy (per 355ml beverage), body weight increased 1 kg (2.2 lbs.).
2. When energy was added to the diet (i.e., without adjustment for extra calories) **honey and fruit** were associated with reduced body weight.

Readers are encouraged to access the original publication in order to review detailed results for sugar sweetened beverages and fruit. Results are shown here for when **honey was added to the diet** (with no reduction in overall energy intake to compensate for that addition). In these studies, honey was fed at a median of 9% of total energy intake (ranged from 3.2% to 33% of total energy). The 2020-25 *Dietary Guidelines for Americans* recommends limiting added sugars to ≤ 10 % of total energy.

Number of trials	Number of Subjects	Mean difference in body weight (95% CI)	p-value	Certainty of evidence Interpretation of magnitude of effect
5	189	-1.65 kg (-2.46, -0.85)	<0.001	Moderate Moderate



1. Chiavaroli, et al. Important food sources of fructose-containing sugars and adiposity: A systematic review and meta-analysis of controlled feeding trials. *Am J Clin Nutr* 117 (2023) 741-765.

Conclusions and Implications: The authors concluded that both energy control and food sources matter when drawing conclusions about the relationship between fructose-containing sugars and body weight. In terms of food source, most food sources were neutral, except that both honey and fruit were associated with lower body weight in controlled feeding studies, even when calories were additive to the diet. This is remarkable given that these studies added calories to the diet.

The researchers explain that fruit’s benefit may be related to its fiber content. They also noted with respect to honey that “These findings may be explained by honey’s rare sugar content. Honey contains up to 14% by weight (in milligrams per gram) rare sugars, notably allulose, tagatose, and isomaltulose, all of which have shown improvements in cardiometabolic risk factors.”

Particularly notable results from this review of the totality of evidence is keeping daily sugar intake from sweetened beverages below 10% of total energy (including from fruit juices). To help translate reported results into amounts of honey that might be used in beverages, adding 1 teaspoon honey (which is the most frequently reported amount used) at 5.7 g sugar/teaspoon, provides 1% total daily energy in a 2,000 kcal diet. In ready-to-drink beverages, if a product developer is aiming to be at or below the 10% total energy and assuming for illustration purposes two servings of beverage using the FDA reference amount commonly consumed of 12 oz, the following levels of honey are useful benchmarks:

% Daily Value (DV) for added sugar	Amount of sugar per 12 fl oz serving (360 ml)* (2,000 kcal *0.10)/4 kcal per gram sugar	Amount of honey to deliver the sugar (g) (82.1 g sugar/100 g honey)	Amount of honey in beverage on w/v% basis	Calories from honey per serving (kcal) (4 kcal/gram sugar)
5%	25	30	8	100
2%	10	12	3	40
1%	5	6	2	20

* Any other serving can be used. This example is based on the Reference Amount Commonly Consumed defined by the FDA for carbonated and non-carbonated beverages and also for coffee or tea.