

# Effect of Sugars on Metabolic Disease Risk Factors

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## Key takeaways:

- When sugars are substituted for other macronutrients and total energy intakes remain the same, sugars do not have negative effects on key risk factors of major chronic diseases.
- Consuming sugars at high doses that provide excess energy is associated with adverse effects on weight and chronic disease risk factors.



## Why Was This Research Conducted?

Sugars (e.g. glucose, fructose, sucrose) are found both **naturally in fruits and vegetables** and **added as an ingredient** to some packaged foods and beverages. Many health associations recommend limiting sugars consumption because of concerns it may increase risk of chronic diseases.

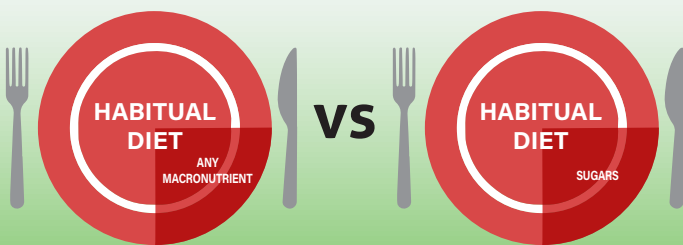
## How Was This Research Conducted?

Researchers at the University of Toronto conducted a series of systematic reviews and meta-analyses to assess all available clinical trials, and provide the best quality of evidence on this topic.

Study results were analyzed to answer the following questions:

- Is there a specific effect of sugars on metabolic disease risk factors compared to other macronutrients when total energy intakes remain the same? (**substitution trials**)?
- Are effects dependent on if sugars are consumed as a source of excess energy? (**addition trials**)

## Study designs and results are summarized below:



### Substitution Trials - Energy Matched

Energy from sugars is **substituted** for other sources of energy in the habitual diet. (**energy-matched** conditions where total energy intakes remain the same)

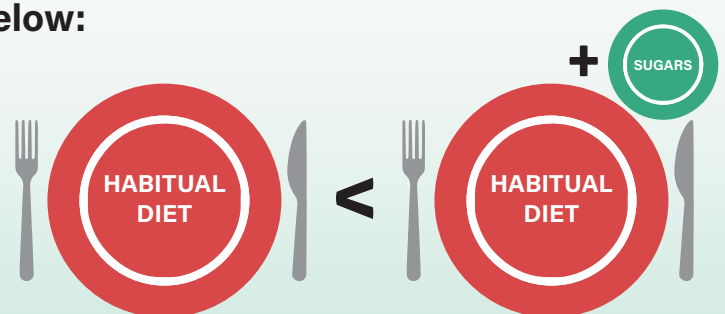
#### NO EFFECT on:

- Body weight<sup>1</sup>
- Blood cholesterol (LDL-C, apolipoprotein B, non-HDL-C, HDL-C)<sup>2</sup>
- Triglycerides (fasting and postprandial)<sup>2,3</sup>
- Fasting blood glucose<sup>4</sup>
- Insulin sensitivity (HOMA-IR) or fasting blood insulin<sup>4</sup>
- Systolic blood pressure<sup>5</sup>
- Uric acid (risk factor for gout)<sup>6</sup>
- Markers of non-alcoholic fatty liver disease (liver fat, liver enzymes)<sup>7</sup>

#### DECREASE in:

- Glycated blood proteins, like HbA1c (improved blood glucose control)<sup>4</sup>
- Diastolic blood pressure, mean arterial pressure<sup>5</sup>

\*The majority of substitution trials tested sugars at doses between 22-213 grams/day (equivalent to 5-53 tsp, 5-33% energy)



### Addition Trials - Excess Energy

Energy from sugars is **added** to the diet (the effect of **excess energy** where the intervention is providing calories in addition to the habitual diet)

#### NO EFFECT on:

- Blood cholesterol (LDL-C, non-HDL-C, HDL-C)<sup>2</sup>
- Glycated blood proteins, like HbA1c (blood glucose control)<sup>4</sup>
- Fasting blood insulin<sup>4</sup>
- Mean arterial pressure<sup>5</sup>

#### INCREASE in:

- Body weight<sup>1</sup>
- Fasting apolipoprotein B (blood cholesterol marker)<sup>2</sup>
- Triglycerides (fasting and postprandial)<sup>2,3</sup>
- Fasting blood glucose<sup>4</sup>
- Insulin sensitivity (HOMA-IR)<sup>4</sup>
- Uric acid (risk factor for gout)<sup>6</sup>
- Markers of non-alcoholic fatty liver disease (liver fat, liver enzymes)<sup>7</sup>

Most studies used sugars-sweetened beverages as the source of sugars, at high doses ranging from 153-300 grams/day (equivalent to 38-75 tsp, 24-55% excess energy)

## Strengths and Limitations of the Findings

- Overall, these findings are based on data on over **1,000 participants** from over **50 trials**, and included populations of various health status
- Follow-up duration of interventions ranged from **1-52 weeks**
- Some analyses had small sample sizes, short follow-ups, and included trials of low quality
- Analyses on markers of blood glucose control were all conducted in individuals with Type 1 and Type 2 diabetes

## How Can This Knowledge be Incorporated into Practice?

This knowledge synthesis provides an overview of the highest level of current scientific evidence pertaining to sugars and metabolic disease risk. Findings can be used by dietitians and other health professionals to provide evidence-based nutrition recommendations related to sugars for both the general public and those at risk of diabetes and cardiovascular disease.

#### References:

- Sievenpiper et al. Ann Intern Med 2012;156:291-304
- Chiavaroli et al. JAMA 2015;4:e001700
- Wang et al. Atherosclerosis 2014;232:125-133
- Cozma et al. Diabetes Care 2012;35:1611-20
- Ha et al. Hypertension 2012;59:787-95
- Wang et al. J Nutr 2012;142:916-23
- Chiu et al. Eur J Clin Nutr. 2014;68:416-423

For details of these studies and funding sources, see: NIH U.S. National Library of Medicine [ClinicalTrials.gov](https://clinicaltrials.gov) Meta-analyses of Fructose and Cardiometabolic Risk Study Identifier: [NCT01363791](https://clinicaltrials.gov/ct2/show/study/NCT01363791)

The Canadian Sugar Institute Nutrition Information Centre aims to gather and share up-to-date research and evidence-based information about sugars, nutrition, and health. The Nutrition Information Centre is managed by registered dietitians and nutrition researchers, and is guided by a Scientific Advisory Council.



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