

## Sweetened drinks accelerate the development of cancer

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*An article published in the prestigious journal SCIENCE shows that high-fructose corn syrup, the principal sweetening agent in industrially sweetened beverages, promotes the development of colorectal cancer in animal models, which are genetically predisposed to this disease.*

Several studies have established a link between the consumption of sweetened beverages, particularly soft drinks, and the increased incidence of obesity seen in most countries since the 1980s<sup>1</sup>. This increase in excess weight is quite disturbing because it coincides with a strong increase in several chronic diseases (most notably type 2 diabetes), as well as with a significant increase in at least 12 types of cancers.

Another troubling point is that this phenomenon seems to particularly affect young adults (<50 years): for example, one American study recently documented a large increase in the incidence of 6 cancers linked to excess weight (multiple myeloma, colorectal, uterine, bile duct, kidney and pancreas) in men and women aged 25 to 49<sup>2</sup>. This is truly an alarming situation, which risks becoming even worse over the next few years.

### CARCINOGENIC SUGARS

The results of a preclinical study recently published in *SCIENCE* indicate that, beyond simply favouring weight gain, the excessive consumption of added sugars can directly influence the progression of cancer<sup>3</sup>.

By using animal models which were genetically predisposed to develop colorectal cancer (deficiency in a tumour suppressor gene APC), it was found that adding small quantities of high fructose corn syrup (HFCS), a sweetening agent present in most soft drinks, to their daily diet (equivalent to the consumption of about one can of a soft drink, ~20 g of sugar) over 2 months increased the number and size of colorectal cancerous lesions, which developed within their intestines. Because this low quantity of sugar did not lead to any weight gain nor did it affect metabolism, this suggests that chronic ingestion of free sugars, even in relatively weak concentrations, is sufficient to accelerate the progression of colorectal cancer.

As for the sugar contained in fruits, that situation is different because their abundance of fibre slows the absorption of fructose and diminishes its bioavailability. As well, certain phytochemical molecules in fruits have anti-cancerous properties, as has been shown by population studies where a reduction in cancer is observed in those who consume fruit.

### GLUCOSE-FRUCTOSE SYNERGY

Sugars such as HFCS or sucrose (table sugar) are composed of a mixture of glucose and fructose (45% glucose and 55% fructose in HFCS). Glucose and fructose possess very similar chemical structures but are metabolized in completely different ways by the body: glucose is easily absorbed by the intestine and is transported by the blood to be used as a source of energy by all of the cells in the body, whereas fructose is instead directed to the liver where it is transformed into fat. The metabolism of fructose is not, however, very efficient: the consumption of as little as 5 g of fructose overwhelms the ability of the intestine to absorb it and causes an accumulation of fructose within the colon.



An analysis of the metabolism of glucose and fructose by cancer cells indicates that this excess fructose plays a major role in the pro-cancer effects of HFCS. The researchers determined that progressing tumours avidly absorbed the fructose present within the colon and transformed it into fructose-1-phosphate, a reaction that is associated with a dramatic fall in the energy level (ATP) of the cell. To compensate for this drop in ATP, the cancer cells import an even greater quantity of the glucose present in the blood and metabolize it to allow the synthesis of the fatty acids essential for the multiplication of cancer cells.

In other words, a moderate consumption of sugar, the glucose present in the blood and the fructose present in the colon collaborate to accelerate cancer cells' metabolism and thus support the progress of colorectal cancer.

### DRASTIC REDUCTION

Fructose is not a nutrient that is essential for survival, and these results suggest that the development of agents capable of interfering with fructose metabolism might prove to be a useful approach for preventing the development of cancer.

Along these lines, it is interesting to note that individuals who exhibit essential fructosuria (excretion of fructose in the urine) cannot reabsorb the fructose due to a mutation in a key enzyme involved in the transformation of fructose (ketohexokinase) and are at much less risk of obesity, type 2 diabetes and hepatic diseases. Medications targeting this ketohexokinase are currently under development and could contribute to reducing the impact of these sugars on the development of cancer.

While we await them, it goes without saying that the best way to prevent these harmful effects associated with added sugars is to eliminate, or at least to drastically reduce the consumption of sweetened beverages. Particularly since a recent study has indicated that the daily consumption of a single can of one of these sugary drinks increases the risk of premature death by 14%<sup>4</sup>.

- (1) Malik VS et al. Intake of sugar-sweetened beverages and weight gain: a systematic review. *Am. J. Clin. Nutr.* 2006; 84: 274-288.
- (2) Sung H et al. Emerging cancer trends among young adults in the USA: analysis of a population-based cancer registry. *Lancet Public Health* 2019; 4: e137-e147.
- (3) Goncalves MD et al. High-fructose corn syrup enhances intestinal tumor growth in mice. *Science* 2019; 363: 1345-1349.
- (4) Malik VS et al. Long-term consumption of sugar-sweetened and artificially sweetened beverages and risk of mortality in US adults. *Circulation*, published online March 18 2019.