

THE SUGAR'S ROLE IN OUR FOODS AND LIVES

*The etymology of the word "**sugar**" reflects the spread of the commodity. From Sanskrit (śarkarā), meaning "ground or candied sugar", came Persian shakar and Arabic sukkar. The Arabic word was borrowed in Medieval Latin as succarum, whence the 12th century French sucre and the English sugar. Sugar was introduced into Europe by the Arabs in Sicily and Spain.*

Nearchus, admiral of Alexander the Great, knew of sugar during the year 325 BC, because of his participation in the campaign of India led by Alexander. Crusaders brought sugar back to Europe after their campaigns in the Holy Land, where they encountered caravans carrying "sweet salt". Early in the 12th century, Venice acquired some villages near Tyre and set up estates to produce sugar for export to Europe. It supplemented the use of honey, which had previously been the only available sweetener.

There was a drastic change in the mid-15th century, when Madeira and the Canary Islands were settled from Europe and sugar introduced there. By 1492, Madeira was producing over 1,400 metric tons of sugar annually. For a comparison in 2022/23, the world sugar production amounted to approximately 177 million metric tons. Provisional numbers for 2021 put the amount of sugar consumed in the European Union (EU-27) at approximately 16.6 million metric tons (just in EU27, it is 11.857 times more than in 1492).

Sources: Wikipedia and Statista

As you can imagine sugar was not a food for almost all the blinkeye time in our evolution as Homo Sapiens Sapiens. However, this is not such a big issue because we evolved digesting different kinds of "sugars" like glucose, fructose, maltose and galactose.

Despite humans knowing sugar since relatively ancient times, it started to be a food recipient only starting in 1492. At that time, the consumption was quite limited both in quantity and social demographics. Poor people were still relying on expensive but cheaper honey, like in the ancient times.

Nowadays, the picture is quite different: sugar is extremely cheap and it is added in many common foods. For example ketchup has 22% of sugar in its weight. Hence, we eat a lot of sugar behind our awareness of doing that. So, it is the right time to take a second thought at this habit of ours. Or paying more attention to it, at least.

For having an idea, 16.6 million metric tons in EU27 (450 millions people) means 36.9 Kg/year eq. to 101 grams/day eq. 404 kcal/day to each person. For a confrontation in the USA (333 millions people) the sugar consumption in the same 2022/2023 was 11.5 millions metric tons. This means that each person in the USA eats 34.5 Kg/year eq. to 95 grams/day eq. to 348 kcal/day.

For a sedentary kid, this sugar daily dose supplies between 18% and 25% of the daily energy need, but instead provides no other nutrients nor fibers like fruits, vegetables, rice, pasta or grain baked products. Fibers which play a role in the stomach volume filling and feces consistency, thus they also regulate the appetite and the evacuation.

Q&A DIALOG

In this case, it is not a single prompt but a dialog: a series of answered questions which aim described in the section above [**TODO**]. Prompts and the related answers are separated by horizontal lines. Few missing words have been added in the prompt queries just to help the English native speakers to quickly grab the meaning but for sake of correctness those words appear between [squared] parentheses.

CUSTOMISATION

none

NOTES

This is an article written in Italian related to this topic.

- [Zucchero, alimentazione e salute](#)

However, this article has not been used as data input for the chatbot which is the reason because its link is reported here in the "notes" section instead of in the "upload" section.

UPLOAD

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CHATGPT 4o

PROMPT #1

Compare high fructose corn syrup and sugar from canes or other vegetables (the tablespoon sugar, in common grocery, sucrose) about the their ability to sweeten a water-based drink (e.g. grams for liter to obtain the same sweet taste) and the calories provided to human body in digesting them (e.g. kcal for each gram of product). For a reference put also in this comparison pure Aspartame and the compound (a mix of sweeteners) which is mostly used in the market today.

CHATGPT #1

Certainly! Here's a comparative overview of **High Fructose Corn Syrup (HFCS)**, **Table Sugar (Sucrose)**, **Pure Aspartame**, and a **Common Sweetener Blend** regarding their sweetness potency in water-based drinks and their caloric contributions.

1. Overview of Sweeteners

• Table Sugar (Sucrose):

- **Source:** Extracted from sugar cane or sugar beets.
- **Composition:** A disaccharide composed of glucose and fructose (1:1 ratio).
- **Usage:** Widely used in beverages, baking, and general sweetening.

• High Fructose Corn Syrup (HFCS):

- **Source:** Derived from corn starch.
- **Composition:** Varies, commonly HFCS-55 (55% fructose, 45% glucose) used in soft drinks.
- **Usage:** Predominantly used in processed foods and beverages as a sweetener.

• Pure Aspartame:

- **Source:** Synthetic sweetener.
- **Composition:** Composed of two amino acids, aspartic acid and phenylalanine.
- **Usage:** Used in low-calorie and diet beverages, as well as tabletop sweeteners.

• Common Sweetener Blends:

- **Source:** Combination of multiple high-intensity sweeteners.
- **Composition:** Often includes aspartame, acesulfame potassium (Ace-K), sucralose, and others.
- **Usage:** Designed to mimic the sweetness profile of sugar while minimizing calories, used in various diet and "zero-calorie" products.

2. Comparative Table

In this table below is shown the relative sweetness to sucrose of various sweeteners and their energy supply for obtaining a liter of water as sweet as it would be using the sugar instead.

Sweetener	Sucrose Ratio	Grams/Liter	Kcal per Liter

Sucrose (Table Sugar)	1x	100 gr.	400 kcal
High Fructose Corn Syrup (HFCS)	1.1x	90 gr.	360 kcal
Pure Aspartame	200x	0.5 gr.	2 kcal
Common Sweetener Blends	300x - 700x	0.14 - 0.33 gr.	0.56 - 1.32 kcal

This section and table have been human-edited for being shorter and more meaningful, especially about its aim.

3. Detailed Breakdown

- **Sucrose (Table Sugar)**

- **Sweetness:** Baseline (1x). It serves as the standard for measuring other sweeteners.
- **Usage:** Approximately 100 grams per liter (g/L) are needed to achieve desired sweetness in water-based drinks.
- **Calories:** Provides about 4 kilocalories (kcal) per gram, totaling roughly 400 kcal per liter.

- **High Fructose Corn Syrup (HFCS)**

- **Sweetness:** Slightly sweeter than sucrose (~1.1 times). This means less HFCS is needed compared to sucrose to achieve the same sweetness.
- **Usage:** Around 90 grams per liter are typically required.
- **Calories:** Similar to sucrose, HFCS provides approximately 4 kcal per gram, totaling about 360 kcal per liter.

- **Pure Aspartame**

- **Sweetness:** Approximately 200 times sweeter than sucrose.
- **Usage:** Only about 0.5 grams per liter are needed to match the sweetness of sucrose.
- **Calories:** While aspartame contains about 4 kcal per gram, the total caloric contribution is minimal (~2 kcal per liter) due to the small amounts used.

- **Common Sweetener Blends**

- **Sweetness:** Varies widely, typically ranging from 300 to 700 times sweeter than sucrose depending on the specific blend.
- **Usage:** Typically between 0.14 to 0.33 grams per liter are required to achieve equivalent sweetness.
- **Calories:** Despite having similar caloric content per gram as sucrose and HFCS (~4 kcal/g), the total calories contributed are negligible (~0.56 to 1.32 kcal per liter) because of the minimal quantities used.

4. Practical Implications

- **Sweetness Efficiency:** High-intensity sweeteners like aspartame and sweetener blends provide the same level of sweetness as sucrose with significantly lower quantities, making them highly efficient for reducing sugar content in beverages.
- **Caloric Impact:** While sucrose and HFCS contribute substantially to the caloric content of beverages, pure aspartame and sweetener blends contribute negligibly, which is beneficial for calorie-restricted diets.
- **Taste Profile:** Sweetener blends are often used to replicate the taste profile of sucrose more closely and mitigate any aftertastes associated with individual high-intensity sweeteners.

5. Additional Considerations

- **Metabolic Effects:** While not covered in detail here, it's important to note that different sweeteners can have varying effects on metabolism, insulin response, and gut health. For instance, excessive consumption of HFCS has been linked to various metabolic disorders, whereas artificial sweeteners like aspartame are often debated regarding their long-term health impacts.
- **Regulatory Status:** All mentioned sweeteners are approved for use by major health authorities (e.g., FDA, EFSA) when consumed within acceptable daily intake levels.

6. Conclusion

When formulating or choosing sweetened beverages:

- **Sucrose and HFCS** provide similar levels of sweetness and caloric content, with HFCS being slightly sweeter and slightly lower in grams needed per liter.
- **Pure Aspartame** offers a high sweetness potency with virtually no caloric impact, suitable for low-calorie or diet beverages.
- **Common Sweetener Blends** leverage multiple high-intensity sweeteners to achieve desired sweetness with minimal caloric contribution, often enhancing the overall taste profile compared to single sweeteners.

This comparison underscores the trade-offs between sweetness intensity, caloric content, and flavor profiles when selecting sweeteners for water-based drinks.

PROMPT #2

Produce a table in which 35 grams of sugar which is the amount of sugar found into a 33cl Coca-Cola's can (as far as I know due to a Google search, but feel free to adjust that value in a more precise way keeping the gram as metric) is compared with the calories need for children and adults, men and women, sedentary life and active workforce life, in term of percentage of the daily calories needed. Plus put also in that confrontation how much common foods in grams should be eaten for reaching the same amount. Suggested foods: banana, apple, orange, potato, carrot, bean, beef, egg, milk, bread, pasta (without any sauce), boiled rice (without any sauce), salmon, tuna fish (raw not under oil), butter and olive oil.

CHATGPT #2

Comparison Table: 35g of Sugar in a 33cl Coca-Cola Can (140 kcal) vs Daily Caloric Needs

Demographic	Daily Need	140 kcal	Ratio
Children (Sedentary)	1600 kcal	8.75%	11.43
Children (Active)	2000 kcal	7.00%	14.29
Adult Women (Sedentary)	1800 kcal	7.78%	12.86
Adult Women (Active)	2200 kcal	6.36%	15.71
Adult Men (Sedentary)	2200 kcal	6.36%	15.71
Adult Men (Active)	2800 kcal	5.00%	20.00

This section and the table have been human-edited for being shorter and more informative, especially about Ratios.

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Equivalent Food Quantities to Reach 140 kcal (35g of Sugar)

This table below shows the equivalent food quantities to reach 140 kcal, the same supplied by 35g of sugar.

#	Food	Grams for 140 kcal	Kcal for 100 grams
	(data source)	(ChatGPT 4o)	(Google search)
1	Bananas	157 g	89 (72 - 135) kcal
2	Apples	269 g	52 (38 - 70) kcal
3	Oranges	298 g	47 (45 - 50) kcal
4	Potatoes	182 g	77 (68 - 92) kcal
5	Carrots	341 g	41 (35 - 54) kcal

6	Beans	98 g	143 (33 - 333) kcal
7	White Bread	56 g	250 (219 - 294) kcal
8	Pasta (boiled)	107 g	131 (131 - 155) kcal
9	Rice (boiled)	108 g	130 (113 - 139) kcal
10	Beef	56 g	250 (250 - 295) kcal
11	Salmon	67 g	206 (127 - 261) kcal
12	Tuna Fish	97 g	144 (108 - 201) kcal
13	Eggs	98 g	142 (131 - 147) kcal
14	Milk	333 g	42 (34 - 64) kcal
15	Butter	20 g	717 (714 - 803) kcal
16	Olive Oil	16 g	884 (884 - 999) kcal

This section and the table have been human-edited for being shorter and more informative, especially about classes and ranges.

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Conclusions

This comparison highlights how much common foods you would need to consume to reach the same caloric intake as found in 35 grams of sugar (140 kcal), which is equivalent to what's in a 33cl Coca-Cola can. Additionally, it shows what percentage of daily caloric needs this amount of sugar represents for different groups.

CONSIDERATIONS

For assuming the same amount of calories contained in 35 grams of sugar that is contained in a can of original taste Coca-Cola 33cl can, on average, need 144 grams of food which is 4.1x more in sugar weight. While a Coca-Cola can contains c.a. 365 grams of liquid (water 330 gr. + sugar 35 gr dissolved in the water volume). This makes Coca-Cola equivalent to green apples in terms of calories vs weight ratio (42 kcal for 100 ml eq. to 111 gr.). Do you think that a solution of 10% of sugar into water can provide all the nutrients of the same amount of green apples?

Output check

- In particular, we know that LLMs usually are very bad in math and also arithmetic. Before anything else I am going to check the values in the food tables because the others tables are just a list of standard values which have not math.
- So, the food table is the one at risk. In fact, apples have 52 kcal as Google search first answered while it is easy to find that different apple varieties provide different nutrients and thus energy amounts (between 38 and 70 kcal).
- However, we can take 52 as an average value. Surprisingly, the chatbot did well with apples. Also 400 kcal for 100 grams of sugar implies 140 kcal for 35 grams.

Table adjustments (suggested):

- beans variety (green, white, spring, etc.) has wide range
- beans cooked/fresh also vary calories but less than variety
- beef energy apport can var, better using 270 kcal for 100 gr.
- potato w o w/ skin differs, boiled potato w/ skin in the table
- carrots raw/cooked differ but inversely than beans, potato or rice
- like carrots tuna fish gets more calories when cooked and smoked
- rice variety (basmati, italian, parboiled, etc.) creates a range
- about boiling: 100g of uncooked rice = 300g of cooked rice
- pasta and rise are listed both in boiled (cooked) serving
- bread variety (black, brown, white, etc.) creates a range
- white bread has been chosen because the most common

Daily food intake

This brings us to calculate the minimal and the maximum weight of food which are related to the diets listed above:

diet type	food intake	daily kcal	two cans
lightest	1.65 Kg	1.600	17.5%
actaviest	2.88 Kg	2.800	10.0%

However, we need to notice that 2 cans of Coca-Cola original taste with 35 grams of sugar in it, will provide 18% of the calories needed for a sedentary school-home kid living in a city and just 10% for an adult male involved into a workforce activity.

Unfortunately, calories are just an aspect of a human diet. All that food brings a lot of nutrients among which vitamins, proteins and fibers. Hence a workforce adult male can drink two cans a day and still receive enough nutrients from the other 90% of its food (2.88 Kg). While on the opposite side (1.65 Kg) a certain amount (18%) of the nutrients are eliminated or 18% more calories are added to the daily nutritional food.

This clearly has a HUGE impact on sedentary school-home kids living in a city and way less on those people that are consuming a lot of energy.

16 food rows basket diet

The foods table contains 16 rows and has been re-ordered in sections:

- 3 in fruits
- 3 in vegetables
- 3 in pasta, bread & rice
- 3 in beef & fish meats
- 2 in eggs & milk
- 2 in butter & oil

Because all of these foods are considered in the same energy apport serving:

- 37.5% for fruits & vegetables
- 18.75% for pasta, bread & rice
- 18.75% for beef & fish meats
- 12.50% for eggs & milk
- 12.50% for butter & oil

The list above shows the energy supply for each class of food. Moreover, because the foods list contains 16 rows each with a 140 kcal energy supply, the whole list is a 2.3kg basket of food which supplies 2.240 kcal.

This should not be considered a diet suggestion even if it resembles the Mediterranean diet style but it can be taken as a simple way of establishing a relationship between energy and nutrients.

For example, in this 2.3Kg food basket for 2.240 kcal/daily diet, meats weighs 221 grams and intake 420 kcal which is 19% of the daily energy allowance. However, proteins came also from beans, eggs, milk and butter. Maily eggs and beans contribute to the protein's supply and thus we have 417 grams of protein foods which bring in 700 kcal which is 31% of the daily energy intake.

In this specific frame, it is quite easy to check that 1/4 pound hamburger (113gr.) is about half of the daily intake for meats food class. This means that a double hamburger reaches full allowance for that class. Moreover, consider that it takes 13-16 liters of milk to produce a 1kg of cheese or 9-10 liters of milk to have 1kg of yogurt. Therefore, 24 grams of cheese or 37 grams of yogurt can be equivalent to the 333 gr. of milk in the food table.

A fast-food double cheeseburger will intake 740 kcal which is about 5.3x rows. For comparison, we can decide to prepare the double cheeseburger at home with real foods: bread (1 row), meat (3 rows), fresh onion, salad and tomatoes (1 row), cheese (1 row, milk) and mayonnaise (1 row, eggs). There are 7 rows, each with 140 kcal intake, thus 980 kcal. Put on top of it a 33cl can of coke and it reaches 50% of your daily energy intake.

It seems not so much, but it deletes an entire row of real food. That's ok, we will not use olive oil to dress the potatoes in the evening. However, even potatoes are more nutritious than a soft drink made of sugar and water, plus fancy things. Obviously, the problem is the sugar especially because it is not anymore necessary as a sweetener and 'till widely used despite it.