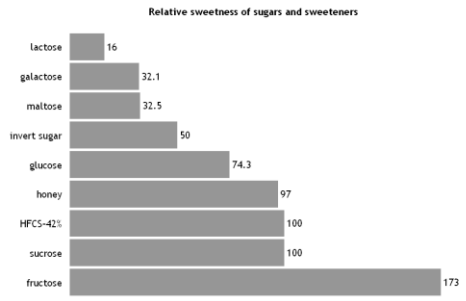
Sugar Intake

Sugar is confusing. While some people only use certain types of sugars, others dismiss them completely. But is this necessary, or even grounded? All the sugars are used as a source of fuel, but there are subtle differences in the way they are digested and absorbed. All added sugars are devoid of vitamins, minerals and dietary fibre by definition, and all contribute unwanted calories for most people. Sugars are considered to be 'empty' calorie (or energy-dense, nutrient-poor) foods.

Glucose -- the body's main source of energy and is found in pasta, whole grain bread, legumes and a range of vegetables.
Fructose -- this 'fruit sugar' found naturally in foods such as fruit, honey and some vegetables and soft drinks.
Galactose -- this is a component of lactose (the 'milk sugar') and can be found in foods such as legumes, dairy products and dried figs.
Sucrose -- referred to as 'table sugar' or 'refined sugar' and chemically consists of glucose plus fructose. It is a common form of sugar found in products which have been sweetened (e.g. cereal, ice cream, desserts, sugar sweetened beverages (SSB's), yoghurt etc.). High-fructose corn syrup (HFCS) is a mixture of glucose and fructose. Commercially, fructose is derived from sugar cane, sugar beets, and maize.
Lactose -- referred to as 'milk sugar' and chemically consists of glucose and galactose. Lactose is found primarily in dairy products but is often added to bread and baked goods, lollies, cereals and processed snacks.
Maltose -- referred to as 'malt sugar' and chemically consists of two glucose molecules. Maltose is founds in cereals containing barley and 'malt products' such as malted milkshakes, lollies and beer.

Carbohydrates are classified into two basic groups, complex and simple. Complex carbohydrates are composed of multiple simple sugars, joined together by chemical bonds. The more chains and branches of simple sugars, the more complex a carbohydrate is and in turn, the longer it takes to be broken down by the body and the less impact it has on blood sugar levels. Examples of complex carbohydrates include wholegrains such as jumbo oats, brown rice, spelt, rye and barley. Simple carbohydrates are either monosaccharides (one sugar molecule) or disaccharides (two sugar molecules). They are digested quickly and release sugars rapidly into the bloodstream. The two main monosaccharides are **glucose** and **fructose.** The two major disaccharides are **sucrose** (composed of glucose and fructose) and **lactose** (which is made up of galactose and glucose).



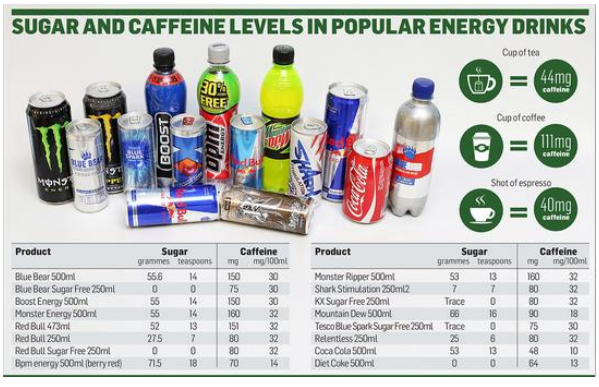
A lot of evidence has shown that excessive intake of added sugar is harmful. This includes table sugar (sucrose) and high-fructose corn syrup, both of which are about half glucose, half fructose. One reason that excessive added sugar intake is harmful is the negative metabolic effects of fructose when consumed in large amounts. All forms of fructose, including fruits and juices, are commonly added to foods and drinks for palatability and taste enhancement, and for browning of some foods, such as baked goods. Many people now believe that because added sugars are bad, the same must apply to fruits, which also contain fructose. However, this is a misconception. Fructose is only harmful in large amounts, and it's almost impossible to overeat fructose by eating fruit. Fruits are loaded with fibre, water and have significant chewing resistance. For this reason, most fruits (like apples) take a while to eat and digest, meaning that the fructose hits the liver slowly. Plus, fruit is incredibly filling. Most people will feel satisfied after eating one large

apple, which contains 23 grams of sugar, 13 of which are fructose. Compare that to a 16-ounce bottle of Coke, which contains 52 grams of sugar, 30 of which are fructose, and has no nutritional value at all. A single apple would make you feel quite full and less inclined to eat more food. Conversely, a bottle of soda has remarkably poor hunger satisfaction and people don't compensate for the sugar by eating less food. When fructose hits your liver fast and in large amounts, as is the case when you drink soda, it can have adverse health effects over time. However, when it hits your liver slowly and in small amounts, as is the case when you eat an apple, your body is well adapted to easily metabolize the fructose. While eating large amounts of added sugar is harmful to most people, the same does not apply to fruit.

Fructose sugar is often added to food because it is both cheap and enhances taste. Negative health effects of too much fructose include obesity, increased LDL cholesterol, gout, and non-alcoholic fatty liver disease. These ill effects are thought mainly to come from added fructose, and not the fructose found in fruits. However, dried fruits and fruit juices are of concern and should be limited. Foods high in added fructose include syrups, sauces, salad dressings, energy and cereal bars, commercial cereals, sugary drinks, colas, and pickles.

One study, evaluating glucose levels as a time-varying phenomenon, suggests that higher glucose levels may be a risk factor for dementia, even among persons without diabetes (1). Data suggests that higher levels of glucose may have deleterious effects on the aging brain. Findings underscore the potential consequences of temporal trends in obesity and diabetes and suggest the need for interventions that reduce glucose levels. Higher glucose levels may contribute to an increased risk of dementia through several potential mechanisms, including acute and chronic hyperglycemia, insulin resistance and increased microvascular disease of the central nervous system.

Trends in sugar consumption have been linked with the epidemic of obesity and metabolic syndrome and possibly dementia(2). Excessive consumption of fructose may contribute to insulin resistance, obesity, elevated LDL cholesterol and triglycerides, leading to metabolic syndrome, type 2 diabetes and cardiovascular disease (6). The transition in the world age demographic toward older age is associated with an increased risk of neurodegenerative diseases, such as Alzheimer's. Risk profiles for dementia may also be changing. Obesity and type 2 diabetes have increased in prevalence in the last half-century and have been associated with increased dementia risk. Specific changes in nutrition may also represent a direct risk. A diet transition in the United States has occurred in the intake of refined sugar, particularly high-fructose corn syrup (HFCS) from a yearly estimate of 8.1 kg/person at the beginning of the nineteenth century to a current estimate of 65 kg/person with the possible promotion of the development of dementia.



Product	Sugar grammes	Sugar teaspoons	Caffeine mg	Caffeine mg/100ml
Blue Bear 500ml	55.6	14	150	30
Blue Bear Sugar Free 250ml	0	0	75	30
Boost Energy 500ml	55	14	150	30
Monster Energy 500ml	55	14	160	32
Red Bull 473ml	52	13	151	32
Red Bull 250ml	27.5	7	80	32
Red Bull Sugar Free 250ml	0	0	80	32
Bpm energy 500ml (berry red)	71.5	18	70	14

Product	Sugar grammes	Sugar teaspoons	Caffeine mg	Caffeine mg/100ml
Monster Ripper 500ml	53	13	160	32
Shark Stimulation 250ml2	7	7	80	32
KX Sugar Free 250ml	Trace	0	80	32
Mountain Dew 500ml	66	16	90	18
Tesco Blue Spark Sugar Free 250ml	Trace	0	75	30
Relentless 250ml	25	6	80	32
Coca Cola 500ml	53	13	48	10
Diet Coke 500ml	0	0	64	13

Sugar and artificially-sweetened beverage intake have both been linked to cardiometabolic risk factors, which increase the risk of cerebrovascular disease and dementia. To examine whether sugar- or artificially sweetened beverage consumption were associated with the prospective risks of incident stroke or dementia a 10-year follow up study of incident stroke and dementia was undertaken (3). Total sugary beverages, which combine sugar-sweetened soft drinks, (eg high sugar carbonated beverages such as Cola) with noncarbonated high sugar beverages, such as fruit juices and fruit drinks were compared to the artificially sweetened drinks, (eg sugar-free carbonated beverages such as Diet Cola). Sugar sweetened

beverages provide a high dose of added sugar, leading to a rapid spike in blood glucose and insulin, (4) providing a plausible mechanism to link consumption to the development of stroke and dementia risk factors. Like sugar-sweetened soft drinks, artificially sweetened soft drinks are associated with risk factors for stroke and dementia (5), although the mechanisms are incompletely understood, and inconsistent findings have been reported. Artificially sweetened beverages are typically sweetened with non-nutritive sweeteners, such as saccharin, aspartame, neotame, sucralose or stevia. Collectively, these synthetic substances are much more potent than sucrose, with only trace amounts needed to generate the sensation of sweetness (4).

In conclusion, it was found that artificially sweetened soft drink consumption was associated with an increased risk of stroke and dementia but not sugar-sweetened beverages despite the increased calorific intake (3). Although the study did not find an association between stroke or dementia and the consumption of sugary drinks, this certainly does not mean they are a healthy option. Although concluding that artificially sweetened soft drink consumption was associated with an increased risk of stroke and dementia in people who drink more artificially-sweetened drinks, the study doesn't show that these drinks are the cause of this altered risk. Nevertheless it, is intriguing and at the same time somewhat worrying because a Public Health England initiative at the moment is to decrease added sugar levels in food and drink and by inference, increasing levels of artificial sweetener. As the consumption of artificially sweetened soft drinks is increasing in the community, along with the prevalence of stroke and dementia, future research needs to look at this further and to investigate the mechanisms underlying the reported associations.

1. Paul K. Crane, Glucose Levels and Risk of Dementia New England journal of Medicine September 26, 2013
2. Stephan BC, et al. Increased fructose intake as a risk factor for dementia. J Gerontol A Biol Sci Med Sci 65, 809, 2010
3. Pase M P et al., Sugar and Artificially Sweetened Beverages and the Risks of Incident Stroke and Dementia., Stroke., 48, 1139, 2017
4. Ludwig DS. Artificially sweetened beverages: cause for concern. JAMA. 302, 2477, 2009
5. Fowler SP et al.,. Diet soda intake is associated with long-term increases in waist circumference in a biethnic cohort of older adults,. J Am Geriatr Soc. 63, 708, 2015
6. Rippe J M et al., Fructose-Containing Sugars and Cardiovascular Disease., American Society for Nutrition. Adv Nutr 6:430, 2015

Sugar content of selected common plant foods (g/100g)

Food Item	Total Carbohydrate including "dietary fiber"	Total Sugars	Free Fructose	Free Glucose	Sucrose	Fructose/ Glucose Ratio	Sucrose as a % of Total Sugars
Fruits							
Apple	13.8	10.4	5.9	2.4	2.1	2.0	19.9
Apricot	11.1	9.2	0.9	2.4	5.9	0.7	63.5
Banana	22.8	12.2	4.9	5.0	2.4	1.0	20.0
Fig, dried	63.9	47.9	22.9	24.8	0.9	0.93	0.15
Grapes	18.1	15.5	8.1	7.2	0.2	1.1	1
Navel orange	12.5	8.5	2.25	2.0	4.3	1.1	50.4
Peach	9.5	8.4	1.5	2.0	4.8	0.9	56.7
Pear	15.5	9.8	6.2	2.8	0.8	2.1	8.0
Pineapple	13.1	9.9	2.1	1.7	6.0	1.1	60.8
Plum	11.4	9.9	3.1	5.1	1.6	0.66	16.2
Vegetables							
Beet, Red	9.6	6.8	0.1	0.1	6.5	1.0	96.2
Carrot	9.6	4.7	0.6	0.6	3.6	1.0	77
Red Pepper, Sweet	6.0	4.2	2.3	1.9	0.0	1.2	0.0
Onion, Sweet	7.6	5.0	2.0	2.3	0.7	0.9	14.3
Sweet Potato	20.1	4.2	0.7	1.0	2.5	0.9	60.3
Yam	27.9	0.5	tr	tr	tr	na	tr
Sugar Cane		13–18	0.2 – 1.0	0.2 – 1.0	11–16	1.0	high
Sugar Beet		17–18	0.1 – 0.5	0.1 – 0.5	16–17	1.0	high
Grains							
Corn, Sweet	19.0	6.2	1.9	3.4	0.9	0.61	15.0