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# The Effects of Sugar on Health

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## **Introduction**

Sugar can be found in our everyday lives and can occur in even the most innocuous of places. As well as table sugar that people add to drinks and the more obvious sugary snacks such as sweets, chocolate and fizzy drinks, sugar can be found in a wide variety of “normal” everyday foods – from breakfast cereals and yoghurt, to savoury foods such as ready meals, supermarket bought soups and sauces. Furthermore, when we consider sugar in our bodies, we must also consider that starches (bread, pasta, rice, potatoes) convert to sugar in our bloodstream and generally has the same impact as table sugar.

Sugar has also been used by food manufacturers to increase the attraction of their foods. There are teams of researchers focussed on finding the “bliss point” – the optimal level of sugar at which sensory pleasure is at its maximum – thus creating products which consumers will crave and therefore return to buy. The “low-fat” food industry has also exploited the use of sugar – researchers found that removing fats from foods made their taste deteriorate, so they counter-balanced this by adding more sugar to make them more palatable to the average consumer.

According to the National Diet and Nutrition Survey, which tracked food consumption over the period 2008/2009-2011/2012, adults in the UK consume on average up to 58.8g, or 17 teaspoons, of sugar per day.

The World Health Organisation has recently published draft guidelines recommending that a normal adult’s sugar intake should be no more than 25g, or 6 teaspoons, per day – nearly a third of the average UK adult’s consumption.

This short paper examines some of the reasons why sugar might have a detrimental effect on our health.

## **The problem with sugar**

To understand why sugar consumption is a problem, we need to first understand how our bodies process sugar.

When we consume sugars and starches, this is digested in our intestines to form glucose, which is transported around the body in our bloodstream. This glucose can be taken up by our body’s cells for energy.

To regulate the amount of glucose in our bloodstream, the pancreas releases a hormone called insulin. The more sugar in our bloodstream, the more insulin gets released. Any excess sugar is stored first in the liver and muscles, if glycogen levels are low, which may be the case after say a long run for example. However if glycogen levels in the liver or in the muscles do not need replenishing, the excess sugar is stored as triglycerides in fat cells around the body.

If the body needs more energy, a second hormone called glucagon is released by our pancreas to convert the stored sugar back into glucose, so it can be transported around our bloodstream for absorption by our cells. This process usually happens when blood sugar is low – e.g. between meals or during exercise.

Both insulin and glucagon work together to regulate blood sugar levels. However the problem occurs with the consumption of too much sugar. When we put a high level of sugar into our bodies too quickly, our body releases too much insulin in response to the sugar “flood”. This causes our blood sugar to drop below normal levels, resulting in hypoglycaemia, or a sugar crash. There is a delay between when the sudden sugar crash occurs and when our body starts trying to convert the stored sugars in our bodies back to glucose, and this is when we crave sugar, to replenish the sugar our body thinks it has lost. So we take on even more sugar, and the process starts again.

A further complication is that the consumption of fructose (fruit sugars, which is where table sugar is derived from) has been shown to increase the resistance of the brain to leptin – the protein which tells your body that it is full and satiated.

To put this into perspective one can of Coca-cola contains 35g of sugar (approximately 7 teaspoons). This is 10g more than the WHO's recent recommendation regarding daily sugar allowance.

### **Why we love sugar**

Human beings are designed to crave sugar. If you consider the caveman days, when humans had to hunt for or gather their food, sugar was hard to come by. Humans may have eaten the occasional fruit and would have recognised sugar as an instant energy source, however the availability of sugary foods was limited.

As part of our evolution, humans therefore recognise sugar as a means of survival, and are therefore naturally designed to seek out sugary foods in time of need. You may therefore begin to imagine why this starts becoming an issue in a world where sugar is so readily available.

Sugar has also been shown to have a similar effect on our brains as any addictive substance. Chemically speaking, dopamine is released in our brains when we consume drugs, nicotine or alcohol, leaving individuals to seek that "high" and ultimately resulting in addiction. Whenever we eat food, dopamine is released in the brain, however after eating the same food again and again, the dopamine levels begin to even out and we no longer find the same foods as satisfying. This is an evolutionary tactic, to ensure that we are constantly eating a large enough variety of food so that our bodies receive the nutrition it requires.

Interestingly enough, no matter how much sugar a person consumes, dopamine levels will never even out enough to discourage an individual from eating more sugar. Laboratory experiments with rats have shown that signs of sugar dependency developed over the course of 10 days. People who have tried to cut down on sugar have often reported withdrawal symptoms akin to drug withdrawal symptoms; for example, dizziness, headaches, fatigue, irritability, shakes and mood swings.

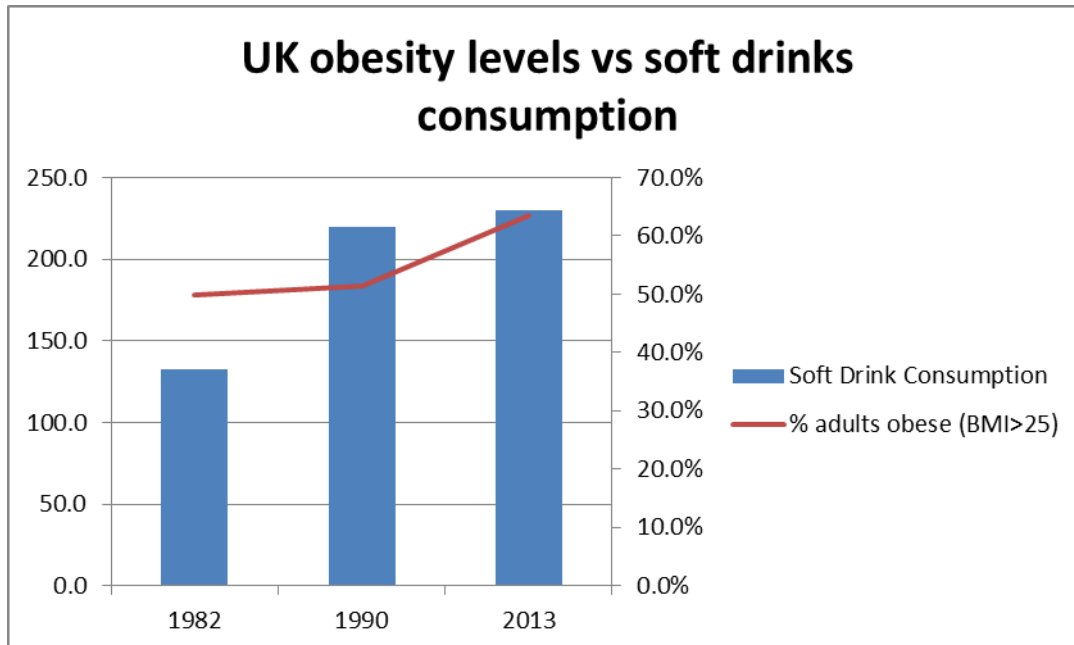
### **Impact on health**

Apart from the impact on fat storage and therefore obesity, sugar also has many other implications for our health:

1. It can lead to tooth decay, as it provides easily digestible energy for the harmful bacteria in our mouths
2. Too much sugar stresses the liver, and the build-up of fat in the liver can ultimately lead to Non-Alcoholic Fatty Liver Disease
3. Too much glucose in the blood can lead to insulin resistance, which in turn is a driver for many diseases such as metabolic syndrome, cardiovascular disease, obesity and Type 2 diabetes
4. Increased risk of cancer – cancer is caused by uncontrolled growth and multiplication of cells, and insulin is one of the key hormones regulating this sort of growth. Many scientists believe that constantly elevated levels of insulin can therefore contribute to cancer. In addition, increased sugar consumption can lead to increased inflammation as a result of metabolic problems, and this in turn can be another potential cause of cancer.

5. Too much sugar leads to increased triglycerides, increased LDL cholesterol (the bad cholesterol), raised insulin and blood glucose levels and increased abdominal obesity – all major risk factors for heart disease. Studies have shown that it takes as little as 10 weeks of raised sugar consumption to increase these levels.

The following graph demonstrates the worrying picture of growing obesity vs soft drink consumption in the UK:



### Considerations for life / health insurance

There is some evidence to demonstrate that sugar consumption levels can result in higher risk of developing obesity, diabetes, cardiovascular disease and cancer. It might therefore be appropriate to use sugar consumption as a rating factor in the underwriting process. In theory, if we could measure the level of a person's sugar consumption, we could calculate the risk of even a healthy individual developing a disease.

Current rating factors measure levels of cholesterol, blood glucose and abdominal obesity - however these are measures of risks that have already occurred. Individuals could answer questions about their food habits to give us an idea of the amount of sugar they are consuming - however this is highly dependent on the individual's memory and on them answering the questions accurately and honestly. We need some way of measuring the amount of glucose that goes into someone's mouth or digestive system over a certain period of time. If such a test were available, this may be a good indicator of future health before a disease develops.

It looks like measuring sugar consumption is not too distant a possibility, based on the following developments:

- 1) In the health world, there already exists a technology called the Continuous Glucose Monitor (CGM) for diabetics, something that became available commercially around 4-5 years ago. This involves putting a tiny sensor under the skin of an individual's stomach, which automatically measures blood glucose levels every five minutes, and sends a signal to a receiving device. The CGM will sound an alarm if blood sugar drops below a certain level. Currently there is a list of FDA-approved smartphone apps, which pair with the device. Such apps also exist on the more recently released Apple Watch, and although the technology is still being further developed, it is set to become more readily accessible in the world of wearable technology.

- 2) An article published in the June 2013 edition of the Journal of Nutrition reported that researchers in the United States have recently identified a biomarker for dietary sugar, which would enable detection of habitual sugar intake from a hair or blood sample. The methodology is still being developed but it would appear that such a test may become available in the not too distant future.
- 3) Other non-invasive methods of measuring blood glucose levels also now exist – an example is a device called Gluco-Wise, which was developed in 2014. This device measures blood sugar levels simply by gently squeezing the skin between the thumb and forefinger, or the earlobe, and connects wirelessly to a smartphone app, giving users a pain-free and non-invasive method of continuously measuring their blood sugar.

We can see that with the examples of technology and medical advances development above, it may soon be possible to measure sugar consumption simply with the aid of wearable technology in the future. Should this become a reality, sugar is only one part of the picture - we should also consider the impact of salt and fat consumption on an individual's future health.



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