

WHAT IS FRUCTOSE AND HOW DOES IT MAKE SWEET DRINKS DANGEROUS FOR YOUR HEALTH?

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YOUNG REVIEWERS:



ARASI

AGE: 9



NOAH

AGE: 11

Nowadays, overweight and obesity are increasing in young people, resulting in several health problems. New scientific evidence shows that consuming too much fructose, a basic type of sugar, can cause some of these problems. Sugary foods such as soft drinks are sweetened with syrups that have very high fructose content. Drinking too much of these beverages results in weight gain from the accumulation of body fat. Scientists have also found that, in children, consuming excessive amounts of fructose can harm the liver, lungs, and heart. This article will explain how fructose in sweetened beverages leads to overweight and obesity in children and adolescents, highlighting the alarming number of young people all over the world who suffer from these diseases and what can be done to prevent this situation.

OBESITY

A health condition in which a person is very overweight.

SIMPLE SUGAR

The smallest molecules that sugars are made.

Figure 1

Fructose and glucose are simple sugars, which means they cannot be divided into simpler molecules. In contrast, one molecule of sucrose consists of two molecules (one fructose and one glucose) joined by a chemical bond.

HIGH-FRUCTOSE CORN SYRUP

Sweet syrup obtained from corn through chemical reactions.

ENZYMES

Molecules that make a chemical reaction happen faster.

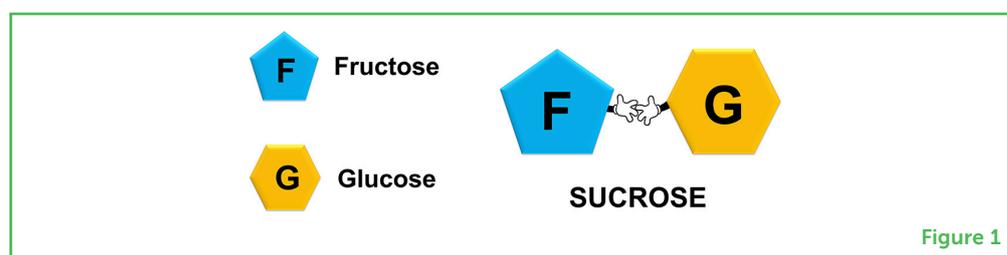
INTRODUCTION

Diseases related to overweight and **obesity** can directly affect a person's health, financial situation, and wellbeing. In young people, these problems can also reduce school performance and may trigger a series of diseases in adult life. Nowadays, there seems to be an epidemic of overweight and obesity in young people worldwide. How did this happen?

This article will take a look at how this alarming situation is connected to consuming too much of a sugar called fructose in sugary drinks. As you read, you will first learn what fructose is, how it is made, and why it is used in drinks. Then, you will find out how your brain can become used to the consumption of sugary drinks and how this can cause health problems in young people. Finally, you will learn about how serious this situation is all over the world, especially in Latin America, and how we can prevent it from happening to even more people.

WHAT IS FRUCTOSE AND HOW MUCH SHOULD WE CONSUME?

Sweetened or sugary drinks are products that are made with water, flavors, and various sugars, like sucrose, glucose, or high-fructose syrups. Sucrose is the granulated table sugar you probably use at home. Each granule of sugar is made up of many tiny molecules. One molecule of sucrose is made up of two smaller molecules called **simple sugars**: one molecule of glucose and one molecule of fructose (Figure 1). Sucrose is normally obtained from plants like sugar cane or sugar beet, and glucose and fructose are naturally present in honey and fruit. However, when a big factory needs a lot of simple sugars to make sweet drinks, it is cheaper and easier to make glucose and fructose from other natural sources, like corn, through chemical reactions.



Most sugary drinks are made with a sweetener called **high-fructose corn syrup**. This syrup is obtained from corn because this plant is rich in glucose. To extract the glucose, the cornstarch is hydrolyzed, which means that it is cooked in water with special chemicals called **enzymes**, which help to break down the cornstarch into glucose. In

the next step, the glucose is transformed into fructose, with the help of another enzyme. At the end of this long process, we get a very sweet syrup, almost entirely made up of fructose molecules. Depending on what it will be used for in food factories, the high-fructose corn syrup is mixed with glucose and other sugars, but usually about half of the syrup volume is pure fructose. Who would have thought such a sweet syrup could be made from corn!

Many beverages that we drink every day are sweetened with high-fructose corn syrup, including soft drinks, energy drinks, fruit juices and nectars, flavored milk, and many others. Children really like to drink many of these readily available beverages. However, the American Heart Association recommends that children and adolescents do not add more than five extra tablespoons of sugars to their diets per day. This amount is approximately equal to one sugary drink a day! The bad news is that consuming more than the recommended amount of sugar can cause many health problems, including tooth cavities, overweight, obesity, diabetes, fatty liver disease, and sores in the digestive tract. Excess sugar can also cause memory disorders that can negatively affect language skills, behavior, and learning abilities [1]. Sounds terrible, right? But those sweet drinks taste so good!

WHY DO SUGARY DRINKS TASTE SO DELICIOUS?

The brain is the organ that controls the entire body. When you perform certain activities, your brain experiences pleasure—and this motivates your brain to make you repeat those activities. For example, when you drink something sweet you get a feeling of happiness, which is regulated by the reward system in your brain. The reward system is physically made up of several circuits of brain cells called **neurons**. Brain neurons are connected to each other as well as to the body. Neurons send messages to the rest of the body that control activities like muscle movements, habit formation, learning, decision making, memory, pleasure behaviors, and many others. The chemical signals that neurons use to send messages are called **neurotransmitters**.

Dopamine is an important neurotransmitter that is specifically involved with the feeling of pleasure. Dopamine works in parts of the brain called the ventral tegmental area, nucleus accumbens, frontal lobe, and amygdala (Figure 2). When you do something rewarding, like drinking a sweetened beverage, dopamine is released in these brain areas, causing you to feel happy and your body to feel good. This is why you are tempted to consume sugary drinks more often, which can lead to a habit—eventually you cannot help yourself and need to drink more and more [2].

NEURONS

Brain cells which send messages to the rest of the body that control activities.

NEURO-TRANSMITTERS

Chemical signals responsible for communication between neurons.

DOPAMINE

Substance produced in the brain involved with the feeling of pleasure.

Figure 2

The reward system in the brain is made up of the ventral tegmental area, nucleus accumbens, frontal lobe, and amygdala, which are directly involved with the feelings of pleasure that come from activities like drinking sugary drinks.

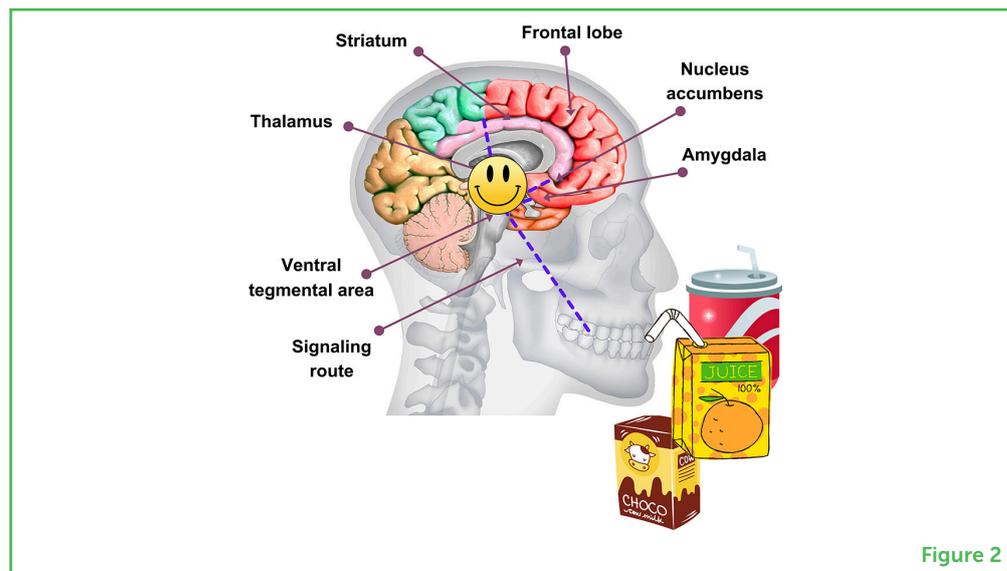


Figure 2

HOW ARE SUGARY DRINKS RELATED CERTAIN DISEASES?

High-fructose corn syrup is the key factor in the relationship between sweetened beverages and overweight, obesity, and accompanying diseases like diabetes, heart problems, and high blood pressure. When people consume too much fructose, they gain body weight and their livers get fat. But why does this occur?

The liver is the organ that **metabolizes** sugars, which means that it breaks them down into energy for the muscles. The liver also controls how much energy the body needs and stores the excess as fat. The problem with fructose is that the body sometimes absorbs and metabolizes this sugar very differently than glucose. To break down fructose, the body actually *uses* energy. So, when we consume fructose, our energy levels go down and our bodies create new fat more easily, especially in the belly area. Also, beverages sweetened with high-fructose syrups do not satisfy hunger the same way that solid foods, such as meat or bread, do. This means that fructose tricks the body into thinking that it has not consumed any calories, which leads to eating more food and, eventually, to an increase in weight [3].

Scientific studies have also shown that excessive consumption of fructose by children and adolescents can cause asthma, bronchitis, heart diseases, and other serious health problems [4]. In other words, drinking sugary drinks sweetened with fructose can not only cause you to get fat, but can also cause you to get seriously ill.

ALARMING NUMBERS

Although the epidemic of overweight and obesity in children and adolescents is growing rapidly all over the world, Latin America and

METABOLIZE

To break down food to produce energy for the body.

the Caribbean are experiencing this epidemic more rapidly. In 2016, Mexico, Chile, and Argentina had the most overweight and obese children and adolescents in the whole Latin American region (Figure 3A) [5]. According to the Organization for Economic Cooperation and Development (OECD), which has members from 38 countries around the world, almost a third of children in its member countries between 5 and 9 years old are overweight. But this number is not the same for all countries—some have more overweight children than others. In 2016, only one in four children was overweight in Japan, Estonia, Lithuania, Switzerland, and Latvia. In contrast, one of every two children was overweight in the United States of America, Italy, New Zealand, and Greece (Figure 3B) [6].

Figure 3

(A) Data for overweight and obesity in Latin America in 2016. Mexico, Chile, and Argentina had the most overweight and obese children in 2016. “America” includes the United States of America, Canada, and the Caribbean (Data were modified from [5]) (B) Worldwide data showing less overweight in green/yellow and more overweight in orange/red for children 5–9 years old, from the countries that made up OECD in 2016. In the United States of America, Italy, New Zealand, and Greece, one of every two children was overweight in 2016 (Data were modified from [6]).

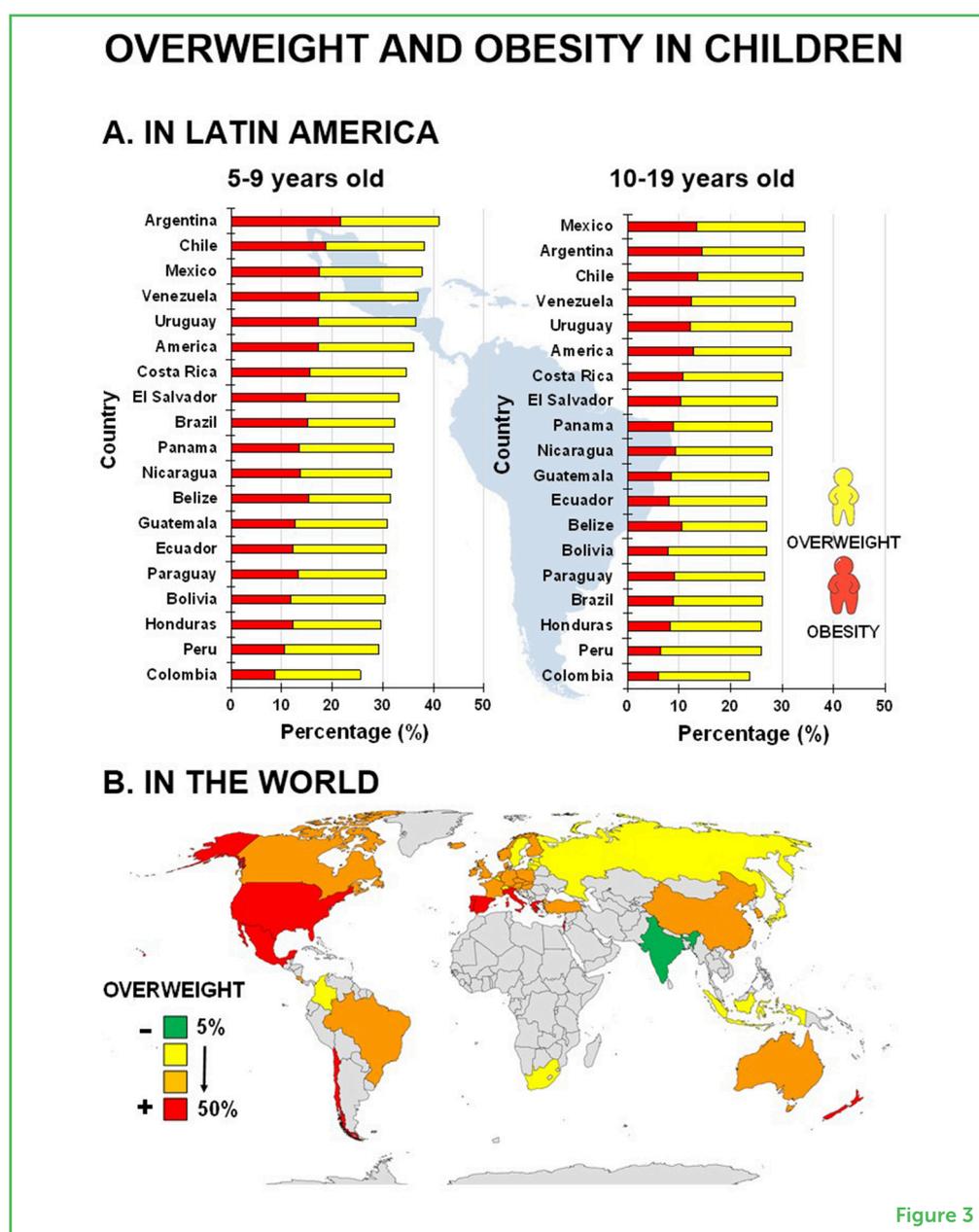


Figure 3

These numbers are alarming, right?! Will you continue to consume sweetened beverages, or will you think twice before doing so?

CONCLUSIONS AND RECOMMENDATIONS

Overweight and obesity in children and adolescents, along with diseases related to these conditions, like diabetes, heart problems, and high blood pressure, can be prevented. If *you* want to decrease *your* risk, you can start by changing your behavior and your lifestyle. For example, you can avoid sweet and fatty foods, including drinks sweetened with syrups that have high fructose content. When you go shopping for food and drinks, try reading the labels on the packaging to find out how much fructose those items contain. That way, you can decide whether you want buy those foods or choose something else. There are other things you can do to fight obesity: you can do the kind of exercise you like most, eat more fresh fruits and vegetables, and drink lots of water every day. You can also share what you have learned about sugary drinks with your classmates, friends, and family, to teach them more about the negative effects that too much fructose can have on their health!

ACKNOWLEDGMENTS

This work was supported by the CONACYT (Consejo Nacional de Ciencia y Tecnología de México) National Grant 2019 awarded to EN-M (grant number 780022) and by the University of Guanajuato (grant number 095/2022). The authors would like to thank Dr. Stanislav Mulík for his valuable contribution in revising the English version of this paper.

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SUBMITTED: 05 March 2022; **ACCEPTED:** 04 November 2022;

PUBLISHED ONLINE: 23 November 2022.

EDITOR: Atsushi Asakura, University of Minnesota Twin Cities, United States

SCIENCE MENTORS: Alison K. Ventura and Medha Priyadarshini

CITATION: Nieto-Mazzocco E, Franco-Robles E, Jaramillo-Morales OA and Ozuna C (2022) What Is Fructose and How Does It Make Sweet Drinks Dangerous for Your Health? *Front. Young Minds* 10:890406. doi: 10.3389/frym.2022.890406

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YOUNG REVIEWERS

ARASI, AGE: 9

Hola Amigo! I am Arasi. I am in 3rd grade. I love to dance, play the piano, and draw! In my free time, I read books, my favorite series are diary of a wimpy kid, and dork diaries. My favorite colors are pastel pink and purple, and mint green. When I grow up, I want to be a lawyer. I just want to say, for a better world, kindness is the way to go!

Addios!

NOAH, AGE: 11

I am a 11 year old kid named Noah. I like to code and read during my free time, and can type at over 40 words per minute. I like to play the piano, and know two guitar chords. My favorite song to play is "Turkish March," by Ludwig van Beethoven. When I grow up, I would like to become a teacher.



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