

CHAPTER 1

THE FRUCTOSE FACTOR

A Sugar Like No Other

A century ago, few Americans were overweight. Heart disease and diabetes were rare medical conditions. Today, people who are plump and paunchy outnumber those who are thin and fit in the United States and many other parts of the world. Heart attacks are the leading cause of death. The incidence of diabetes has exploded into a full-blown epidemic.

What happened? How could such dramatic changes to overall health occur during this relatively brief period in human history? I believe the rise of obesity and these formerly rare diseases can largely be traced to a single factor. Unlike a disease-carrying microbe, however, this culprit is hiding in plain sight—on the shelves at your local supermarket, in the cooler at the convenience store, and very likely in your refrigerator and kitchen cupboard.

The goal of this book is to help you understand, identify, and avoid this menace. What's more, I am going to show you how to reverse the damage it may have already caused in your system.

You don't need to be a doctor or scientist to see the most obvious signs of this scourge's handiwork. Simply walk through a shopping mall or playground—that is, if you haven't already noticed the problem in your bathroom mirror. In other words, consider how the American physique has changed over the years.

In the 19th century, few people in this country worried about their waistlines. It's not that our ancestors didn't care about their weight. The fact is, fat people were extremely rare, typically found among the upper class. After all, only the wealthy could afford to overindulge in rich, decadent foods back then. In 1890, for example, a survey of more than 5,000 white males in their fifties found that just 3.4 percent were obese.

However, that once-lean population has gone the way of hoop dresses and top hats. Today, 32 percent of Americans are obese. What's more, according to the Centers for Disease Control and Prevention, an additional one-third of Americans are overweight, meaning they are not quite obese but still have an unhealthy amount of body fat. When you do the math, it adds up to an alarming problem: Two-thirds of Americans are either obese or overweight. However, unlike in the 19th century, weight problems afflict all segments of the population—rich and poor, young and old, every race and educational background. The nation's schoolyards may offer the most disturbing view of this epidemic: One in three children in the United States is overweight or obese.

Doctors and public health authorities are alarmed by the nation's growing girth for good reason. Carrying around excess weight increases the risk for deadly conditions such as heart disease, diabetes, and kidney disease. What's more, being fat in a culture that idolizes slender and beautiful celebrities can be psychologically crippling. But what's most worrisome, and most puzzling, is why obesity rates are rising so rapidly. On the eve of the American bicentennial—in 1975, when the nation had been in existence for nearly 200 years—the obesity rate in the United States reached 15 percent. Since then, in a period of just 30 years, the obesity rate more than *doubled*.

Why? What has caused America to become so flabby so fast?

Frustrated dieters often blame their genes. Perhaps you have tried to lose weight in the past, but you couldn't shed those extra pounds. Or maybe you managed to trim down, but the weight eventually returned. If so, in the back of your mind, you may have been tempted to blame your parents. After all, if you have your mother's eyes or your father's smile, doesn't it make sense that you got your chunky thighs or bulging belly from them, too?

In fact, scientists have isolated genes that may be linked to obesity. But we merely inherit a *tendency* for one body shape or another from our parents. Whether or not you become overweight and obese depends largely on the lifestyle choices you make—that is, what foods you eat and how much exercise you get. Further, when you consider the bigger picture, it's hard to imagine how genetics could possibly be blamed for the current rapid rise in obesity. After all, the human genetic code dates back millennia. Has some mutation in the human genome occurred across the US population during the past 3 or 4 decades that is causing widespread uncontrollable weight gain? That's highly unlikely. In fact, such a genetic alteration would have to be occurring in populations all over the world, because obesity rates are rising in countries across the globe.

Instead, something must have changed in our environment that is exploiting the human tendency to accumulate body fat. A couple of obvious candidates come to mind. For instance, you no longer need to be wealthy to eat a waist-expanding diet. Thanks to advances in farming, manufacturing, and shipping, delicious high-calorie foods are cheap and widely available. Meanwhile, Americans burn fewer calories each day than our ancestors did, due to the rise of laborsaving devices, from the lawn mower to the laptop computer.

But while there is no doubt that Americans eat too much and don't exercise enough, I believe that some other mechanism has contributed to the disturbing and unprecedented weight gain that has swept across the United States in recent years. Reams of data that have emerged from research labs over the past decade indict a specific food: a common form of sugar called fructose that most of us eat every day.

Americans consume 30 percent more fructose today than in 1970. Our rising consumption of this sugar began at roughly the same time that obesity rates in the United States were climbing sharply. In the pages that follow, I will explain why I believe these corresponding trends are intimately linked—why feeding on so much fructose is fueling a public health catastrophe in the United States, and how you can lose weight and safeguard your overall health by limiting your exposure to this dangerous sweetener.

The Fructose Connection

Fructose has always been part of the human diet, since the first hungry forager plucked an apple from a tree or berries from a bush. That's because fructose, as the name suggests, is the main form of sugar found in fruit. Honey is another abundant natural source. What's more, half of every crystal of refined sugar consists of fructose, too.

If you have read much about fructose lately, that's probably because it is the critical component in a controversial sweetener called high-fructose corn syrup (HFCS), which is used in a wide variety of processed foods and beverages. Most brands of soda and many kinds of candy contain HFCS. If you were to start reading product labels, you'd find that HFCS is also in many foods that might surprise you, such as pasta sauce, yogurt, soups, ketchup and other condiments, and sandwich bread. In 1970, the average American consumed less than ½ pound of HFCS per year. By 2000, per capita consumption of the corn-based sweetener had risen to more than 42 pounds per year.

Critics call HFCS “Frankensyrup” and other damning names, blaming it for the current outbreak of obesity, especially among children in the United States. In later chapters, I'll examine HFCS more closely and sort out some of the claims its defenders and detractors have made. For now, though, here's the important point: There is mounting scientific evidence that consuming too much fructose, no matter where it comes from, can make you fat and increase your risk for high blood pressure, heart disease, diabetes, and kidney disease.

Fructose and Your Waistline

In the past generation, scientists from all over the world have begun to closely examine fructose and its effects on human health. My colleagues and I at the University of Florida are actively involved in this research. We have made a number of discoveries about changes that occur in the body from consuming fructose and certain other foods and how they can cause weight gain and health problems. Our work, along with investigations conducted by other scientists, strongly suggests that America's fondness for fructose-rich foods is fueling the obesity epidemic. I will discuss these findings in greater detail throughout this book, but here is a snapshot of what we have learned so far.

Eating a high-fructose diet causes rapid weight gain. Eating too much of any form of sugar will make you fat. However, recent studies—performed in my laboratory, as well as by other scientists—have found that animals gain weight very quickly and develop other unhealthy symptoms when they eat too much fructose. Yet the same thing does *not* occur when animals are fed equal amounts of other sugars. In other words, eating fructose appears to cause greater weight gain than other forms of sugar, *even if the same number of calories is consumed.*

High-fructose foods do not satisfy your appetite. When you eat most types of sugar, your body responds by producing appetite hormones, which signal your brain that your body has consumed enough food to meet its energy needs. As this occurs, feelings of hunger subside. But unlike other sugars, fructose escapes the attention of appetite hormones. Because of this phenomenon, your brain never gets the message that your body has consumed a load of calories. As a result, the appetite center in your brain remains unsatisfied, so you continue eating. In one study, subjects felt hungrier after drinking beverages sweetened with fructose than they did after drinking beverages that contained another simple sugar, glucose. This may mean that fructose tricks you into eating more calories than your body needs. The result? You gain weight.

High-fructose foods may interfere with the signaling system that controls your appetite for *all* foods. We have discovered another way in which a high-fructose diet encourages overeating. Chronic consumption of sugary foods seems to promote biochemical changes that prevent the brain from receiving messages from appetite hormones—even when you are not consuming fructose. We have shown that this phenomenon leads to substantial weight gain in animals, and some studies suggest that it occurs in humans who consume too much fructose, too.

Fructose may sabotage weight-loss efforts. Your body does not metabolize fructose in the same way that it processes other sugars. When fructose enters a cell, enzymes break it down. Unfortunately, the actions of these enzymes raise blood pressure, increase blood levels of artery-clogging fat, and eventually cause obesity. As if that weren't bad enough, eating fructose actually increases your body's production of the very enzymes that cause all of these problems. Over time, your body may produce such a high concentration of these enzymes that eating foods

that contain even a small amount of fructose will set in motion all of the powerful biological changes that we believe cause obesity, cardiovascular disease, diabetes, and other related conditions. This phenomenon may help explain why obese people struggle to lose weight and keep it off: Their bodies become ultrasensitive to fructose.

People who consume a lot of soft drinks and fruit juice—two major sources of fructose—tend to be overweight. Several large population studies have shown that people who drink beverages sweetened with fructose are more likely to be overweight than people who avoid soft drinks and juice. The “Supersize Me!” phenomenon is partly to blame. HFCS is cheaper than refined sugar, so fast-food restaurants and the beverage industry have been able to sell extra-large servings of soda and other fructose-rich beverages at low prices, which has led people to consume more calories. Soft drinks appear to pose another problem for anyone trying to control their weight and stay healthy. Consuming fructose rapidly—the way you might when gulping down a cola or bottle of fruit juice—causes levels of this sugar to soar in the blood. Studies suggest that could lead to greater weight gain.

Beyond Obesity

As every doctor learns in medical school, obesity raises the risk for many common conditions, including heart disease, high blood pressure, diabetes, and kidney disease, among others. As I just explained, strong evidence suggests that consuming too much fructose will make you gain an unhealthy amount of weight. Recent research has revealed that exposing the body to too much fructose makes you sick in other ways, independent of its effect on weight. In fact, I believe that consuming excessive amounts of fructose not only is making the United States one of the fattest nations in the world, but it also is hastening the rise of several of the leading killers in this country.

Indeed, even if you are currently eating a low-calorie diet and you are at a stable weight—or even if you are currently *losing* weight—you may still be creating health problems if your diet contains too much fructose. Actually, you could end up developing many of the complications associated with obesity, *even though you are not obese*. With this in mind, it’s worth noting that rates of several other serious conditions, in addition

to obesity, have soared at the same time that consumption of fructose has risen.

High blood pressure. Over the past 30 years, the number of Americans with high blood pressure has climbed by 20 percent. About 73 million people in this country have high blood pressure, also called hypertension, making it the most common disease in the United States. While hypertension often has no symptoms, it can have serious consequences, because it raises the risk for stroke, heart failure, and kidney disease.

Type 2 diabetes. The incidence of diabetes in the United States has increased by about 35 percent since 1994. A rare disease in this country as recently as the late 19th century, diabetes now affects more than 20 million Americans. New cases of type 2 diabetes account for almost all of this dramatic rise. This condition used to be called adult-onset diabetes, but its name was changed to reflect the unfortunate new reality: Like obesity and hypertension, type 2 diabetes has become commonplace among children and adolescents.

Kidney disease. During the past quarter-century, the incidence of end-stage renal disease, or kidney failure, has nearly quadrupled. Meanwhile, about 20 million Americans have mild to moderate degrees of kidney disease. Unfortunately, while treatment can slow its progression, there is little we can do to stop it completely.

Liver disease. In the past, a condition known as fatty liver occurred primarily in poorly nourished alcoholics. Now we know that too much nourishment—that is, overeating, which results in obesity—can cause a condition called nonalcoholic fatty liver disease (NAFLD). Once exceedingly rare, NAFLD now affects 15 to 30 percent of Americans, including 6.5 million children. This disease can lead to complete liver failure and has become one of the most common reasons for liver transplantation. Recent studies by our group strongly suggest that consuming too much fructose may cause this condition.

Metabolic syndrome. Perhaps the best way to sum up the troubling state of overall health among Americans is to consider the rising number of adults in this country who have metabolic syndrome. Physicians use this term (which replaced *syndrome X*) to describe a cluster of conditions that includes obesity, high blood pressure, elevated blood

fats, and insulin resistance. Having metabolic syndrome increases the risk for heart disease, strokes, diabetes, kidney disease, and other leading causes of death. During the 1990s, the portion of the American population with metabolic syndrome rose by a stunning 25 percent, to 55 million.

How do we know that consuming too much fructose is driving up rates of these various conditions? You could argue that these diseases are becoming more common simply because Americans are living longer. Thanks to the introduction of better public hygiene, immunizations, antibiotics, and other improvements to our health-care system over the past century, more people are living to ripe old ages. As the median age continues to rise in the United States—the oldest baby boomers turned 60 in 2006—a growing number of people are middle-aged or older, which is when many of us gain weight and develop features of metabolic syndrome.

That said, the current epidemic of obesity and metabolic syndrome in the United States and much of the world can't be blamed entirely on aging. If that were true, only older people would be getting fatter and sicker. To see that this is not the case, visit an elementary school or sit in the waiting room of a pediatric clinic. Obesity, hypertension, diabetes, and kidney disease are becoming more common among people of all ages, including our children. In other words, we're getting fatter and sicker not because we're living longer but because of how we live.

High-Fructose Fallout

If fructose were on trial, then so far all we'd have is circumstantial evidence against it. We know that rates of obesity and metabolic syndrome have multiplied in this country at the same time that Americans have been on a fructose binge. But that's not enough to prove that this sugar is the guilty party. To demonstrate that consuming too much fructose is contributing to ill health, we need to know *how* it causes metabolic problems in the first place. Fortunately, we're learning more every day about fructose's dark side. For example, studies show the following:

A high-fructose diet causes high blood pressure. Overloading the body with fructose raises blood pressure. As we will discuss in later chapters, this seems to occur because fructose increases blood levels of

a compound called uric acid. Other forms of sugar do not raise uric acid, so they do not appear to have any effect on blood pressure.

A high-fructose diet raises levels of unhealthy blood fats. Fructose causes liver cells to produce triglycerides, a type of blood fat. Fructose also lowers HDL cholesterol, which is the “good” kind of cholesterol that guards against heart disease. Other forms of sugar do not have this effect on the liver. By raising triglycerides and lowering HDL cholesterol, a high-fructose diet may lead to blockages in the arteries that promote heart disease. Eating a high-fructose diet may also increase deposits of triglycerides within liver cells, causing swelling and damage. Over time, this damage could lead to fatty liver disease and eventually cirrhosis.

A high-fructose diet causes insulin resistance. Eating fructose for extended periods can make cells less responsive to insulin. People who develop the condition known as insulin resistance are at increased risk for type 2 diabetes and high blood pressure.

A high-fructose diet causes kidney disease. We have evidence from animal studies indicating that fructose-rich diets cause kidney damage and worsen existing kidney disease. Other forms of sugar do not have this effect on kidneys. This discovery is particularly frightening given that physicians often advise patients with kidney disease to eat low-protein, high-carbohydrate diets, which could lead to increased fructose consumption.

The results of research on fructose have been remarkably consistent. While most of these investigations have involved laboratory animals, a growing body of research is demonstrating many of the same effects in humans, too. Meanwhile, millions of people are presently engaging in a massive, uncontrolled trial of fructose and its impact on the human body.

Humans have been consuming fructose for millennia, but it didn’t come to play a major role in our diets until about a century ago. Since then, fructose consumption has risen sixfold in the United States. In the next chapter, I will examine how our diets became dominated by food and drink sweetened with the two major sources of fructose: sugar and HFCS.