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## [Robert Lustig, M.D.](http://www.huffingtonpost.com/robert-lustig-md)

Professor of Pediatrics, UCSF Benioff Children’s Hospital

# Still Believe 'A Calorie Is a Calorie'?

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If you do, you fly in the face of mounting and incontrovertible evidence that some calories -- in particular, "sugar calories" -- are jeopardizing both your and your family's health. Physicians and politicians who cling to the dogma that "all calories should be treated equally" imperil our country's health care system, food supply and standing in the world for the next hundred years.

A calorie is a measurement of energy (a matter of physics), not a value judgment on where that energy goes (a matter of biochemistry). As my book [*Fat Chance*](http://www.amazon.com/Fat-Chance-Beating-Against-Processed/dp/159463100X) explains, you get sick from inappropriate energy storage (in your liver and muscle), not defective energy balance (bigger love handles). Nonetheless, "a calorie is a calorie" continues to be promulgated by the food industry as their defense against their culpability for the current epidemic of obesity and chronic metabolic disease. But it is as dishonest as a three-dollar bill. Here are just four examples that refute this dogma:

1. **Fiber.** You eat 160 calories in almonds, but you [absorb only 130](http://www.ncbi.nlm.nih.gov/pubmed/22760558). The fiber in the almonds delays absorption of calories into the bloodstream, delivering those calories to the bacteria in your intestine, which chew them up. Because a calorie is not a calorie.
2. **Protein.** When it comes to food, you have to put energy in to get energy out. You have to put [twice as much energy](http://www.ncbi.nlm.nih.gov/pubmed/21228266) in to metabolize protein as you do carbohydrate; this is called the thermic effect of food. So protein wastes more energy in its processing. Plus protein [reduces hunger](http://www.sciencedaily.com/releases/2006/09/060905225848.htm) better than carbohydrate. Because a calorie is not a calorie.
3. **Fat.** All fats release nine calories per gram when burned. But omega-3 fats are heart-healthy and will save your life, while [trans fats](http://www.ncbi.nlm.nih.gov/pubmed/22583051) clog your arteries, leading to a heart attack. Because a calorie is not a calorie.
4. **Sugar.** This is the "big kahuna" of the "big lie." Sugar is not one chemical. It's two. Glucose is the energy of life. Every cell in every organism on the planet can burn glucose for energy. Glucose is mildly sweet, but not very interesting (think molasses). Fructose is an entirely different animal. Fructose is very sweet, the molecule we seek. Both burn at four calories per gram. If fructose were just like glucose, then sugar or high-fructose corn syrup (HFCS) would be just like starch. But fructose [is not glucose](http://www.ncbi.nlm.nih.gov/pubmed/20800122). Because a calorie is not a calorie.

Up until now, scientists have shown that sugar is "associated" or "correlated" with various chronic metabolic diseases. For instance, the increase in sugar consumption over the past 30 years [paralleled the increase](http://www.ncbi.nlm.nih.gov/pubmed/20407058) in obesity, diabetes and heart disease. Areas that drink more soda (e.g., the American Southeast) experience [higher prevalences](http://www.cdc.gov/heartdisease/maps_statistics.htm) of these diseases. But correlation is not causation.

Which direction do the data go? Does sugar cause obesity and metabolic disease? Or do obese people with metabolic disease drink soda? You can't tell, because you only have one point in time -- the snapshot, not the movie. In the February 27 issue of the journal PLoS One, my colleagues Dr. Sanjay Basu, Paula Yoffe, Nancy Hills and I put this issue to rest, because we now have the movie.[1]

We asked the question, "What in the world's food supply explains diabetes rates, country-by-country, over the last decade?" We melded databases from the Food and Agriculture Organization ([FAOSTAT](http://faostat.fao.org/?lang=en)), which measures food availability, the International Diabetes Federation ([IDF](http://www.idf.org/)), which measures diabetes prevalence, the World Bank [World Development Economic Indicators](http://data.worldbank.org/data-catalog/world-development-indicators), and the World Health Organization [Global Infobase](https://apps.who.int/infobase/). We assessed total calories; meat (protein); oils (fat); cereals (glucose); pulses, nuts, vegetables, roots, and tubers (fiber); fruit excluding wine (natural sugar); and sugar, sugarcrops, and sweeteners (added sugar). We controlled for poverty, urbanization, aging, and most important, obesity and physical activity.

Bottom line -- only changes in sugar availability explained changes in diabetes prevalence worldwide; nothing else mattered.

Total caloric availability was unrelated to diabetes prevalence; for every extra 150 calories per day, diabetes prevalence rose by only 0.1 percent. But if those 150 calories per day happened to be a can of soda, diabetes prevalence rose 11-fold, by 1.1 percent (and Americans on average consume the added sugar equivalent of [2.5 cans of soda](http://circ.ahajournals.org/content/120/11/1011.full.pdf) per day, so that's 2.75 percent!). And this effect of sugar was exclusive of obesity; controlling for body mass index did not negate the effect. Even more important, we showed that the change in sugar availability preceded the change in diabetes (that's cause, not effect); and we showed directionality -- those countries where sugar availability rose showed increases in diabetes, while those where sugar availability fell showed decreases in diabetes. This is a very robust signal, with little noise. While epidemiology can't prove scientific causation, the data allow for objective inference. Sugar drives diabetes worldwide, and unrelated to its calories.

When you do the math, fully one-quarter of the world's diabetes is explained by sugar alone.

The food industry has contaminated the American food supply with added sugar to "sell more product" and thereby uphold their Wall Street mandate to increase profits. Of the 600,000 food items in the American grocery store, [80 percent](http://www.ncbi.nlm.nih.gov/pubmed/23102182) have been spiked with added sugar; and the industry uses 56 other names for sugar on the label. They know when they add sugar, you buy more. And because you do not know you're buying it, you buy even more.

The outcome: By the year 2050, [one-third](http://www.ncbi.nlm.nih.gov/pubmed/20969750) of all Americans will have diabetes. Trustees of the Medicare program [predict](http://www.forbes.com/sites/aroy/2012/04/23/trustees-medicare-will-go-broke-in-2016-if-you-exclude-obamacares-double-counting/) that Medicare will be broke by 2024. No health care for you. Yet just six weeks ago, Coca-Cola had the temerity to introduce its two-minute ad ["Coming Together,"](http://www.youtube.com/watch?v=zybnaPqzJ6s) in which they say: "All calories count" because a calorie is a calorie; if you're fat, it's your fault (they claim no culpability); and because they make non-caloric drinks, they're part of the solution. The problem is that a calorie is not a calorie; if non-caloric drinks are the solution, then by inference they're saying that caloric drinks are the problem.

Sugar in excess is a toxin, unrelated to its calories. The dose determines the poison. Like alcohol, a little sugar is fine, but a lot is not. And the food industry has put us way over our limit.

The food industry will summon their spin doctors. They will yet again argue that the statistics are wrong, the interpretation is too broad -- but they will not be able to effectively refute the science. They haven't yet, and they won't succeed now. Sunlight is the best disinfectant, and it's shining brightly on the food industry's practices. They will continue the propaganda, and try to sow the seeds of doubt. But they will be on the losing end of this battle. The [UK](http://www.bbc.co.uk/news/health-21478314) and [Australia](http://www.eatforhealth.gov.au/sites/default/files/files/the_guidelines/n55_australian_dietary_guidelines.pdf%20) have just this past week laid down stricter guidelines for sugar consumption. The people and scientists of the United States are onto them as well. It's just a matter of time before the politicians follow.

Robert H. Lustig, M.D., is Professor of Pediatrics at UCSF, and President of the Institute for Responsible Nutrition ([*responsiblefoods.org*](http://responsiblefoods.org)), at which the Doctors' Food Project is the first campaign. He is currently getting his Masters in Studies of Law at UC Hastings College of the Law. His YouTube lecture, "[*Sugar: The Bitter Truth*](http://www.youtube.com/watch?v=dBnniua6-oM)" has been viewed over 3 million times. His book, [Fat Chance: Beating the Odds Against Sugar, Processed Food, Obesity and Disease](http://www.amazon.com/Fat-Chance-Beating-Against-Processed/dp/159463100X) (Hudson Street Press, 2012), is in bookstores now.

**References:**

[1] The relationship of sugar to population-level diabetes prevalence: an econometric analysis of repeated cross-sectional data. Basu S, Yoffe P, Hills N, Lustig RH. PLoS One Epub Feb 27, 2013.

**It’s the Sugar, Folks**

*By* [*MARK BITTMAN*](http://opinionator.blogs.nytimes.com/author/mark-bittman/)



[Mark Bittman](http://opinionator.blogs.nytimes.com/category/mark-bittman/) on food and all things related.

Sugar is indeed toxic. It may not be the only problem with the Standard American Diet, but it’s fast becoming clear that it’s the major one.

[A study published](http://graphics8.nytimes.com/packages/pdf/oped40/Lustig.pdf) in the Feb. 27 issue of the journal PLoS One links increased consumption of sugar with increased rates of diabetes by examining the data on sugar availability and the rate of diabetes in 175 countries over the past decade. And after accounting for many other factors, the researchers found that increased sugar in a population’s food supply was linked to higher diabetes rates independent of rates of obesity.

In other words, according to this study, obesity doesn’t cause diabetes: sugar does.

The study demonstrates this with the same level of confidence that linked cigarettes and lung cancer in the 1960s. As [Rob Lustig](http://www.chc.ucsf.edu/coast/faculty_lustig.html), one of the study’s authors and a pediatric endocrinologist at the University of California, San Francisco, said to me, “You could not enact a real-world study that would be more conclusive than this one.”

The study controlled for poverty, urbanization, aging, obesity and physical activity. It controlled for other foods and total calories. In short, it controlled for everything controllable, and it satisfied the longstanding “[Bradford Hill](http://changingminds.org/disciplines/argument/types_reasoning/bradford_hill.htm)” criteria for what’s called medical inference of causation by linking dose (the more sugar that’s available, the more occurrences of diabetes); duration (if sugar is available longer, the prevalence of diabetes increases); directionality (not only does diabetes increase with more sugar, it decreases with less sugar); and precedence (diabetics don’t start consuming more sugar; people who consume more sugar are more likely to become diabetics).

The key point in the article is this: “Each 150 kilocalories/person/day increase in total calorie availability related to a 0.1 percent rise in diabetes prevalence (not significant), whereas a 150 kilocalories/person/day rise in sugar availability (one 12-ounce can of soft drink) was associated with a 1.1 percent rise in diabetes prevalence.” Thus: for every 12 ounces of sugar-sweetened beverage introduced per person per day into a country’s food system, the rate of diabetes goes up 1 percent. (The study found no significant difference in results between those countries that rely more heavily on high-fructose corn syrup and those that rely primarily on cane sugar.)

This is as good (or bad) as it gets, the closest thing to causation and a smoking gun that we will see. (To prove “scientific” causality you’d have to completely control the diets of thousands of people for decades. It’s as technically impossible as “proving” climate change or football-related head injuries or, for that matter, tobacco-caused cancers.) And just as tobacco companies fought, ignored, lied and obfuscated in the ’60s (and, indeed, through the ’90s), the [pushers of sugar will do the same now](http://www.motherjones.com/environment/2012/10/sugar-industry-lies-campaign).

But as Lustig says, “This study is proof enough that sugar is toxic. Now it’s time to do something about it.”

The next steps are obvious, logical, clear and up to the Food and Drug Administration. To fulfill its mission, the agency must respond to this information by re-evaluating the toxicity of sugar, arriving at a daily value — how much [added sugar](http://www.choosemyplate.gov/weight-management-calories/calories/added-sugars.html) is safe? — and ideally removing fructose (the “sweet” molecule in sugar that causes the damage) from the “generally recognized as safe” list, because that’s what gives the industry license to contaminate our food supply.

On another front, two weeks ago a coalition of scientists and health advocates led by [the Center for Science in the Public Interest petitioned the F.D.A.](http://www.cspinet.org/new/201302131.html) to both set safe limits for sugar consumption and acknowledge that added sugars, rather than lingering on the “safe” list, should be declared unsafe at the levels at which they’re typically consumed. (The F.D.A. has not yet responded to the petition.)

Allow me to summarize a couple of things that the PLoS One study clarifies. Perhaps most important, as a number of scientists have been insisting in recent years, all calories are not created equal. By definition, all calories give off the same amount of energy when burned, but your body treats sugar calories differently, and that difference is damaging.

And as Lustig lucidly wrote in “[Fat Chance,](http://www.us.penguingroup.com/nf/Book/BookDisplay/0%2C%2C9781594631009%2C00.html)” his compelling 2012 book that looked at the causes of our diet-induced health crisis, it’s become clear that obesity itself is not the cause of our dramatic upswing in chronic disease. Rather, it’s metabolic syndrome, which can strike those of “normal” weight as well as those who are obese. Metabolic syndrome is a result of insulin resistance, which appears to be a direct result of consumption of added sugars. This explains why there’s little argument from scientific quarters about the “obesity won’t kill you” studies; technically, they’re correct, because obesity is a marker for metabolic syndrome, not a cause.

The take-away: it isn’t simply overeating that can make you sick; it’s overeating sugar. We finally have the proof we need for a verdict: sugar is toxic.