

METABOLICAL, by Dr. Robert H. Lustig, MD, MSL,
Book Report and Comment, Part II
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September 27, 2021

In this part, the author looks at “a calorie is not a calorie,” food that children and adults eat, how they are processed and their effects on health. Dr. Lustig describes nutritional myths that the public and health professionals have bought into. He states that a calorie is not a calorie, a carb is not a carb, a fat is not a fat, a protein is not a protein, and a fiber is not a fiber. What the heck does he mean? The food industry would like us to believe the simplistic formula that too many calories eaten without enough exercise causes weight gain. Calories in, calories out. Sounds very neat and simple, but is a very simple-minded approach and doesn't account for how different types of food affect metabolism. There are so many different kinds of calories, fats, etc., especially when so many have been adulterated. Also the terms “weight,” “fat,” and “sugar” are so loaded that they are often misleading in the way they are used.

Weight can be fat, muscle, bone, fluid, etc., and the BMI or Body Mass Index commonly used to measure body composition, is based on only weight and height, and it doesn't say what kind of weight. Likewise total body fat doesn't correspond well with health or illness. Which weight does? It is mainly the visceral or intra-abdominal fat, and the liver fat that counts. The maximum visceral fat is about 6 lbs, and the maximum fat in the liver is approx. 1 lb. “Normal weight” people can have these kinds of fat in excess, and they are hard to measure and don't show on the scales. These are “TOFI,” Thin on the Outside, Fat on the Inside.” It takes about 5 lbs of visceral fat to worsen health, 0.3 lbs of fat in the liver, and about 22 lbs of subcutaneous fat to worsen health. Likewise, someone could be 22 lbs overweight with no excess fat in the liver or abdomen and still be metabolically healthy. Another myth is that dietary fat makes you put on fat. By itself it does not, but combined with sugar and refined carbs, it can. So much for “fat.”

The word “sugar,” is also nebulous. The food industry says you need sugar to live. Well, you need glucose in the blood, but the body can make glucose from triglycerides from dietary or body fat, or from amino acids from protein. You don't have to consume it. Now, the molecule that makes food taste sweet is fructose, and dietary fructose is not needed by “any animal cell on the planet” for any biochemical reaction. My sense is that the sweet taste of fructose's function was to encourage consumption of high calorie foods for survival benefit, when food was scarce. So if we eat less sweet food now, that doesn't damage our health. No, food industry, we don't need to *consume your sugar* to live.

What does “a calorie is not a calorie” mean? Regarding fiber, of 160 calories of almonds, 130 gets absorbed, and the other 30 is eaten by the gut bacteria, for many beneficial biochemical reactions. Regarding protein, a calories is not a calorie because it takes much more energy to metabolize protein, than for carbohydrates. This is the *thermal effect of food* (TEF). And for fat, omega-3 fatty acids aren't burned but are used for building cell membranes and other structures. Trans fatty acids cannot be burned either, but they can clog arteries. Other fats can be burned for energy.

A sugar is not a “sugar” because table sugar, sucrose, is made up of equal amounts of glucose and fructose, and an equal number of calories. Glucose can be metabolized by all body tissues, and only 20% goes to the liver to be stored as glycogen. Fructose, in contrast, goes totally to the liver, the only place where it can be metabolized, to triglycerides, and too much can overwhelm the mitochondria in liver cells, and then it gets stored as liver fat. And then also a calorie stored is not a calorie stored.

Subcutaneous fat (butt fat) does no damage if it's less than 22 lbs, but 0.3 lbs of liver fat and 5 lbs of visceral fat can be harmful. That's why a primary objective in good nutrition is to protect the liver.

Now, what about zero calories? Unfortunately, diet sweetener consumption is also correlated with metabolic syndrome. The FDA studies what the body does to the drug (pharmacokinetics), but it does not study what the drug does to the body's biochemistry (pharmacodynamics). The food industry doesn't want to study that (It probably doesn't want to know). The NIH doesn't study it and says the food industry should do it. So we do not have good scientific studies on the complex biochemical effects if these drugs.

The studies we do have show the effect of diet sodas. Drinking the same volume of milk resulted in no weight gain or loss, but the diet sodas resulted in weight gain. Equal amounts of water had weight loss. Sugared drinks resulted in a lot more weight gain than diet sodas, but this "zero calorie" drink was not neutral. The most likely explanation is that the sweet taste alone can drive insulin release, which promotes appetite and energy storage. The pancreas islet cells can say, "Where's the sugar that I'm primed for? The hypothalamus told me something sweet is coming. Lets eat more to get it."

Diet sweeteners likely change the composition of intestinal bacteria, causing leaky gut, inflammation, deposition of visceral fat, and metabolic syndrome. Animal studies show correlation of diet sweeteners with sugar addiction.

Other studies show correlation (not causation) of artificially sweetened beverages with diabetes, cardiovascular disease, and dementia. Animal models show that aspartame (NutraSweet) affects 3 of the 8 subcellular pathologies, oxidative stress, membrane integrity, and inflammation. In the approval of aspartame by the European Food Safety Authority, it discounted 100% of the studies showing harm, and accepted 84% of the studies that showed no harm.

A fiber is not a fiber. Fiber from real food is not the same as "added fiber" to processed food, which has the insoluble fiber milled out or dissociated from the soluble fiber. Both kinds of fiber together from whole food form a gel inside the duodenum to slow the absorption of starches and sugars, protecting the liver, and keeping the insulin response down. Both kinds of fiber promote beneficial bacteria in the gut microbiome. The fiber increases the speed of transit of food through the gut, increasing the satiety peptide, YY. Soluble fiber provides food for the bacteria that produce short-chain fatty acids, which feed colonic cells and are absorbed to decrease inflammation and insulin secretion. To learn more about fiber, read my article in the archives on Fiber Fueled, by Dr. Will Bulsiewicz.

A carbohydrate is not a carbohydrate. Sugar vs. starch. Starch is a complex polymer with many bonds to break, and it is digested and absorbed more slowly. Sugar has few bonds to break, is absorbed quickly, and drives a higher insulin response and weight gain.

A starch is not a starch. *Amylose* in "brown" foods like beans and legumes and whole kernel grains are digested and absorbed slowly, and *amylopectin* in "white" foods like wheat flour, pasta, white rice, and potatoes are absorbed more quickly, flooding the liver and generating more insulin response.

Carbs are usually eaten with protein, fat, and fiber. This also affects their absorption vs. pure carbs by themselves. Different people absorb the same food differently. Fructose doesn't raise blood sugar but goes to the liver. So the Glycemic Index, G.I. (how fast glucose enters the blood) is not a good measure for carbs because of all of the above mentioned variables. The food industry touts fructose as having a low G.I.

A fat is not a fat. Substituting polyunsaturated corn and soy oil fats in the diet for saturated fats lowered LDL cholesterol, but actually increased CVD (cardiovascular disease). Not all saturated fats are the same. Those in red meat (16 or 18 carbon fatty acids) are neutral for cardiovascular disease. The saturated fats in dairy, (15 or 17 carbon fatty acids) are likely protective for CVD.

A protein is not a protein. Some proteins are of higher quality in eggs, poultry, and fish, more than in beans. Body builders may need protein powders that have branched-chain amino acids (BCAA's), but for the rest of us, the BCAA's may turn into liver fat. Processed meat (bacon, sausage, salami, etc.) has a hazard ratio for diabetes much higher than unprocessed meat. Better to stay with grass-fed only and nitrate-free meat.

If we used science to promote public health instead of mythology promoted by the food industry, we would no have warnings about saturated fat, but would require warning labels about sugar.

Regarding Covid-19, chronic disease puts people at risk for acute disease from viral infections. Real food won't prevent Covid, but if it means less chronic disease, you are more likely to survive the acute infection and less likely to suffer from "Long Covid."

Dr. Lustig is not just a lone voice in the wilderness. Dr. David Ludwig at Boston Children's Hospital and the Harvard School of Public Health has spoken consistently about the hazards of sugar and processed carbohydrates and how we miss the boat if we just talk about carbohydrates, fats and proteins, because the processing of food makes the difference.

The author discusses how adults eat and how children and adolescents eat in this country, and the consequences. Many adults are obsessed with losing weight. Several kinds of diets, vegan, keto, Ornish, paleo, Mediterranean, etc., all do better than the Standard American Diet, usually because they decrease processed food. Within each diet people tended to lose weight for 2 month, and then they couldn't stay on the rigors of the diets, and then they lost the benefit. Some people within each diet group did better than others because their metabolic situation may have been matched better with the specific diet. For example, people with the rare genetic severe hypercholesterolemia need more low fat choices, and the more common metabolic syndrome or pre-diabetic or diabetic condition need very low carb diets. But the upshot of all that is that each diet works best with Real Food, *protecting the liver and feeding the gut*.

None of the drugs for weight loss work over the long term without bad side effects, except metformin, and only if it is used with real food. It improves mitochondrial function and increases AMP kinase.

Many of the elderly need to gain weight. Many are malnourished from overall calorie restriction. Many have conditions which increase inflammation, and inflammatory cytokine IL-1 acts on the hypothalamus like leptin, and thus causes loss of appetite. Some things that reduce inflammation are exercise, and cutting out processed food.

There seems to be a battle between the keto diet and the vegan diet. Both have benefit if they use real food, and there is no good evidence for one being better than the other for people in general. The ketogenic diet can do a lot of good things like reducing insulin and insulin resistance and leptin resistance, activating AMP Kinase and decreasing mTOR, inducing autophagy, helping neurons grow and fight dementia; but hardly anyone can stay on such strict diet for long, and people can get deficient

in minerals and vitamins because of lack of fiber. Ketone supplements increase ketones in the blood, but don't decrease insulin.

The vegan diet gives better results than the Standard American Diet, and the Ornish diet has lots of fiber and real food, but many vegans eat processed food and are likely to be deficient in iron, omega-3's, B-12, and tryptophan.

The "flexitarian" plan, mostly vegan with occasional meat and animal products, may be the best general diet, (with variations for people with specific needs mentioned above), as long as it has non-processed food.

Artificial or fake "meats" are processed, and it is not apparent that they are more healthful. FDA safety data cover only 28 days.

Fasting, or not eating at all can stimulate AMP-Kinase, make new mitochondria, inhibit mTOR, increase autophagy, and lower insulin, but leptin level drops in one day, and metabolic rate decreases, and hunger, fatigue, and irritability can ensue. Not likely to be maintained for long. Some people can handle it better than others.

Regarding supplements, they can treat a deficiency, but many of the 8 subcellular pathologies are due to excess, and some are due to deficiencies. 1. Glycation is from excess carbs and can't be stopped just with a supplement. 2. Oxidative stress can be decreased with antioxidant supplements, but more needs to be done than that alone. 3. Mitochondrial dysfunction. Mitochondrial boosters may not get into the mitochondria to help. 4. Insulin resistance. There are many compounds and herbs that have good animal data, but this is an excess condition, not a deficiency. 5. Omega-3's can help because they are correcting a deficiency in the Standard American Diet. 6. Inflammation. Vitamin D can reduce inflammation by correcting a deficiency. Polyphenols may also work that way, but data is lacking. 7. Epigenetics. Folate deficiency is common in the processed food diet, and in certain conditions like malabsorption, chemotherapy, pregnancy, and I would add, certain genetic polymorphisms. So folate supplementation can be helpful. 8. Autophagy. No supplement has been proven to affect this, but having a healthy gut microbiome helps, with real food fiber. Overall, Real Food provides most of these micronutrients. I would add that in my experience, I have seen dramatic results in patients with many supplements in many chronic conditions, but they have often been accompanied by lifestyle improvements. Probiotics can be useful, but adding bacteria without food for them to grow, from dietary fiber, they may starve. Prebiotic supplements provide some of this fiber, but the biggest effect comes from food.

What about non-celiac gluten sensitivity? This may be more non-celiac wheat sensitivity. Modern wheat has 700 different proteins to which people can react.

We may get alarmed about what adults are eating, but wait till we look at adolescents, children, toddlers, infants, and fetuses, and how their food is critical for windows of development.

Dr. Terrence Kealey, Dean of the U. of Buckingham in the UK wrote the book, Breakfast Is a Dangerous Meal. The American Heart Association recommends limiting kids to 3-4 tsp of sugar *per day*. Yet a typical school day breakfast is a bowl of Froot Loops and a glass of orange juice, totaling 11 teaspoons. Sugar has 262 different names. If different sugars are 5th, 6th, 7th, & 8th ingredients, it can become the dominant ingredient. If sugar is among the 1st 3 ingredients, it is a dessert. Chinese chicken salad is a dessert. Trader Joe's Beef and Broccoli is a dessert (32 grams).

Children in general are eating and drinking dessert all day long. Their brains get hooked on sugar early in life. This makes a tidal wave of chronic disease that keeps kids sick for decades to come. Tell a cocaine addict to lay off the drug. How well does that work? It gets you about as far as telling a kid to cut out the cookies. See Dr. Lustig's book, Fat Chance, and my article on it in the archives.

If breakfast is dangerous, lunch is no better. School lunches have been modified to cater to kids' tastes, since much of the healthful foods end up in the trash. Do we expect anything different if kids are addicted to processed food? The National School Lunch Program counts pizza as a vegetable, and hash browns as a fruit, and there's no limitation on sugar.

I insert here a note from JAMA 08/10/21, p. 520. "From 1999 to 2018, the estimated proportion of energy intake from consumption of ultra-processed foods increased in the US among youths and comprised the majority of their total energy intake."

What happens to kids' brains with fructose? With an overload of sugar, the fructose that the liver can't clear goes to the brain, blocks the actions of leptin, which is supposed to help neurons branch and connect, and it also inhibits BDNF, brain derived neurotrophic factor, which helps make new connections in the hippocampus (the "memory" center). Teachers know that when the sugar flows, education stops. I saw a garden show on TV about the "Green Bronx Machine," in which kids grew vegetables hydroponically in their New York classroom, and they enjoyed eating the vegetables. Attendance and grades dramatically increased. In a UK study, changes to less processed food led to improvement in English and science scores and a 14% drop in absences.

Sugar alters behavior, cognition, and affect. Give a thin 5 year old a cookie, the leptin results in brain stimulation, and he's off the walls. Give a cookie to an obese kid, who is leptin resistant, there is no sugar high, but he's looking for more cookies. Metabolic syndrome is increasing earlier in life. Adolescents with metabolic syndrome have reduced size of the hippocampus and the prefrontal cortex (executive function), predisposing to distractibility and attention deficit.

Alcohol is toxic and abused, and so it is limited for access by kids. The WHO and the USDA similarly provided upper limits on sugar, because sugar fries the liver and brain in the same way alcohol does. Our children now get fatty liver without drinking any alcohol.

What about infants and toddlers? Low fat vegan diets should not be given to infants. The liver can manufacture one kind of fat from carbohydrate, but not the monounsaturated, polyunsaturated, or omega-3 fatty acids needed for growing brains and bodies of infants. The Royal Academy of Medicine of Belgium published a legal opinion, that it is unethical to subject children to a vegan diet.

The brain is 60% fat, so a lot of fat has to be laid down in a short time as the brain develops. Omega-3's are vital for neuronal membranes and for reducing inflammation at the nerve terminal. They can be turned into endocannabinoids, which alleviate anxiety. Breast milk is full of omega-3's if the mom ate them, either through fish (or fish oil supplements, since much of the fish is loaded with mercury.)

Galactose is a milk sugar essential for babies to make the brain fats cerebrosides and ceramides. The mammary gland is the only organ that can make galactose. Lactose-free formulas do not have galactose.

If a pregnant mom drinks a Coke, the fructose goes to the fetus' liver and affects the taste receptors on the tongue by 30 weeks gestation, so the baby can be addicted to sugar at birth, just like crack or opiate addicted newborns. If mothers consumed the upper limit of sucrose at 50 grams/day, (10 teaspoons), the mid-childhood cognitive scores were negatively impacted. The fructose gets into the breast milk. Also prenatal diet soda consumption negatively affected mid-childhood verbal scores. Before 1901, babies ate adult food turned into pastes, but when manufacturers introduced baby foods, they marketed it to babies by adding sugar. To introduce a savory food to an infant, it takes 13 times before they accept it. A sweet food takes only once. By age 6 months, 60% of infants consume some added sugar daily. After 6 months, it is 98%. Yet the AHA, the WHO, and the UK Royal College of Paediatrics and Child Health say babies and toddlers should not be consuming any added sugar.

Feeding pregnant women processed food, feeding babies commercial formula and pureed baby food, and using pacifiers, all set children up for malocclusion, malformed palates, and OSA (obstructive sleep apnea), and the OSA contributes to metabolic syndrome and probably to ADHD.

Part III next month details what makes processed food and adulteration, and discusses the food industry and agriculture, the corruption of food politics, and how we can “un-process” our food supply. “Stay tuned.”