

Why fat is the preferred fuel for human metabolism **by Mark Sisson of Primal Blueprint**

There's a good reason so many people (mostly the sugar-burners, whose disparate group includes fruitarians, veg*ans, HEDers, body-builders, most MDs, the USDA and virtually every RD program in the country) can't seem to grasp why a lower carb, Primal approach to eating is a better choice for health and fitness: their fundamental paradigm – the core theory that underpins everything else in that belief system – is flawed. They remain slaves to the antiquated notion that glucose is the king of fuels, so they live their lives in a fear of running low. The truth is, fat is the preferred fuel of human metabolism and has been for most of human evolution. Under normal human circumstances, we actually require only minimal amounts of glucose, most or all of which can be supplied by the liver as needed on a daily basis. The simple SAD fact that carbs/glucose are so readily available and cheap today doesn't mean that we should depend on them as a primary source of fuel or revere them so highly. In fact, it is this blind allegiance to the "Carb Paradigm" that has driven so many of us to experience the vast array of metabolic problems that threaten to overwhelm our health care system.

It boggles my mind that such a large segment of the so-called health and fitness community would continue to defend high carbohydrate diets with such tenacity. It should all be very obvious by now. The studies keep piling up indicating that carbohydrate intake is the major variable in determining body composition and that excess glucose from carbohydrate intake (especially from processed grains and sugars) is the primary culprit in obesity and in many disease processes. It follows logically that if you can limit carb intake to a range of which is absolutely necessary (and even up to 50 grams a day over) and make the difference up with tasty fats and protein, you can literally reprogram your genes back to the evolutionary-based factory setting you had at birth – the setting that offered you the opportunity to start life as a truly efficient fat-burning organism and to continue to do so for the rest of your life as long as you send the right signals to your genes. Becoming an efficient fat-burner is the major premise of the Primal Blueprint eating and exercise strategies.

But logic doesn't rule when you are stuck in the Carb Paradigm. How many more times do I have to overhear a trainer advising a still-portly client to "eat 5 or 6 small meals throughout the day, always with some carbs, so you keep your blood sugar up and don't go into starvation mode."? It's time to stop this nonsense and reframe the current views of human metabolism to accurately reflect the two and a half million years of evolution that shaped the current human genome – a perfect DNA recipe that fully expects us from birth to function largely on fats.

The Faulty Carb Paradigm "Logic" Goes Something Like This

The basic underlying assumption is that glucose is the preferred fuel of most cells; BUT, because we can't store very much glucose (as glycogen in liver and muscles), we need to provide a continuous source of glucose in the form of exogenous carbohydrate (high carb meals) to keep the brain, blood, and certain organs humming along and the muscles primed for activity. AND, if we don't feed ourselves enough carbohydrate every few hours, our blood sugar will drop and we'll go into "starvation mode" and cannibalize our precious muscle tissue. AND any lack of regular glucose refilling (i.e. skipping a meal

or fasting) will cause cortisol to rise, which will have additional deleterious effects. FURTHERMORE, an excess of glucose in the bloodstream is known to raise insulin and will predispose excess calories (from all sources) to be stored as fat. THEREFORE, we should also be doing a lot of moderate-to-heavy cardio or lifting activity most days to burn off this excess stored body fat. HOWEVER, if we want to be ready and able to exercise frequently and strenuously to burn off our stored fat, we need to eat lots of complex carbohydrates between workouts to refill our glycogen stores. And ULTIMATELY, the only way to lose weight is to restrict calories (calories in < calories out), BUT if you're working out regularly, it's almost impossible to maintain a calorie-restricted regimen and still be able to work out hard enough to burn appreciable calories. Sheesh.

Sure, there are exceptions, like the driven and genetically gifted types, who can train long hours, refuel on carbs and not add much body fat (hey, I was one). But unless you love to work out incessantly and have really lucky familial genes, **the Carb Paradigm is an unsustainable and ridiculous literal and figurative treadmill**, a self-fulfilling prophecy for most people who tend to gain weight steadily and insidiously over the years and wonder why. If you are one of the 60+% of the American population who is overweight, the above scenario plays itself out because you have spent your life programming your genes in the direction of being an effective sugar burner and, as a result, have become dependent on a fresh supply of sugar (carbs) every few hours. Naturally, in the presence of all that glucose, and provided you actually do some exercise, **your genes will eventually get the signals to up-regulate the enzyme systems, pathways and receptors involved in sugar-burning and fat storage** and they'll down-regulate all those involved in accessing and burning fat for energy. Of course, **that doesn't make it right, but it sure makes it appear as if glucose is king**. What makes it worse, if you don't exercise, you head down the path to insulin resistance and/or obesity.

The Problem: The Basic Assumption of the Carb Paradigm is Wrong

Glucose is not the preferred fuel of muscle cells under normal human resting metabolic conditions or even under most normal human movement patterns (exercise). Fat is. Sure, given an unlimited supply of glucose and regular refilling of glycogen stores, skeletal muscle will burn through it during exercise the same way a fire burns through kindling when that's all you have to offer. The body can shift carbohydrate oxidation to keep up with intake. But skeletal muscle can burn fat with great efficiency (and far less oxidative fallout) at relatively high outputs for very long bouts. Cardiac muscle actually prefers ketones, and the brain can run just fine (maybe even optimally) on a blend of ketones and minimal glucose. Our survival as a species has depended on these evolutionary adaptations away from glucose dependency. Entire civilizations have existed for ages on what is practically a zero-carb diet. Think about this: ***there is actually no requirement for any "essential dietary carbohydrates" in human nutrition***. It's possible to live a very long and healthy life never consuming much – if any – in the way of carbs, provided you get adequate dietary protein and fat. The same can't be said for going too long without protein or fat. Cut too far back on either of those macronutrients and you will eventually get sick and die.

The Evolutionary Model

Fat and protein were the dominant macronutrients (when food was even available) over the majority of

our two-and-a-half million years as evolving humans. The lack of regular access to food and a scarcity of carbohydrates for much of this time necessitated that we adapt efficient pathways to readily store and access body fat for energy if we were to survive day-to-day and generation-to-generation. Our movement patterns were such that we never required large amounts of glucose or that we needed to store very much glycogen. **It was predominantly fats, ketones and the minimal infusion of glucose via gluconeogenesis that got us here. Dietary carbs were insignificant.** In fact, when you consider how ridiculously small the body's glycogen reservoirs are, you understand that it would have been impossible for us to survive as a species if glucose were truly the "preferred" fuel. The liver, the main back-up glycogen/glucose storage facility for the brain and other glucose-burning organs, can only store about 100 grams of glycogen. Less than a day's worth. Your muscles can only hold another 350-500 grams, barely enough to run for 90 minutes at a reasonable clip, and that glycogen isn't even available to provide fuel for the brain. Meanwhile, we have a virtually unlimited storage capacity for fat (like 100,000 grams or close to a million calories on some people). The reason glycogen storage wasn't necessary is because, between our copious fat storage capability, easy access to fats as fuel, gluconeogenesis and ketones, we just didn't need much. Evolution tends not to reward structures or functions that take up unnecessary space or waste energy.

So How Much Glucose Do You Really Need?

Much less than most people assume. At any one time, the total amount of glucose dissolved in the bloodstream of a healthy non-diabetic is equivalent to only a teaspoon (maybe 5 grams). Much more than that is toxic; much less than that and you pass out. That's not much range for a so-called "preferred" fuel, is it? Several studies have shown that under normal low MET conditions (at rest or low- to mid- levels of activity such as walking and easy work) the body only needs about 5 grams of glucose an hour. And that's for people who aren't yet fat-adapted or keto-adapted. The brain is the major consumer of glucose, needing maybe 120 grams a day in people who aren't yet on a low carb eating program. Low carb eating reduces the brain's glucose requirements considerably, and those who are very low carb (VLC) and keto-adapted may only require about 30 grams of glucose per day to fuel the brain (and little-to-none to fuel the muscles at <75% max efforts). Twenty of those grams can come from glycerol (a byproduct of fat metabolism) and the balance from gluconeogenesis in the liver (which can actually make up to a whopping 150 grams a day if you haven't metabolically damaged it with NAFLD through fructose overdosing). Bottom line, unless you are a physical laborer or are training (exercising) hard on a daily basis, once you become fat-adapted, you probably don't ever need to consume more than 150 grams of dietary carbs – and you can probably thrive on far less. Many people do very well (including working out) on 30-70 grams a day.

The Fat Paradigm

The Fat Paradigm, under which the human species has thrived quite effectively for two and a half million years, recognizes that **human metabolism is pre-programmed by evolution to be primarily fat-based (the real preferred fuel)**. In other words, our genes expect us to function optimally when we consume fats and can easily access our stored fat. The Fat Paradigm acknowledges that the body is able to manufacture adequate glucose as needed. It acknowledges that most typical human movement patterns can be fueled almost entirely by fats and/or ketones ([PDF](#)) if need be, but can draw on glycogen when

energy bursts are required (and which can then be replaced over time). It acknowledges that fat (and cholesterol) are not the proximate cause of heart disease. It acknowledges that fat cells are designed to release stored fatty acids as required, especially during times of scarcity or fasting. It allows for intermittent fasting as a means of accelerating fat loss without sacrificing muscle tissue. It increases insulin sensitivity, modulates energy and mood swings, and allows for a normal and healthy drop in hunger and cravings. There is a downside, however: you can't train long and hard day-in and day-out in the fat paradigm.

Now then, having explained all this, please understand that I am not carb phobic. I actually permit more carbs in the Primal Blueprint than many other low carb eating strategies. I prefer to view carbs as the "elective" macronutrient, as a tool to use to manipulate your glycogen levels as needed. Low carb isn't even the main objective: eliminating grains, sugars and seed oils are the primary objective. Of course, when you get rid of that crap and naturally limit your carb intake to veggies, root tubers and a few fruits, you almost invariably decrease carbs to under 150 grams a day. And that emulates our ancestral dietary intake.

I came up with a simple Carbohydrate Curve a few years ago that offers a pretty concise picture of where most people ought to fall if they are seeking optimum health and energy, depending on their size, weight, sex, age, goals, etc. Now, many hundreds of thousands of user experiences later, I am finding that the Curve is pretty much spot on for a large segment of the population.

When I say generally that a chronic intake of over 150 grams of carbs can lead to insidious weight gain over a lifetime, I am factoring in the concept that many people are at the effect of a familial genetic predisposition to storing fat easily under the carb paradigm (the 60+% overweight). I am also factoring in the drop in metabolism that happens naturally with age, as well as the fact that some people don't NEED to purge and refill glycogen stores every day via exercise. Yes, there are some people (a small percentage of outliers) who might maintain pretty decent body composition at up to 300 grams a day on little exercise. I would bet that they also are selective about the carb sources and do a better job of controlling overall calories, so there's little excess to store. For most of the population, that 150 mark remains a good average level for maintaining ideal body composition.