Fasting and Muscle Mass – Fasting Part 15

by Jason Fung | posted in: Fasting, Health and Nutrition | 29

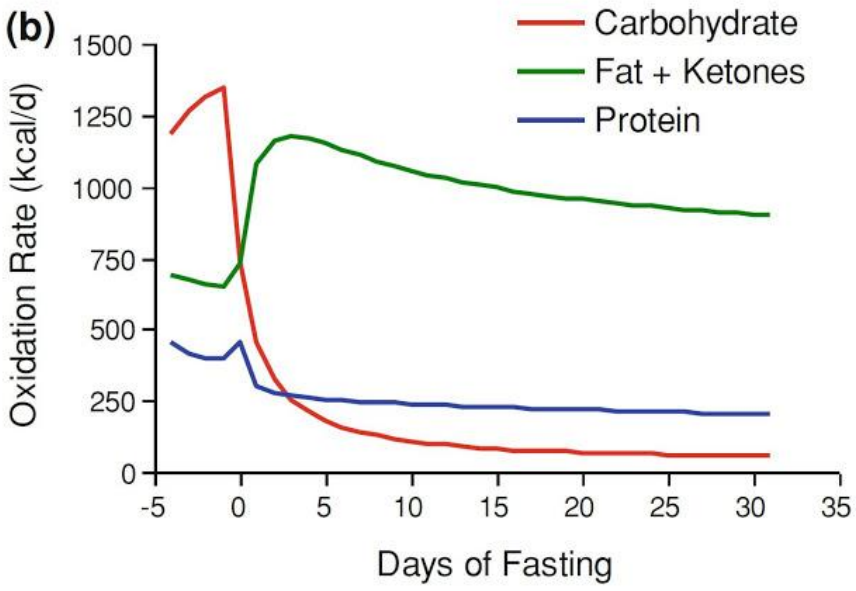
It seems that there are always concerns about loss of muscle mass during fasting. I never get away from this question. No matter how many times I answer it, somebody always asks, "Doesn't fasting burn your muscle?"

Let me say straight up, NO.

Here's the most important thing to remember. If you are concerned about losing weight and reversing T2D, then worry about insulin. Fasting and LCHF will help you. If you are worried about muscle mass, then exercise – especially resistance exercises. OK? Don't confuse the two issues. We always confuse the two issues because the calorie enthusiast have intertwined them in our minds like hamburgers and french fries.

Weight loss and gain is mostly a function of DIET. You can't exercise your way out of a dietary problem. Remember the story ofPeter Attia? A highly intelligent doctor and elite level distance swimmer, he found himself on the heavy end of the scale, and it was not muscle. He was overweight despite exercising 3-4 hours a day. Why? Because muscle is about exercise, and fat is about diet. You can't out-run a bad diet.

Muscle gain/ loss is mostly a function of EXERCISE. You can't eat your way to more muscle. Supplement companies, of course, try to convince you otherwise. Eat creatine (or protein shakes, or eye of newt) and you will build muscle. That's stupid. There's one good way to build muscle – exercise. So if you are worried about muscle loss – exercise. It ain't rocket science. Just don't confuse the two issues of diet and exercise. Don't worry about what your diet (or lack of diet – fasting) is doing to your muscle. Exercise



builds muscle. OK? Clear?

So the main question is this – if you fast for long enough, doesn't your body start to burn muscle in excess of what it was doing previously in order to produce glucose for the body. Hell, no.

Let's look carefully at this graph by Dr. Kevin Hall from the NIH in the book "Comparative Physiology of Fasting, Starvation, and Food Limitation". Great title guys. Amazon probably couldn't keep enough stock on the shelves.

But anywho, this is a graph of where the energy to power our bodies comes from, from the start of fasting. At time zero, you can see that there is a mix of energy coming from carbs, fat and protein. Within the first day or so of fasting, you can see that the body initially starts by burning carbs (sugar) for energy. However, the body has limited ability to store sugar. So, after the first day, fat burning starts.

What happens to protein? Well, the amount of protein consumed goes ***down***. There is certainly a baseline low level of protein turnover, but my point is that we do not start ramping up protein consumption. We don't start burning muscle, we start *conserving*muscle.

Reviews of fasting from the mid 1980s had already noted that "Conservation of energy and protein by the body has been demonstrated by reduced … urinary nitrogen excretion and reduced leucine flux (proteolysis). During the first 3 d of fasting, no significant changes in urinary nitrogen excretion and metabolic rate have been demonstrated". Leucine is an amino acid and some studies had shown increased release during fasting and other had not. In other words, physiologic studies of fasting had already concluded that protein is not 'burnt' for glucose.

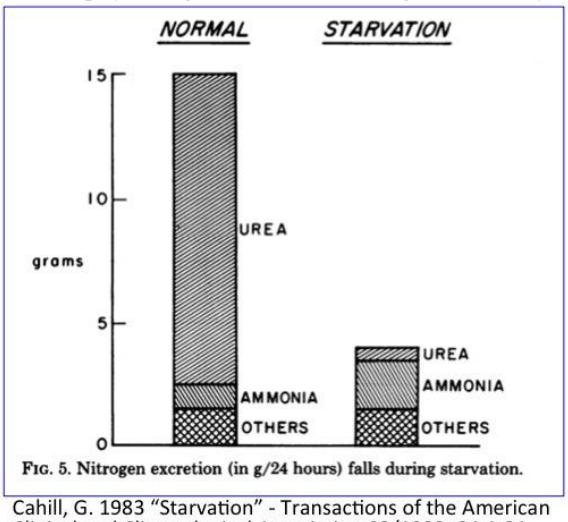


FIG. 5. Nitrogen excretion (in g/24 hours) falls during starvation.

Cahill, G. 1983 "Starvation" - Transactions of the American Clinical and Climatological Association 02/1983; 94;1-21

It further notes that you can get increase leucine flux with no change in urinary nitrogen excretion. This happens when amino acids are reincorporated into proteins. Researchers studied the effect of whole body protein breakdown with 7 days of fasting. Their conclusion was that "decreased whole body protein breakdown contributes significantly to the decreased nitrogen excretion observed with fasting in obese subjects". There is a normal breakdown of muscle which is balanced by new muscle formation. This breakdown rate slows roughly 25% during fasting.

The classic studies were done by George Cahill. In a 1983 article on "Starvation" he notes that glucose requirements fall drastically during fasting as the body feeds on fatty acids and the brain feeds on ketone bodies significantly reducing the need for gluconeogenesis. Normal protein breakdown is on the order of 75 grams/day which falls to about 15 – 20 grams/day during starvation. So, suppose we go crazy and fast for 7 days and lose about 100 grams of protein. That is approximately the equivalent of 5 jumbo shrimp (my favorite oxymoron). We make up for this protein loss with ease and actually, far, far exceed our needs the

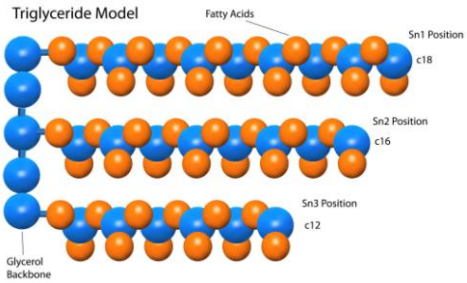
next time we eat. Yes, if you fast for 7 days and then eat no other protein than 5 shrimps, you are fine.

TABLE 3
Quantitative Estimates of 24-hour Substrate Turnovers in Prolonged Starvation

Component	Amount g
Brain glucose utilization	40
Brain ketone utilization (41)	100
Splanchnic glucose output (40)	80
from amino acid	20
from glycerol	20
from returning lactate and pyryvate	40
Muscle proteolysis	20
Adipose lipolysis	180
Splanchnic ketogenesis (47)	150

Cahill, G. 1983 "Starvation" - Transactions of the American Clinical and Climatological Association 02/1983; 94;1-21

From Cahill's study, you can see that the urea nitrogen excretion, which corresponds to protein breakdown, goes way, way down during fasting/ starvation. This makes sense, since protein is functional tissue and there is no point to burning useful tissue while fasting when there is plenty of fat around. So, no, you do not 'burn' muscle during fasting.



Triglyceride

Where does the glucose comes from? Well, fat is stored as triglycerides (TG). This consists of 3 fatty acid chains attached to 1 glycerol molecule. The fatty acids are released from the TG and most of the body can use these fatty acids directly for energy.

The glycerol, goes to the liver, where it undergoes the process of gluconeogenesis and is turned into sugar. So, the parts of the body that can only use sugar have it. This is how the body is able to keep a normal blood sugar even though you are not eating sugar. It has the ability to produce it from stored fat.

Sometimes you will hear a dietician say that the brain 'needs' 140 grams of glucose a day to function. Yes, that may be true, but that does **NOT** mean that you need to **EAT** 140 grams of glucose a day. Your body will take the glucose it needs from your fat stores. If you decide to EAT the 140 grams instead, your body will simply leave the fat on your ass, hips, and waist. This is because the body will burn the sugar instead of the fat.

Table 2 Body weight and body composition at baseline and at the end of each phase of the trial

	Baseline control phase		Weight loss/ADF controlled feeding phase		Weight loss/ADF self-selected feeding phase	
	Day 1	Day 14	Day 41 Feed day	Day 42 Fast day	Day 69 Feed day	Day 70 Fast day
Body weight (kg)	96.4 ± 5.3	96.5 ± 5.2	93.8 ± 5.0*	93.7 ± 5.0*	92.8 ± 4.8*	90.8 ± 4.8*
BMI (kg/m^2)	33.7 ± 1.0	33.7 ± 1.0	32.8 ± 1.0	32.8 ± 0.9	32.1 ± 0.8*	31.4 ± 0.9*
Fat mass (kg)	43.0 ± 2.2	43.5 ± 2.5	41.8 ± 2.7	41.3 ± 2.7	38.1 ± 2.6*	38.1 ± 1.8*
Fat-free mass (kg)	52.0 ± 3.6	51.4 ± 3.4	51.8 ± 3.8	51.1 ± 3.2	52.8 ± 3.3	51.9 ± 3.7
Waist circumference (cm)	109 ± 2	109 ± 3	106 ± 3	106 ± 3	105 ± 3*	105 ± 3*

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But let's look at some clinical studies in the real world. In 2010, researchers looked at a group of subjects who underwent 70 days of alternate daily fasting (ADF). That is, they ate one day and fasted the next. What happened to their muscle mass?

Their fat free mass started off at 52.0 kg and ended at 51.9 kg. In other words, there was no loss of lean weight (bone, muscle etc.). There was, however, a significant amount of fat lost. So, no, you are not 'burning muscle', you are 'burning fat'. This, of course, is only logical. After all, why would your body store excess energy as fat, if it meant to burn protein as soon as the chips were down? Protein is functional tissue and has many purposes other than energy storage, whereas fat is specialized for energy storage. Would it not make sense that you would use fat for energy instead of protein? Why would we think Mother Nature is some kind of crazy?

That is kind of like storing firewood for heat. But as soon as you need heat, you chop up your sofa and throw it into the fire. That is completely idiotic and that is not the way our bodies are designed to work.

How, exactly does the body retain lean tissue? This is likely related to the presence of growth hormone. In an interesting paper, researchers fasted subjects and then suppressed Growth Hormone with a drug to see what happened to muscle breakdown. In this paper, they already acknowledge that "Whole body protein decreases". In other words, we have known for 50 years at least, that muscle breakdown decreases substantially during fasting.

By suppressing GH during fasting, there is a 50% increase in muscle break down. This is highly suggestive that growth hormone plays a large role in maintenance of lean weight during fasting. The body already has mechanisms in place during fasting to preserve lean mass and to burn fat for fuel instead of protein.

So let me lay it out as simply as I can. Fat is, at its core essence, stored food for us to 'eat' when there is nothing to eat. We have evolved fat stores to be used in times when there is nothing to eat. It's not there for looks, OK? So, when there is nothing to eat (fasting), we 'eat' our own fat. This is natural. This is normal. This is the way we were designed.

And its not just us, but all wild animals are designed the same way. We don't waste away our muscle while keeping all our fat stores. That would be idiotic. During fasting, hormonal changes kick in to give us more energy (increased adrenalin), keep glucose and energy stores high (burning fatty acids and ketone bodies), and keep our lean muscles and bones (growth hormone). This is normal and natural and there is nothing here to be feared.

So, I will say it here, yet again.

1. No, fasting does not mean you burn protein for glucose. Your body will run on fat.
2. Yes, your brain needs a certain amount of glucose to function. But no, you do not have to EAT the glucose to get it there.