Fasting

Part 1

"There is nothing new, except what has been forgotten."

-Marie Antoinette

Fasting is one of the most ancient healing traditions in human history. It has been practiced by virtually every culture and religion on earth. Before industrialization, times of feast and famine were a normal way of life. When edible plants were naturally bountiful and/or hunters were successful in their trade, people feasted. In the winter, when food was more scarce and animals were hibernating, people fasted. Ancient people did not generally feast and fast because they chose to, but because that was the only option. Luckily, human genetics are designed for this type of eating pattern and we survived to tell the tale!

As a medical therapy, fasting has been recorded back to at least the 5th century BCE when Hippocrates, who is widely considered the father of modern medicine, prescribed the practice of fasting to his ill patients. He wrote, "To eat when you are sick, is to feed your illness." The ancient Greeks believed that medical treatment could be observed from nature. Humans, like most animals, do not eat when they become sick. For this reason, fasting has been called the 'physician within.' This sensation of losing your appetite is certainly familiar to everybody. Consider the last time you were sick with the flu. It is likely that the last thing you wanted to do was eat. In this case, fasting seems to be a universal human instinct to multiple forms of illnesses. Thus fasting is ingrained into human heritage, and as old as mankind itself.[1]

Today, we have continuous food availability which has allowed our body to stay in a continual state of feasting. Fasting has become demonized, feared and even deemed 'dangerous' by much of modern culture. Many people today intertwine the term 'fasting' with 'starving,' but there is an inherit difference between the two. Fasting is defined as the voluntary act of with-holding food for a specific period of time. Starving, on the other hand, is an involuntary act of being deprived of food for a period of time that causes suffering, malnourishment and possible death. Fasting is done deliberately and is controlled (you can end a fast at any moment of your choosing), where starvation is completely uncontrolled and involuntary. Dr. Jason Fung compares the difference between fasting and starvation like comparing suicide to dying of old age. They are completely different and should not be confused.

In today's world, fasting is still used for both preventative and medical treatment, though not as commonly as we have seen historically. Benefits from fasting include: mental clarity, illness prevention (especially from neurological conditions such as Alzheimer's disease), blood sugar control, reduction of inflammation, increased growth hormone (which provides an anti-aging effect) and so much more!

If there is so much to benefit from fasting, then why have we moved so far away from this ancient healing tradition in modern day society? Money. The food retail industry comprises foods sold at food retailers such as grocery stores, mass merchandisers, drug stores, convenience stores and foodservice facilities. Total retail and food service sales in the United States amounted to approximately 5.75 trillion U.S. dollars in 2017[2] which made it the fourth largest industry in the US economy. So what happens when millions of people decide that fasting is a good idea and should become part of their regular health protocol? No one makes any money. Since it is the job of large corporations (like Walmart, Costco and Amazon) to convince you to spend money with them, it would be completely idiotic for them to promote fasting as method of obtaining optimal health. Instead, major food and beverage companies spend upwards of $10 billion per year marketing their products to consumers. According to research completed at Yale Center for Food Policy & Obesity, in 2010, the fast food industry alone spent $4.2 billion on advertising to encourage frequent visits by young people to fast food restaurants, targeting children as young as two years old.[3] Today, the food industry has spread its marketing from TV commercials to social media pop-ups and straight into your email inbox, all in one big attempt for you to want what they have to offer…food.

PHYSIOLOGY

The body only exists in one of two states: fed or fasted. Since our body requires a continual source of energy for basic metabolic functions (such as pumping blood, detoxification, breathing, etc) and most of us are not sitting at the dinner table continually feeding ourselves all day long, our body has a way of storing energy for times of fasting. This leads to the somewhat obvious point that our body can only obtain energy from two different sources: food, or stored food (as glycogen in the liver and muscles or body fat). Your body can only use energy from one source or the other (food, or stored food), but not both at the same time. The key hormone in the process of either utilizing stored energy, or actually storing energy, is insulin. When insulin is present in the blood stream, we are storing energy (both glycogen and body fat). When insulin is low in the blood stream (and glucagon is high), we are using stored energy (utilizing glycogen and/or body fat).

A healthy body has 2 main sources of stored energy: glucose and fat. In a fed state, when insulin levels remain high, your body derives its energy from the food you are consuming. Alternatively, in a fasted state, the storage signaling hormone insulin declines and glucagon rises. This signals the body to obtain energy from alternative sources (glycogen in the liver). Dr. George Cahill identified 5 stages to fasting which helps explain where our body obtains energy during a prolonged period without food, and they are:

STAGE 1 (0-4 hours)– The body burns through any exogenous glucose remaining in the blood.

STAGE 2 (4-16 hours)- The body slows down the oxidation of glucose in the blood and begins to burn glucose from the liver. Gluconeogensis* (the natural process of glucose production from non-glucose sources) begins to ramp up.

STAGE 3 (16-32 hours)– Glycogen that has been stored in the liver provides the body with required glucose. Majority of the organs are still using stored glucose as energy, but the liver, muscles and fat cells begin to burn fat.

STAGE 4 (32 hours-24 days)- Glycogen stores have been depleted and the liver and kidneys are now providing glucose to the brain, red blood cells, and renal medulla through gluconeogenesis. Ketone bodies are now being used as energy by majority of the organs.

STAGE 5 (24+ days)- The brain (at a diminished rate), red blood cells and renal medulla continue to use glucose from gluconeogensis and ketone bodies produced in the liver provide the remainder of the body with energy.

*To understand how gluconeogenesis works, you need to understand the structure of a triglyceride. A triglyceride is an organic compound made up of glycerol and three fatty acid groups. Fat consists of mostly triglycerides. During gluconeogenesis, the liver (and to a lesser extent, the kidneys) breaks apart the triglyceride into the glycerol backbone and the 3 fatty acids. The glycerol backbone is turned into glucose and used by the brain, red blood cells, and kidney, and the fatty acids are used directly by other organs and body parts.

During a prolonged fast, there is no need for the body to break down lean mass as long as body fat percentages stay above 4%. When a persons body fat percentage drops below 4%, lean tissue (aka. muscle) will be broken down and protein will be used for energy. The body preserves muscle mass until the body fat becomes so low that it has no choice but to burn lean tissue for survival.

CALORIE RESTRICTION VS FASTING

There is a hypothesis, called the Energy Balance hypothesis, that states that the primary factor in obesity is calories, and reducing calories is the primary mode of treatment. This is commonly called the "calories in, calories out" model and is basically understood as any calories consumed that are not used in movement or basic bodily functions will be stored as body fat. These models assume that all eating ("calories in") along with all exercise ("calories out") is under voluntary control. If this were true, we would predict that by reducing the amount we eat and increasing our exercise would result in reduction of obesity. But these theories also assume that Resting Metabolic Rate (RMR) is not affected by changes in caloric intake, which is incorrect.

This all sounds like a really easy thing to test, right? Take individuals with excess body fat, have them eat less and move more, watch them lose weight and live happily ever after. Done. Well…it doesn't exactly work like that (as many people can attest to). Over the last 100 years, there have been plenty of studies done to help explain why this doesn't work:

- **A Biometric Study of Basal Metabolism in Man-** This study was completed by the Carnegie Institute in 1917. They took 12 healthy men and put them on a "semi-starvation" diet of 1400-2100 calories per day, but kept their energy expenditure the same (in other words- less calories in, but same calories out). The expected outcome using the Energy Balance hypothesis would be weight loss. Initially, the men lost weight. However, over time, what they found was the subjects RMR dramatically dropped and the men were complaining of low heart rate, low blood pressure, constantly feeling cold (despite putting on more warm clothes), the inability to focus and weakness during exercise. What was happening? Their metabolism was shutting down in response to the lower caloric intake. In total, the subjects RMR rate dropped 30% over the course of the study. After the study ended, all the subjects went back to their normal pre-study diet and gained all the weight back in the form of fat.

- **Minnesota Starvation Experiment-** This study was completed in 1950 by Ansel Keys. This study took 36 volunteers who were eating an average of 3,200 calories per day. For 24 weeks, the subjects reduced their caloric intake to 1,560 calories per day. The results were similar to the study completed in 1917. Subjects lost both body weight and body fat, but they also reported: coldness, muscle wasting, exhaustion, hair loss, extreme depression, obsessive thoughts of food, binge eating behaviors, irritability and loss of libido. Once the experiment ended and subjects were allowed to go back to their diet prior to the experiment, not only was the weight regained, but additional body fat was incurred.

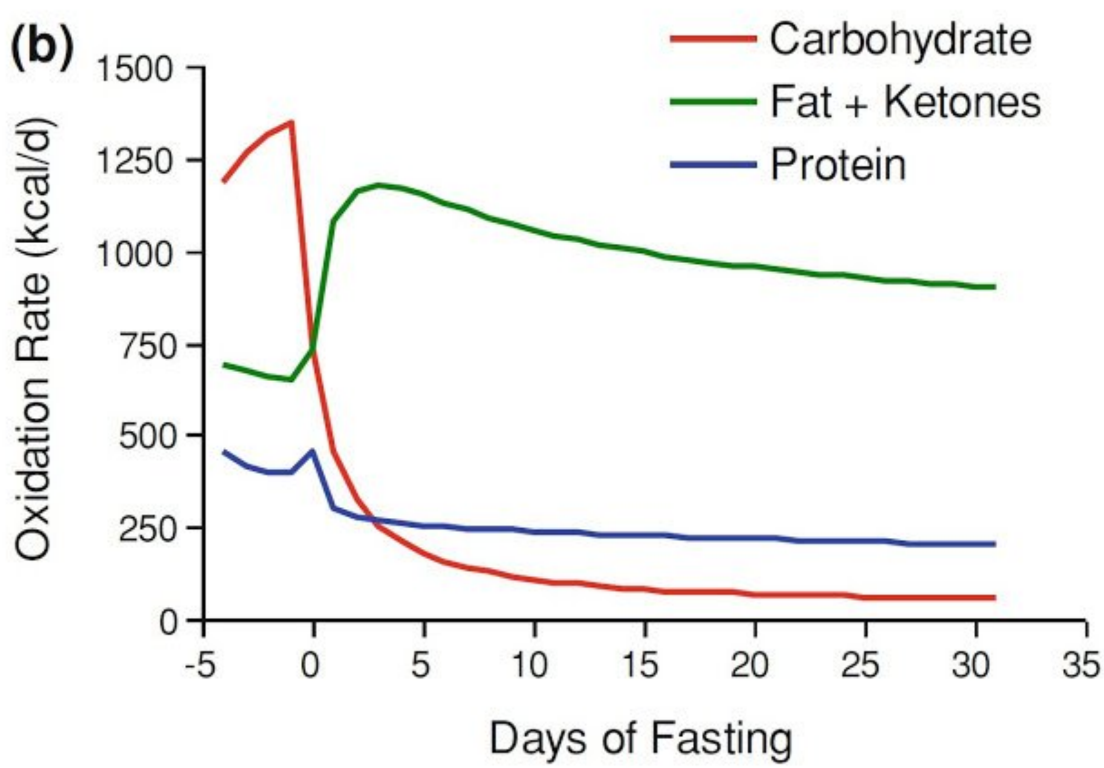
- **Changes in Energy Expenditure Resulting from Altered Body Weight[5]-** This study was completed by Rudolph Leibel and was published in the New England Journal of Medicine in 1995. Here, the study took 18 obese subjects, and 23 subjects who had never been obese, and measured their energy expenditure after either losing 10-20 percent of body weight by underfeeding (for the obese subjects) or gaining 10 percent of their body weight by overfeeding (the non-obese subjects). The findings were again the same as previous studies. Maintenance of a reduced or elevated body weight after weight gain or weight loss is associated with related changes in energy expenditure. This study showed the poor long term efficacy of calories restriction for obesity treatment.

These studies are examples of numerous studies that have been completed over the last 100 years that show the Energy Balance theory is incorrect. When calories in are reduced, calories out are also reduced. As a matter of fact, calories out (or the RMR) is not stable and has been measured in studies to go up or down by as much as 50%. And the most frightening statistic of all for those trying to lose excess body fat: the weight lost during a calorie restricted diet is both muscle and fat, however, the weight regained after the diet has ended is mostly all fat. This has been shown in majority of the Energy Balance studies completed.

Study after study have shown that calorie restricting diets consistently create two things: a bigger appetite and a lower resting metabolic rate. So if restricting calories results in undesirable metabolic changes, how does complete calorie restriction, or fasting, affect your energy expenditure?

In a strong contrast to calorie restricting diets, during a complete fast, studies have shown appetite to go down, and resting metabolic rate to increase (opposite of the Energy Balance hypothesis). Also important to note are the hormonal differences between a calorie restricted state (in which insulin levels remain high) and a fasted state. 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).[4]

Dr. Kevin Hall from the NIH created a graph which was published in the book *Comparative Physiology of Fasting, Starvation, and Food Limitation* which provides a visual representation of Dr. George Cahill's 5 stages mentioned earlier. The graph demonstrates where the human body obtains its energy during a prolonged fast. In the early stages, the body obtains energy from a mix of macronutrients: carbohydrates, fat and protein. But after just 24 hours, the body begins to ramp up fat burning. After approximately 72 hours, fat oxidation has reached its peak, and protein and carbohydrate oxidation have dramatically dropped. This is all directly related to the hormones released during a fast which conserve lean tissue and make stored body fat available for energy utilization.



FASTING PROTOCOLS

There are many different fasting regimens and simply put, there is no 'best' one. Similarly to all the other protocols we have learned up to this point, fasting protocols will also work to different degrees for different people. One regimen will work wonderfully for one person but be utterly ineffective in the next.

Dr. Jason Fung categorizes fasting into to groups: short fasts (less than 24 hours) and long fasts (24 hours or more). He recommends short fasts for people who are mostly interested in weight loss and who do not suffer from type 2 diabetes, fatty liver, or other metabolic disease. He recommends long fasts for people with more significant illnesses, because the results are faster.

SHORT FASTS

Intermittent Fasting (IF)- this is an eating pattern that cycles between periods of fasting and periods of feeding. It doesn't specify which foods you should eat but rather when you should eat them. The most popular IF pattern is called a "16/8" where you remain in a fasted state for 16 hours, and consume all of your calories in an 8 hour window. This is one of the easier fasting styles for most people to adopt because you can ease into it slowly. If you normally break your overnight fast at 8am with your first meal (called "breakfast" for a reason), you can start by pushing that back by 1 hour. Slowly, over the course of days or weeks, you will reach the 16/8 fasting/feeding pattern.

The 'Warrior' diet- Written by Tri Hofmekler in 2002, this diet encourages all meals to be consumed in the evening in a 4 hour eating window. The remaining 20 hours of the day would be fasted.

This can be incredibly beneficial for busy people, but can be hard if digestion is not optimized since the meals consumed in those 4 hours tend to be large.

LONG FASTS

Eat Stop Eat- Written by Brad Pilon, this fasting protocol recommends a 24 hour fast 1-2 times per week.

The 5:2 Diet- Popularized by Dr. Michael Mosley, this fasting protocol consists of 5 days of normal eating, followed by 2 days where you can eat a total of 500 calories. You can eat all 500 calories in 1 meal, or you can spread the 500 calories out over the 48 hour period.

Alternate Day Fasting- Popularized by Dr. Krista Varady, this approach is similar to the 5:2 diet, but with alternate day fasting rather then fasting 1-2 times per week.

36+ hour fasts- once you start to fast longer than 36 hours, the benefits start to dramatically increase, but the complications can also go up. For any fast longer than 36 hours, blood pressure and blood sugar should be monitored. If someone is on medication (especially for blood sugar or blood pressure), they should be monitored by their medical provider during fasts longer than 36 hours.

Prolonged fasts lasting over 24 hours will be discussed in detail in Fasting, Part 2.

Homework

Fasting

The goal over the next 2 weeks is to adopt a short fasting protocol. If you have never done intermittent fasting before, this is a great place to start. Aim to push out your breakfast by 1 hour every day (or every few days) and only consume water, tea or black coffee in the fasting window between meals. If you have already adopted an intermittent fasting routine, try a longer fast of 24 hours 1-2x per week. Continue to consume clear liquids throughout the fast, but avoid all foods/drinks that have calories.

REFERENCES

1- Fung, Jason https://idmprogram.com/fasting-a-history-part-i/

2- U.S. Food Retail Industry - Statistics & Facts, https://www.statista.com/topics/1660/food-retail/

3- http://www.fastfoodmarketing.org/fast_food_facts_in_brief.aspx

4- Fung, Jason https://idmprogram.com/fasting-and-muscle-mass-fasting-part-14/

5- Study 3- *Changes in energy expenditure resulting from altered body weight* N Engl J Med 1995 Aug 10;333(6):399. Leibel RL, Rosenbaum M, Hirsch J.

6- https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2495396/pdf/postmedj00315-0056.pdf