**Dr. Jason Fung –**

**Therapeutic Fasting Solving the Two-Compartment Problem (Vail 2016)**

So what we're going to talk about today

is really why intermittent fasting and low carbohydrate diets work

whereas the calorie counters it just doesn't seem to work.

And the problem with the calorie theory is that it's just like wrong.

And because we don't really understand obesity,

that's why we can't cure it.

So I'm sure many of you have seen this show, it's called The Biggest Loser.

And it's on North America and Australia, it's everywhere.

And what people do is they're contestants that compete to lose weight.

And they get put on a diet - it's a calorie reduced diet

and they do a lot of exercise.

And you've seen Jillian Michaels screaming at everybody. Right?

So it's a lot of exercise and they don't show it on the show,

but there's actually a fairly severe caloric restriction as well.

It's not a low carbohydrate diet,

it's more a kind of everything in moderation sort of approach.

So the problem of course is that this show has been running for a long time

and certain of the contestants have come out and said,

"Well, you know, this really doesn't work."

Now the reason more haven't come out is

because they're essentially under a legal gag order.

They're actually not allowed to say any of this stuff.

But certain contestants have actually come out.

And so this contestant, Suzanne, said,

"Well they never do a reunion show.

Why? They've all gained that weight again."

And it's not unique to the Biggest Loser.

A lot of diets, and we've all done these calorie reduced diets,

it does the same for everything.

It does fine for about six months,

but then after that, it just keeps coming back.

Your weight "plateaus", then it starts to come back.

And everybody knows this, because everybody's done this diet.

The question is, "Why?"

And that's what we really have to understand

and that's what I mean by we have to solve the Two Compartment problem.

And I'll explain that in a second.

So the Biggest Loser diet, despite the fact that we all know it doesn't work,

is actually ranked very highly.

So USA News for example just this past year

put the Biggest Loser diet at number three for weight loss and number 11 overall.

So really a very good diet - And why not?

It's a "eat less, move more" sort of approach.

Cut your calories in, increase your calories out

and hey presto, you're going to lose weight.

So that's why it does so well, because all the doctors recommended it and so on.

The thing is that there have been some studies,

that have been done on these contestants.

And it's very interesting to look scientifically

at what actually happens to these people

as they do this sort of "eat less, move more" approach.

Now, The Biggest Loser of course is that approach on steroids.

So eating a lot less and you're moving a lot more

and that's why you get these dramatic weight losses.

So one season they actually took these contestants, made them sign consents

and then actually did metabolic studies on them.

And what's interesting is that at first it looks amazing. Right?

And we've all seen that show, the before and the after looks amazing.

And the studies really bear that out.

So if you look at the before and after, so at week 6 and week 30,

at the end of the show is week 30,

you can see that they've lost a lot of weight.

This is 60 kg. Right?

And this is fat mass.

So most of it is fat. Right?

Everybody says, "Oh, you're going to loose muscle."

No, you're losing mostly fat.

There's a little bit of muscle loss, but it's mostly fat.

And this is their body fat percentage.

It falls a pretty steady trend downwards

and the average went from 329 pounds to 202 pounds, so amazing results.

Body fat went from 49% to 28%,

so at the end of the show you get these great results,

you have the end of the show, everybody wins.

And they pretend like everything's fine, but we know that it isn't.

And why not? What's the problem?

It sounds like it should work. Right?

You keep doing what you're doing and you keep losing weight,

but you don't and the reason-- and we've known this for actually 100 years

is that your metabolism starts to slow down.

And this is what happened to the metabolism of all these contestants.

And you can see in the solid bar,

that's their baseline rate of metabolism before they started this

and the open circles is that afterwards.

You can see that in virtually every case

these people are cutting the amount of calories they expend by a lot.

So you can look at some of these dramatic examples.

So this fellow for example starts out by burning 3500 cal a day

and he has dropped all the way to about 1700 cal a day.

And it's not just him, it's everybody.

If you take the entire group of people,

the average decrease in metabolism is over 700 cal a day.

So if you start by burning 3500, which is a lot, so you start at 2000,

you're going to drop down to like 1200 - 1300 by the end of the show.

So you wonder why you are not losing weight.

Well it's because your metabolism has slowed down so much,

that if you are burning 1300 and you are eating 1500,

remember that's still a lot less than you used to eat,

you are going to gain the weight back.

That's exactly what we all know happens.

You feel cold, you feel tired, you feel hungry, you feel like shit

and the weight is going back up.

And that's the problem. Right?

We all know that's the problem.

It's the decrease in metabolism.

So you can try to make up for it with more exercise

and that's what they pretend that you can do.

So you can see our baseline, there's a certain amount which is resting metabolic rate,

certain amount of exercise.

During the show they burn a hell of a lot of calories as exercise.

You see at the grand tops, your total energy expenditure is better,

but when you stop exercising for like you know five hours a day,

look at what was happens to your basal metabolism.

This is your resting metabolic rate...

It's already gone down by week six,

so don't kid yourself - this is happening all the time,

but by week 30 it's gone down even more.

And that's the whole problem - you get this metabolic slowdown.

And because you're not burning as much energy,

you don't have that, you know, liveliness, you don't feel very good.

And you can see this in this graph, you can see these are the Biggest Loser contestants,

and you see that the basal metabolic rate just keeps on going down.

But there's a similar extreme measure that doesn't seem to have this problem.

And the question is, "Why?"

So you can look at bariatric surgeries--

So bariatric surgery is stomach stapling surgery.

So you cut your stomach into the size of a walnut, you really just can't eat.

And you can't eat for months and months and months.

And guess what? The weight goes down. Right?

That's not a surprise.

The surprise is that it works to keep weight off in the long term.

Yeah, there are a lot of problems with this.

So I'm not recommending it for anybody.

But if you look at the resting metabolic rate,

with a similarly sort of extreme measure, it goes back up.

The question is, "Why?"

So this is another study of the long-term effects of bariatrics

and you can see that a baseline and a follow-up - this is several years later,

the resting metabolic rate and the total energy expenditure,

how much energy you're burning, has really not gone down.

As opposed to the "eat less, move more",

where it keeps going down, keeps going down until you fail.

That of course is the saddest part of all.

The saddest part of the entire thing is that we know about this metabolic slowdown.

This was shown in 1915, so we've known about it for 100 years.

What I think is sad is that we give people this really horrific advice

to "eat less and move more"

and then when they fail, we blame them for it.

And that's basically you're blaming the victim.

Because here's this poor fellow, or poorly lady, who's victimized

because they're suffering from obesity, from type 2 diabetes.

You give them really bad advice, which you know is going to fail...

Because we've all done it, it fails every single time,

and then when the weight goes back, you say, "You should have listened to me better.

You should have had more willpower, you shouldn't have eaten that bagel."

Or whatever it is you tell people. Right?

That's really the saddest part of all, that doesn't make any sense.

How can like 40% - 50% of the population be so morally bankrupt

that they let this happen to them?

Is it not more logical that the advice that we gave was just really crappy?

That seems to me much more sensible.

So we're going to explain why this sort of discrepancy exists.

So in order to do that, you have to understand what happens when you eat.

So what happens when you eat is that insulin goes up.

So most foods, almost all foods, have a mixture of macronutrients -

fats, carbohydrates and protein.

So your insulin goes up to a varying degree.

And insulin basically is the hormone that tells your body to store fat.

So it stops your body from burning fat,

you start to store some of the sugar and store some of the fat.

And this is normal.

So carbohydrates get turned into glycogen, which are chains of glucose.

The chains of glucose in the liver is basically a storage form of sugar.

And when you have too much of that, your liver produces lipids,

which is called De Novo Lipogenesys

and it basically stores fat.

So when you don't eat, when you're fasting...

so fasting is merely the absence of eating...

your insulin levels fall.

And that's a signal to start pulling some of that energy out.

So you are going to start by pulling some energy out from the glycogen,

which is your stored sugar

and you are going to pull some energy out of the stored fat.

So you can think of it, the glycogen, like a refrigerator.

You're storing food energy.

And the reason it's like a refrigerator is that it's easy to access.

So you can put food in easily, you can take food out easily.

And the fat is more like your freezer.

So you can store more of it, but it's in your basement, you know,

it's hard to get to, it's hard to get out, it's hard to put in.

So you generally prefer to use your refrigerator.

It's the same idea - you have two storage forms of energy.

One easy-to-use and one not so easy to use.

The refrigerator though has a limited capacity.

If you have to much stuff, you have no choice but to put in your freezer.

Now the reason that the calories don't work,

is that they operate on what I call a One Compartment Model.

So that means they pretend that all your calories go into your body

and they are all the same.

All your calories are the same.

They are stored in one giant compartment like this sink,

and when it comes to taking out energy, it all comes out to the same thing.

Therefore if you follow this sort of very simplistic, incorrect model,

what you see is that if you simply reduce the calories going in,

you will reduce your weight.

And if you increase the calories out, you will increase the weight.

But the entire premise of this sort of "calories in, calories out" model

is completely fictitious,

because we know that's not what happens in the body.

The body doesn't have some giant vat of calories.

You can store sugar, you can store fat.

It's not some giant vat of calories that's held somewhere in your liver.

But that's what they all pretended it is.

So if you have the entire wrong idea of why this should work,

then it's not going to work.

What instead is a better model is a Two Compartment Model.

That is there are two places in the body where you can store food.

You've got your fridge and you've got your freezer.

Calories go in into your fridge and calories go out from the fridge.

Because that's the easiest place they go.

But there's a third thing that you have to consider

and that is how much food goes back and forth between the freezer and the fridge.

Because that's what we're really interested in.

This - the fat.

That's the one that's much harder to get to.

And the question is, "What's controlling this?"

Because that's really the key - the main player is insulin.

We know this because insulin inhibits lipolysis. Right?

What that means is it stops you from getting the fat coming out.

That's its job, that's it's normal job.

So if you have a lot of insulin--

so normally if you eat a huge meal, your insulin is high,

it's going to tell the body to move all the storage in this way.

If your insulin is very high, then you can't get the food back out this way.

And that's the problem.

So if you have a lot of insulin resistance for example,

which keeps your insulin levels very high,

it's like that freezer has kind of locked away in the basement,

behind, you know, steel bars - you can't get at it.

So what happens now when you start reducing your calories?

If you start reducing your calories in

and you can't get at your storage,

what your body is simply going to do is reduce the calories out.

That's what it does. Right?

Because it's not going to keep losing weight until you die.

That's just ridiculous.

So if you look at the Women's Health Initiative,

which is a huge 50,000 persons study,

they reduced calories by 350.

Per day for like seven years.

And they estimated that people would lose 30 pounds,

women would lose 30 pounds per year.

So in seven years they should have lost 210 pounds.

Of course that didn't happen.

How much did they lose? Not even a single pound.

It was ridiculous, because what happened of course is that their body--

if you are not affecting the insulin, you can't get out that fat.

You're just going to reduce your calories out.

And notice here that we're not breaking any laws of thermodynamics.

"Calories in, calories out", yeah, you are accounting for all the calories,

but what's important is the compartmentalization of energy.

That's what we are talking about, not the total energy, but where it goes.

Because that's what we want to know.

If you eat and you just burn it off, who cares?

That would be great.

But if you eat and all of it goes into fat... well, now you care a lot.

But it's not that calories or imbalance.

If you eat an extra 500 calories, your body burns it all off as heat...

yeah, who cares?

You don't have any extra body fat.

If you eat 500 extra calories, the insulin is telling it all to shunt into here...

well that's a problem.

And that's really the problem of the To Compartments syndrome.

So if you look at what happens during fasting--

What happens? Because everybody worries about this. Right?

"Oh, what about protein? You're burning your muscle, right?

So this is a study by Kevin Hall from the NIH

and he basically looked at what happens during fasting.

And this is what happens.

So for the first couple of days of fasting,

what you see is that carbohydrate oxidation goes up, it goes way up.

In other words you're burning sugar.

You can see that fat doesn't actually move for a couple of days.

You are not burning a hell of a lot of fat.

And then as you run out of the glycogen,

remember that the glycogen is your easily accessed energy,

but limited in terms of how much you can store,

once it all burns out, then look - fat oxidation goes off.

Now you're burning fat for energy.

That's perfect.

That's exactly what we want to do.

What happened to protein? Are you burning muscle?

No, it goes up slightly at the very beginning, then drops.

So protein is not a storage form of energy.

Why would your body burn it for energy?

You hear this argument all the time - "You are going to burn muscle."

So it is ridiculous, right?

Because you're telling me that the way we're designed is to store energy as fat,

but when the chips are down, we'll burn muscle.

Right?

I don't think so.

It's like if you have a wood burning stove, you store firewood,

because you are going to burn it.

But when the chips are down, you don't chop up your sofa and thrown it into the fire.

Right? It's crazy!

The other thing that's ridiculous is that

if you have repeated fast famine cycles, like cavemen might have had for instance,

so you store fat, burn muscle. Right?

So at the end of a few of these cycles,

you're like one giant ball of 100% fat.

Is that's what happens to the bears. Right?

It's like, come on, don't be ridiculous.

You don't burn muscle.

Protein, yes, you do need a certain amount of protein

to maintain your lean protein, but it's not increased.

That's my point, it's not that is not zero... there is some.

But it's not increased in response to fasting.

The reason I talk about fasting and low carbohydrate diets is that

what it does very effectively

and probably more effectively than any other intervention

is it empties out that fridge.

Remember, what you want to do is get rid of all that insulin too.

Because now if you don't have insulin

telling your body to shunt all that energy into fat,

now you can start to move your calories out this way.

If you have a lot of insulin-- so we do this for example -

if we give people exogenous insulin, they can't lose weight even if they fast.

It's very hard, because they can't access that fat.

They just keep reducing their calorie expenditure.

But the whole point is that fasting provides the easiest way.

You get rid of all that glycogen, you get your insulin down,

so you can actually access your body fat... and there!

And the whole thing is that, "Why can't you fast?"

I asked my son one time a few years ago,

"How do you lose weight?"

He was six or seven at the time.

And he goes, "Just don't eat!"

So easy... right?

I was like, "Oh, how can you be so right about this?"

Point that has escaped like 99% of the world's doctors and dietitians.

If you don't eat, you're going to lose weight.

And here's the thing to understand - there is nothing wrong with that.

That's the way we're built.

That's the way lions are built, that's the way tigers are built,

that's the way bears are built, that's the way we're built.

We're built to withstand these repeated episodes, where there's no food.

Because back in the caveman days, there's no McDonald's,

there's no refrigerator, there's nothing.

So one of the most ironic things is that this is what you hear all the time -

"Fasting is going to put you into starvation mode."

This is actually very ironic.

Because starvation mode refers to the idea

that your metabolism slows to such an extent, that you're going to regain weight.

So I've heard that before somewhere.

That's exactly what happens when you try to reduce your calories.

If you don't do anything about your insulin and just reduce your calories,

your metabolism goes down, you're going into starvation mode.

But what happens during fasting? Does it happen?

Well here's a study of four consecutive days of fasting.

So this is in normal people.

And what you see is that at the top the weight goes down, so that's great.

That's exactly what we expect to see.

But what happens to your REE? - This is this middle line here.

That's the Resting Energy Expenditure.

That's your basal metabolism.

It doesn't go down.

It goes up.

Right?

You're burning more energy than you did.

Now you might think, "Why is that so?"

Well, it makes a lot of sense,

because suppose again you're a caveman and there's nothing to eat.

It's winter there's nothing to eat.

So if your body starts shutting down,

then you're even less likely to find something to eat.

Because you're tired, you can't go out there and hunt a woolly mammoth.

You're tired, you need to sleep.

So you're all going to die like that.

Your body is just not that stupid.

Your body says, "Wow, you have nothing to eat,

"so I'm going to give you energy.

"I'm going to increase the amount of energy you're burning

"and I'm going to provide it from your fat stores,

because you need to go out and eat and fill up this refrigerator again."

So that's exactly what you do,

otherwise we wouldn't be here. Right?

We would be like cockroaches and insects running the world.

So what happens to your VO2?- That's how much oxygen you can metabolize.

Does it slow down? No, it goes up.

Again, you have more capacity to do exercise, more energy.

Now why is that so?

One - you're burning fat for energy and your body's like,

"Whoa, there's a lot of this! So there's plenty of it, let's go!"

But the other thing you see is that the norepinephrine--

so norepinephrine and epinephrine are called adrenaline or noradrenalin...

--so your body is actually providing you with a big kick in the pants

to keep your energy expenditure high.

Because that's what you need to do to survive.

So insulin drops, which is one of the major things that we want to see,

and your hormones-- remember, obesity is a hormonal disease, they go up.

They are providing you the tools to burn fat.

So there's no starvation mode, actually it's quite the opposite.

It goes up.

You can do something called Alternate Daily Fasting,

which is kind of one day of fasting, one off

and in these studies it's not actually a full fast,

so they still allow about 500 calories on those fasting days.

So it's not even a true fast,

but the calories are low enough that you still get the benefits.

And again, if you look at that resting metabolic rate, which is the first line,

you can see that from baseline to day 22, so a couple weeks of alternate daily fasting,

your resting metabolic rate really hasn't dropped.

Your fat oxidation goes way up, so you're burning fat.

You can't argue with that.

You can measure these things - you're burning fat.

Why? - Because you have no carbohydrate to burn.

Right?

Because you're clearing out that fridge,

you're clearing out all that stored sugar and burning fat.

That's great, that's exactly what we want to do.

The other thing we talked a little bit about already

is that you're going to burn muscle.

Again the idea is that you're going to burn protein to provide glucose.

And that doesn't actually happen.

This has been known again for 20 - 25 years.

So if you look at your urea - urea is breakdown product of protein.

So you can see that you excrete a certain amount of nitrogen every day.

You're also taking in a certain amount of nitrogen every day.

This is under normal conditions.

Now you fast people, like you just give them nothing to eat.

Well what happens? - well there's virtually no urea coming out.

Now there's nothing going in too, but what you notice

is that you're not burning muscle, because if you're burning muscle,

that urea should skyrocket or at least be as high as this.

Your body is actively conserving your protein, your muscle mass.

And that's what happens during fasting.

And you can do 70 days of alternate daily fasting.

So 70 days is more than two and a bit months

and what you see is that if you measure fat mass and fat free mass in this study,

you can see that fat mass goes down very nicely from 43.5 to 38.1 kg.

And the fat free mass, your lean mass, doesn't move at all.

So these are some of myths that everybody tells you.

Starvation mode, burning proteins

and here's my favorite - "It doesn't work, that's never going to work."

It's like okay, genius,

if you don't eat, do you think you will lose weight?

Well, yes you will.

So it's not exactly a very good come back for people

to say, "It won't work."

Because it will definitely work.

I'm not saying is easy, okay? That's a whole other thing.

"Can you do it?" - that's a separate question.

I actually think that most people can do it.

But if you are able to do it, yes, you will lose weight.

And here's the thing -

so back in the 1960s they have done a bunch of studies on these patients

and what they did was they admitted them to hospital...

they did that back then and they just watched them.

And you can see that people lose weight.

And here's the thing that it's always said - people go, "How about women?

Women shouldn't fast."

Why not? Don't you think you'll lose weight? Yes, you will.

Now if you are underweight, then yeah, you shouldn't be fasting.

You're going to get amenorrhea, you are going to get menstrual problems,

but if you're knit to lose weight, yes you will lose weight.

And that's exactly what they found in all the studies.

So you have men - they lose weight, you have women - they lose weight.

And what you can see there - it's fairly steady.

There's no kind of drop off,

there's no drop off that kind of graded weight plateau,

because that's the whole problem with weight regain is that we all plateau.

There's so many advantages to fasting that are just not available,

and that is completely different from most other diets,

which tell you what to do.

This is really the opposite, it's something you don't do.

So one of the biggest advantages is really that it's completely simple.

I'm going to explain it in like two seconds.

And everybody understands intrinsically what it is.

Now there are variations.

There are fat fasters, juice fasters, water only fasters,

no water fasters - all kinds of variations.

But at its very core it's easy to understand.

That's important because if people don't understand what you're trying to do,

they can't do it. Right?

It's free.

Like, you know, as much as I would love to always eat home-cooked meals

than you know long simmered bone broth,

the truth is that most of us sometimes don't have the time

and don't have the inclination, don't have the money.

If you want to eat grass fed beef every day, it's going to cost you.

You want to eat organic all the time, it's going to cost you.

I am not saying that you shouldn't, but it's expensive.

And some people just have no money.

It's convenient.

So again you can cook all you want, but it takes time.

And sometimes you just don't have the time.

But this one there is no shopping, there's no preparation,

there's no cooking, there's no cleanup, there's no eating.

There is nothing.

It's so convenient.

Because again the key is not something to do.

It's something to not do.

And that makes it completely different and something that you can have.

Something that's completely flexible.

So it's not like, "Oh, yeah, you need to eat six times a day."

It's like sometimes you just don't want to eat,

sometimes you are busy.

This is going to give you more time.

You can put it anywhere, you can do it tomorrow

and you can not do it the whole next week and then do it again.

You can do whatever you want - it's completely flexible.

You could do it for 12 hours, you could do it for 12 days.

It doesn't matter.

And really the point is that you can add it to any diet,

because again it's something that you can put in and fit in wherever you need to.

So say you want to eat, you know, the Rice Diet, or something like that.

You could still fast. Right?

That's the whole point.

You don't eat meat? You can still fast.

You don't eat wheat? You can still fast.

You have a nut allergy? You can still fast.

You don't have time? You can still fast.

You don't have money? You can still fast.

You are traveling all the day? You can still fast.

You don't cook? You can still fast.

And probably the most important thing

is that it really has unlimited power. Right?

And as a doctor sometimes you get into these things very--

you want to do something and it's not strong enough. Right?

Well, you can just keep fasting until you get the results you see.

As I said, if you don't eat, you will lose weight.

It's almost impossible to not. Right?

"Can you keep it up?" - that's a separate question.

I'm not saying it's easy, I'm not saying that--

I mean you do have to have the proper medical supervision,

especially if you're on medications and so on,

but you could fast.

I have a 75-year-old who did like 30 days and he felt great.

The world record is 382 days.

You can keep going.

And this is the whole point, that this gives you options,

because it's not a diet, it's no diet, it's nothing.

It's like Costanza, it's a show about nothing.

There's a talk about nothing.

George Costanza is so smart.

That's the whole point - is that because it's the opposite,

it gives you so much flexibility.

And it has the ability to really free yourself of the chains that bind us down.

We have all these problems, the number one problem in the world today...

You got heart attacks, you got cancer, you got strokes,

you got diabetes, you got kidney disease

and it's all due to obesity, it's all due to diabetes.

But yes, we have the ability to free ourselves

from all of these modern afflictions.

Only with the application of a technique

they knew 5000 years ago.

The ancient Greeks were all about fasting.

Not for health, they didn't have a lot of obesity back then.

But because it gave you energy, it gave you like mental focus.

That's why they did it.

And these involuntary periods of fasting

eventually got taken out as we started getting more reliable food,

then religion started introducing periods of fasting.

So if you look at any major religion in the world, they have periods of fasting.

And remember that they are not trying to kill all their practitioners.

They are not like, "Oh, you should fast, you will die."

That's not it at all.

They did it because there is something

deeply intrinsically beneficial to the fasting.

And it was always known it's a cleansing, it's a detox.

There's probably only one thing

that the three most influential people in the history of the world agreed on.

So the Prophet Mohammed, Jesus Christ and Buddha -

they all agreed on one thing.

And that is fasting is very beneficial.

It's uniquely beneficial.

Not only for the spirit, but also for your body.

We need to clean ourselves out of this junk that accumulates.

All this extra sugar, all the insulin, all the fat.

We need to clean it out once in a while.

It's a spring cleaning, that's all it is.

And yet with the application of this kind of ancient time-tested technique,

we can break free of all this.

In the last century we broke free of a lot of infectious diseases -

tuberculosis, pneumonia and all this.

Now all that replaced with was all these diseases.

But we have the knowledge, we only have to apply it.

And that's the most ironic part of all.

We won't.

But there's no reason why we won't.

We have always been told by everybody that we have to do this.

And yet why do we not?

My son knew it.

Thank you very much.