[00:00:00] **Dr Mike T Nelson:** Hey there, what's going on? It's Dr. Mike T. Nelson here. I'm back with another episode of the Flex Diet Podcast, and today is just a solo cast with yours, truly nerdy, and I'm talking all about the effects of cold water immersion primarily on metabolic rate. I think there's been some interesting discussions on this, and I wanted to go back and do an even more immersive deep dive into the literature on this again, so that you can be updated and decide for yourself if cold water immersion for the purpose of changing metabolic rate is going to be useful for you or not.

[00:00:48] And if you enjoy this podcast, today, check out the Physiologic Flexibility Certification cuz a big component of this is temperature changes. Your body is a homeotherm, it wants to maintain 98.6 degrees, or didn't even trust that stat. So I pulled more data on it and it's probably about 97.7, but whatever

[00:01:13] Your body wants to keep that core temperature. It has to keep that core temperature. It can't deviate by more than a few degrees, otherwise you're dead. But we can go into a sauna, we can go into cold water via air, also cold air exposure, exercise in the heat, et cetera, and we can challenge the body, just like you would challenge your right bicep or your pectoralis muscles on bench press Mondays in the gym.

[00:01:41] It's really the same idea and when you challenge it in an intelligent manner and don't go too far, just like lifting too heavy of a weight or improperly, you could injure yourself. If you're following immersion in cold water or exposure to heat, and you do it in an intelligent manner, You will also see adaptations, right?

[00:02:07] We all know of times when you were more acclimated to the heat. It seems easier In the past we've gone to our good buddy, Dr. Ben House's place flow retreat in Costa Rica. And most of the time when I've been down there it's been in spring and normally it's not very warm in Minnesota. So I tend to not to do very good in the heat down there unless I've done some specific sauna work and you've had this experience.

[00:02:37] If you live in a cold climate such as Minnesota, Canada, Midwest, Northeast, Northwest, et cetera, or even different parts of the world, we've got people listening in from all sorts of northern climates. That when it gets to a warmer temperature in spring, it's T-shirt weather. It's time to run around in a t-shirt, even though that temperature may be 10, 15, 20 degrees Fahrenheit below what it felt like in fall.

[00:03:03] So just that little bit of exposure when you're outside, during the winter, you adapt to the colder temperature. So in the Phys Flex Cert, we cover temperature as one of the main ways you can challenge your homeostatic, setpoint of your body, so homeostasis. That is the point where your body wants to stay happy and it will defend that.

[00:03:27] The other three core areas are pH. And then also fuels, which will be glucose and ketones. And the last one is air oxygen and carbon dioxide. This gets into breath holds and breathing fast, some kind of Wim Hoff type techniques and other things. The reason you want to train these systems, which I don't think it trained all that often, is that it's gonna enhance the resilience of your body and allow you to recover even faster.

[00:04:00] And again, in my biased opinion, I think this is also probably one of the best ways to increase your longevity, right? So after you've been good at doing exercise and great nutrition, getting good sleep, all those things obviously help longevity. I think this would be the next main area to look into. So the Phys Flex Cert is the level two follow up to the level one, which is a Flex diet certification.

[00:04:25] So on the Flex Diet certification, we go over the eight interventions to better Nutrition and recovery and the Physiologic Flexibility Cert we expand that into the four areas I just talked about. and the action items. So what you would actually do include everything from cold water exposure, like taking a cold shower, being outside when it's just a little bit cold.

[00:04:47] Heat breathing techniques from breath holds to breathing really fast box breathing many different ways of doing breath work. Also, pH changes, which can be done by lower intensity exercise or especially high intense exercise. Some things such as blood flow restriction training that's gonna alter the local environment in the muscle when you should consider doing a ketogenic diet, even if you are a healthy individual.

[00:05:14] And once you consider bumping up glucose and carbohydrates even more. Especially for performance. So all that's included in the Phys Flex certification. It is open today, which is Monday, March 20th. So go to physiologicflexibility.com for all the information there. It will be open for one week until midnight March 27, 2023 to go to physiologicflexibility.com and enjoy my solocast here of me ranting away with data about the potential effects of cold water immersion primarily.

[00:05:53] and its effect on metabolism. Is that even true? So claims of boosting your metabolic rate by 350%. If it is true, what do you have to do to get that kind of bump in metabolism? So listen in. Thank. All right, welcome. So on this one, you may be listening to this only in audio, but there will be a video also.

[00:06:19] What I wanted to do is cover the effects of specifically cold water and the claim of does it increase your metabolism. We're all looking for things to increase metabolism with the idea there that would help weight loss, which that itself is a separate question. So we're gonna tackle this sub-question here of does cold water immersion increase metabolism?

[00:06:44] And so if you type this into the old Googles here, you'll see some interesting things pop up. Some of it they did get correct. So what you'll find right away is that cold water immersion increases metabolism in two main ways, shivering of thermogenesis and non shivering thermo genesises. Non shivering thermo is mediated by a special kind of mitochondrial dense fat called brown fat, which converts food to heat to keep you warm without shivering.

[00:07:15] So that part is a hundred percent true. And what's interesting about some of these claims is if you think about them, they do make sense. Your body wants to maintain. It's normal core temperature, so if you expose it to hot or cold, in this case cold, it has to then produce a little bit more heat in order to keep up that core temperature, and the production of heat is going to consume calories.

[00:07:43] Therefore, doing this is going to be a big caloric drain, therefore increasing your metabolism. and the two ways here are shivering thermogenesis and non shivering thermogenesis. So the term thermogenesis increase in thermo increasing heat. If you've ever been really cold and you started shivering, that is your body's way of trying to create muscular activation, because we all know the byproduct of that is going to be heat, and this is important to keep in track or to think of.

[00:08:19] Because shivering is going to burn more calories than non-shivering. While it's a little bit of an oversimplification, non-shivering thermogenesis is primarily using fat as a fuel. Shivering thermogenesis is primarily using carbohydrates as a fuel. So again, we're not gonna go too far down into that.

[00:08:43] We're gonna talk overall, does it increase metabolism? So looking at the total amount of calories, . It is also true that exposure to cold water, cold temperatures over time can increase brown adipose tissue or this bat tissue, b a

t, brown adipose tissue, and it is brown because it does have a whole bunch of the mitochondria.

[00:09:07] Little furnaces of the cell. And yes, they do more than just create energy, but that is their primary job. So some of that part, so far, all good and true. So I tried to find some other claims here. We've got another one of, let's see, this was drinking, I think it was drinking cold water which we won't talk too much about here.

[00:09:30] This is actually talking all about cold water therapy. Who uses it what are some of the benefits and most of the time you'll see here in other articles that this increases your metabolic rate. Another article, nine Ways to Boost Your Metabolism Backed By Science. And this gets a little tricky because.

[00:09:53] they're talking about drinking more cold water. So when you drink cold water it does increase metabolism by about 10 to 30%. This is about half a liter of cold water. Again, only that stays for about an hour. So if you do some small things like that, could it add up to something beneficial? Yeah, I think that it could but we have to keep in mind how easy is it to do those things?

[00:10:18] Drinking cold water, relatively easy, getting exposure to cold water. Take some more time, even if you're just doing a shower and it's much higher than what I call the pain in the ass factor. One of the other claims that you'll find is, let me see if I found it earlier, but that cold water immersion will increase metabolism by

[00:10:43] 350%. So that seems like a huge amount. Also be careful when you are Googling these things. Most of the time it's not gonna take you to the actual study. I was able to find this one. So my Google search here is preferentially loaded into that. So we will come back to that particular study.

[00:11:06] looking at how cold the water do you need? How long do you need to see that kind of increase? So it is true that we do have a study showing that your basal metabolic rate, so this is increased from baseline, how much energy takes just to be up and moving around. We found one study that does show it is increased by 350%.

[00:11:28] So keep that in mind and we will come back to that one. So some other things to consider when we're looking at actual studies is like most things, it's pretty darn messy, right? I've pulled up some of the studies here and if we go into just a little bit more depth on that. So the first one I'm gonna talk about

here, Is, this is a great table and I will give you the full reference here at the end, but this was the best accumulation of cold induced thermogenesis in humans that pulled together a lot of the studies that have been done in the flex diet, or I'm sorry, in the Phys Flex certification.

[00:12:14] I do talk about this VOT was one of the very first studies that had been done that actually had been. Published. That was in the year 1878. So in terms of scientific things, we've been looking at this for quite a while. So that study was pretty interesting. If you read the subject line, this is actually true.

[00:12:32] They used one in air quotes, strong man. They did put him in cold for six hours sitting, and this was an air temperature that ranged from 4.4 to 30 degrees C. So keep in mind zero degrees. C is 32 Fahrenheit, 10 degrees centigrade, or C is 50 degrees Fahrenheit. So this person was sitting in minimal clothing.

[00:12:57] If you pull the full study for six hours, At just above freezing. So if I go through some of these real quick, if we look at the percentage increased in most studies now again, this is pulling together other studies. The two things I want you to think about is, , what was the average percent increase and then how long and how cold does it have to be?

[00:13:25] Now again, keep in mind some of these early studies, and a lot of 'em are done with exposure to air. So you could argue that if you're doing exposure to cold water, which we'll get into, you can decrease the amount of time, right? Because we know that cold water, like water, is a medium compared to air. Is going to pull heat away from the body really rapidly especially compared to air.

[00:13:50] So what you may not know is that my master's thesis I did masters in mechanical engineering and I initially did study biomechanics, but my thesis because I could not find research funding for biomechanics, I actually did heat transfer. So I did heat transfer making a computer generated model.

[00:14:09] The big monkey head and we shot the monkey head with these very high gigahertz microwaves. And we looked to see on the computer generated model how much deep tissue heating we saw in the monkey. Turns out we didn't really see a whole lot. All that to say I have a fair amount of experience of looking at heat transfer rates in humans, or I guess you could argue monkeys.

[00:14:32] So if we're looking at here, percentage of increase, I'm not gonna so swift. 1932 11% increase. This was about 1.2 hours supine in air of two to 24

degrees centigrade. A couple other studies saw zero increase. Granted they used a small number of people. Two in most of those studies. Again, that was air exposure again.

[00:14:56] Next study is 7.5% increase for what they called responders. So in that study, they divided 'em into responders versus non-responders. That was actually 13 women. Most of these studies were men, but not all of 'em. And that's two and a half hours. Supine air temperature, a little bit warmer, 22 to 35 degrees.

[00:15:14] And that was dubois in 1952. Another one, 7%, another one 5%, another one, 8.5%. And again, these are all percentages of average increase in what's called cold induced thermogenesis. Most of 'em here. Ten five point one, 2.8. Here's one who compared lean versus obese? 13.7 for lean. 17.2 for obese.

[00:15:36] Another study here. 1% increase, 5.9%. 3.5. So you get the gist here that most of the percentages have increased. Here are relatively small. We're not seeing huge increases, and most of the time, because this is air exposure, it is gonna be quite some time. Right now, some of these didn't use super crazy temperatures.

[00:16:01] We've got a couple, like this one used, five people saw 6% increase. And they dropped the air temperature for 24 hour daily living between 19 to 24 degrees centigrade. That's published by Lee 2014. In terms of methods to analyze this the next way we can divide them is by using something called the portable metabolic cart.

[00:16:21] The early version of this used something called Douglas bags. So for my PhD work, I did a lot of stuff with metabolic. , you've already seen those pictures of a device where you're breathing into some tubes and they go out and be analyzed by this device that's usually sitting next to the treadmill or the bike.

[00:16:38] Some of the newer, more smaller units now, like I have a device called a PNOE, that's p n O e that is in a backpack shape. So I do have a, have my own metabolic cart, which I can do my own measurements, which is pretty. . Not cheap, but definitely fun. So these devices look at the air, so oxygen and carbon dioxide.

[00:16:57] And from that they can make inferences on the total number of calories burned, and then sometimes are using fat or carbohydrates dependent upon the sophistication of the device. So this is a more accurate way of doing

measurements. And what we'll see here is that for some of the studies, again, we do see a little bit more of a bigger increase.

[00:17:18] Again, this is called a new thermogenesis percent increase. Again, so this is not necessarily the same as converting it to metabolic rate. But what I wanted to point out is that overall we're not seeing huge percentage changes. So for this one, one of the greatest ones they saw was looking at winter swimmers, 65% increase.

[00:17:41] Again, two hours supine at air. 11.8 degrees centigrade. That was by Davis, 1961. So for some of the other ones, again, we're seeing 11%. We did see one here at about 280%. I don't know how much I trust that study though, some of the later studies they were trying to differentiate between people who are more cold adapted versus people who were not.

[00:18:05] And they're trying to make some corrections for that. We had some studies that were comparing endurance trained versus untrained people for endurance. We saw an 11.8% increase for untrained, an 8.0% increase for trained individuals. And this was actually trying to account for the point at which they would start to shiver.

[00:18:26] So they changed the temperature based on that, and that was 2015. So I won't go through all the other ones here. Again, we see there's a fair amount here also at the end. One study, which I thought was pretty interesting started getting into water immersion. So on this one we do see some studies for that.

[00:18:45] So here was a bigger study by Canon Andre 1960. We saw a 91% increase for lean and 26% increase for overweight. This looked at six normal weight and two overweight or obese young men. And this was about 2.5 hours seated submerged up to their neck. They did individualize a temperature per individual, so the temperature did range from eight degrees C to 38 degrees, which is relatively warm.

[00:19:13] Keep in mind that eight degrees C is about 46 degrees Farenheit. , if you've ever gotten into a tank of cold water at 46 degrees, it's not real fun. I don't wanna sit in there for long periods of time. Again, like I mentioned, they did some studies on Eskimos here. One hour immersed except for the face water temp there, 33 or 35 degrees centigrade, so not super cold.

[00:19:38] They did see an increase of around 5.7 to 2.6. . So again, the key takeaway here is even when we look at water immersion, we're generally seeing

longer times in colder temperatures, although not super cold. Again, if you wanna read this whole study, which was awesome, it's called Cold Induced Thermogenesis in Humans.

[00:19:59] It is by RJ Broca. I probably slaughtered that name, B r y c h T a and k y Chen just looked that up. You'll be, you'll find it a European Journal of Clinical Nutrients 2017. So that shows us that, yeah, we do see changes there. In terms of cold water and also air, but they are relatively small. So if we go back to the other main study here and we look at, so where this 350% increase was mentioned first the first place I saw it cited was in a paper called measurement and Prediction of peak Shivering intensity in humans.

[00:20:43] I accepted September, 2000. Main author here is Douglas a Elson, and this is in the European Journal of Applied Physiology, 2001. And with this one, they were trying to model when peak chevron intensity occurs in humans. So if you're gonna look at just total caloric burn or percentage increased above metabolism.

[00:21:07] You wanna look at maximal shivering, right? That's gonna be the point at which that introduction. They talk about, oh, shivering is a well-recognized mechanism, the maintenance of body, core temperature. This goes all the way back to Horvath in 1955 and some earlier studies, and this is the first time I saw that they record that it is five to six times a metabolic rate based on O2 consumption.

[00:21:33] So they said, quote, the intensity of the shiver peak has been reported to be five to six times resting metabolic rate and 46 to 50% of maximal oxygen consumption. And they cite some of the earlier work here from Andler 1946 and some other papers. So if you see things that say cold water immersion can increase your metabolic rate by five to six times.

[00:22:00] That is what it is. In reference to keep in mind that this is shivering most of the time, again, for this not very much fun, right? And in this paper, what they did is they took a group of 15 young fit healthy men. Four women were studied and they took a bunch of measurements. They looked at their VO two max body fat bunch of other things.

[00:22:28] and they were trying to correlate actually skin temperature and other methods to determine when a peak Chevron would occur. So they're trying to do a more predictive model. But if you pull the full study and you look at it, what you'll see is the time that they had to spend again, they use a particular protocol.

[00:22:54] that. So 4.9 times a metabolic rate, right? So this is giving their average and milliliters of O2, right? So in the lab, if we're measuring metabolic rate with a metabolic cart, we're gonna look at, O2 consumption. So for this study, here's what they actually used. I have people come into the room, which was 22 degrees.

[00:23:16] C they had 'em do a resting measurement for 10 minutes while they sat outside the tank. and then quote they were immersed to a level of the sternal notch, so basically almost up to the neck and stirred in a water bath initially set at 20 degrees centigrade, so not super cold. Definitely cold, but not super cold.

[00:23:36] And then they lowered the temperature to eight degrees C, about 46 degrees Fahrenheit over 15 minutes by adding ice. And then next they did their measurements at that low temperature of eight degrees C 46 degrees Fahrenheit for 60 to 70 minutes of immersion. And then they slowly raise the water temperature again.

[00:23:58] So if you can imagine sitting in water temperature that's about 46 degrees Fahrenheit for 60 to 70 minutes, yes, you can dramatically increase your metabolic rate during that time. But that sucks. I don't really want to do that. I've done up to five or eight minutes pretty easily at 46 degrees Fahrenheit.

[00:24:20] The thought of sitting in there for another 50 plus minutes would not be real fun. And that's after I was doing it a fair amount. So yes, you will see an increase there, but pretty long temperatures, long times also, or low temperatures I should say. So if we go back to our study here that we promised, we'd look at, that says a 350% change in metabolic rate.

[00:24:44] This is human physiologic response to immersion into water of different temperatures. The main author here is th ceramic. I may have mispronounce that. S r a M e. . This is in the European Journal of Applied Physiology 2000 pretty interesting study. Side note, this is also the study that looked at big changes in epinephrine, norepinephrine, and dopamine.

[00:25:08] There have been some other studies that showed maybe shorter times and colder We can see pretty big changes in that. But again, I won't necessarily cover that right now. . So our main question is if this 350% increase in metabolic rate is true the thing that I always see left out online is the context i e what do you have to do to get that rate?

[00:25:35] So in the study, again, generally using healthy individuals they did a lot of measurements. They used oxygen consumption again, so that's a good

way to look at changes in metabolic rate. So that was good. They used 10 young men, ages 22 on average. Body fat, relatively low because they're not necessarily overweight VO two max or peak of 56.

[00:25:57] So pretty good people in terms of representative. Of more athletes and in terms of healthy individuals that you would see in terms of a study. Yeah. And so some studies are looking at different pathologies, which is very interesting, but may not necessarily correspond to healthy human beings.

[00:26:17] And then they put them in underwater for head out immersion, sitting on a chair for one hour. . Another interesting part when you're reading studies is the water constantly moving or do they move the water? You will build up a little bit of heated water next to your skin. If you are not moving.

[00:26:36] If you've ever gotten into super cold water, you'll realize that you don't wanna move. And the second you move around a little bit, it feels a lot colder. That's because your skin is heating up and transferring. Energy to a thin layer of water next to you is thermal barrier, and when you move, it disrupts that barrier and you get much colder.

[00:26:59] This is why things like wetsuits work so well. So wetsuits have different thicknesses and usually you can buy them in terms of the seams are sealed or not. It's a way of looking at how much water is gonna be exchanged between you and the environment. The thicker the suit, the more sealed the seams are.

[00:27:16] The more you can heat up that thin layer of water next to the skin and it will help keep you warmer. So similar idea here, but we're not looking at anything that's keeping that barrier in. So as soon as you move, disrupts that barrier immediately. So in this study, the water was stirred manually every two minutes.

[00:27:35] During the emergent, the subjects only wore swimming trunks and they did have them rest beforehand. Did a bunch of other measurements and everything else, so that part interesting. They also collected a whole bunch of measurements and everything else, and they did this study over different water temperatures.

[00:27:55] They did 14 degrees, 20 degrees, and 32 degrees in random order with one week interval between each one. . So again, for our reference point 14 degrees C. 10 degrees C is about 50 degrees Fahrenheit, so 14 degrees C is cold, although not ridiculously cold. I think that is definitely more manageable.

[00:28:19] However, you're looking at an exposure time of most of your body here for about one hour, right? So yes, you can see an increase in metabolic rate. Yes, that is true at least based on this study. True is always relative, but that is what they did show in this study. However, youre gonna need a place where you can be most of your body exposed to water.

[00:28:49] You'll need to move around every couple minutes and the water, not super cold, but relatively cold. . Yeah. And you need to be in there for about one hour. Now if we compare that to, what are some other things that you could actually do and what are like a realistic rate of calories that are being burned, right?

[00:29:13] Because we know exercise will burn a lot of calories. So I did find this other study here called the effect of cold water emergent on metabolic rate in humans as the International Journal of Kinesiology and Sports Science Volume five, number two, April, 2017. And with this one they took six males, 14 females, no injuries, and they came into the lab.

[00:29:37] This is on the University of Wisconsin Lacrosse. And they did a whole bunch of measurements. Again, they're looking at oxygen consumption. And if we just skip to the parts that are most interesting for us, they looked at this over 15 minutes of treatment. And the temperature, let's see that they used here.

[00:29:59] Let's see. Let me double check the temperature.

[00:30:04] The temperature they used was waste deep cold water at nine degrees centigrade. So about 48 degrees Fahrenheit. Pretty cold, not horrible. Horrible, but pretty darn cold. And what was nice is this converted to mean energy expenditure. And if we look at the little graph that they have and interesting enough, mean energy expenditure.

[00:30:31] Went down a little bit, the longer they were exposed. Again, this is just looking at, what was it? If you take a sample every five minutes, if we take the highest amount, and we assume that would be around that point for the whole time it's actually, it was lower. It is 2.43 kilo calories per minute. So if you did this for 10 minutes, you would burn an extra 24 kilo calorie.

[00:31:00] really not that much right now. Again, you could argue is there some other effect of this after you get out? Maybe, some studies have looked at that, but generally, once your skin temperature has rewarmed up, there's not too much of an after effect. Again, if you're getting crazy and you're doing really

cold levels and you're almost shivering, Maybe there is some carryover effect for a couple hours at best.

[00:31:29] And again, the data in that area is almost nonexistent. I had a really hard time finding anything related to that. What was interesting though is that they published the changes in metabolic rate during the five minutes and beforehand, and then the 15 minute cold water treatment. And you see a pretty high amount of variability.

[00:31:51] Now, again, this was not necessarily total per se but we see it range anywheres from participant 10 here was at 3.61 and one of the lowest ones for the cold water block at about 1.73. So what's interesting to me is that we do see a fair amount of variability from one person to the next.

[00:32:15] But it wasn't massive. It wasn't a huge effect. We're not seeing, five or 10 times different effects. Now, keep in mind that the average for the baseline for most people here is about 1.5, right? So this is not an absolute, we're seeing a change. For example, participant one 1.63 kcals per minute at baseline, and then five to 10 minutes later, 2.6.

[00:32:41] So they are definitely going up. What's interesting is that almost all of 'em over time went down and if we do look at the treatment afterwards, so they used a five minute post-treatment measurement. They were staying elevated over baseline, but even at that point, almost all of 'em were starting to come down.

[00:33:01] So this is some data to show that it does stay elevated above baseline, but we're not seeing massive. Elevations above baseline stain for long periods of time. If we compare it to exercise, and again, I'll give the title of what the study is from here. Most people would say if you're doing an intense, say, CrossFit workout, and that's what they did in this study which was I think a PhD or Master's defense.

[00:33:26] So some data, again, you could argue this wasn't the most high quality data and published in a peer review journal. But you can look up a rate of caloric burn for different types of exercises online. Tons of data on that, multiple sources. Just using this one as a reference if you did about one hour of CrossFit training, the amount of calories you would burn ranged from 362 to 693.

[00:33:50] Kals they compared this to what they call the quote traditional workout, which was 327 to 600 kals per hour. So that just gives you some frame

of reference of how many calories you can burn with exercise. Again, these are all pretty well established tables that you can find online, so you can look that up.

[00:34:10] And this one was caloric expenditure during one exercise session following a C S M and CrossFit guidelines. And this was a thesis defense. The takeaway here is that yes you can see changes. In cold water immersion with relation to metabolic rate. The caveat is you have to be careful reading just the abstracts without the context.

[00:34:40] So for the main study we talked about here if you read the abstract sounds amazing, right? So we have here cold water immersion at 14 degrees lowered rectal temperature and increased metabolic rate. By 350% plasma or adrenalin and dopamine concentrations were increased by 530 and by 250% respectively.

[00:35:01] So again, super interesting. But the abstract here doesn't necessarily tell you how long you were does at the very top, which is removed. This was for a duration of one hour. So if you have a lot of time to kill and you like being miserable and you like shivering, You can increase the metabolic rate using cold exposure.

[00:35:21] However for just a simple caloric burn, I don't think it's all that useful. I do like cold water emergent. I'm actually a huge fan of it. I do think it has a lot of potential. Again, in the Phys Flex Cert, I cover all sorts of things from effects on exercise performance hypertrophy. What parameters, how would you set everything up?

[00:35:43] But. I didn't go super hard down the metabolic total calories burned area because I don't think most people are gonna sit in a tub full of cold water for an hour and be miserable. There's probably a lot of other things you can do. If you look at air exposure, you're gonna need to sit in a very chilly room with minimal clothing for many hours.

[00:36:06] right now. You could argue if you want to drop your temperature at home to a super cold temperature, and those can add up to changes over time, maybe. But I do think there is some benefits to cold water immersion potentially for aerobic performance, which is modified via something called PGC one Alpha.

[00:36:22] There is some interesting things on athletic performance. There is some big caveats related to hypertrophy, adding muscle. , super interesting stuff

with changes to metabolism, especially fat use brown adipose tissue glucose, how well your body can use that. So I am a big fan of cold water immersion and especially do just train your body to do hard things day in and day out.

[00:36:46] So I'm a big fan of cold water immersion, however, to bump up or to increase your metabolic rate, it is true, but the parameters to do that. I don't think our very good investment of your time for the most people. So there you go. That's probably trying to use a sledgehammer to kill a mosquito. Way more information than you probably ever wanted to know.

[00:37:11] Thank you for sitting through all the studies and the reason I wanted all the quotes and stuff from the actual studies and had them pulled up in the video is so you can go back and read them yourself and see where they actually came from and make sure that you do understand the context. Thank you so much.

[00:37:33] Thank you so much for the podcast and listening. Really appreciate it. If someone you think would enjoy this podcast, please send it over to them. If you enjoyed this and you want a much greater deep dive, Into all things related to physiologic flexibility that looks like different breathing techniques, ketones, glucose, high intensity interval training more lower intensity training, so cardiovascular adaptations, and as we just mentioned, temperature changes.

[00:38:07] Go to physiologic flexibility.com. The Phys Flex Cert is now open as of today, which if you're listening to this on the day the podcast came out is March 20, 2023 . It will be open until midnight on March 27, 2023 . If you're listening to this, outside of that time, you can still go to the same link and it'll put you onto the newsletter wait list for the next time that it opens.

[00:38:34] I'm super happy with how the certification turned out. As far as I can tell, it's the only one that covers all four areas. In terms of the actual research and then brings everything back together with a physiologic reason of why you would want to do these things, and especially when would you want to do them all into one system.

[00:38:57] And it has 40 specific action items you can do yourself, or if you're coaching clients. And we have a system to determine which action item is going to be best for the client. That particular system is client led, meaning that the client then also helps decide what is going to be. Best for them by using the concept of coaching leverage.

[00:39:21] So check out physiologicflexibility.com. If you have any questions, you can reach out to me also via the website at contact. And thank you so much for listening to this podcast and sharing it. Really appreciate it. And I hope to see you enrolled in the course there. Last thing is when you enroll in the course, any questions you have about the material in the course, you will get my personal email and I will answer your questions.

[00:39:50] Normally within about 48 hours, sometimes it's a little longer if I'm traveling or away. But I'll do whatever I can to help you understand the material and make sure that you can apply it. So I will personally answer any questions that you have. Go to physiologicflexibility.com. Thank you so much.

[00:40:08] Really appreciate it. Talk to you next week.