Keep Muscle During Fat Loss, Increase Performance, And Add M...

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Hey, welcome back to the flex diet podcast. I'm your host, Dr. Mike T. Nelson, where on this podcast we talk about all ways to increase lean body mass, increase performance and improve body composition, all done in a flexible manner without destroying your health in the process.

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Today, I've got a very interesting study of we're going to break down about a potential supplement that can do all sorts of cool things, appears to be anabolic, anti catabolic, non hormonal, may enhance mitochondrial function may be a good fuel source for high intensity exercise and weight training. And all of that probably sounds too good to be true. But we'll review some actual data on that. And today's program is brought to you by physiologic flexibility, calm, you can go to physiologic flexibility, calm and get on the waitlist via the daily newsletter for the next time that it opens. So if you're looking for what is the next level to do with yourself, and your clients and athletes, once they're pretty darn good with nutrition, recovery, and exercise itself, my bias is by targeting the four homeostatic regulators in the body. This allows you to be much more anti fragile, more robust and increase your recovery ability in record time. So those four areas would be temperature, pH, your body's ability to regulate OTU and co2, and fuels such as blood glucose and ketones. So go to physiologic flexibility.com. Get on the waitlist there. The next time that it opens, you will be the first to be notified. In addition to lots of great, wonderful, geeky information like this delivered free into your email box. Today, we're going to talk about a study that looks at some very interesting effects. So as I hinted to, at the beginning of the show, this supplement, and again, you would only right now be able to find this kind of in a supplemental form per se. Although it is something that your body will manufacture or make endogenously makes on its own, that appears to be anabolic, meaning that it helps to build up muscle tissues specifically appears to be anti catabolic, helping reduce the process of tearing down tissue in your body. Now this is especially beneficial if you are cutting or looking to have a fat loss phase. And perfect world, we want to reduce body fat as low as possible or to wherever is ideal for you. And we want to do that without losing muscle mass and function at the same time. This may enhance mitochondrial function. Mitochondria are the little powerhouses that make energy in your body. Yes, of course, they do lots of other things. But that's kind of their main job to make ATP, adenosine triphosphate, the energy currency for your body. This compound is also non hormonal, doesn't necessarily interact with the hormonal system, which would make it approved as an over the counter supplement may even be a fuel source for high intensity intervals, weight training, that type of work. Now I

know all of that sounds too good to be true. And it sounds like I'm doing some sort of ad for a supplement company. And at this point in time, I don't have any disclosures with any companies. I do think you will see this in more sports supplements coming up. I've seen it show up in a couple products so far in a little bit higher amounts. It's kind of been on the periphery for quite some time, but usually in just very, very tiny amounts. I believe it was under a patent for a period of time without the patent appears to have expired. So I don't think there's any legal holdups to it. So if you haven't figured out what this is, it is actually lactate. And you may be thinking lactate, wait a minute, that's horrible. I don't want lactate that's related to lactic acid. You know, doesn't that Making my muscles really sore and decrease performance. I don't understand why I would want to take this as a supplement. And I think that's probably still the biggest objection to this as a supplement. So I've been looking at this oh, gosh, going on for almost like six years now. And again, I'm not the first person to think of this. There's very, very early studies that have looked at this. Going back a long way in time, you can find some studies from think the earliest study I could find was of these 20. Net this in terms of the theory was late 50s, I think. So again, not necessarily a new idea at all. But I think because lactic acid has such a bad rap than anything related to lactate still has a very poor PR perception in exercise physiology and just general world. So we're all on the same page. Lactic acid is sort of a real thing, but yet, not necessarily immediately disassociate from lactic acid into lactate plus hydrogen ions. And it turns out that lactate is a really good fuel source. And it's the hydrogen ions that are the things that bugger up everything else. Right. So if you think back to your organic chemistry, or even high school chemistry, the definition of pH is the concentration of hydrogen ions, more hydrogen ions, the more acidic something is. So in a real sense, you are creating an acid hydrogen ions that are getting dumped into the muscle during high intensity intervals. When I was in the lab, doing my PhD at the University of Minnesota, we ran students through a whole bunch of different tests so they could get practice being both the subject and administering them for 400 level exercise physiology class that I was a TA for. And one of the super fun ones we did is something called a Wingate test. If you've never done this before, I would highly recommend you, you do it at least a couple of times. For this particular test, we had special bikes, but you can do this on a rower and some other bikes, you need something that can provide a relatively high resistance though, while we were doing the lab, we routinely ran a 22nd Wingate, it's also a 32nd 60 seconds on other forums, and with the bike, you would get someone on there, they would do a warm up period for two to five minutes. So they're good to go. They would rest. And then they would pedal as fast as they possibly can, with a very, very low load. Alright, so load we typically would measure in power, so we do 50 or 100 watts. And then when we say go, we would crank it up to depending upon body weight is what we expected off of, you know, 300 400 500 600 Watts, they would be required to output for 20 seconds. So you're putting out a very, very high amount of power over a relatively short period. And on a bike at first you're like, Ah, I got this, this isn't too bad. And about halfway through, which is literally 10 seconds later, you're starting to wonder if you're going to make it last few seconds. It literally feels like somebody dumped concrete into your legs and you're pedaling much slower than when you started for sure. After you get off it feels very nauseating. And some people, we would have a running pool of how many workers we would have because you would see certain people run to the bathroom very, very fast. We'd even have people come over from Coach Cal Dietz and some of his staff were just down the hallway. And so they would kind of come over and peek into the lab when we were doing lactate testing data Wingate testing, usually because one of the students was puking in the bathroom since we shared a bathroom with their gym space. So not a lot of fun. Again, definitely something worth experiencing. But what happens then is your body is literally producing a ton of lactate at that point, along with the hydrogen ions. So if you've ever heard of lactate testing, you can do a finger prick or sometimes they'll prick the ear lobe or different areas. And we can measure the amount of lactate that is produced if you're looking at higher end endurance performance testing. lactate threshold testing is relatively common. The theory there is you want to exist at a high running speed, but hang out just under the lactate threshold, right, the lactate threshold is that point where the accumulation of lactate starts to be exponential. And if you can hang out just under that you're producing and clearing lactate at the same rate. So it's gonna kind of suck, but it's not going to be to completely miserable. Once you start producing a lot more lactate than you can clear, remember, lactate is showing up with those hydrogen ions at the same time, that is going to

make your life very, very miserable quite fast, and your speed will have to slow down. So even with lactate threshold testing, we're using lactate as a proxy for hydrogen ions, we just don't really have a good way of measuring hydrogen ions in the muscle. That's a handheld test. So again, I think that's why lactate tends to get a bad rap. Athletes know that if they're at a high lactate level during exercise, that it sucks. So you kind of associate that well, it must be the lactate because lactate is showing up at that point. And as we mentioned in the intro, it turns out lactate is a really, really good fuel. Your brain loves lactate. So Dr. George Brooks kind of the exercise physiology godfather of lactate research. Him and other colleagues have been looking at IV infusions of lactate, maybe even post concussion. Because the brain can use lactate. The brain can also use ketones quite well, too. I did a program for the Carrick Institute where I'm associate professor on potential use of a ketogenic diet or state of ketosis, or supplements to increase ketone levels in relation to concussion and traumatic brain injury. So you will find a link for that program. So I think alternative energy sources are an interesting way to look at exercise Phys. The cardiac system loves using lactate. So lactate itself is a relatively high energy substrate. When we normally have it produced though by the body, it almost always comes with the cost of having these high levels of hydrogen ions associated with it. So while it is used during high intensity exercise, it's the hydrogen ions itself that actually limit how much of it can be produced. It's a little bit an oversimplification, there's some other enzymes and some other pathways to get limited there too. So back to the new study. This is published in Current research physiology 2021 publish date of September 16. So pretty much brand new. It is titled The effect of lactate administration on mouse skeletal muscle under caloric restriction. The main researcher, their last name is Hari Shi Rai, and we'll have a link to that here for you also. So this model again, I'll go over the pros and the cons of it. But what they were doing here is they're using something called CR caloric restriction involves reduction of caloric intake without altering nutrient balance, may have other beneficial effects such as improving oxidative metabolism, and potentially extending lifespan. Now, if you look at the extension of lifespan, what we see compared to other research is caloric restriction of 40 to 60%. pretty effective in earthworms, nematodes, but starts becoming less and less effective as you scale up into humans. To the studies that were done in chimps were kind of sort of mixed results. That's a whole podcast in and of itself. But in humans, how well caloric restriction works is still up for debate. But for lifters such as yourself listening to this podcast, we can think of less kind of extreme forms as just cutting calories in order to lose body fat, caloric restriction, at least above model in a study gives us kind of the more extreme form, right, we're probably not going to in this study reduce their calories by 40%. Overnight. I'm not a big fan of very restrictive diets that are extreme, especially for long periods of time. However, this does give us a model of kind of a worst case scenario, that if we're still seeing positive adaptations with that, then might be something to look at a little bit further. So in this, they had three groups they had a control group and had a caloric restriction group that's cut their calories by about 40%. Again, this was in mice, which is A downside of the study, but it's easier to do things in animal models a lot of times and humans. And they had a group that they gave a daily lactate administration to, which they said was equivalent to about one gram per kg of body weight. And the study was, again, relatively short term, but some interesting data. So if we back up a little bit, we know that in most people, skeletal muscle mass accounts for at least 30 to 40% of the human body, obviously lifters is going to be much higher than that. We know that this can be made to increase by exercise performance, proper nutrition, we know that periods of inactivity cause skeletal muscle mass to go down quite fast. We also know that if you slash calories severely, that you can lose muscle mass, especially if your protein intake is not on the higher end of the spectrum. So I helped with the book chapter. Looking at that, again, you're going to be at around point seven grams per pound of body weight. Even the case in some short term human subjects studies, it's going to be a pretty good buffer against losing a lot of protein in the form of muscle tissue.

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As you mentioned, caloric restriction may be associated with improved lifespan health, decreased mortality in other animal studies. Again, this is very hard to study in humans, there are a group of humans

who have sort of self selected to dramatically slashed their calories by 40 to 60%. Look up groups like the cronies, a lot of times they don't have a lot of muscle mass, and they look pretty miserable. So I'm not convinced that caloric restriction in and of itself, is the best for longevity. Again, you can probably find other podcasts where we've talked about that. But here, it's a good model because it is the extreme form of a more fat loss based type diet. Another side part note here, before we get into the study more, I did propose something called the four s model macronutrients. This is in the Keto traumatic brain injury course for the caregivers to talk about. It's also in the Carrick institutes human performance system. I did the nutrition and HRV portion for that course. And we tend to think of macronutrients right protein, fats, carbohydrates, as just things that are sustenance that are fuel. However, they do have other functions. One of those other functions is signaling, right in the flex diet cert, I go through how protein, especially leucine and essential amino acids are required for the response of muscle protein synthesis. Taking amino acids, right the building blocks of protein and shoving them into muscle to make the muscle a little bigger and stronger. Turns out the main one, there is a leucine. Leucine is going to start the muscle protein synthetic response. So when you consume protein rich foods like whey and other foods, it has leucine. So leucine, there is serving primarily a signaling role. So there are other facets of macro nutrients, again, that are useful for that. So keep that in mind. So it turns out here that lactate administration has been reported to enhance not only signaling and oxidative metabolism, but also protein synthesis in skeletal muscle, which I thought was pretty interesting. So not only can lactate be used as a fuel kind of follows the the four s model there and that it does have specific signaling effects in and of its own. It appears to increase both the phosphorylation of something called the P seven the s6 kinase, which is downstream of mTOR signaling mTOR being mammalian target of rapamycin or mechanistic target of rapamycin. That is the main little structure guy that we want to increase if we want to see additional protein response ie bigger muscles. And it turns out lactate may increase mitochondrial biogenesis so mitochondria little furnaces that make ATP and biogenesis is creating more of them. So in theory that would be beneficial for exercise performance. Last part too, is that there's some data that lactate may suppress some of the catabolic responses. So catabolic tearing down of muscle tissue, especially under low levels of calories, right, so caloric restriction in this case. So in this study, they used a specific strain of mice never aged for seven to eight weeks, they were kept in temperature controlled areas, they had them specific light, dark cycling, the control group had what's called ad libitum, access to food. They use the protein fat carbohydrate ratio of 23% protein, 5%, fat and 71% carbohydrates. And then they divided them into three groups, we have one group that they call the phosphate buffered administration group, which is just the control group. They've got the caloric restriction group, and then they've got the lactate plus caloric restriction group.

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And if we look at what testing they did, they used grip strength testing, which is pretty common in animal models, as a marker of performance. They did a whole bunch of other stuff to the little guys, they did muscle fiber cross sectional area, from the gastrocnemius muscle, calf muscle. They looked at antibodies via Western blotting, they looked at enzyme activity, such as citrate, synthase, succinate, dehydrogenase, etc. While blah, blah, whole bunch of Uber geeky stuff, what they found, was pretty darn interesting. So body weight was significantly lower and the caloric restriction and the lactate plus caloric restriction groups. Now, this is what you would expect, right? So if the little mice were are doing well with their caloric restriction, again, that's the advantage of using mice that have to be controlled. Humans don't tend to do real well and severe caloric restriction in terms of compliance, we would expect that with caloric restriction, you would see a drop in body weight. And that's exactly what we saw the wet weight of the planters and gastrocnemius muscles. So in this study, they looked at both in terms of weight, were significantly lower in the caloric restriction and caloric restriction plus lactate groups, compared to the control group. Again, now, statistically significant just means that that's probably a real effect. And we'll come back to this point also. So lactate wasn't completely able to ameliorate the drop in terms of all of the loss of muscle. But keep that in mind, we'll come back to that. grip strength was significantly lower in the

caloric restriction group than in the control group. Again, we would expect some drop in performance there. They looked at the cross sectional area of muscle fibers, so how big a little individual fibers and again, they were significantly lower in the caloric restriction and the lactate, plus caloric restriction groups. What was interesting, though, is that the transverse area of the myofibrils were significantly higher in the lactate plus caloric restriction group then compared to just the caloric restriction group itself. So maybe there's some sort of weird differential effect going on here when you're adding lactate to caloric restriction also. Now, again, as we mentioned above, that didn't completely ameliorate all of the drops with caloric restriction. However, we're looking at a caloric restriction effect you have around 40%. So in my opinion, if you were going to put someone on a fat loss diet, and you slash their calories by 40%, that is very, very aggressive in my biased opinion. They looked at some of the mitochondria, well, they did protein and enzyme activation. This is looking at the effects of caloric restriction on mitochondria, different levels of something called a NPK. They looked at NPK was not different between groups, which I thought that was kind of interesting. A NPK you can think of is kind of the opposite of mTOR. If you're increasing amtk, which normally happens during periods of fasting, and caloric restriction mTOR is usually seeing the opposite effect.

24:42

led to mitochondria, they looked at something called PGC one alpha, this is widely regarded as kind of the master regulator of mitochondria. We looked at some of the downstream functions of those guys to like MTC, 01 and ATP five A. What they found was Was that in the mitochondrial complex, these downstream and PGC, one Alpha were significantly higher in caloric restriction and the lactate plus caloric restriction groups compared to the control. In general, that's an oversimplification. Without exercise. If we reduce calories PGC, one alpha tends to go up. What we see is that lactate did not reduce that effect in caloric restriction. And that's probably a good thing. Right? So we're seeing some mitochondrial benefits, at least at a mechanistic level with caloric restriction, and that was still there when we added a lactate to it. So to quote the study here in the discussion, in this present study, we investigated the effects of lactate administration on skeletal muscle adaptation, and its molecular mechanisms under caloric restriction, focusing on muscle anabolic and catabolic signaling and mitochondria. Our data suggested lactate administration suppress the decrease in myofibril cross sectional area and enhance mitochondrial function under caloric restriction. As a result, body weight decrease significantly from the beginning to the end of the experimental period, and the reduction of muscle weight due to caloric restriction was not rescued by lactate administration. However, liked administration did prevent the decrease in grip strength and cross sectional area due to caloric restriction. These results indicate that lactate administration suppressed the decrease in muscular strength caused by caloric restriction. So in English, the lactate did seem to reduce some of the quote negative gains or negative effects of caloric restriction. And as we talked about related to muscle protein synthesis, expression levels of p 70, s 6k, and S six, related to muscle protein synthesis were also decreased by caloric restriction, and but they were rescued by lactate administration, we saw a slight bump into those guys, which means lactate under caloric restriction was becoming a little bit more anabolic from a signaling perspective.

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Yeah, and as we kind of sum up, what they found here is that lactate may be beneficial under caloric restriction. They say quote, in the present study, we found the lactate administration under a caloric risk, caloric restriction, increase the activity of mitochondrial respiratory chain complex proteins, mitochondrial enzymes, such as citrate, synthase, and succinate. dehydrogenase. So lactate was making mitochondria more beneficial in this particular study. last quote here, is these results strongly suggest that lactate is not only an important factor in mitochondrial adaptation, but also an important signaling molecule that

activates muscle hypertrophy signaling, in a future study will be necessary to examine the combination of lactate with resistance exercise, and amino acid intake to increase muscle size, and study the role of lactate on muscle size and the signaling molecules that regulate it. So pretty interesting. Again, this is a mouse study. And the downsides of some of this research to me are, again, this is a mouse study. So we don't know how this would translate to humans. We could speculate, but my studies a lot of times don't translate to humans all that well. However, they do make some very interesting mechanistic stuff, make it much easier to do earlier research, and then see if that can be replicated in humans. If we look at the effect of lactate to increase, high intensity exercise performance, I'll link some of those studies below. I won't go through all of them, I'll just highlight a couple. It's pretty darn split. Right. So in theory, you would think that if you can get more lactate to be a fuel, you should be able to see an increase in exercise performance. Some of the studies looking at that. Not really, super efficacious, but the data on that is very limited. That gets into what type of exercise performance are you looking at? How did you measure it? And you look into what they did was some early caffeine research, right time to exhaustion versus time trials. What was the dose? How long was a dose given? Was that acute was it given for many days? beforehand, etc. And we just don't have a whole lot of data that's looked at lactate as a supplement to increase performance. What's interesting about this study, though, is maybe lactate is providing other different effects. And maybe it can be used for periods of caloric restriction for athletes that are looking to preserve as much muscle mass as possible, maybe getting some slight increase in mitochondrial function. And if it could potentially help with high intensity interval exercise, that would be kind of a nice bonus too. So to wrap up, very interesting study, effects of lactate administration on mouse skeletal muscle and our caloric restriction. I do think that lactate may have a role in terms of a supplement how exactly that would be used the still up for debate. But this study shed some light that maybe there's some effects on reducing muscle loss under periods of fat loss, so caloric restriction of different types. And maybe it can help preserve mitochondrial function or potentially increase it. I do think that is worth future studies. As I said, in the intro, I've spent, started looking at this five or six years ago, I've talked to several different supplement companies, good friends, I know who formulated for different companies. And at first, I kind of thought this would be a no brainer, especially if there isn't a patent or anything impeding it. And so far, pretty much everybody thinks I'm kind of crazy, except for a couple people. I do think it'll probably show up as a supplement at some point. And people are interested on more of the all the data, the research and everything on that they know where to find me. Yes, I know, of course, someone could take all this information and go develop as a supplement on their own and not credit me, which is, at this point, I'm

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totally fine. Because I just want to know, is it actually going to work or not. But of all the supplement research that's done, I would say this has pretty good physiologic basis, we have lots of earlier data, of how it may work, we've got some new data such as this one. And in terms of actual data, potentially supporting it, and has much more data than most new supplements that come out. So if anyone is interested in looking at that further, you know where to find me. But as of this recording, I don't have any disclosures related to that. I do go in depth on lactate, other effects of some of the buffers in the effect of pH, because pH is one of the homeostatic regulators. And in the physiologic flexibility course, I talk a lot about that, how we can do periods of time of increasing pH periods of time of a decreasing pH. We're not necessarily trying to get your blood pH to change all that much. But we're trying to increase your body's ability to be adapted to high and low periods of pH, just like temperature, temperature is another homeostatic regulator. We're not looking to change your body temperature per se. But we are looking to have you be more accustomed that periods of cold and periods of heat, because I believe that will make you a more anti fragile, robust individual and will increase your body's inherent recoverability. That is such a word. So there you go. Again, this is brought to you by physiologic flexibility course go to physiologic flexibility.com, you'll be able to go on the waitlist there. So the next time that it is offered, you'll be the first to know. Thank you so much for listening to this, I have all the references that I've talked about below

and I've added a few more. Again, that's not an exhaustive list, but it'll keep you busy for a little while. If you enjoyed this, leave us a review on iTunes or whatever your favorite platform is. And make sure to subscribe. Thank you so much for listening greatly appreciate it. Talk to you next time.