In this episode, Ciaran O' Regan reviews the following recent research paper: Silveira-Coswig et al., 2018 – Weight Regain, But Not Weight Loss, Is Related to Competitive Success in Real-life Mixed Martial Arts Competition

DANNY LENNON: So, with all that said I think that's plenty of context from me. I'm going to hand it over to Ciaran who is going to take you through this paper, look at some of the way they set it up, some methodology, some of the results, and then some practical implications along the way. For those who have interest in this I hope you find it valuable and the last thing I'll say is for those of you do want to get more of the resources that we have if you just go to sigmanutrition.com you'll see loads of stuff related to combat sports, and making weight, and overall nutrition whether that's articles we have, previous podcasts, the Sigma Weight Cutting System which is easy to find, and also coaching that we do directly with high level athletes. So, as I mentioned Ciaran is working there and also our other coaches including myself have worked with many top-level athletes who do that. So, all of that will be over sigmanutrition.com, specifically if you're looking for the show notes for this episode it's sigmanutrition.com/episode235/ and I think that's about everything. So, without further ado let me hand it over to Ciaran O' Reagan.

CIARAN O' REAGAN: The paper that we're going to review today is combat sports related paper. We've got a lot of cool stuff in it with regards the nutrition strategies, particularly pertaining to weight regain, so that period that Danny refers to in his Sigma Weight Cutting Book as the Phase 4 nutrition, which is the period between their weigh-in and the fight itself or the kind of like refueling, recondition, rehydration kind of a period.

The title is 'Weight Regain, But not Weight Loss is Related to Competitive Success in Real-life Mixed Martial Arts Competition," and the lead author for this paper is Victor Silveira-Coswig. From a methods perspective I want to read out some little sections of this just because I want to give you kind of idea of what it is that they actually did, and also point out some things that I wish they did or that at least they have recorded but didn't publish. I don't know, I have never contacted the author and I'll provide more context for it as we go along. But for the methods it says – okay I'll read out a few lines here, and then I'll come back to it again, to meet our objectives, body mass, habitual weigh-in on fight day, so that's the body mass they recorded, right? So, habitual body mass was defined as the last value before starting the weight recording period that varied from 15 to 30 days and was declared as the body mass goal for the pre-competitive period. So, the habitual weight is what I just think of habitual weight if I heard if it was the weight outside of fight camp, so we don't have date in mind it's just the weight that they train at where they are ideally not carrying a whole lot of excessive body fat with the participants.

I'm going to read out a few lines of what inclusion – next to you could see here were and what the athletes supposed experience level were. The initial sample consisted of 18 professionals male athletes and 15 completed all data collection procedures. These athletes were separated into winners and there are a number of characteristics there for the winners and losers. Basically there were eight winners and seven losers that had completed all the data collection procedures. As inclusion criteria all the participants were required to have experience in MMA tournaments and the practice of rapid weight loss prior to the experiments. What they don't have here is

they don't have the records of the fighters, so I'd love to have seen the combined win-loss records of the losers and the winners just so we have an idea of what their experience levels were like, and then potentially what a win-loss record might also show is potentially it might give an indication as to the competency levels of the winners versus the losers. So, not just the amount of fights that they've had, but how many they've actually won, so it's a rough indicator base, you have competency. You can have a fantastic fighter who just had a number of losses, but overall you'd assume it would provide a good idea of competency if you have someone you can see how many wins they've had versus how many losses they've had and then an idea of overall experience levels with regards to how many fights they've had. And the reason that's important is because the more fights you have, the more practice you have at making weight. So, literally have more attempts – you have more practice at finding strategies that work and making mistakes, and learning from them and figuring out what works and what doesn't. So, that's something I wish that they had here, and that I'll be here. The researchers only described rapid weight loss and did not intervened with the applied rapid weight loss strategies, which is surprising because they don't want to interfere in the study.

And back to the text data collection took place over 2 days. On the first day 24 hours before the event the weigh-ins occurred and the official body mass was recorded from each athlete. Additionally, three questionnaires were completed; one profile and mood state, two 24-hour recording food intake, and three practice of weight loss. So, that practice of rapid weight loss is a questionnaire. The competition occurred on the second day and all the procedures of the first day were repeated 30 minutes prior to the combat with the exception of the practice of the rapid weight loss questionnaire. In addition, combats were recorded for further notational analysis.

So, the measure the high to low intensity ratio observation and preparation were defined as low intensity blocks, whereas interactions were considered high intensity actions. So, from understanding of reading through the paper and

looking at what it is that they, how they defined the stuff. Observation is like you're outside, you're just kind of like observing your opponent preparation is maybe like a faint or something that you're preparing to attack maybe, and then interaction where you actually doing something physically to your opponent like you're punch, kick, knee, elbow, grappling them whatever that was your high intensity actions. So, you're physically doing something to your opponent rather than setting something up.

Okay, I'll read out a little bit on this and then I'm going to talk you through each bit as we go. So, rapid weight loss was not different between the winners and losers with small effect size. So, basically from the way it looks, and also from the fact there was no difference in questionnaire, so the rapid weight loss questionnaire we'll also get to in a minute that both groups winner and losers lost the same amount of weight and apparently seemed to go through the same amount of stuff to actually make weight, so the same amount of discomfort we'll get to in a minute and what they actually went through physically to get there which is pretty cool that they lost and I think if I remember correctly from the data it's about 7% of their body weight that they lost in order to make weight. However, rapid weight loss is not different between the winners and losers with one effect size, however weight regain was significantly for higher for winner and showed a large effect size. So, we'll get to the actual numbers in a bit, but they're roughly – I'll skip ahead a little bit that basically what happened both winners and losers roughly lost I think it was around 7% of the body weight, but the winners regained nearly all of that by regaining 6% and the losers only regained about 3%. And we'll get into how that happened regards the nutritional choices afterwards, right?

The amount of weight lost ranged from 6 to 22 kilos, so that's obviously the lowest and the highest and the actual mean and standard deviation was 14 plus or minus 4 kg. In each of the 6 to 12 times the participants performed rapid weight loss procedures in the year before the investigated event. Participants declared their coaches/masters, physical trainers, colleagues and all the fighters were the most

influential in terms of rapid weight loss. So, they just learned, like anyone was going to do they're going to listen to those around them, and so their coaches, their colleagues, all the fighters basically like people telling them how to make weight. So, how lucky you may be and how experienced your coaches and training partners are it's probably look at a draw depending on what kind of gym you're in and what kind gym you're in and what their experience levels are. Again this sounds messed up and it is messed up. This is so common in a combat sports world is really poor weight loss strategy, so of course in regard to rapid weight loss methods there was a high prevalence for increased exercise practices followed by restriction of liquid ingestion, plastic clothing, wearing hot clothes, spitting, sauna, laxatives, diuretics, skipping meals and all day fasting in order dizziness, excessive heat moments, headaches, increased heart rate, nausea and fever were the most cited symptoms related to rapid weight loss. Obviously that stuff is not cool like this is the last stuff you want to be experiencing when you're getting ready to having a fist fight with a fellow in a cage do you know what I mean? And it's just again from most likely from just poor practices like the way they did what they did like not eating food for an entire days, laxatives, spitting like who knows how long they were even doing this for. They might not even understand what a manipulation it might have doing this stuff for that 15 to 30 days I don't even know because we don't have those definitions.

The rapid weight loss questionnaire showed no difference between the winners and losers. So, that questionnaire that they did basically showed that the winners and the losers went through the same stuff in order to make weight and I assume for the same periods etc, so if that's the case then it just goes to show how important or impactful that that Phase 4 nutrition potentially can be to get that right, because let's say all else being equal and all these fighters were just as experienced as each other which we don't know because we don't have a win loss record combined or ratio between winners to the losers we don't have that. So, like let's say if we assume all else being equal and just as experienced as each other just as skilled as each other, just as much training and training for just

as long and that they all went through the same amount of stress and discomfort and all this mad stuff in order to make weight then the only differences are what happened afterwards. So, like what they ate between the weigh-in and the fight which we'll get to in a minute, but again we don't have the other information so we can't draw definite conclusions but that's what it looks like from the day I'm presented here with this paper. Again this is just one study and it's providing a bunch of information and there is some obvious mechanistic understanding as to why there might have been such a dramatic differences in performance between the winners and losers based on what they did, but again this is just a side not but we can't draw real solid causal conclusions without knowing all the information, and even then we still can't because the only certainty in science is we should remain uncertain. So, we can't easily say for definite this is the thing, but anyway I'd digress. The Friedman's test indicated significant differences in terms of total caloric intake and absolute ingestion of carbohydrates, proteins, and lipids.

I am going to read a little bit of results here a few lines to you guys just the variables that turned out from the analysis. They did video analysis on them in terms of breaking down the fight and trying to quantify the elements of the fight and these three things have popped up and I'll read those out what they were and also in terms of time-motion variables the non-parametric analysis indicated significant differences in high intensity relevant time, which I explained earlier on, with higher values for the winners and a medium effect size, again I explained it earlier on that basically the interactions of doing physical stuff to your opponent aka beating them up with punches, kicks, and knees or elbows or just motion on the grappling that's what I assume it is. No motor effects were observed when comparing to time-motion analysis between groups, so there was a whole load of variables but they looked for two. For the technical tactical variables the winners presented a higher frequency of lower limb sequences with a medium effect size and higher frequency of ground and pound actions with a medium effect size. The additional technical tactical variables were not significantly different. So, two things here first one lower limb

sequences were defined as any attempt to carry out a high intensity attack with a sequence of striking techniques kicks or knees at key points. So, that's basically using a lower body to hit your opponent and there was a big difference between groups. So, two things popped up there as potentials, so again these are my hot takes. They said two right? One is that the opponent which we get to nutritionally was really tired, so that they were just basically walking around like a heavy bag and you could just kick them because – kick them or knee them, which it's really hard to do like really to properly kick someone or knee someone it's actually really difficult thing. The timing, the distancing and everything is really difficult, especially against another skilled person who knows whether a kick or a knee coming at him looks like. It's not as easy as just swinging your leg. It's really hard, so if that either occurred it was either such a big difference I get to anyone I actually got out the medians and everything. It was either because one the opponent was just really exhausted and they were just walking around the place like a human heavy bag and they were just so tired that they couldn't defend or they didn't look like they were going to be able to defend kicks or knees or two that the winners were just more skilled and had more experience and had been around the fight game longer, and that a driver may have been that they were just generally more experienced and more skilled fighters and so were able to not just make weight or make the weight regain period more optimal in terms of what they decided to eat which I'll get to in a minute when we get to the tables, but also that they also were just around the fight game longer so better at kicking and kneeing. It's probably like a bit of both may be, I don't know, because obviously there's no way of knowing because we don't have the experience that this is just a hot take on my side.

And then what we got is the ground and pound actions, so the ground and pound actions if you ever seen a MMA fight you know what a ground and pound is where you're over your opponent throwing punches or elbows at them, which again if there is a dominant person that's winning a fight it makes sense it's going to be a higher amount of ground and pound actions because they are either hurt their opponent and are finishing a fight with a ground and pound sequence or

they are just more dominant physically in a grappling perspective or striking perspective and are able to take their opponents down or are able to drop them with strikes, and then walk them on top and just get more shots off and they're spending more time on top just because they just have more energy which I'll get to in a minute that might have been the case later on. But what a ground and pound sequence is defined as is quite eloquent. If you think about what a ground and pound is which is you are over your opponent swinging punches or elbows at them this is quite an eloquent way of describing it. So, their definition for ground and pound is any attempt to carry out striking techniques on the ground from top position with descendant movements. So, again as a side not I'd been around the combat sports game a long time as I said as a fan and a participant and I've never heard a more poetic way of putting punching someone in the head while they are underneath you. This is a little side note.

Okay, so the high intensity relative time which I already described earlier on was basically doing physical stuff to your opponent. The way that the actual data worked out like in terms of seconds of doing stuff; for the winners they had a median value of 58 seconds with a lower interquartile of 10 seconds and a higher of 98, whereas the losers had a median of 32 and a lower of 1 second and a higher of 60. So, if you imagine if those numbers – so the lower and higher end of quartile range is just the way of describing the spread of the data. I think about in terms of numbers that nearly – so 58 versus 32 as a median, so that's nearly double the time where the winners were doing physical stuff to their opponent.

In terms of the kicking sequences just given what the data looks, right? So, the lower limb sequences which I obviously described earlier on like that's – in terms of what that actually looked like in terms of the median and the spread of the data it goes like there was a median of 3.5 this is the lower limb sequences, a median of 3.5 for the winners with a spread or lower interquartile of 1 and a higher of 7.5, and the loser had a median of 1 with a lower of zero and a higher of 1. So, in the discussion I'm going to read out a few bits and pieces from the discussion, and then talk you

through it just a few bits, and then I'm going to get onto some of the juicy bits in the table and leave you with that, right?

A magnitude of weight regain found here is 6% for the winners and 3% for the losers was not higher than the rapid weight loss around 7%. The winners showed higher weight regain rates than the losers and it is possible that this is due to an inadequate post weigh-in recovery nutrition strategy. Again, Danny's labeling of the Phase 4 potentially they made a mess of their Phase 4 nutrition strategy.

Back to the text, regardless to the best of our knowledge this is the first study to show that weight regain is associated with fighting tactical parameters – technical-tactical patterns in winning MMA athletes. So, that's pretty cool that this is the first paper. I haven't come across any before, so I think it's a really cool piece of data to show and what I like about it is it really highlights the importance of what takes place in that Phase 4 period directly after the weigh-in. What did we learn here taking to data we suggest that the time for weight regain modality characteristics and athlete's ability to safely lose and recover body mass should be considered by coaches and athletes before making decisions regarding weight classes and weight management strategies. This is a really good line that best puts the recommendation in like it's not just about – you should if you're a fighter, you're working with a fighter you should not be basing the weight class decisions just on your ability to make weight. You should be basing it on the athlete's ability to regain weight and what strategies do you have in hand to optimize how much weight they can regain not just from a health perspective directly after the fight but massively from a performance perspective and how you actually plan to strategize this not just about making weight. It's about optimizing performance in the fight. The fight is the goal like people say, "Oh, the weight cut is the hardest part and the fight is easy." Yeah, that may very well be the case in some circumstances, but the fight is the most important bit because you can make weight but then fine even really well you can make weight but if you make a mess of that Phase 4 you get a tire bit now to follow you know just because you've

got a messed up nutritional or rehydration strategy or you can just underperform or potentially increase the likelihood of injury if you're not just firing in all cylinders, who knows you know. So, it's not just about making weight you have to pick your weight classes for yourself and for your athletes based on what strategies do you have to effectively perform after you've made weight and those strategies are just going to happen to coincide with regaining weight not just because regaining weight is handy in a fight because you're heavier and bigger and you can lean on your opponent and your shots are going to have more weight behind them. But also because the things that happen that cause the weight regain are also drivers of performance such as we get onto it glycogen restoration and rehydration and the electrolyte balance etc.

So, I'm going a read a little bit here just because it goes through some of the risks of dangerous dehydration and what it can actually do just because I want to highlight this to any fighters or coaches that are listening just to highlight the magnitude of the severity like fighting is a serious business in general, but fighting in a less than healthy state is even more serious business. So, I think the reason myself and Danny like to put out or try to put out kind of information and education on kind of safer way of doing things that are potentially are going to also optimize performance is because we realize how serious a business this is and we want to get that good content out and good information out so I'm going to purposefully read this bit because it's just a kind of like something to keep in mind shows the kind of repercussions of doing things inappropriately.

So, back to the text; dangerous dehydration can reduce plasma volume and lead to the development of subsequent factors such as decreased stroke volume, increased heart rate, reduced arterial venous oxygen modification which can disturb renal flow and cause electrolyte abnormalities making MMA athletes possibly more susceptible to heat injury and muscle cramps. I'd also add in just leaving the text for a sect, I'd also add in brain damage not just because your body isn't working better and you're actually going to – potentially if you're not firing all cylinders because

of stress and your body isn't working when you're less likely to see a shot but brain damage because if you're not appropriately hydrated you have less fluid around the brain to help protect it when it gets impacted. There is a mention in this, but there is loads of work on it in rehydration and brain trauma, so you can go and dig up that stuff yourself but that's only thing I want to add in, and then back to the text. Other potential health concerns of several bouts of rapid weight loss that have been estimated include acute effects on hormonal variations, growth variation, declined bone development, falling basal metabolic rate and negative protein balance does causing a loss of fat free mass. So, that's with several bouts of rapid weight loss, so again if you're putting your body to a ringer and you're using really extreme not very optimal or – that's a bad word, not very clever approaches I suppose not to say that people who use the kind of more old school approaches are stupid but by any means they are not they just don't have the knowledge to know how to manipulate this stuff and as safe and may not as the evidence base currently shows, and what I mean by evidence base is not just about the scientific literature but if you take evidence base as the evidence based of three legs on the stool, whereas one leg on the stool is the actual empirical scientific evidence, the second leg on the stool is I suppose you can call it as the anecdotal evidence and experience in the field, and I suppose the third leg of the stool is the practitioner expertise. So, if look at that in respect of that definition of evidence base those three legs of the stool – there's more than one way to skin a cat but some ways are just more efficient and safer based on our current knowledge, right? So, that's basically what I'm getting to is that – and here like several bouts of rapid weight loss who knows what the – even if we pick the most safe way of doing it then we do it like who knows there is still negative effects of that like the likelihood of it being good for you, let's put it one way is that the likelihood of it being good for you isn't very high. So, whoever guide to how bad it is for you I suppose it's probably relative to the stress that you're putting your body under in order to actually make weight. So, that's just something to keep in mind that there are all these other kind of long-term effects, especially in younger athletes that are forced to make weight like especially

when you're under bone development etc, like that's the stuff keep in mind.

And physiologically we could speculate that the higher weight regain exhibited by the winners possibly allowed for greater restoration of phosphogen sources and glycogen storages which would explain the intensity differences, so I want to get into why that's important not just from availability of ATP and the actual ability for most of that to fire but there is some other cool stuff that potentially takes place when there is higher levels of carbohydrate availability, especially when you hear how different the carbohydrate intakes were.

In summary, based on our data we could speculate that increased carbohydrate energy and fluid intake post win would increase glycogen stores, restore physiologic status and optimize weight regain. These responses could explain the increased high intensity efforts and strikes showed by winners who had higher weight regain rates and probably had better carbohydrate availability. This then could be considered as the link between weight regain and increase chances to competitive success.

Something else that got me thinking a little bit and maybe that's contributed to them starting at a slightly lower weight is that they had the same weight loss in the rapid weight loss phase apparently, right? But the calories and the carbohydrates were higher in the winners during the weight cut period, which leads me to think that they potentially had a easier job of making weight, because for the rapid weight loss period the winners had a median calorie intake 745.5 with a lower and a higher interquartile of 103.5 as a lower and 1104.5 as the upper. The losers had a median of 303 with a lower of 159.4 and a higher 702.8, so again the median is twice as high in the winners more than twice as high 2.5 times. So, again that's something that just had me thinking of like they seemingly ate a lot more in the weight loss period than the loser did, so either they knew more what they were doing because they were able to eat more and still make weight or again these are just hot takes or that they had less weight to lose, I don't know what to think about that to be honest.

One thing else I want to point out is that – and what we don't have here as well is that we don't have – they also ate a lot more carbohydrate like the winners had 79.8 grams of carbohydrate as a median with a low of 26.3 and a higher 166.7 in the weight loss period that's so much carbohydrate. The losers had 20 versus – as I said median of 20 versus a median of 79.8 in the winners with a low of 1.2 and a higher 96.5, so carbohydrate intake was dramatically higher again from these values in the winners in the weight loss period as they were trying to make weight, so even ate more carbs. It's something that again it's like stripping carbs is something that we do – it's quite effective because carbohydrate holds water in your muscle and liver as well. So, a good idea when you're trying to manipulate body water in the weight loss period coming up to the win is to depending on the time period you have after the win in the fight of course, assuming you have 24 hours to replenish or more because water in your muscle and liver – sorry carbohydrate in your muscle and liver when it's stored holds water.

Something else that came up here and I could see in the data was the actual protein intakes in what they ate in the weight loss period. So, I haven't gone to the weight regain period yet, but the weight loss period the protein intakes for the winners were median of 8.3 with a lower of 1.2 and a higher of 60.4. Losers' median of 17 with a lower of 11.7 and a higher of 30.3. So, something I want to highlight potentially that's potentially useful to those of you that are making weight is like if anything the thing to use in a rapid weight loss period when you're trying to manipulate body water and you're trying to strip off most of the glycogen is protein, so things like chicken breasts or pieces of lean beef or even the fatty beef even depending on how many calories you can get away with because it will fill you up provide some amino acids, so you can recover even from your training sessions or whatever movement that you have to do that week you provide some protein and it's filling and there is no fiber in it obviously because it's meat and it's going to be low gut residue, it's not going to contribute to like bulk in your intestine because of the fiber intake. You have to eat loads of it or you're very

inactive in order for the protein to have a dramatic impact maybe on being used to restore muscle glycogen through gluconeogenesis like it's something here that potentially these guys don't even know about just for yourselves like to put in perspective from my last fight I was for the last 2 days for the whole week coming after the win I basically ate 2 pounds of sirloin steak a day for 5 days and I had veggie with that up to about 2 days out, and then for the last 48 plus hours – 48 hours the last 2 days before the win it was no veggies just the steak itself and it was 2 pounds of sirloin steak only about 1500-1600 calories, and when I shifted to veggies that's just to remove gut residue from the fiber, so that's just to put it in perspective and still made weight perfectly fine. But again I'm a bigger fellow I fight a heavyweight in kick boxer 94.5, so I was a heavier dude, so 1500 calories for me at point was very little because I was still quite active on feet coaching all kind of stuff while in that fight week. So, that's just put it in perspective what can be done in the week of the fight when you kind of understand this information. I had a great time with 2 pounds of sirloin steak is delicious, but it's because I had gradually shaved off body fat bit-by-bit, bit-by-bit, bit-by-bit coming into it. So, I was basically just in the short-term manipulating water content, manipulating muscle glycogen and manipulating gut residue. So, just keeping it really simple you know and I could get away with eating 2 pounds of delicious fatty sirloin steak every day the week of the fight. Anyway I digress again I was just giving you an example.

Okay, to get onto the difference in the winners. This is where it is really juicy. This is the last few bits I'm going to touch on, right? So, for the winners – I'm going to start with the winners, and then compare to losers. Okay, so the total calorie intake in the weight regain period aka as I mentioned the Phase 4 nutrition, the period between the weight-in and the fight are as the researchers framed it the combats, the total calories for the weight regain median for the winners was 5100 and 91.5 calories with a lower of 2,887.0 and a higher of 6,117.0 that's quite a good chunk like you know it's quite a good chunk of calories. And took for the losers then and this is going to indicate to you how you're going to see straightaway now why what I was mentioning earlier

on about the obviousness of the difference without needing to do a statistical significance in terms of difference in what the losers and winners is. The losers median calorie intake was 2,952.1 with a lower of 2166.5 and a higher of 4722.1 that is an enormous difference like you don't need to do some statistical analysis to see how dramatically different those numbers are between the winners and losers, and when you hear that it's not that surprising then that how much weight the winners were able to regain in that period before the fight versus the lads who lost, and I'll get into what role that plays in a minute, but only little thing I'm going to focus on here is on the this table this carbohydrate intake, so that the median carbohydrate intake was 610.6 with a lower of 377.2, a higher of 663.2 for the winners, so 610 grams is the median and I gave you the lowers and the uppers. For the losers the median was 299.1 less than half with a lower of 224.8 and a higher of 492.2. So, again dramatically different and if you think about like what each gram of that carbohydrate holding a few grams of water as well because the way that carbohydrate holds water it's like no wonder again such enormous weight difference between the winners and the losers, and then there was obviously difference in the other macros as well.

Protein wasn't that different the median difference was only about 25 grams, but the fat difference was more than 50 grams which potentially if the fat was lower again maybe they could have been even higher in the carbs and gained even more weight because even more muscle glycogen stores. Because if you're totally drained which they maybe were coming into it, again we noted this it's more carbs slightly more that you can store lot of carbohydrate and the fat maybe added from a satiety perspective one of my hot takes maybe is that some of the foods that were chosen say by the winners is like the median intake a fat of 170 grams, and a low of 105 and high of 205. Again they already had quite a lot of carbohydrate anyway but maybe they could have gotten even more carbohydrate, but when you look at what their carbohydrate intake was in terms of grams per kilo it's 6.3 grams per kilo. Maybe even more might be needed depending on severity of the weight cut that's the median of 6.3 grams per kilo of bodyweight for

carbohydrates for the winners with a lower of 3.4 and a higher of 8.0 and in the losers was 3.9 grams per kilo bodyweight of carbs with a lower of 2.3 and a higher of 6.6. So, that just shows the dramatic differences in the calories, carbohydrates, and fats and carbohydrate grams to kilograms quantities between the winners and losers, and then when you hear that you're like, "Oh, yeah that's – of course it makes total sense that the winners would have to regain so much," so one of my hot takes here is that or when I mentioned that fat actually isn't known to have clear base is that potentially the role that that extra fat can play as well is palatability, so you have that extra bit of fat in your meals like as I said like the 170 grams of fat potentially maybe they ate the same food or more we don't know. We don't have the actual diet we just have the macros and the calories, so maybe they ate the same food but more or maybe they ate just more palatable – maybe they ate quite a lot of – maybe the fat was because they were eating like really highly palatable junk food that also have loads of calories, but also had some fat in there to make it more delicious and potentially again a hot take maybe the losers maybe even meant well after the weigh-in and just didn't have the knowledge and maybe they meant well and that they thought that they should eat healthy and that they ate a load of really satiating foods like a lot of steak and spouts and veggies and fruit which is maybe in a normal every day it's fine when you're not totally drained and trying to maximize your glycogen stores but when you're totally drained and you're trying to replenish your body probably not the best idea to be putting a load of really satiating high volume fibrous foods into your body because then it just makes it harder to get sufficient quantities of carbohydrates, whereas if maybe they had gone with easy digestible sources like sugary cereal, coco pops, frosties, jelly babies, white rice which again we don't know because we don't have their actual diets. Something else I'd love to have seen from this is the actual – I'd love to have seen what kind of foods they actually ate just to see in terms of their potential satiety differences between the foods that they ate, and then why they ate so little food because you're assume that they were starving after making weight, but they still only ate a median of 3,000 calories. So, I don't know maybe it was the

weight loss affected their appetite and they couldn't eat more or there was a massive diet different I don't know. Again I'd loved to have seen the actual food that they ate, because you don't know just to see again as I mentioned satiety etc.

Yeah, I have that data but the actually diets – okay it makes total sense. So, these are last few of my hot takes, right? These relate to carbohydrate intake for the most part. From mostly glycogen perspective, so if the losers ate so little and kind of the winners ate way more carbohydrate and calories that the availability of carbohydrate does the obvious stuff which you'd think which is the actually provide a fuel substrate for the body to be able to work and produce mechanical work and to move. But there's also some cool stuff that takes place that's not as obvious and if you haven't come across the research on these areas they might be new to you and I find this stuff really cool. So, like there's some stuff I've come across over the years that I wanted to highlight I guess. What actually happens with carbohydrate outside of the obvious provision of fuel substrate for the muscle to actually work, right? One of them is energy signaling, so decreased glycogen stores can potentially lead to a decreased release of calcium to the cytoplasmic reticulum and the reason that's important is because calcium is needed for excitation contraction coupling of the muscle and this has been shown I think they did it with like actually muscle fibers where they provided loads of ATP but the muscle still didn't work, so it's independent of the amount of ATP that's even available. So, it's like something there that can detect glycogen stores that if the glycogen stores are too low shuts down the release of calcium thereby shutting down muscle function. So, it's really interesting to know and that's something else to keep in mind that it's more than just the availability of energy, because 300 grams of carbs is probably way more than off carb – that's way more carbohydrate than you would need like you're not going to burn 300 grams of carbs in a 15 minute fight you know that's 300 grams or carbs that's 1200 calories like you're not going to burn 1200 calories in the 15 minute fight. They had more than enough energy to actually fight in term of if you just look at it from a fuel substrate energetic perspective.

But there is more to carbohydrate in the muscle than just the provision of energy.

The second thing I wanted to point out was – this is another kind of like central governor kind of area thing where carbohydrates swirling studies have showed some kind of a connection between the oral receptors for carbohydrates in the mouth and in the brain, and this is independent of actually swallowing the carbohydrates, so swirling carbohydrate around in your mouth just switching it around in your mouth like mouthwash and spitting it out can still result in a performance improvement independent of even swallowing it. So, there's some kind of a central governor thing that kind of regulates your energy output and how much energy you're allowed to produce and how much work in your performance. Again independent of the actual energy in the tissues or the actual energy provision you're not even getting the sugar in your blood stream even from the carbohydrate with just swirling again is really cool and that fits into this kind of central governor theory of the T kind of area, it's really interesting.

Another one I want to highlight is it's another one of the hot take for me, I mentioned earlier on I'll come back to it, the temperature, it was between 26 and 30 degrees, and another thing I came across over the years was that heat stress can cause you to go through muscle glycogen at a faster rate, so causing increased muscle glycogen utilization. So, you'd assume that these lads maybe well – on one hand you can assume that it played no affect because they're acclimatized to those temperatures or performing in the temperatures. On the other hand maybe some of the fighters weren't because they weren't from that area and they were from the cooler regions, I don't know, but just in general 26-30 degrees is spicy hot and heat stress has been shown to increase muscle glycogen utilization. So, that's something else to keep in mind regards to if the lads were coming in already drained because they ate so little and they made a mess of their Phase 4 nutrition that there also pointing them in their ass is the temperature. Another little bit of hot take I have just because it's been going around in my head so much just from talking to a lot of athletes, and also there being more and more digging on it recently

is this idea of sleep and stress and just how stress can impact sleep quality. So, is that another factor that could have led to the losers having kind of a poor performance can potentially have been that because of the weight cutting protocols that they lost weight and the weight regained that there's obviously going to be quite a lot of physiological stress on their body from the weight and the psychological stress which again does not really – physiological and psychological stress aren't separable really, but when you look at it like that you're like potentially that – and of the things that being in a – if someone has ever done a fasting or come across any fasting studies you often see that the sleep gets disrupted because of stress levels you know, so your body is in survival, it's probably evolutionary way or survival thing just man you need to eat, go and eat stuff you know and part of that is probably because cortisol levels are high when there is physiological stress, especially when you're calorie deprived, because I'm pretty sure cortisol is used by the liver to make carbohydrate and stress levels are going to be higher. So, that potentially add if not – let's assume all else being equal, again if we just look at the data just from this and look at the statistical data and go okay let's assume that just as this data presented that both winners and the losers went through the same thing to make weight, and that they are all at the same experience levels everything else equal until they got to the win that if the winners ate sufficient food and enough calories and load the calories which we know they ate way more that they're potentially going to have lower physiological stress that day just because their body is getting well fed and is potentially blunting cortisol levels etc, and kind of making the body bit more relaxed and we all know how good it feels to have a good fed and a nap afterwards if you've ever had a Christmas dinner. If a big feed of food, loads of calories, and then you just have a lovely nap afterwards. So, potentially that the losers didn't eat enough food which we can see they didn't eat anywhere as much as the winners and that potentially didn't blunt the stress levels that much from a physiological and maybe psychological, again to separate them is kind of a misnomer, but they potentially the night before even had a messy night sleep, the night before the fight, so the night before the weigh-in and the fight itself. That's it please.

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