

PHYSICAL EXERCISE – WHAT KIND AND HOW MUCH?

A Conversation with Tinna Troustadottir of the The Kronos Longevity Research Institute

By Michael Patterson

Tinna Troustadottir, Ph.D. is currently the Associate Director of Exercise Sciences for The Kronos Longevity Research Institute (KLRI). Both her Ph.D. and MS in Exercise Physiology were received from Arizona State University where she also was Assistant Professor of Research in the Department of Kinesiology. Dr. Troustadottir is a certified Athletic Trainer and a certified strength and Conditioning Specialist. Her areas of expertise include exercise and aging, oxidative stress and muscle physiology.

As befits a certified athletic trainer and expert in exercise, Dr. Troustadottir is fit, trim and athletic. There is no question that she practices what she preaches. She is a firm believer in the health benefits of regular exercise.

“I was home recently in Iceland,” Tinna told me with a smile, “and I went to the gym with my parents to see what their program is; to be sure they were doing everything right and working our hard enough.” Her dad keeps track of his exercise records in a little notebook. Tinna took a look at the book and gently chastised her Dad, “You only came here four times in the month of April! That’s not enough!”

That is probably a good answer to the questions of how much exercise. Probably, “not enough.” It’s free, it’s powerful and the more exercise you do, the more benefits you reap.

I was eager to talk with Dr. Troustadottir about exercise, aging and the brain. I wanted to see if she had specific recommendations about what type of physical exercise is most beneficial.

When we talk about the benefits of physical exercise, it’s not sufficient just to say go out and exercise. We need to say how much, what type and so on. Do you have recommendations?

Well there are two answers to that question. Because on the one hand when you ask what is the best type of exercise, it’s really going to be the exercise that you enjoy the most. Because, otherwise, you won’t do it. And if I tell you, you must run, you must do this, and you absolutely hate it, then the chances of that being anything ongoing is not going to happen.

The funny thing is that what I’ve seen happening recently at scientific conferences is that researchers are much more talking about exercise as having a role in brain and cognition, arterial and cardiovascular disease. And they are really bringing that more to the forefront. And the question that most often comes up from the audience, especially if it is not exercise physiologists who are in the audience is, they ask, “How much should I exercise?”

And, we don’t have the exact answer. And, that’s because it depends upon what the outcome variable is. If you are just trying to improve health, you don’t need very much exercise. We can see great improvements in a lot of different things from as little as walking 30 minutes three to

four times a week. But if you want to improve fitness. And in general they've shown that the more you do... its not like theirs a ceiling on the benefit. So, if you do more, you'll get greater benefits.

Getting started.

So, as far as overall recommendations -- because I've been thinking about that -- and what I came up with is first of all, if you are not exercising currently and you are wondering, how do I get started? I think that the best recommendation would be to really start off extremely easy. By that I mean... I remember reading in an exercise book a long time ago when they were talking about a certain type of training and they called it "guilt producingly easy." It always stuck with me.

So, you should go out there and whatever you want to do, whether it is walking, or if you prefer going to a gym. But, almost do so little in the beginning that when you are done, you feel like you didn't really do anything. If you start out like that and just gently increase it, you won't get so sore that you won't want to go back. It will allow the body to adapt to it in a very nice manner. And, the chances of you sticking with that program are much greater. Because you will be successful.

You can go into other areas of research when they are talking about behavioral change; which really is what you are doing if you are going from no exercise to exercise. I'd like it to be a life long endeavor. So it really is a behavioral change for a lot of people. So, if you do it very gradually, it takes some time to make it into a routine.

I always like the image of a high dive. If you think you are going to dive off a very high diving board it is very intimidating. But, if you just take the first step -

Stick your toe in! One step at a time.

Presumably, you are suggesting that exercise should become part of one's daily routine.

Absolutely! And even, we say daily routine. But it is also important ...we now know that most of the adaptations that occur from exercise don't occur during the actual bout of exercise but during the rest. So you also have to be aware of getting rest periods in between. So, some people that have sort of Type A personality get so into it that they are going every day and it is very important too, to have rest days and let the body recover.

Is that true with all types of exercise? I've heard that said about weight bearing exercise in particular. That if you work with weights one day, you should let your muscles rest the next day to recover. Is that correct?

Yes, that's correct. Usually with the resistance training, we say to have a resting day in between. Cardiovascular training, like walking or swimming or biking. That can be done more regularly. But there are those times when you just feel that you need to get that rest. So, its not a bad idea to plan one day a week when you don't get a lot of exercise.

That usually isn't a problem. You are also working on oxidative stress. What is oxidative stress? What is going on there and how does it relate to aging?

Well, as far as how it relates to aging, it's really thought to be one of the key mechanisms in aging. The best way to explain it, perhaps, is that you want to have a balance in your body between free radicals, which are oxygen molecules that have an unpaired electron. I don't want to get too technical. But, basically, they want to be in balance too, so they want to mate with other molecules. If you have too many of these free radicals it overwhelms the defense system of the body. You'll get damage to the cells, to the proteins, to lipids. And, the end result is that aging and disease.

So is it that the loose electrons are latching onto molecules that they should be latching on to?

Well, sometimes they steal an electron from one and then you have chain reaction. The other thing that is important is that they also play a positive role. It's good to have some (free radicals) because it stimulates your antioxidant defense system in the body. So, we wouldn't want to completely abolish it. You want to have that right balance. It's very similar, we see the same thing with stress hormones. You cannot live without cortisol and some of these stress hormones. But if there's too much and it overwhelms the system, it is associated with disease and the repair of the system is not occurring.

It seems that in so many of these systems, it's a balancing act. You need just enough, but not too much. And things go wrong if you've got too little or too much of something. So, does the body produce its own antioxidants?

Yes, it does. And the reason I am so interested in exercise is because exercise can also stimulate some free radical production because it's tied in with oxygen consumption. So when you are exercising you are consuming more oxygen. (310) You are also stimulating some free radical production. But, it has been shown that unless it is a very, very high intensity and long duration exercise, you are also stimulating the up regulation of your own defense system. So the end result being that you have a better balance.

What's my main interest in exercise is how the improvement in resilience can transfer to other systems. I've done a study where I showed that when you take people in the lab and you have them do mental and psychological stressors. So, that's all brain stimulation you can say. We see that in older women, they have an increased stress response to these type of stressors. But when we brought in older women who were age matched but were physically fit, they had a response like the younger women did. So, just with the physical fitness we did not see these age related diseases.

Let me make sure I understand. (350) you bring people in and you give them cognitive tests that are difficult, so they are creating some degree of stress. With the people who were not physically fit, you saw more stress.

Yeah. And what we looked at was changes in heart rate, changes in blood pressure, and increases in stress hormones. We were doing blood draws during these stressors. And they range from mathematics to anagrams and also interviews about a stressful event in their lives. It's a potent test. You see a very nice increase, even it also effects the young and the physically fit. But the difference is that they can bring their response rate down. When the stimulus ends they are able to adapt to that and come down immediately.

Their stress levels come down, but with the older people, it stays elevated.

It stays elevated.

What is the mechanism? What is it about exercise that is helping these people deal better with the mental stress?

Well there's probably effects in two different areas. One is the sensitivity. That is one we see with exercise a lot. If you go out and you walk at a certain pace, lets say. And you continue doing this in an exercise program, after a while you can walk at your same pace, but your heart rate is going to be lower than it was in the beginning. (401) And that is a typical thing we see with exercise. So at the same absolute level of intensity, it's a lower stressor and you can see that in the physiological response.

Now this seems to transfer over. Like I said, there's greater sensitivity so you don't need as high a hormonal response to get the same results. Also the feedback system -- with the hormonal system, it's a very nice redundant system to make sure that you don't sort of overshoot. So you have receptors in the brain that then tell the glands that they can stop making the hormone. And that seems to be working better as well.

Let me paraphrase again to see if I am understanding this. You are taking a mental test. You are getting a little bit of stress because it is difficult. And you will get a hormonal response, but if you are exercising, a smaller amount of the hormone will do the job better than a larger dose of hormone. So your body says, "Okay. I get it.: And it goes back?

Yes. They can handle the same stressor with less of a perturbation to the system. So, it is hard to say whether it is just that they don't see it as stressful. But what has been shown is that they have the ability to have a greater hormonal response. So, let's say that if there was a very high intensity physical stressor. People always talk about, you are walking out there and a lion comes. Now you have to outrun the lion. Well, the people that are more physically fit are able to respond to that better. So, they really have the ability to use the system. They are able to adjust to different stressors in a more sensitive manner. So when it is this psychological stress there really isn't the need for a huge response, because you don't need fuel. Which is the main reason for having something like the stress hormones. They are better adapted to just a lower response. So that would be beneficial for health. Because like blood pressure. If it keeps shooting up to really high levels then eventually that can have detrimental effects for the system.

So exercise in general, moderates all of the systems. It keeps them within that desirable homeostatic range?

Yes. That is exactly what it is.

Are you familiar with the book by John Ratey, called Spark? (489) He inspired me to exercise more and to get out a heart rate monitor. So I am exercising more and as my body adjusts I find I need to keep ramping up the intensity to keep my heart rate at a good working level.

That is actually one of my second points. As we said, the first point is to start out gently. As I get older if I for some reason am not exercising a lot. Which, hopefully doesn't happen too often. But, I really allow my body to take it slow and I'm finding that that is a very important thing. But then the second recommendation, is to have variability. (520) that can be variability in the mode of exercise. Try to change it up a little. It's amazing that you have people that always walk and now you put them on the elliptical trainer in the gym – how much harder it is. You can take someone who is a good runner and cyclist and you put them in the pool. It is a completely different challenge.

So, it's almost like you have to always try to outsmart the body by throwing a different stimulus at it. (548). Change the mode, change the intensity. Which is great when you have a heart monitor that is very easy to do. Change the duration.

Ratey makes a suggestion. Let me ask your opinion. He suggests that you get up to 65% 75% of your maximum heart rate capacity. He says that if you do a spurt --- even 30 seconds of high intensity activity – that seems to be almost as good as doing that high intensity for a long period of time. It's almost as though little pulses of high intensity are good. Does that make sense?

(577) Absolutely. They have done a lot of research again with different things, for example, people that are concerned with losing weight. We know obesity is a huge problem. Over 200 million Americans are overweight or obese. And, a lot of times if you do these interval training, with these little bursts of high intensity, in the long run they seem to burn more calories and you lose more weight. Also they've talked about if you were to have any kind of stressor like a heart attack, someone who has done these spurts is much more – first of all they are much more likely not to have a heart attack. But, if they were to have it, they were more likely to survive. Because they are used to these kind of differences in the energy status.

When I am talking about brain health in particular, I'm trying to refine what we recommend in terms of physical exercise. Let me check this with you. Certainly cardiovascular, elevated enough to build up a sweat. But also strength training, weight bearing exercise is important. Flexibility and balance.

Absolutely, I think that if you talk strictly about brain health the research data is much stronger for cardiovascular exercise. And that makes sense. More oxygen, more blood flow. But I think most people are going to be more interested in overall health and really being able to defend against all diseases, not just brain diseases. And so it's very important to have both cardiovascular training and resistance training.

One of the huge problems with aging is sarcopenia, or loss of muscle mass. Even with a good cardiovascular training, it's not really enough of a stimulus for the muscle. And you know, resistance training (650), it doesn't mean you have to go to the gym. Of course, it is a lot easier in many ways. But there are a lot of things that you could do just at home. I think also, it's important at times to separate these two activities. You know, some people will go to the gym three times a week, and they'll do both cardiovascular training and resistance training at the same time and then, that's it. There is some research to suggest that the adaptations to resistance training can be slightly at disadvantage if you do cardiovascular training at the same time, because it goes through different pathways in the muscle. So, I think it is important to say that some days it's good to do just resistance training. And some days, just do cardiovascular training. And sometimes both, because that's how it works out best with time.

Do you stretch before, or after, exercise? Or, both? (682)

Well, I don't stretch very much. And I've looked at the research data. Now, I wouldn't say that there isn't a role for flexibility exercise. But, there's not very good evidence that it prevents a lot of injury necessarily. I think if you are going to do flexibility exercise it is important to do it after training when you are nice and warmed up. People are doing more yoga and things like that. That's very good. It's more – at least in the athletic world – it's switching much more to dynamic movement rather than doing just the static stretching.

What is dynamic movement? (715)

You are stretching out, but you are doing it through movement patterns that are more related to the sport. Do you want me to show you? For example, rather than just standing here and stretching the hamstring... If you watch the sports teams when they are warming up.... I was watching the college women's softball championship on ESPN and what you saw was this.. (demonstrates movements that mimic reaching down to field a grounder, or throwing the ball to a base.)

(750) Related to aging though, I think there are a lot of people who get stiffer. Joints aren't as lubricated perhaps. So it's a good idea. You just have to do it within your limits. Now the balance thing, I think is very, very important, because it is so important. People don't pay a lot of attention to it. And a lot of times they don't really realize if they have bad balance. It is very easy just working on it once a day or once or twice a week, to very much improve the balance.

What would you do? Practice standing on one foot for a while? Extending your limbs?

(765) Yeah. We've done that. I did this in a study with women who have rheumatoid arthritis. We tested it before and after an exercise intervention and we included a station in the circuit training that was for balance. And we saw huge improvements. But most of it was also for them to realize... they really didn't realize that they had such bad balance. When it relates to falls, which of course are a very important subject for older people, the strength is really what comes into play there; the strength and power. If you do trip, that's going to be the difference between being able to stay standing and right yourself, versus falling.

I've been reading recently about brain maps. One of the things I've started to say in my presentations, which I hope has some foundation in reality, is that you have to keep moving your body in ways that remind your brain that you still have a body and that your body wants to move in these different ways. It would seem, intuitively, because of the plasticity of the brain, that if you continually contract your movements and you limit your movements your brain will forget how to do those movements. Does that make sense to you?

(817) That totally makes sense. Why is it that when we are kids we sprint from here to there and we don't even think about it. And we jump rope. And then something happens as we grow older and we stop doing these things. And that's exactly the thing; to keep doing these activities and doing things that you enjoy doing. But that exactly it, doing different movement patterns. We know doing a crossword puzzle, doing sudoku, that's helpful. But through exercise you can get a lot of those neuronal patterns that are going to be stimulated by the exercise.

The idea of cross-training for physical exercise seems to be a very nice model for mental exercise as well. Just as you need to cross-train

(850ish) Yeah, I think that's a good term. There's more and more research coming out with young kids. The ones that are more physically active do better in school. So, why are we getting rid of PE in most of these schools? There's some very nice research out of Illinois where they have looked at both cross-sectional fit versus unfit older individuals and they've done cognition and brain scans and looked at differences in the way the brain is activated and how it uses glucose. Then they took the individuals that were untrained, or were sedentary, and then did an exercise program and saw excellent improvements.

Who is doing that research?

It's Stanley Colcomb and Art Kramer. (884)

Well, first off I would say that the most important thing is safety. So it is always important to have a good technique. So, if someone wants to start resistance training, it really is worthwhile to try to get some professional input in the beginning. There are a lot of things that you can do at home, though, that just involve step ups, Or, you can sit up from in a chair; you can do squats into a chair. You can get little dumb-bells. There's lots of things you can do. But there's also a huge advantage to going to a gym, obviously, because as you progress, and you want to increase the stimulus, to make sure that you are improving, you need more weight and more variety. Again, coming back to variety; changing it up, doing something different.

(1505) The unfortunate thing that I think has occurred in gyms is that most people don't get very good service when they join. They may be shown what the machines are one time and that's it. So that's an issue I don't have an answer to. Not every one wants, or needs, a personal trainer, but [it would be good to] get some sort of help to at least set up a program. One thing that I think is important for people, in order to continue, is to have a plan to make sure that you follow your progress.

So, day one I'm going to do seven step-ups and day two I'm going to do eight. Or, for a week I'll do seven –

Exactly. Something like that. It makes a difference, in both continuing – you know there are going to be days, when you get up in the morning and you say, “Ugh, I wish I didn't have to go to work today,” but you go. And, there are going to be days like that for exercise. But, if its well meshed in to your daily routine, you'll still go.

I've seen workout rooms in some retirement communities that have fabulous equipment with computerized programs. Each resident has their own key that they put into the machine. It tracks when hey exercise, what level they worked at. It's fantastic.

Yeah, it keeps a tab on you.

Yeah. The physical activities director read the printout and sees, “Gladys. I see you haven't been in the gym in a few days. Is everything all right?”

I was at home recently in Iceland and I went to the gym with my parents and dad to see what their program and be sure they were doing everything right and that they were working out hard enough. So, my dad has a little book where he keeps track of what he's done. I looked at it and said “You only came here four times in the month of April. That's not enough.” So, whether it is sophisticated or something simple, it is important to have a plan and keep tab on what you do. It doesn't have to be anything real sophisticated. It can be something as simple as a little notebook, and saying, you know, “I walked today.” And then when you look at it and you say, “Oh, wow. I haven't done anything in five days.” It's a nice little reminder.

I have high cholesterol. Doing more vigorous exercise this year has .

There are so many things where we see the benefits of exercise. And, there aren't any bad side effects, really. It's free! It's easy! It's fun!

The last point may be to have the proper supporting nutrition. To maximize the benefits you get from exercise you also have to supply the body with good building blocks, good materials. And, tht is something that is important to pay attention to. There is a big initiative going on right now, from the American College of Sports Medicine (ACSM), and the American Heart Association, which is called “Exercise is Medicine.” It's really geared towards physicians, health professionals and the public. It is focusing, one, on trying to get physicians to track patients exercise as part of their history. The last time I went to a physician, they asked if I smoked. They asked if I drank alcohol. But, they never asked if I exercised. So that initiative is to raise awareness about that and to improve communication, and get people to participate in exercise. And there are some great tools on the web that might be of interest to AARP. I'll send you the exercise is medicine.

What will be very interesting will be to do an intervention that is not just exercise, but trying to improve in a variety of ways. We know that Omega-3 is very important. And has an incredible

impact on brain and heart and on different aspects of health. Maybe some anti-oxidant supplementation, whether it is in the form of fruits and vegetables, or juice like the tart cherry juice, and then the exercise. Then we will want to learn more about what's the best volume of physical exercise to minimize oxidative stress. So, there is still a lot of work to be done.

It also strikes me that it is important to look at the sequencing. In my presentations I say, half seriously, that sequence of activities to promote mental well-being is to go out and do hard physical exercise first, because it seems to prime the brain for learning. Then, next, go study a foreign language with another person, so that you are taking the primed brain and challenging it intellectually. And, then the third step is to take a nap. Because the sleep will give you a rest period and consolidate your learning. So, that's my secret formula for mental exercise.

That's great. I like that.

So I think we need to figure out the best dose, but is also, probably a good sequencing that we could figure out.

You know, there is research to back that up, but I don't think it's ever been put all together like that. That would be an interesting study.

Well. Thank you very much.

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