

Everything You Need to Know to Help Your Loved Ones Prevent, Delay, and Discover Sarcopenia

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ABSTRACT

Aging is a scary part of life, and sarcopenia can make it much scarier. This is a condition that directly affects your skeletal muscle mass and has the ability to greatly affect your life for the worse. Some pre-requisites of sarcopenia cannot be affected by you, but some can be changed. This affects many elderly people and causes many hardships in the later stages of life. In most cases sarcopenia isn't alone as it commonly occurs with other muscle mass related conditions like cachexia. The best way to aid a sarcopenic person or discover sarcopenia is to know your body and make sure that something isn't wrong. Many sarcopenic patients assume that weakness and fatigue isn't a "big deal" and this mindset causes them to learn about their condition too late to do anything about it. The main reason for this is that they simply don't know, and even if they tried to learn about it many articles are very hard to comprehend and digest. So, I created the opposite of these articles, a digestible and easily understandable article on sarcopenia, an article that highlights many aspects of it, specifically what it is, what it does, who it affects, and how we can prevent or delay it.

Introduction

For those that don't know, sarcopenia is a type of muscle deterioration. The phenomenon of muscle deterioration is much like influenza, there are many types of it, however in this paper the ailment of sarcopenia will be specifically targeted. Sarcopenia affects many people, many later in life, but some early in life. Sarcopenia describes one's muscles slowly losing muscle mass due to its lifespan being met. This life span is around 60 years old for a normal person. Sarcopenia affects the elderly's independence, as they cannot support themselves, but not many people know of it as it mainly occurs with other ailments. So, the purpose of this article is to inform people of what sarcopenia is, the sarcopenic demographic, the effects of sarcopenia, the potential ways of preventing sarcopenia, and any additional information to help people identify sarcopenia.

What is Sarcopenia?

Sarcopenia is a condition that causes many problems later in life, mainly muscle and bone related. Sarcopenia increases the risk of falls and fractures. It causes a ripple effect, for example sarcopenia causes weaker muscles and bones. This means that peoples' bodies cannot support themselves as well as they need to, or can't support them at all. With this inability to support themselves, it becomes significantly easier for them to lose balance and fall. This elevated falling is made much worse because the victims also have decreased muscle mass and lower bone density. So, they have less "padding" to protect their bones, and their bones become much weaker, thus elevating fracture and break risks. Unfortunately, many sarcopenia patients are elderly people, meaning that chances of their bones healing in a timely manner are quite low, essentially ruining a large portion of their remaining time. As previously stated, sarcopenia affects the elderly, but that isn't the only demographic affected.

What Should You Expect from Sarcopenia?

If you or a loved one has been confirmed to have sarcopenia, one must be prepared and ready for what's to come. Many menial tasks will soon become too strenuous to do, so if you are sarcopenic find a relative to do those things for you, and if your family member is sarcopenic help out and do those tasks. Some tasks that would become hard would be walking up the steps. You could aid them in this by providing support from the backside, and making sure they don't fall onto the steps. Another task that could become too hard to do is opening heavy doors such as the main entrance to a house or building. By simply opening the door for the sarcopenic patient, you would be preventing a lot of pain and help alleviate the risk of hurting a bone. So, you should expect to be helping the sarcopenic person with tasks that may seem easy to you, as they are simply too weak to do them on their own. Another thing that is commonly linked with sarcopenia is weight gain. Your body is not building new muscle, and is not consuming energy, and these two things cause fat buildup. This fat buildup is quite dangerous, so a sarcopenic person should be watching their diet, and by that I mean avoiding heavily processed foods like fast food chains and vegetable oil. They should be attempting to sustain themselves in the healthiest way available as if they don't they would essentially be fueling the fire that is sarcopenia. So, when a sarcopenic person is added to your close circle, meaning family members, friends, and yourself, you should be prepared to help with many tasks that seem easy, and you should be prepared to have a shift in your or a loved one's diet.

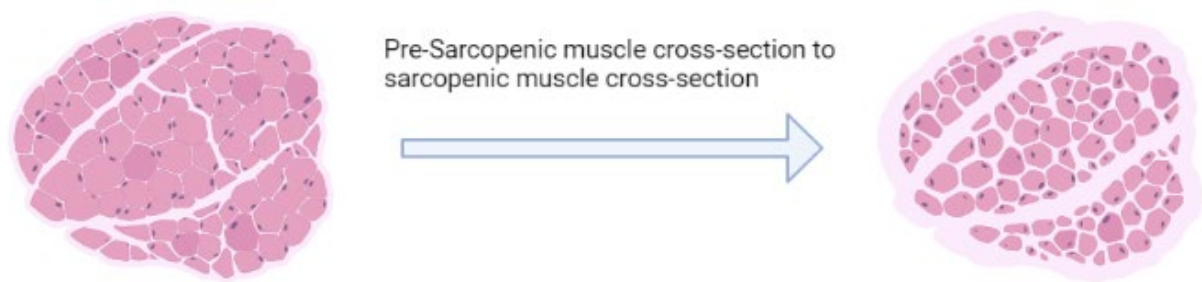


Figure 1: This is describing the difference in muscle mass between the same muscle. The image on the left side of the picture is a non-sarcopenic person, while the figure on the right is a sarcopenic person.

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Who Gets Affected by Sarcopenia?

Firstly, sarcopenia does not treat everyone the same. If you are a woman, then your chances of getting sarcopenia is much higher. This is because they have smaller and weaker muscles and bones than the average man, making it easier to break down and deteriorate. Their bones and muscles also start to weaken earlier and faster. People above the age of sixty are the primary demographic, but athletes above the age of thirty are also prone to contracting sarcopenia. There are many reasons for the elderly to be affected, most of them being lifestyle decisions such as being quite sedentary, mal-nutrition, inflammatory problems, usage of drugs, bad genes (low metabolism), and a bad environment growing up. Many athletes have different causes of contracting sarcopenia. During the course of their careers, athletes perform at their maximum capacity on a regular basis, something people don't regularly do. To understand why athletes can obtain sarcopenia much earlier, one must understand that a human's bones and muscles have a lifespan. This lifespan usually reaches its end at age sixty or above, explaining why the elderly obtain sarcopenia, and this lifespan is shorter in women than it is in men. Their bones and muscles start decaying and deteriorating because their lifespan has been met, but constant strenuous exertion shortens this lifespan as you are pushing your body to the brink regularly. So, retired athletes have a high chance of getting sarcopenia when above age thirty because they shortened their bones' and muscles' lifespans, and people above age sixty have a high chance of getting sarcopenia if they made

poor lifestyle choices. However in many cases this life span does not guarantee sarcopenia, as the percent of people who have addictions to nicotine, weed, and alcohol along with the group of people who don't move much because of their occupation or simply choosing not to is very small compared to the percentage of people who didn't do those things, and the percent of professional athletes to not professional athletes is even smaller. There is a chance that in your lifetime you don't meet a person who obtains sarcopenia, but there is a chance that you do meet that person, and there is also a chance that that person is close to you. In a situation like this you must know all the necessary information on sarcopenia, as this knowledge may help you or a loved one live the rest of their life on their own two feet.

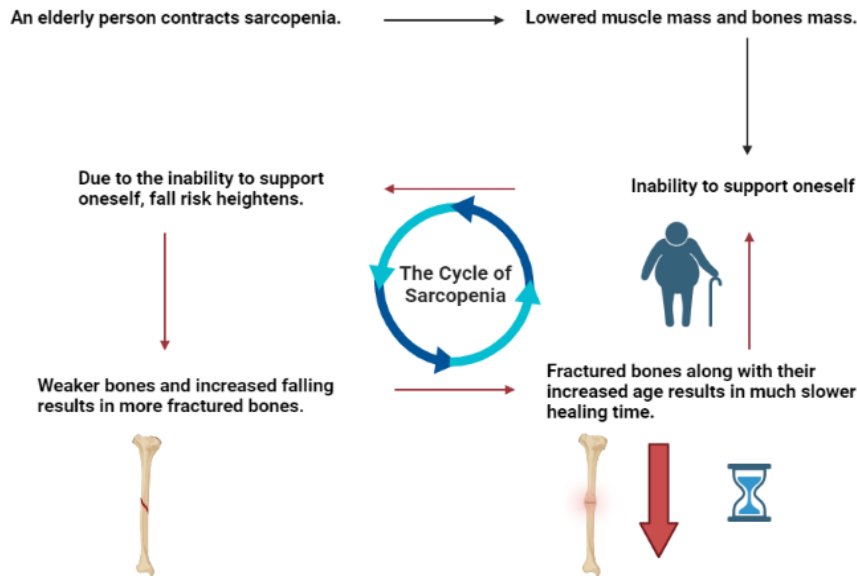


Figure 2: This is describing the cycle of sarcopenia that causes loss of independence. The figure highlights how the butterfly effect from simply obtaining sarcopenia to not having the ability to walk or move without aid. Copyrighted By: Vidhur Varada

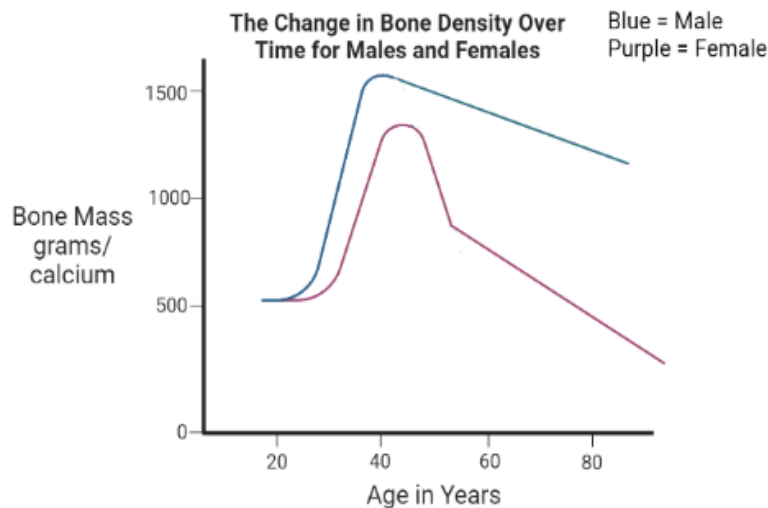


Figure 3: This line graph is displaying the difference in bone mass between men and women, while also showing the difference in average bone density throughout someone's life. It directly shows why women are more likely to get sarcopenia and that is because they simply have less bone and muscle mass. Copyrighted By: Vidhur Varada

How Can We Prevent or Delay Sarcopenia?

Unfortunately, sarcopenia is incurable. It is directly linked with the aging process in most cases, so unless we can prevent the process of aging, sarcopenia cannot be cured. However, it is preventable and delayable. Some things that can cause sarcopenia cannot be affected by you, like your genes, metabolism, gender, and hormone level. Some factors can be affected, and may prevent sarcopenia from affecting you. Having a balanced and healthy diet is quite helpful. You don't have to avoid candy and processed food, but you shouldn't allow yourself to become diabetic, overweight, or anorexic. You should find a good balance, meaning eating your vegetables, consuming consistent protein, and getting enough calcium. Despite that you shouldn't prevent yourself from eating any sugary foods like chocolate, nor should you eat them in very minuscule quantities. You should limit yourself to some candy every month so you can quench your desires. You should also attempt to stay physically active. Again, you don't need to be in the gym seven days a week, and you don't need to be performing a sport at incredibly high levels. Sarcopenia affects muscle mass, so if you build some muscle mass in the gym that's good, but you shouldn't overdo it as that may speed-up the process, so I recommend going on a run once or twice a week and going to the gym and building muscle two or three times a week. As long as you are able to build muscle in all the areas of your body, arms, back, chest, abdominals, and legs, sarcopenia won't be much of a worry if you keep that schedule up. You should prevent yourself from becoming overweight, and you should prevent a completely sedentary lifestyle. On the topic of being sedentary, you shouldn't be seated or lying down for the majority of the day, but you don't need to always be standing or moving. By working out in the ways previously stated this box should be checked off. This one also happens to be the easiest thing to prevent, so if you are starting to show signs of sarcopenia, then moving around by the means of a walk, jog, or run would be beneficial. The main way to prevent sarcopenia is to find a healthy balance. You don't need to be extremely healthy, working out every day, and always moving, but you shouldn't have unhealthy food habits, never working out, and always sitting. It's alright if you are a little chubby or a little skinny. It's fine if you are working out two-four times a week, and it's not detrimental if you are sitting down from nine-five or seven-four. You just need to find a good balance. The most important thing about avoiding sarcopenia is knowing the symptoms and being aware of if you have those symptoms. If you don't know if you have it, but are experiencing weakness, fatigue, and an inability to perform at sports you should check with a doctor to see if you have sarcopenia, as catching it early is imperative.

	Muscle Mass	Muscle Strength	Performance in Physical Activities
Early-Sarcopenic	Decreased	Normal	Normal
Sarcopenic	Decreased	Decreased	Slightly Decreased
Sever Sarcopenic	Heavily Decreased	Heavily Decreased	Heavily Decreased

Figure 4: Describes to a certain extent what one should expect if they are sarcopenic. The diagram highlights the main effects of sarcopenia and varying stages of a sarcopenic person's life.

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How to Know if You Have Sarcopenia or are at Risk of Sarcopenia?

In many cases, sarcopenia isn't alone. It is commonly a secondary ailment, while the primary ailment is the main reason for sarcopenia being present. One underlying condition that can cause sarcopenia is cachexia. This is a severe metabolic syndrome which is distinguished by loss of muscle mass, regardless of loss of fat. It also causes inflammation, resistance to insulin, anorexia, and increased decay of muscle mass. As previously stated sarcopenia can be caused by a low metabolism, something cachexia provides. They work together to remove freedom and independence in the elderly. So, if someone has cachexia, then it is very likely that they also have sarcopenia. Sarcopenia is also linked with frailty, and although sounding like an adjective, this is a serious medical condition. Many things that cause sarcopenia also cause frailty, and they both affect the same type of people. Simply put sarcopenia is the loss of muscle mass, while frailty is the loss of muscle function, meaning someone suffering from frailty cannot use their muscles and appendages as effectively as they should be able to. Frailty causes a slew of negative effects, ranging from neuronal decrease and impaired neurotransmission to low testosterone levels and low microbiota diversity. Frailty affects most aspects of life, and the aspects not affected by frailty are affected by sarcopenia. So, to know if you have sarcopenia or are at risk of sarcopenia you must know your body, meaning you have to know if you have pre-existing or underlying medical conditions that sarcopenia often works with, but sarcopenia can still affect people even if they don't have pre-existing medical conditions.

In that case, one must know how to affirm that they have sarcopenia. One of the easiest ways to tell if someone has sarcopenia is the grip strength test. Sarcopenia directly affects skeletal muscle mass, and this decreased muscle mass makes a sarcopenic person much weaker, and because they are much weaker they won't be able to create a high or average score for the grip strength test. Their numbers would be much lower than the average person, which is an indicator that something is wrong with their muscles. Another simple, cheap, and easy way to test if someone has decreased muscle mass is the gait speed test. This test involves walking a certain distance through different levels of elevation. This test does not show endurance but shows muscle strength in their legs as they have to walk slightly uphill and downhill. These two tests are very simple and only require one instrument, the grip strength machine, and the surface for the gait speed test. I would recommend doing the grip strength test at home, as it can be obtained for twenty-five dollars on amazon, however if you don't want to buy it, one can do the gait speed test as it can be done on a variety of surfaces like your house, a sidewalk, or a hill. These two tests can be done by you to tell if a loved one is sarcopenic. Just make sure that you know how to do the tests beforehand, so you don't create inaccurate data. If these tests show that you are weaker than you should be, then go to a doctor and tell them your current bodily state. They would run these two tests again to solidify your claims, then they would do a bioelectric impedance analysis and an array of other tests to check how severe your potential sarcopenia is, and to identify if you have other ailments. So, to know if you are at risk of sarcopenia, one must know their body, meaning they have to know if their pre-existing ailments and sarcopenia commonly work together. They should also know they are becoming weaker. If previously easy tasks, like opening a door or walking up the steps, start to become harder in a short time, then they should consult with their preferred medical practitioner.

Ideal Physical Activity and Beneficial Diet

As previously stated, a sedentary lifestyle is a large contributor to sarcopenia, but how should one go about avoiding this lifestyle? Simply put, one should move a decent amount in their youth, whether it's a walk, a run, or weightlifting. Physically exerting yourself is ideal to avoid sarcopenia as in many cases physical exertion helps build muscle. For example, say I'm curling a dumbbell. As I'm doing the exercise my biceps, the targeted muscle, begins to contract micro-tears, microscopic tears in one's muscle that occur due to tremendous stress via weight or elongated periods of stress. This tear is later fixed by adding an additional layer of muscle tissue on top of the damaged or torn fibers, effectively growing your muscle. By growing muscles, the chance of sarcopenia decreases significantly as you are

building muscle while it's breaking down, or you have built enough muscle in your lifetime to be able to withstand the deterioration.

The diet side of things is also simple. If you substitute heavily processed foods and generally unhealthy things with healthier alternatives your chances of sarcopenia will decrease and a sarcopenic patient will have an easier time. For example, instead of cooking with vegetable oil, a heavily processed oil, use peanut or coconut oil as they are more natural and much better for you. Despite trying to eat healthier another component must be taken into account and that is the fact that sarcopenia almost never comes alone. It is often aided by other ailments, ailments that could limit your dietary choices. Whether it's diabetes, high blood pressure, cachexia, frailty, or kidney problems, your diet is likely to be affected. For example, if someone has diabetes they need less sugar in their diet, something that could be achieved by self-control. Diabetes also restricts the foods someone is allowed to eat because they need less insulin and less sugar, making their choices of food smaller. Another factor in eating healthy is cost. Some people simply cannot afford to buy and consume these healthy foods. It can be much more fiscally responsible to eat the unhealthy counterparts as they have a much lower price. This is why when someone is sarcopenic they should eat the healthiest they can. If that happens to be the expensive, all natural and farm-raised foods so be it, and if it happens to be a healthy meal every couple of days so be it. A healthy diet is much harder to achieve as this isn't an ideal world and unfortunately healthy foods cost much more than unhealthy foods. The best advice to avoid sarcopenia is to take care of yourself early in your life. Do the hard work of eating healthy and working out when you're young and full of vigor so you don't have to suffer in your future. So, if you or a loved one is diagnosed with sarcopenia attempt to eat the healthiest you can. If you find that other ailments impede your attempt, try again but with a lower bar, a bar that can be reached based on your medical history and financial state.

Conclusion

Sarcopenia is an ailment that directly affects muscle mass. As you get older, the risk of getting it increases, meaning it has a direct relationship with your age in most cases. The reason for this is that people's bones and muscles have a set lifespan, around 60+ years, but even if this threshold is met sarcopenia isn't guaranteed. Sarcopenia is heavily influenced by lifestyle choice so if you don't partake in them your chances of getting sarcopenia decrease heavily. However, once it is met your bones and muscles stop growing and developing, causing them to weaken. In this weakened state, sarcopenia can easily occur and speed up the process, if the affirmation lifestyle choices were done by you. Lifestyle choices like level of activity and diet. By being active and eating healthy your chances of getting sarcopenia decrease drastically, however some things that cause sarcopenia cannot be controlled like gender and metabolism levels. Also, in many cases sarcopenia can be aided by other ailments, which can easily remove independence in the elderly's lives. To know if you are at risk of sarcopenia, you must know your body. You have to be aware of your decreased strength, and you have to be aware of your increased fatigue. If you don't realize that you are at risk, then sarcopenia could effectively ruin the rest of your life. It could prevent you from doing almost everything like walking up steps. You should not assume that your weakened state is temporary, especially if you or a loved one is above 60. You have to assume the worst and get a check-up, because if you don't you'll live the rest of your life as a hollow shell of your former self. You have to take action because sarcopenia will remove your ability to do so.

References

Cruz-Jentoft, A. J., Bahat, G., Bauer, J., Boirie, Y., Bruyère, O., Cederholm, T., Cooper, C., Landi, F., Rolland, Y., Sayer, A. A., Schneider, S. M., Sieber, C. C., Topinkova, E., Vandewoude, M., Visser, M., Zamboni, M., Writing Group for the European Working Group on Sarcopenia in Older People 2, & Extended Group for the European Working Group on Sarcopenia in Older People 2. (2014, September 24). *Sarcopenia: revised European consensus on definition and diagnosis*. NCBI. Retrieved May 30, 2023, from <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6322506>

Curtis, E., Litwic, A., Cooper, C., & Dennison, E. (2016, May 1). *Determinants of muscle and bone aging - PMC*. NCBI. Retrieved May 30, 2023, from <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4530476>

Hasni, S., & Dhillon, R. J. (2017, February 1). *Pathogenesis and Management of Sarcopenia - PMC*. NCBI. Retrieved May 30, 2023, from <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5127276>

Larsson, L., Degens, H., Li, M., Salviati, L., Lee, Y. i., Thompson, W., Kirkland, J. L., & Sandri, M. (2019, January 1). *Sarcopenia: Aging-Related Loss of Muscle Mass and Function*. NCBI. Retrieved May 30, 2023, from <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6442923>

Tandon, P., Merli, M., Lai, J. C., Montano-Loza, A. J., & Dasarathy, S. (2021, July 1). *Sarcopenia and frailty in decompensated cirrhosis - PMC*. NCBI. Retrieved May 30, 2023, from <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9125684>