

BENEFITS OF EXERCISE FOR PATIENTS WITH MITO

The thought of regular exercise for many people with mitochondrial disease (mito) seems unreachable, as just getting through the day requires all the energy they have. There is evidence to show that that exercise is beneficial for many aspects of daily life. This article provides a guide to exercising.

BENEFITS OF REGULAR EXERCISE:

- Improved Quality of Life: Remain independent with the ability to complete daily living tasks
- Feel Less Fatigue: The fitter you are, the more energy efficient you will be meaning tasks will take less energy to do
- Maintains your balance and minimises the risk of falls
- Limit Injuries: Through improved flexibility, strength, and coordination
- **Cut your Risk of Depression in Half:** For every 50 minutes of exercise added each week, the rate of depression can fall by half. Research shows that people who reported doing no exercise at all had a 44 per cent increased chance of developing depression compared to those who were exercising one to two hours a week.
- Improves Body Composition: Decreases levels of body fat and increases levels of muscle mass. This reverses sarcopenia (age related loss of muscle mass) and muscle atrophy (inactivity or injury related muscle loss)
- Improves immune system function, inflammation levels and oxidative stress levels
- Interrupts of the spiral of fatigue – inactivity – loss of fitness and function
- Slows the onset of and treats specific illnesses such as diabetes and heart disease

RISKS RELATED TO INACTIVITY AND MITO

- Loss of motivation, energy and mobility
- Risk of other complications (diabetes)
- Poor mental health
- Deterioration of mitochondrial symptoms
- Reduction in personal independence

WHAT DOES THE RESEARCH SAY?

A number of studies involving animal models, and human patients living with mito have demonstrated the benefit of endurance exercise. The benefits for mito patients include increased mitochondrial content, antioxidant enzyme activity, muscle mitochondrial enzyme activity, maximal oxygen uptake, and increased peripheral muscle strength. Other benefits included decrease in resting and post-exercise blood lactate levels.

Most studies report no harmful effects to patients with mito from slowly accelerated exercise training, either resistance or endurance. In particular, there are no reports of elevated creatine kinase levels, negative heteroplasmic shifting, or increased musculoskeletal injuries in mitochondrial patients during supervised progressive exercise aimed at physiological adaptation.

The Research Recommends:

1. Physical endurance training to improve mitochondrial biogenesis, meaning you are able to retrieve more energy from the glucose in your body.
2. Endurance exercise which can increase mitochondrial enzyme activity in muscle and quality-of-life scores, and can reduce the energy cost of activities of daily living. Resistance exercise can increase muscle strength and growth in mito patients.
3. A combination of progressive and resistance exercise is thought to be safe when instituted in a supervised, progressive fashion with training beginning at a low intensity and duration.
4. Mito patients should undergo cardiac screening prior to beginning an exercise program.
5. Exercise intolerance is a real phenomenon in patients with mito, but a deconditioned mito patient should be encouraged to exercise. Physicians should encourage compliance with exercise programs for mito patients.

6. High-intensity interval training has been shown to induce similar mitochondrial adaptations as compared with endurance exercise in healthy and diabetic adults, but the effectiveness and safety have not been adequately studied in patients with mito.

You can review the findings here: *A Consensus Statement from the Mitochondrial Medicine Society*. Parikh et al, *Genetics in Medicine* volume 17, pages 689–701, 2015, <https://www.nature.com/articles/gim2014177>

WHAT DOES ALL THIS MEAN?

Exercise can give you more energy on a biochemical level by increasing the number of healthy mitochondria in cells – studies have shown a 67 per cent increase in mitochondria in three months of aerobic training done four times weekly. Research also indicates that exercise makes the body use oxygen more efficiently, increases exercise tolerance, improves mitochondrial function along with muscle metabolism, volume and performance. Exercise has also been shown not to damage muscle, and one study even demonstrated that resistance exercise actually diluted the unhealthy or mutant load of mitochondria in muscle cells. To maximise energy production, mito patients must remain active as the positive effects will reverse if exercise is stopped.

Exercise does not provide a cure for mito, however, it will improve the person's quality of life and chances of independence. The key is to exercise correctly and know your limits.

SO WHERE AND HOW SHOULD I START EXERCISING?

1. *Visit your GP first* – Before beginning an exercise program, it is important to seek your GP's approval. Your GP can provide information on exercise, keep track of your health conditions and assist in preventing injuries. They can provide chronic disease care plans, giving you up to five free appointments with health professionals such as physiotherapists and exercise physiologists who are qualified to guide you in your exercise program.
2. *Research types of exercise*
 - i) *Aerobic exercise*: This includes walking, running, hiking, swimming and cycling (also known as “cardio” or “endurance exercise”). These activities are longer in duration and cause the body to use more oxygen, increasing cardiovascular endurance and efficiency. This means that over time and with progress in the amount of exercise done, the body uses less energy to do the same activities, and so induces less fatigue.
 - ii) *Anaerobic exercise*: exercise that is short and intense in duration, including resistance training such as weightlifting, strength training and body weight training, which cause an increase in strength and power of muscles, improved bone strength and improved balance and coordination. Anaerobic training

also includes short bursts of very high intensity exercise such as sprints, high intensity interval training (HIIT) or circuit training. These types of training should only be done under professional guidance and the research is uncertain if it is beneficial for people with mito. Anaerobic exercise lasting longer than about two minutes begins to have an aerobic component, which means the body is running out of ATP and glucose to use as energy and must begin to use oxygen instead. People with mito generally have a lower “anaerobic threshold”, meaning their bodies are not using oxygen as effectively and must switch from the aerobic system to the anaerobic system. Exercise increases the anaerobic threshold, (ability to use oxygen as fuel source) and the ability to process lactate.

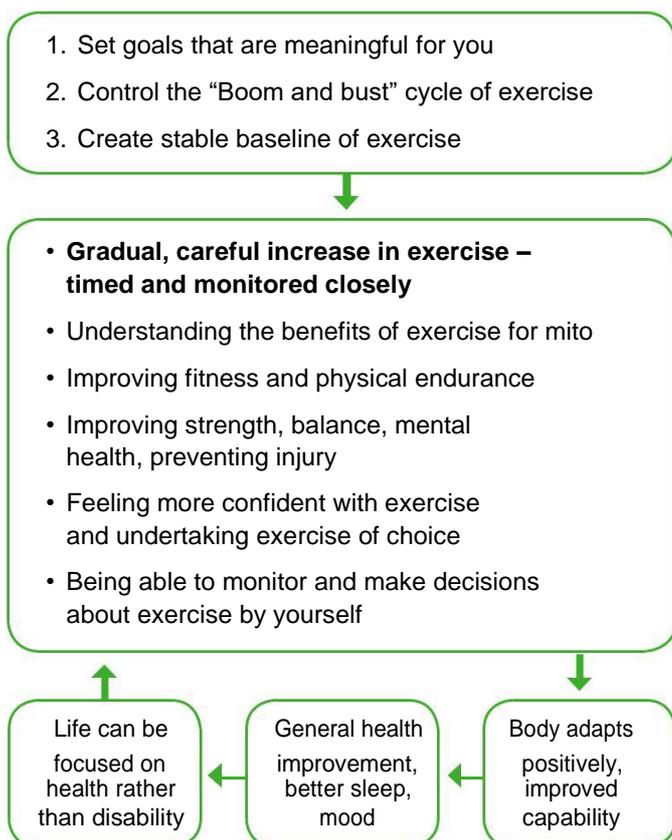
3. *Address your expectations of exercise*: Mito patients don't need an hour of high intensity exercise to get health benefits. This is definitely not the case, especially for mito patients. There is a high chance of injury or “crashing” with sudden and large increases in exercise. Gradually building up your exercise regime will help you prevent injury and extreme fatigue. *Stop if you experience any unwanted symptoms such as nausea, vomiting, dizziness, light headedness, chest pains, palpitations or excess pain* (specific information on pain with exercise is provided below). Check with your doctor if you are okay to continue and then decrease intensity and/or duration.

Using vibration plates have helped to increase muscle tone, strength, bone mineral density, core strength and balance - this may be a good start if you have poor mobility. Swimming is also an excellent option. People with mito may have problems with temperature regulation and overheating, so be mindful of this if swimming in hydrotherapy or warm pools.

It is important to plan your meals and drinks around exercise. Eat an hour before you exercise to give your body enough energy. Good examples include fruit juice, skim milk, a banana or some toast with peanut butter. Ensure you continue to drink water or sports drinks during activity, and eat after exercise to improve fatigue and refuel.

4. *Find what suits you* – Find what you enjoy, or what you are able to do, and build from there. To get the most from exercise, you should feel short of breath and sweat a little. Gradually increase the difficulty of the activity as you get better at it, track your progress and review when to adjust the amount you are doing. There are plenty of options, including: walking, weightlifting, tai chi, sailing, yoga, many different team sports, and swimming. Local medical clinics, community centres and gyms may have adapted exercise programs for people affected by arthritis, muscular dystrophy, fibromyalgia or multiple sclerosis which may suit mito patients. Recumbent exercise bikes, walking and swimming are also very low impact.

5. *Start slow* – Begin with a few minutes of daily stretching or walking, and then begin to gradually increase it, even by one minute a day. A useful technique for carefully increasing exercise is called Graded Exercise Therapy (GET). GET has been shown to safely improve muscle strength, cardiovascular endurance and symptoms in a wide variety of conditions such as heart disease, cancer, chronic fatigue and chronic obstructive pulmonary disease (COPD). It is important to see your GP and/or physio to get assistance with GET before starting.



Source: Bavinton J, Darbishire L, White PD. PACE manual for therapists: graded exercise therapy for CSF/ME. Final trial version: version 7 (internet), p.27. Accessed 5 March 2015 at www.pacetrial.org/docs/get-therapist-manual.pdf

6. *Listen to your body and be mindful of pain and fatigue* – A recent study of 10,000 people suffering from hip and knee osteoarthritis found that exercise is very beneficial and pain-free for 95 per cent of these patients, if they followed two simple pain rules:
 - I. The pain you experience should be tolerable.
 - II. The pain should not increase from day to day.
7. Your pain should be assessed daily on a scale from zero to ten. It is normal for a temporary increase in pain when beginning exercise for the first time. On this scale, zero to two is considered “safe”, two to five “acceptable” and six to ten “avoid”. For instance, if

your average level of pain is three, and after exercising it goes to five, this is acceptable. If it jumps up to seven or eight however, this means the activity needs to be reduced. For the first week, write down your pain levels before and after exercise. After that, write in the diary the next time you have a flare-up or relapse in pain and what caused it.

8. *Balance is key* – Balance your rest and activity to avoid exhaustion. This could mean doing the activity for ten minutes and then resting for another ten before starting again. Exercise is cumulative – thirty minutes broken up into three blocks of ten minutes over a day has the same benefits as exercising continually for thirty minutes. This is especially important for kids with mito, who can forget to pace themselves – a policy of “enforced rest” might be a good idea. It is also important not to expect them to perform at the same level as their peers. For fitness and social development consider a team sport, let them play for ten or fifteen minutes, and then back to their more important role of assistant coach for another ten! Ensure to rest after exercise sessions and leave a gap to recover. There are sporting organisations for kids with disabilities, i.e. Sporting Wheelies and Disability Sports Australia.
9. *Those who fail to plan, plan to fail* – Many people have a mental battle every day in terms of making themselves exercise, so don’t be hard on yourself if you are struggling. A powerful strategy is to treat exercise as an appointment that you can’t miss (like an important work meeting) and to schedule it into your calendar. Exercising in the morning is a good idea as energy levels are at their highest and gets it out of the way. Exercising at the same time every day forms a habit, which over time turns into a lifestyle. Once a habit is formed it is much easier to see the positive effects of regular exercise. Set yourself both long and short term SMART (Specific, Measureable, Achievable, Realistic, Timed) goals so you have something to work towards, and something to achieve! An example of a SMART goal would be “My goal is to walk 500 extra steps each week for the next two weeks”. This is much more powerful than “my goal is to walk more”!