



Building Physical Endurance with a PI and/or AD

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Most people can participate in a physical endurance conditioning program, but it is advised for those with a PI or AD to start slowly and progress steadily.

POOR PHYSICAL ENDURANCE or “the time span between the beginning of physical activity by an individual and the termination because of exhaustion”¹ is often a familiar complaint of people living with a primary immunodeficiency disease (PI) or autoimmune disorder (AD). To be sure, fatigue is not an uncommon complaint for the population at large, and there are many potential contributing factors, including poor sleep, diet, infection, low blood sugar, anemia, some pharmaceutical medications and a number of physical disorders.

Under the premise of improving physical endurance, cardiorespiratory function (or how well the heart, lungs and muscles work together) “to use oxygen to produce energy for movement”² is usually the topic of discussion. Although the

benefits of exercise are generally established and rarely disputed, it’s startling how many people believe they are an exception to the rule and exercise would somehow be more detrimental to their health than not doing anything at all. This is simply flawed perception. When people view themselves performing aerobic exercise, it might be running a marathon, jumping rope, Zumba or other strenuous activities that cause them to pour sweat out of every pore and gasp for air. But, aerobic exercise can be light to moderate in intensity, too. For some, vacuuming the floor is an aerobic exercise and, by applying the principles of cardiorespiratory training, can improve physical endurance over time. The point is, almost anyone can safely improve cardiorespiratory endurance.

Underlying Principles of Aerobic Exercise Prescription

Exercise is normally prescribed according to the parameters of frequency, intensity and time (FIT). In other words, exercise volume equals F times I times T. Once someone understands the principles of exercise prescription and possible exercise adaptations, it's easy to see the wide array of possible activities to increase cardiorespiratory endurance.

Frequency and time (duration). It is generally recommended adults participate in aerobic exercise three days to five days a week, with activity continuing at least 20 minutes to 30 minutes to impact cardiorespiratory conditioning. However, some studies suggest sessions of at least 10 consecutive minutes can be performed intermittently throughout the day to effectively acquire the recommended daily duration; and even sessions that are less than 10 minutes in duration may be of benefit in extremely deconditioned individuals (though more evidence is needed to support their effectiveness).

The American College of Sports Medicine (ACSM) states most adults should participate in moderate intensity exercise for 30 minutes to 60 minutes (more than 150 minutes a week), in vigorous intensity exercise for 20 minutes to 60 minutes (more than 75 minutes a week) "or a combination of moderate and vigorous intensity exercise daily to attain the recommended targeted volumes of exercise." However, ACSM also points out that "less than 20 minutes of exercise per day can be beneficial, especially in previously sedentary individuals."³

Intensity. The overload principle of exercise indicates a minimum intensity (or threshold) must be reached and surpassed to result in physiologic changes. Most exercise and sports science physiologists use someone's maximal volume of oxygen uptake (VO_{2max}) over time to measure gains with cardiorespiratory function. However, the minimum threshold of intensity for benefits appears to vary based on several factors, including current level of cardiorespiratory function, age, health status and genetics. So, establishing an exact threshold for exercise intensity, particularly for someone working out on their own at home, can be tricky.³

The easiest, although not the most accurate, way to determine workout intensity for cardiorespiratory benefits is by establishing a target heart rate (HR).

Target Heart Rate

To figure out the max/peak HR without population-

specific formulas or by taking an exercise or chemical stress test (both which could be contraindicated for some conditions), a participant can simply subtract their age from 220. For example, for someone who is 69 years old, their estimated max/peak HR would be 220 minus 69, which would be 151 beats per minute (bpm).

Once the maximum heart rate is known, the target HR zone is calculated. This is the range in which exercise participants will try to maintain their HR to improve cardiorespiratory endurance over time. The American Heart Association recommends a general target HR of:⁴

- 50 percent to 70 percent of maximum HR for moderate exercise intensity
- 70 percent to 85 percent of maximum HR for vigorous exercise intensity

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Because of factors unique to individuals, it's not uncommon to misestimate exercise intensity when using this simple formula. Therefore, instead, a more accurate target zone can be calculated by using someone's HR reserve (HRR):

- 1) Calculate maximum heart rate as before (220 minus age).
- 2) Figure resting HR by counting bpm when relaxed and sitting down.
- 3) Subtract resting HR from maximum HR to get HRR.
- 4) If aiming for moderate exercise intensity, multiply the HRR by .50 (50 percent), and add the resting HR to this number.
- 5) Multiply HRR by .70 (70 percent), and add resting HR to this number.

6) The exercise participant's HR should be between the two numbers calculated in steps four and five. This is the training zone HR for moderate intensity exercise.

Reusing the example of someone who is 69 years old with a max/peak HR of 151 bpm (220 minus 69), let's say we check his or her resting HR and find it to be 68 bpm. This number is then subtracted from his or her max/peak HR of 151 to get the HRR (151 minus 68 equals 83 bpm).

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If we were creating an aerobic exercise program at a moderate exercise intensity, we would multiply the HRR of 83 by .50, add the resting heart rate of 68 back to this number and round to the nearest whole number (83 times .50 plus 68 equals 110 bpm). This is the low end of the recommended training zone HR. The same steps would be repeated by multiplying the HRR by a factor of .70 instead of .50 to get the high end of the training zone HR (83 times .70 plus 68 equals 126 bpm). The targeted training zone HR for this individual, then, would be between 110 bpm and 126 bpm.

The recommended percentage of HRR varies somewhat by source. For example, ACSM recommends 40 percent to 59 percent HRR for moderate aerobic exercise and 60 percent to 89 percent HRR for vigorous intensity exercise, with light aerobic exercise as low as 30 percent to 39 percent HRR proving beneficial to individuals who are deconditioned.³ The essential warm-up and cool-down periods of an aerobic exercise routine typically take five minutes to 15 minutes each, and are performed at approximately 50 percent of the conditioning period stimulus intensity (i.e., at a level that allows the participant to hold a conversation without much difficulty).

Many exercise machines now have built-in HR monitors, or participants can purchase a portable pulse oximeter at a reasonable cost to take their pulse through their finger. However, the tried-and-true manual method of checking the pulse over the carotid or radial arteries also works. If taken in this manner, the pulse should be checked with the index and third finger placed over the artery while counting the number of beats for 15 seconds. At the end of 15 seconds, multiply by four to calculate bpm.

Modes of Aerobic Exercise

The most effective types of aerobic exercise are those that involve the use of large muscle groups and are rhythmic in nature. The following is a short list of activities to get people started:

- Walking/dancing
- Swimming
- Biking
- Aerobics
- Climbing stairs
- Hiking
- Jogging
- Aqua aerobics
- Rowing
- Skiing
- Elliptical exercises
- Running
- Sports
- Stationary bike

When training for a particular activity, the principle of specificity indicates the physiologic adaptations needed are specific to the type of exercise performed. In other words, if a person wants to become a better-conditioned swimmer, his or her most effective training exercise is swimming, although the benefits of cardiorespiratory endurance certainly do carry over between all activities of life.

Progression of Aerobic Exercise

There are three stages of aerobic (cardiopulmonary) conditioning⁵ (because the parameters that are often presented with each stage should also take into consideration individual factors, they are not included here):

Initial conditioning stage: This typically lasts for the first four weeks to five weeks of training. However, if the exercise

routine is interrupted for significant periods, it may last longer.

Improvement stage: Presuming continued adherence to the exercise routine, this stage usually lasts four months to five months.

Maintenance stage: This tends to begin after the first six months of training. Further gains in cardiopulmonary function may not be significant, although continuing aerobic exercise at least three days a week will help to maintain current levels of fitness.

ACSM suggests “a gradual progression of exercise volume by adjusting exercise duration, frequency and/or intensity is reasonable until the desired exercise goal (maintenance) is attained. This approach of ‘start low and go slow’ may enhance adherence and reduce risks of musculoskeletal injury and adverse cardiac events.”

It’s important to note that volume should not be increased by more than one factor at a time. For example, if a participant feels he or she can increase the duration of workouts, the intensity should only be increased once the person is confident about participating in longer sessions. I usually recommend taking at least one full week to acclimate to a change so participants aren’t only successful with a new workout, but they can also recover from it successfully.

Special Considerations

It was long believed exercise — at least strenuous exercise — could temporarily suppress immune function. However, *if* this is the case, it appears the period of vulnerability, as suggested by a reduction in white blood cells circulating in the blood, is short-lived and only occurs “after an excessive amount of prolonged, high-intensity exercise.”⁶

The theory suggests that this “open window” of increased risk of infection lasts between three hours and 72 hours. However, a widely cited 2018 review study published in *Frontiers in Immunology* concluded “regular physical activity and frequent exercise are beneficial or, at the very least, are not detrimental to immunological health.” The authors further noted that “limited reliable evidence exists to support the claim that vigorous exercise heightens risk of opportunistic infections.”⁷

Although it’s probable that being active is likely to be beneficial versus detrimental to immune function, some modes of aerobic exercise may be contraindicated for people with specific medical conditions. For example, someone who is known to have a low platelet count should not participate

in contact sports. There is also danger in overtraining, particularly for those living with ADs that are characterized by chronic inflammation. Stressful exercise can increase inflammation and make symptoms worse. Too much too soon can also result in musculoskeletal injuries.

Start Slow and Steadily

Almost anyone can improve physical endurance, but rather than exacerbating symptoms of a PI or AD, it’s best to both start and continue to improve one’s cardiopulmonary function slowly and steadily.

Patients should begin by consulting with their doctor, and consider utilizing the expertise of an exercise physiologist, personal trainer or physical therapist to build a program. If they are just beginning an exercise program, or if they have other precautions that would contraindicate exercising at a higher intensity, the objective should still at least initially be at the lower end of their HR target zone, with the goal of building up gradually.

Just “staying in the game” is winning with aerobic training, because once training is discontinued, cardiopulmonary function will decrease by approximately 50 percent within four weeks to 12 weeks.³ Individuals are advised to choose activities that are fun and/or are functional and need to be done anyhow. If someone is consistent in performing them, and consistent in applying the principles of aerobic exercise prescription, the benefits will be felt, and physical endurance will improve. ■

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