

QUESTION:

I've heard the terms aerobic and anaerobic a lot. What do these terms actually mean and are they important for my exercise program?

ANSWER:

Strictly speaking, the terms "aerobic" and "anaerobic" refer to the presence and absence of oxygen, respectively. Most of our cells prefer to get their energy by using oxygen to fuel metabolism. During exercise with adequate fuel and oxygen (i.e., aerobic), muscle cells can contract repeatedly without fatigue. During anaerobic or non-oxygen conditions (i.e., higher intensity exercise), muscle cells must rely on other reactions that do not require oxygen to fuel muscle contraction. This anaerobic metabolism in the cells produces waste molecules that can impair muscle contractions. We call this deterioration in performance **fatigue**.



Fatigue causes you to experience added discomfort and weakening muscles. Eventually you will need to slow down and lower your exercise intensity. Slowing down allows the muscles to once again rely solely on aerobic metabolism and support the removal or chemical conversion of waste molecules.

The problem with the terms "aerobic" and "anaerobic" when applied to exercise is that we actually never switch from total aerobic to total anaerobic metabolic conditions. In reality, the more intensely we exercise, the greater the need for anaerobic energy production. Consequently, it is best to view the terms aerobic and anaerobic as transitions in metabolism, where the proportion between aerobic and anaerobic metabolism changes depending on exercise intensity.

For example, while at rest, we rely on aerobic metabolism to fuel almost all our body's needs for energy. As we start to exercise, such as progressing from sitting to a slow walk, the increased energy needs of muscle contraction require that we increase our breathing and oxygen intake. So long as we increase our exercise intensity slowly, we can maintain our muscles' dependence on aerobic metabolism, and we don't experience symptoms of fatigue.

However, as exercise intensity increases, the need for energy release eventually exceeds that which can be supplied by aerobic metabolism. Our muscles simply need more reactions to support the energy demand. Therefore, anaerobic contribution to metabolism increases. When this happens, we refer to this change in metabolism as a **metabolic threshold**. This metabolic threshold represents the exercise intensity where we start to produce those waste products of anaerobic metabolism that can eventually lead to fatigue. You see this all the time when watching endurance Olympic events, such as a long distance running race. The athletes run at a pace that hovers around their metabolic threshold, and they can only afford to run faster than this pace near the end of the race. If they increase their pace too early in the race, then they fatigue too early and need to slow down to below their metabolic threshold to recover from the fatigue inducing waste products. This would result in poor performance.

So how do these terms relate to you? Well, it depends on your circumstance and goals. Most of us are non-competitive or non-elite active individuals, who just want to exercise to gain health benefits, feel good and possibly lose weight. Aerobic exercise conditions enable you to exercise for long periods of time, potentially benefiting from the sustained energy expenditure (i.e., calories burned). Aerobic exercise tends to be less stressful to muscles, joints, and your heart, which may be important for individuals with arthritis, heart disease, or high blood pressure. However, to more rapidly improve your exercise capacities, tolerance, and performance, some anaerobic exercise training is a necessity. Therefore, performing anaerobic exercise is typically more important for competitive athletes.

When starting a training program, most trainers like to have their clients/athletes start with lower intensity exercise (i.e., aerobic exercise). However, a high reliance on anaerobic metabolism is unavoidable for some types of exercise or activities. For instance, lifting weights is anaerobic. That is why muscles fatigue so rapidly with this type of training. Other types of activities, such as walking up stairs, can also be anaerobic - especially if you are unfit or climb too fast.

Fortunately, we do not need sophisticated equipment to detect when we transition from aerobic to anaerobic exercise. As we approach and pass our metabolic threshold intensity, we start to breath harder and exercise simply becomes uncomfortable. However, if you simply love gadgets, you can use a heart rate monitor to record the heart rate at which you sense these symptoms of developing over-exertion. You then know that heart rates below this value occur when you're in your aerobic zone, and heart rates above this value reflect an increasing anaerobic contribution to your exercise bout.