Should I Eat Carbohydrate or Fat for Exercise?

When it comes to eating for exercise there are several things to consider while meal planning. Carbohydrate, fat, and protein all contribute to the fuel supply needed by working muscles, with carbohydrates and protein providing 4 Calories per gram and fat providing 9 Calories per gram. And all nutrients get converted to energy in the form of adenosine triphosphate or ATP. However, each nutrient has unique properties that determine how it gets converted to energy. Carbohydrate is the main nutrient that fuels exercise of a moderate to high intensity, while fat can fuel low intensity exercise for long periods of time. Proteins are generally used to maintain and repair body tissues, and are not normally used to power muscle activity.

Because the body can not easily store ATP (and what is stored gets used up within a few seconds), it is necessary to continually create ATP during exercise.

There are three main pathways to convert nutrients to ATP and it is the intensity and duration of the exercise that determine which method gets used.

The first path only supplies about 10 seconds worth of energy and is used for short bursts of exercise such as a 100 meter sprint. After this, either aerobic or anaerobic metabolism is used to continue to create ATP. Then major difference between aerobic and anaerobic metabolism is the presence of oxygen to create ATP.

Aerobic metabolism requires oxygen to convert nutrients (carbohydrates, fats, and protein) to ATP. Aerobic metabolism is used primarily during endurance activities.

Anaerobic metabolism (glycolysis), creates ATP exclusively from carbohydrates, with lactic acid being a by-product. As lactic acid builds up in the muscle it causes physical discomfort and pain that limits performance. Anaerobic metabolism produces energy for short, high-intensity bursts of activity lasting no more than several minutes before the lactic acid build-up reaches a threshold (the lactate threshold) and muscle pain, burning and fatigue make it impossible to maintain that intensity.

During exercise an athlete will move through these metabolic pathways. As exercise begins, ATP is produced via anaerobic metabolism. With an increase in breathing and heart rate there is more oxygen available and aerobic metabolism begins and continues until VO2max is reached. If VO2Max is surpassed, the body can not deliver oxygen quickly enough to generate ATP and anaerobic metabolism kicks in again. Since this

system is short-lived and lactic acid levels rise, the intensity can not be sustained and the athlete will need to decrease intensity to remove lactic acid build-up.

So what should I eat, Carbs or Fats?

Carbohydrates and Fats for Fuel
Nutrients get converted to ATP based upon the intensity and duration of activity, with carbohydrate as the main nutrient fueling exercise of a moderate to high intensity, and fat providing energy during exercise that occurs at or below 50% VO2 max. Fat is a great fuel for endurance events, but it is simply not adequate for high level aerobic exercise (over 50% VO2Max) or for anaerobic exercise such as sprints or intervals. If exercising at or below 50-60% VO2Max, you can utilize fat stores for energy. At a low intensity, you have enough stored fat to fuel activity for several days (most people have 100,000 Calories of energy stored as fat) as long as there is sufficient oxygen to allow fat metabolism to occur.

As exercise intensity increases to 60 and 90% VO2Max, carbohydrate metabolism takes over and is more efficient than fat metabolism.

Since a well-fed athlete can hold about 1500 carbohydrate Calories, this level of intensity can be sustained for approximately 2 hours. After that, stored carbohydrates are used up and you may hit the wall or 'bonk.' An athlete can sustain 60-90% VO2Max for more than 2 hours by simply replenishing carbohydrate stores during exercise. This is why it is critical to eat easily digestible carbohydrates during moderate exercise that lasts more than a few hours. If you don't take in enough carbohydrates, you will be forced to reduce your intensity to less than 50%VO2Max and tap back into fat metabolism to fuel activity.

As VO2Max is reached and surpassed, carbohydrate metabolism efficiency drops off dramatically and anaerobic metabolism takes over. This is because your body can not take in and distribute oxygen quickly enough to use either fat or carbohydrate metabolism easily. In fact, carbohydrates can produce nearly 20 times more energy (in the form of ATP) per gram when metabolized in the presence of adequate oxygen than when generated in the oxygen-starved, anaerobic environment that occurs once you reach and surpass your VO2Max.

With training, there are several cardiovascular system adaptations that dramatically improve the ability to reach higher levels of exercise intensity over longer periods of time. First, training can increase an athlete's VO2Max. This improves the efficiency of oxygen transport to working muscles, allowing greater exercise duration at higher intensity before anaerobic pathways are needed. Higher Vo2Max levels also help remove lactic acid more quickly, which leads to faster recovery from anaerobic sprints, or other speed bursts. Another key to training is that it improves an athlete's ability to withstand greater build-up of lactic acid before discomfort requires a reduction in exercise intensity.

For more information about lactic acid, see How lactic Acid Effects Performance.