

Using Intervals to Target VO2max Adaptations

By Stephen McGregor, Ph.D.

Although interval training can be used to improve specific event/competition demands, they can also be used in a broader sense to elicit physiological adaptations that will contribute to the overall development of the athlete. This is particularly pertinent to cycling due to the dynamic and diverse nature of most cycling disciplines. For instance, in running, if one is a middle distance runner, it is relatively easy to specifically address the demands of the event (e.g. the 1500 m) because the distance and pace are well defined. On the other hand, most cyclists participate in very diverse events, and in the course of a single stage may compete in a 20 km time trial, 40km criterium and a 100km hilly road race. Each of these events will be different in duration and the nature of the efforts can be quite different (e.g. constant for the TT and variable for the criterium). Therefore, it is more difficult to precisely target specific efforts, and it may be best for the athlete to train physiological systems or attributes rather than competition specific efforts.

In general, there are two specific physiological attributes, VO2max and the lactate threshold (LT), which are arguably of greatest importance in cycling. Sure it's nice to have a fast sprint, but riding in a break, climbing with the leaders, and performing well in a TT are dependant upon VO2max and the LT. And let's face it, a fast sprint isn't much good if you don't make it to the finish with the leading group. We will discuss LT training in later installments; but specifically with regard to training VO2max, intervals of the appropriate duration and intensity are likely the most effective approach, as opposed to group training rides, or races.

Before I go any further, I will make one recommendation. If you don't have a power meter, get one. I know, I know, they're the latest fad and they are expensive, but training principles for cycling have come a long way in the past 20 years, and more importantly, training approaches in cycling have made huge gains in just the past 5 years with the wide availability of on board power meters. They're not a fad, they're here to stay. Moreover, VO2max training is one of the most effective uses of a power meter. Neither heart rate nor perceived exertion are sensitive enough to appropriately gauge such efforts.

What are we trying to accomplish with VO2max intervals? Well, since VO2max, by definition is the maximal amount of oxygen an individual can utilize to do work in a given period of time (usually a minute), we are trying to stress the body to utilize as much oxygen as possible, and induce an adaptation resulting in improved VO2max. So, if we want to utilize as much oxygen as possible, we should do long, slow rides that are totally aerobic, right? It's true that we do utilize a lot of oxygen over the course of a long endurance ride, but the rate of oxygen utilization is too low. Therefore, we want the intervals to be aerobic in nature, but hard enough to elicit maximal rate of oxygen consumption. One of the basic misconceptions in cycling training is long slow rides are the best way to improve VO2max. It's true that almost any type of training will improve

VO₂max to some extent in an untrained individual, but for trained cyclists, traditional “base” training will do little, if anything, to improve VO₂max.

In general, there are a couple rules of thumb when performing VO₂max specific intervals: The first rule is that you should perform these intervals at an effort between 90% and 105% of your VO₂max power (pVO₂max). The second rule is that the intervals should last between 3 minutes and 10 minutes in duration. Rule one and two are interrelated in that, if performing an interval at 105% of VO₂max power, one will likely only be able to sustain the effort for approximately 3 minutes. Conversely, if performing the interval for 10 minutes, the intensity will necessarily be lower, in the vicinity of 90% of pVO₂max. If we adhere to the training principle of specificity, the duration should be 3 to 5 minutes. Highly trained or elite athletes have been shown to sustain intervals at the effort associated with VO₂max for up to 7 or 8 minutes, but this is a gut wrenching effort, which likely isn't necessary to elicit the desired training effect. Further, in order to introduce the training principle of overload, one could perform multiple short intervals, and theoretically apply a greater overload than a single longer interval.

You might ask, “why not perform intervals harder than 105% pVO₂max?” Again, because at intensities of 110% pVO₂max the duration of the interval will necessarily be too short; likely shorter than 3 minutes. One thing to take into consideration is that at the start of an interval, increased oxygen consumption takes anywhere from 60 to 180 seconds to reach the point of VO₂max, and certainly won't stimulate adaptations that would optimally improve VO₂max, therefore, a two minute interval at 120% pVO₂max may not elicit VO₂max (this lag in the response of VO₂ is also why monitoring heart rate is of little value when attempting to gauge the intensity of these intervals). Performing an effort at a greater intensity than 100% of pVO₂max does not stimulate greater oxygen consumption; our VO₂max is just that, the maximal rate of oxygen utilization, and any effort above that needs to be fueled by anaerobic metabolism. So, if one were to perform an interval for four minutes at pVO₂max, they might achieve actual VO₂max after about 90 seconds and spend the remaining 2.5 minutes stressing the system.

Other considerations when performing intervals are the number of repetitions to perform, and the rest intervals. With regard to the number of repetitions, the accumulated time should be between 12 and 25 minutes total, and the rest duration is typically equal to the work rate. By using these guidelines, you should be able to devise an interval training approach that will target adaptations to VO₂max, and that will result in improved overall performance in diverse cycling events.

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