Cadence Setup

Many cyclists and triathletes ask about which cadence is "best". Lance Armstrong's victories in the Tour de France over the last two years have caused a lot of interest in this question, as we saw a dramatic difference in pedaling styles between Tour contenders Ullrich, with his lower cadence, bigger gear style, and Armstrong, with his higher cadence, low gear form. With Armstrong's style appearing to be more effective with his mountain stage wins, many scientists and coaches looked further into why this higher cadence style may be more effective.

It has been reported in past studies that pedaling a higher cadences, (80+ rpm), is more efficient than slower cadences. One way to measure efficiency is by measuring oxygen consumption rates. This measures the metabolic "cost" of the exercise. In order to determine the cost of slower vs. faster cadences one study compared oxygen consumption rates, heart rates, breathing rates, power production and even blood lactate production of pedaling at 50 rpm vs. 100 rpm. In order to make the comparison, the athlete's speeds were kept constant across the two cadences.

The result was that all of these indicators were very similar between the two cadences for the thirty minute test. One significant difference however, was the greater glycogen depletion in the slower 50 rpm condition. Looking closer, the researchers saw that only the fast twitch muscle fibers used more glycogen when pedaling at 50 rpm than they did when pedaling at 100 rpm. The slow twitch muscle fibers lost comparable amounts of glycogen in both the 50 rpm and 100 rpm conditions.

The slower cadence resulted in fewer, but more forceful contractions required to maintain the constant speed. It may sound counter-intuitive, but the higher force requirements of the slower cadence results in the recruitment of more fast twitch muscle fibers, since these fibers are capable of producing more force than slow twitch fibers. The drawback is that fast twitch fibers consume more glycogen, and fatigue more quickly than slow twitch fibers. As result, over the course of a workout, fast twitch fibers will get depleted and will fatigue. More fast twitch fibers will need to be recruited as the duration increases, which results in an increase of the total number of muscle fibers activated.

In addition, research has found that the faster cadence results in greater fat oxidation. Basically since slow twitch fibers are more efficient fat burners than fast twitch fibers, higher cadences that resulted in greater slow twitch recruitment used less glycogen, which is very important in endurance exercise performance. Over the course of a longer duration, the higher oxygen costs, and faster glycogen depletion seen in slower cadences results in reduced efficiency as compared to fast cadences.

Of course few cyclists would ever pedal as slowly as 50 rpm, but there are still efficiency differences, although smaller, between cadences in the 70s and lower 80s as compared to high 80s and 90 rpm plus. Slow twitch fibers can easily handle cadences of 100 rpm, but there is another factor to consider. When many cyclists do "spin ups", or accelerations to a higher cadence, they find that they bounce on the saddle, and their pedaling form suffers. This is caused by a lack of neuro-muscular co-ordination at high cadences, which in turn negatively affects efficiency. The good news is that co-ordination is trainable, and with practice, pedaling at high cadences can be improved.

So the question remains: what is the best cadence? Examining high performance cyclists and triathletes seems to confirm that cadences of 85-95 rpm are optimal for most athletes, and for most terrain. With proper training at these cadences (at all intensities), the higher cadences will be more economical and thus will result in faster times on the bike. And there is an added bonus: since higher cadences result in more glycogen being spared, especially in fast twitch fibers, there is the ability to have a faster sprint to the finish.

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