Cycling Training Overview - Richard Rafoth MD

A focused training program can increase VO2max by 15 to 30% over a 3 month period and up to 50% over 2 years. And conversely, there is a rapid drop off in metabolic adaptations within a few weeks of stopping training. (The changes in numbers of muscle capillaries and skeletal and cardiac muscle fiber size probably occur more slowly.) Changes in lactic acid removal also contribute to the ability to perform exercise at a higher level of %VO2 max for a longer period of time. And increases in lipid metabolism provide extra calories to supplement those from pure glycogen and glucose metabolism, allowing longer periods of exercise to fatigue.

TRAINING INTENSITY

Is more better? Not necessarily. Although the ceiling for training intensity is unknown, maximum aerobic improvement is thought to occur at 85% VO2 max (90% max heart rate). And training above this level may increase the potential for injury with minimal benefits. Lower levels of exercise - 60% maximum heart rate for 45 minutes, 70% maximum heart rate for 20 minutes - will improve general cardiovascular conditioning but the "long slow distance" approach to endurance training with a maximum heart rate of 60 to 80% VO2 max will not maximize your personal performance for a high level aerobic event.

TRAINING DURATION

HP Womens Challenge There is no easy answer, as training is an interaction of intensity as well as time. 10 minutes of 70% maximum heart rate will be of some benefit, but 30 to 40 minutes are even better. But once again there is an upper limit, and a group of swimmers training 1.5 hours per day was compared to a group training with two equivalent 1.5 hour sessions. There was no difference in the final performance, power, or endurance between the two groups. For aerobic training (continuous, not intervals) at less than 90 maximum heart rate it makes the most sense to look at the duration of the planned event, and trained at the same level of anticipated performance (%VO2 max) for a duration equal to that of the event + 10 to 20%.

TRAINING FREQUENCY

It appears that maximum aerobic conditioning (increasing VO2 max) occurs with 3 workout days per week. So unless one is trying to burn calories to lose weight, or is working on increasing mileage to get the musculoskeletal system (back, shoulders) in shape for a long endurance event

on the bike, it is better to take off 2 to 3 days per week to allow for muscle and ligament repair and decrease the risk of cumulative stress resulting in an increase in training injuries. And interestingly, it appears that these 3 days per week will maximize aerobic conditioning equally in any combination - i.e. 3 days in a row with 4 off, alternating days, etc.

Studies on maintaining the aerobic training effect demonstrated that a 2/3 reduction in training frequency i.e. going from 6 days a week to 2 days a week (maintaining the same intensity of each workout) maintained the gains. But it is important to maintain the same intensity! One can cut a 60 minute, 6/week program to 20 minutes, 6/week or to 60 minutes, 2/week BUT one cannot maintain by cutting the intensity of the 60 minute session and keeping it at 6 times per week. ***If intensity is held constant, the frequency and duration to maintain fitness are much less than the effort to attain it in the first place.***

METHODS OF TRAINING

Training needs to be structured for the intensity and duration of the planned sporting event. Anaerobic (oxygen independent) exercise is generally brief (less than 60 seconds in duration) and is fueled by the anaerobic energy pathways in the cell (ATP, creatine phosphate - CP). The classic anaerobic sport is weightlifting, but sprint activities also use anaerobic pathways. If the sprint will last more than 5 or 10 seconds, lactic acid production also becomes an issue. Training for anaerobic activities not only will enhance the ATP and CP energy transfer pathways in the cell but also will help to improve tolerance and clearance of lactic acid.

Aerobic training, more important for cycling and other sporting events lasting more than 60 seconds, improves the cardiovascular system and oxygen delivery systems to the muscle cell. Improvements occur in both cardiac output (amount of blood pumped by the heart per minute) and at the muscle fiber level where there is an increase in the ability to remove oxygen from the blood in the capillaries as well as in the efficiency of the intracellular metabolic pathways to convert glucose into ATP. Training for aerobic conditioning will include a combination of interval training, continuous training, and fartlek training.

INTERVAL TRAINING

Doing intervals refers to sandwiching periods of intense physical activity between periods of recovery to allow longer periods of training time at your peak performance levels. One study in runners demonstrated that continuous, maximal performance levels could be sustained for only 0.8 miles

before exhaustion occurred, while a similar level of peak exertion could be maintained for a cumulative distance (duration) of over 4 miles when intervals were used.

If one is training for sprints of up to 20 seconds in duration (which do not involve significant lactic acid buildup and basically are training the ATP and CP systems), it is recommended that the duration of the training interval should be increased by 1 to 5 seconds over the usual best time for that sprint distance with exercise intensity or maximum effort being unchanged. For example, if one is training for a 100 yard dash, and has a personal best of 12 seconds, the training interval should be a 13 or 14 seconds sprint at the same pace (ignoring the total distance being covered in the 13 or 14 seconds). And a relief period 3 times longer than the training interval is recommended for recovery - 42 seconds in this example. Training for longer intervals (up to several minutes) produces significant lactic acid along with stressing the anaerobic metabolic pathways. To train for these longer distances (several minutes of maximum output), it is suggested that the distance being trained for be subdivided, and the training interval effort focused on that shorter distance. For example, if one is training for a personal best mile ride on the bike, and the best time for the entire mile is 3 minutes on the bike with the best 1/4 mile segment being 30 seconds and the best 1/2 mile segment being 80 seconds, the training interval could be set at either 1/4 or 1/2 mile and the time for this training interval set at your personal best minus 3 to 5 seconds. In this example the training interval might be chosen as 1/4 mile with a goal of a 25 second time. And the rest interval should be 2 times the training interval (as lactic acid clearance does not require the same recovery time as recharging the intracellular metabolic machinery).

But training program drop out rates can double when intervals are used, so they should be used judiciously. Don't use them all year round, consider a twice a week program during your peak season, and separate each session by at least 48 hours to allow adequate recovery. If your long ride is on the weekend, Tuesday and Thursday make the most sense. The goal should be 10 to 20 minutes of hard pedaling per training interval session, not counting warm up, recovery, or cool down. A good place to start is with 5 minutes of peak effort.

One approach is to use one day a week for short intervals (i.e. five 60 second and five 90 second intervals) and a second for longer intervals (two 3 minute and two 5 minute intervals). Allow 3 to 5 minutes for recovery between intervals and don't forget a 20 to 30 minute warm up and a 15 minute cool down. It has

been shown that as few as a half dozen 5 minute intervals (separated by one minute recoveries) during a 300 km training week will improve both time trial and peak performance. If you have a heart rate monitor, an alternative is to key intervals to your maximum heart rate. Ride your intervals at 80 to 90% of your maximum heart rate and spin easily until your heart rate drops to 60 to 65% of maximum.

CONTINUOUS TRAINING

Continuous training refers to aerobic activity performed at 60 to 90% VO2 max for an hour or more. When done at the lower end of this range, it is often referred to as long, slow distance (LSD) training. This level of training is ideal for those starting off an exercise program, those wishing to maximize Caloric expenditure for weight loss purposes, and as an option for an active "rest" day in a weekly aerobic training program. This level of exertion can be maintained for hours at slightly less intensity than used in personal competitive events in the past, and is particularly suited for endurance event training. It is thought to have a preferential beneficial effect on the slow twitch muscle fibers (as opposed to the fast twitch fibers used in sprint interval training). It is suggested that a distance of 2 to 5 times the actual competitive event be chosen for this daily segment of the weekly training program.

FARTLEK TRAINING

This form of training is a combination of interval and LSD training. It is not as structured as an interval program being based on the personal perception of exertion rather than specific time or distance intervals. It mimics the "sprint to the line" that is part of many road races. While there is little scientific proof of its benefits it makes sense physiologically, and psychologically it adds a feeling of freedom to those long slow days. How many sprints, and for how long? The choice is up to you, but the intervals are probably in the neighborhood of those used for interval training.

Training - Overtraining - Richard Rafoth MD

The feeling of fatigue that follows a good ride or workout tells us that we are pushing our physical limits, and is a necessary part of improving our personal performance. However, in certain circumstances, fatigue may also be our only warning that we are pushing too hard and indicating a need to back off or risk a

deterioration in our abilities. This is a common dilemma in a personal training program: Hard work makes us faster, but how much is too much?

Four levels of fatigue are experienced by the regular cyclist.

1. The fatigue (or bonk) which accompanies muscle glycogen depletion develops 1 to 2 hours into a ride unless we use glucose supplements to extend our internal muscle glycogen stores.
2. The normal post exercise fatigue which tells us we are pushing our normal training limits and will lead to improved performance the next time out.
3. The fatigue we feel at the end of a particularly hard week of riding (really an extension of #2) that, with recovery, will also make us faster and stronger. Exercise physiologists refer to this as "overreaching".
4. The debilitating and long term (often lasting weeks and months) fatigue which degrades performance and is the most common symptom of overtraining.

Your challenge is finding your own individual boundary between overreaching and overtraining.

WHO IS PRONE TO THE RISKS OF OVERTRAINING?

Cyclists seem to be one of the few groups of athletes capable of reaching the over trained level of fatigue. It has been speculated that this is due to the way cycling stresses the body with a concentration of muscle activity in a single muscle group - the quadriceps. And it isn't necessary to undertake an extensive training program to be at risk. In fact it may be those working out sporadically and with light training schedules that are most at risk. While a professional cyclist might consider a 50 mile ride as part of a light recovery week, your 20 mile ride could produce all the symptoms of overtraining.

And several studies have suggested that overtraining may be associated with other health issues above and beyond a deterioration in physical performance. One study of Harvard alumni found a lower death rate (mortality) among men expending as few as 200 calories per week in exercise versus those leading sedentary lifestyles, but when they routinely spent over 4000 calories on exercise per week the death rate began to rise again. And two different studies have suggested a decrease in immune system competence with intense training (cycling 300 miles per week for 6 months or 2 intensive sessions of running per day for 6 days). But before you give up exercising completely, there is plenty of evidence that a moderate cycling program will actually stimulate and improve your immune system. The key is planning your own personal training program to occasionally overreach but not overtrain.

CLUES TO OVERTRAINING

How do you know when you are in danger of overtraining? The following are clues which could suggest that an extra day or two of rest is in order.

1. **Resting heart rate.** A resting pulse rate is done on awakening in the morning and before getting out of bed. An increase of 10% or 10 beats per minute for several days in a row is accepted by most coaches as a sign to slow down.
2. **Personality/disposition.** While your personal demeanor is more difficult to quantify, it may be the most sensitive and reliable indicator of overtraining. Anger, depression, and a decrease in your sense of vigor have all been reported. You won't need a psychologist to help you with this one. Your family and significant others are usually the first to point these symptoms out to you.
3. **Performance.** A short, standardized time trial every week is another helpful tool. And the changes will usually be in minutes, not seconds. If you see a deterioration, take some time off and consider switching to another aerobic activity, keeping your heart rate below 70% of maximum. (A **drop** in your time trial maximum heart rate of 10 beats per minute can also be a sign of overtraining.)
4. **General fatigue.** Ongoing daily lethargy is a clue that it's time to slow down.
5. **General physical complaints.** Sore throat, sore muscles, and chronic diarrhea all may indicate the chronic stress of overtraining.
6. **Disruption of your normal sleep cycle.** Falling asleep easily, awakening abruptly, and then feeling like you need a nap at 10 am all can reflect the change in your normal sleep cycle associated with overtraining.

WHAT CAN YOU DO?

Most training programs include at least one (and sometimes two) rest days per week as well as a day or two of easy spinning. This reflects the practical experience of coaches who have had to deal with the results of pushing too hard for too long.

Overreaching is a normal part of the training cycle, but if your performance is not improving after a few days of recovery, it's time to switch to other aerobic activities which will keep you at 70% of your max. heart rate (to maintain your level of fitness) or risk entering the zone of overtraining which may take a month or two to recover.

How long do you need to rest? Studies have indicated that recovery from overreaching (and again this means keeping your general level of aerobic activity at 70% max heart rate, not complete inactivity) may take up to two weeks with performance improving daily. The implication of this observation is that a 1 to 2 day taper before a big event may not be enough to perform at your personal best.

As in all aspects of personal training programs there is individual variability, so it is up to you to decide where to draw your own line. ***But remember that rest is a key part of any training program and may be the toughest training choice you'll have to make.***

And finally, don't forget to pay particular attention to post exercise carbohydrate replacement. Part of the fatigue of overtraining may be related to chronically inadequate muscle glycogen stores from poor post training ride dietary habits.

Intervals

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But training program drop out rates double when intervals are used, so they should be used judiciously. Don't use them all year round, consider a twice a week program during your peak season, and separate each session by at least 48 hours to allow adequate recovery. If your long ride is on the weekend, Tuesday and Thursday make the most sense.

Physiology

Conventional wisdom says cycling pain occurs when you go anaerobic and lactic acid builds up in your muscle tissue, but studies in subjects who, through a quirk of nature, do not produce lactic acid demonstrated a similar response to yours and mine. The real culprit may be muscular nerve fibers that provide

feedback to your nervous sytem, a different chemical mediator, or some other change at the muscle cell level.

When you train to your maximum (pushing the muscle pain limit), several changes occur which allow you to push even further the next time:

• Muscle metabolism changes to extract more oxygen from a set amount of blood flowing past.
• More capilllaries develop in the muscles.
• Your heart adapts to pump more blood per time interval.
• You learn to mentally deal with the pain and exercise through it.

Interval Duration

Short intervals range from 15 to 90 seconds while longer intervals last from 3 to 5 minutes. Set a definite time for your intervals and then pace your effort so that it is the hardest you can maintain for that period (if you can't make it through the entire interval, you need to cut back your effort a bit). The goal should be 10 to 20 minutes of hard pedaling a session, not counting warm up, recovery, or cool down. A good place to start is with 5 minutes of peak effort.

One approach is to use one day a week for short intervals (i.e. five 60 second and five 90 second intervals) and a second for longer intervals (two 3 minute and two 5 minute intervals). Allow 3 to 5 minutes for recovery between intervals and don't forget a 20 to 30 minute warm up and a 15 minute cool down. It has been shown that as few as a half dozen 5 minute intervals (separated by one minute recoveries) during a 300 km training week will improve both time trial and peak performance.

Heart Rate Intervals

If you have a heart rate monitor, you can key intervals to your maximum heart rate. Ride your intervals at 80 to 90% of your maximum heart rate and spin easily until your heart rate drops to 60 to 65% of maximum.