

Summary of Training Intensities

Lactate 0-1: Training at this intensity produces purely aerobic long-term physiological adaptation such as building and producing capillaries, enzymes, etc. These adaptations occur only under aerobic conditions.

The aerobic system supports the production of energy at all intensity levels. Therefore even athletes competing at a higher intensity level rely on a good low-end aerobic system. The primary benefit of low-end training is that it dramatically improves recovery rates at all intensity levels.

Lactate 1-2: Over 1mmol there begins to be an anaerobic contribution to energy production. Since the benefits we are looking for at low intensities are the result of aerobic energy production the more aerobic the training (the more time at low lactate) the more productive the training. It isn't the case that there are no, or even compromised, aerobic benefits training at this intensity – only that the aerobic quality of the workout is compromised by the anaerobic contribution and also that there is a higher cost to acquire the aerobic benefits at this intensity.

Lactate 2-3: Like above, there are similar gains to training at a lower lactate but at this intensity the cost is higher. Also, with less "time" spent at the desired load our time is not as well spent. When our aim is to achieve aerobic benefits the load we want to train under is as aerobic as is feasible.

Lactate 3: At this intensity the athlete is only benefiting from 70% of the desired aerobic training load as 30% of the energy is coming from anaerobic sources. This isn't enough load on the anaerobic system to create much adaptation in that system and there is too much reliance on the anaerobic system to be maximizing the aerobic benefits.

In skiing there are several other factors that must be considered when performing training. Among these are technique, which includes a quick application of force thus results in a higher workload, and difficult terrain which makes keeping the lactates low while continuing to practice the sport very difficult. The result is that each session must have a goal – and that this goal dictates which factor gets priority.

For this reason skiers often do train with lactates ranging between 1 and 3 in distance training. This must be the intent of the training, however, and not an accidental increase in the training load. After a time spent training under an appropriate load (under 1mmol) skiers will learn to train using proper technique at easier intensities.

Lactate 4: Here the body is in balance between the production and removal of lactate. This intensity puts both the aerobic and anaerobic systems under pressure and elicits an adaptation in both systems. Work at this intensity, especially some form of steady state work, is highly effective in enabling the athlete to ski faster with less anaerobic contribution – aerobically.

Lactate 4-6: At this intensity the body is producing more lactate than it can remove. The goal of this session is producing lactate and flushing it. For this reason the recovery after the interval is important as the athlete is trying to learn to flush lactate. For this reason there should not be a build up of lactate from repetition to repetition.

Lactate 6-8: Here we have the same goals as work at a lactate of 4-6 but there are generally changes to the type of interval and the recovery time. There will likely be shorter intervals at a higher pace with shorter, yet still adequate, recovery to remove lactate.

Lactate 6-10: The goal at this intensity is improvement of maximum VO_2 . The work should aim to stimulate a steady state at a maximal load (hence an improvement of maximal VO_2). It generally takes 3 minutes or more to build up to a sustainable maximum intensity. It is possible to build up to max quicker, but the result will be too high a lactate too soon due to too great a reliance on the anaerobic system. Sustaining the appropriate pace at an intensity of around 10mmol is difficult for long periods of time (over 6-7 minutes). Therefore intervals at this intensity are generally 4 to 7 minutes long – but can be longer as the athlete's fitness improves. Every minute over the initial 3 minutes is time spent at the appropriate (maximal) load. The idea is to maximize time at the appropriate load.

Max stroke volume is the key to max VO_2 . Since max stroke volume cannot be challenged at less than max load, time must be spent at maximum to improve max stroke volume and max VO_2 .

While elements of aerobic fitness (including max VO_2) are challenged and improved at all intensities, work spent below maximum does not stimulate maximum stroke volume or directly improve max VO_2 .

Conclusions

Have a goal for every session.

By focusing on specific aspects of the sport you will improve on these aspects systematically and consistently.

Be dedicated to that goal.

By maintaining focus on specific goals each session will yield improvement.

Progress the training.

Training must progress in order to continually challenge the athletes as they make progress.

Maximize your time under load.

Improvement is made by spending time working at a targeted training load.

General Application of Conclusions

1. Distance training should be directed toward improving low-end aerobic fitness and/or improving technique.

If the goal is to improve low-end aerobic fitness the intensity should be kept below 1mmol.

If the goal is to improve technique the skier should ski at as easy an intensity as possible while making the desired technical improvements. Lactate must stay under 4mmol.

2. Over distance training should be directed at improving low-end aerobic fitness. Therefore the intensity should be kept below 1mmol.

The cost of training at a higher intensity for a long duration is counter-productive.

3. Threshold training should be kept at 4mmol.

At this intensity most technique adaptations can be addressed as well.

4. Training at a lactate over 4mmol (4 to 8mmol) improves the body's ability to produce and flush lactate only when the intensity is high enough to produce over 4mmol lactate, and there is adequate recovery between repetitions to give the body time to flush lactate.

5. Max VO₂ is directly improved only at a maximal load (around 10mmol).

Therefore the intensity must be maximal.

Warm down: 5 to 10 mins level 2 (lactate 2 to 3). 5 mins 55-5's (55secs easy, 5 sec sprints) 10 mins level 1 (lactate under 2). Good for after long sessions and hard sessions. Try to get the lactate down to under 2, and the lower the better.