Tapering for Endurance Sports

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During the final preparation for a major competition, the athlete needs to feel rested, quick, and strong. To accomplish this, a taper is often used. A taper is a period of drastically reduced training volume that lasts from seven to 21 days prior to the year's major competition (Costill et al., 1985; Houmard and Johns, 1994).

The objective of training is to induce physiological and mechanical changes in an athlete so that their performance improves. During periods of high-volume training common to endurance athletes training adaptations are often masked by the fatigue of incomplete recovery between sessions (Zatsiorsky, 1995). The main purpose of a taper is to allow the physiological systems to completely recover and adapt. In order to plan a taper training volume, intensity, frequency, and duration all need to be considered.

Volume

In studies of distance runners, (Houmard et al., 1990, 1991) found that 800m and 1600m running times were improved following a decrease in training volume of 70% over a three-week period. Houmard (1994) found an increase in running economy and a 3% improvement in 5km run time following a seven-day 85% decrease in training volume. If training volume is not sufficiently reduced there appears to be no improvement in performance. Sheply et al. (1992) looked at the effects of a seven-day 62% reduction in volume and compared it to a seven-day 90% reduction in volume. They found the 62% scenario did not increase the time to exhaustion. On the other hand the 90% reduction resulted in an 22% increase in time to exhaustion. A 40-day taper in which training volume was reduced by 76% resulted in a 2.8% increase in swim performance (Johns et al. 1992). Mujika et al. (1995) found there is a significant relationship between the amount of volume decrease and performance improvements during a taper. From the available data, it appears that reductions in training volume of 70 to 90% are necessary for a taper to be most effective.

A taper can either be progressive, meaning there is a gradual decrease in volume over the period of the taper, or it can be stepped, meaning there is a single decrease in volume for the duration of the taper (Mujika, 1998). Martin et al. (1994) found that performance improvements peaked during the first week of a two-week step taper in cyclists. Zarkadas et al. (1994) found an 11.8% improvement in 5km run times following a 10-day progressive taper but only a 3% improvement in performance using a step taper. Houmard et al. (1990) found no improvement in performance following a three-week step taper. Progressive tapers seem to have a greater impact on performance than step tapers (Mujika, 1998). This is probably due to detraining effects that occur when the rapid volume decrease used in step tapering is maintained for an extended period of time. While a progressive taper is the obvious choice for the major competition of the year, a step taper may be better for qualifying competitions and other less important events where the taper duration is much shorter.
Frequency

Training frequency refers to the number of training sessions per week. The reduction of training volume in a taper should not occur as the result of drastic changes in training frequency (Houmard and Johns, 1994). Neufer et al (1987) found that reducing training volume (80 to 90%) through cutting frequency by 50 to 85% resulted in decreased swim power after only seven days of tapering. Studies in which tapering has resulted in improved performance have typically decreased frequency by 20 to 50%. Houmard et al. (1989) has recommended that training frequency not be reduced by more than 20%. The reasons why a reduction in frequency causes a decrease in performance is unclear, but may be related to decreased technical efficiency. As frequency of technical work is decreased there is probably some loss in technique that ultimately affects performance.

Intensity

Intensity during a taper is usually maintained or increased. There is a tendency for a greater proportion of the training to become race-specific type intervals. The time period between the intervals should be long enough to maximize intensity. Hickson et al. (1985) reduced training intensity by 66% and found that cycling time to exhaustion decreased by 21%. In a study that compared high intensity and low intensity tapers Shepley et al. (1992) found that the physiological responses to the two tapers were similar but only the high intensity taper group showed an increase in performance. Houmard and Johns (1994) suggested that training schedules that use intensities of less than 70% VO2 max maintain, or decrease performance during a taper, while schedules which use intensities of greater than 90% VO2 max improve performance. The higher intensity training allows athletes to get used to higher speed, allows them to work on race strategy and tactics, and psychologically give them feelings of speed and power.

Duration

Since the training stimulus is greatly reduced during a taper, the duration of the taper can have an impact on the magnitude of performance improvements. Within one to four weeks of stopping training highly trained athletes start to show decreases in performance (Costill et al. 1985). Mujika et al. (1996) studied the effects of 21-, 28- and 42-day tapers on performance in highly trained swimmers. They found significant improvements in the 21- and 28-day groups but not the 42-day taper group. Several studies have looked at physiological changes associated with tapering and found that haemoglobin and hematocrit peaked after seven days of taper (Yamamoto et al. 1988). Studies that have measured performance and taper duration have found improvements in performance following tapers of seven to 21 days (Costill et al. 1985; Houmard et al, 1994; Shepely et al. 1992).

The number of days needed to taper may be affected by training volume and intensity going into the taper and fitness level of the athlete. Mathematical models have been developed to try and predict the optimal number of days needed to taper (Mujika et al., 1996; Fitz-Clarke et al., 1991; Morton et al., 1991). The models have suggested that tapers should not be longer than 16 days. However, there have been discrepancies between the mathematical models and measured performance peaks. More time is needed to validate these models before they can be used with complete confidence. As a general rule the taper duration should be a function of
the competitive level of the athlete. Lower level athletes can get away with a seven day taper while national level rowers need a 14- to 21-day taper.

**Special Considerations During a Taper**

The taper period can be a time of high psychological stress for both the coach and athlete. Coaches tend to worry about the training that was done during the season, the duration of the taper, and many other things that arise prior to a major competition. It is important at this time of the year that the coach projects confidence both in what has been done during the season and in the taper. If the coach is openly worried about the athlete's preparation or starts making changes to a planned taper the athletes may begin to question their preparedness and ability to win.

Athletes handle the decreased training volume differently. Many athletes will enjoy the feelings of speed, power and renewed energy. Others have a tough time dealing with the decrease in volume. They worry about detraining and don't know how to cope with the extra time as a result of the decreased volume. A coach needs to be aware of the responses of each athlete, and be prepared to deal with the worriers.

Athletes trying to keep their weight down need to pay careful attention to their weight during a taper. One of the adaptations to a taper is an increase in muscle glycogen storage (Sheply et al. 1992). For every gram of glycogen stored in the muscle three grams of water are stored. This can result in a large increase in weight in a relatively short period of time. A certain amount of weight gain may be necessary if the athlete is to see performance improvements as a result of the taper. The increased glycogen storage not only feeds the muscles during training but it is used as an energy source for other adaptations to occur. Lightweight rowers have to carefully balance the amount of glycogen super compensation that will improve performance with the amount of weight they can gain.

**Conclusion**

A well-designed taper can improve performance by about 3% over the year's best performance. The taper should involve a progressive decrease in training volume of 70 to 90% and an increase or maintenance of training intensity over a seven- to 21-day period. The decreased training volume should be accomplished by decreasing distance or time per session. The number of training sessions per week should not be reduced by more than 20 to 50%.

**References**


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