A key element of the physical preparation of athletes is the taper period in the weeks immediately preceding competition. The key objectives for an effective taper are to; (1) maximally reduce accumulated physiological and psychological stress of daily training and to (2) restore training tolerance and further enhance training-induced adaptations.

The expected mean improvement in individual performance time with an effective taper is about 2-3%, ranging from 0-6% in trained athletes [9], which varies according to sporting demands. This can make a substantial difference to the outcome of competition performance in many sports based on time; however more work is required to identify the effect of tapers in sports determined by other dimensions such as mass, distance or points scored. The primary question for coaches and athletes is how to manipulate the volume, intensity, frequency, duration, of training and the pattern of taper to enhance or optimize performance.

Volume of training

In many sports, particularly endurance based sports; training volume is the main currency of the training programme. Many coaches fear a potential loss of fitness when training volume is markedly reduced. However, if manipulated correctly, benefits with reductions of up to 85 per cent in total training volume can be experienced [8]. In general, endurance athletes should have less reduction in training volume than sprinters, or strength and power athletes. Thus, the recommendations are to reduce training volume by 50–85 per cent dependant on sport/event. Bosquet et al [2] indicated that the performance improvement was more sensitive to reductions in training volume than manipulation of other variables. After controlling for all other variables, a reduction in training volume elicited moderate (0.72 ± 0.36) improvement in performance which was twice the size of modifying training intensity (0.33 ± 0.17) and training frequency (0.35 ± 0.17).

Peaking for Performance

Text: Hannah Oguz, Sport Scientist, hpc

Intensity of training

This is the one area in which pre-taper levels should be maintained during the taper itself. The athletes must still practise at competition intensity or higher. In several well-designed studies reviewed in Mujuka [9], researchers have shown that only a high-intensity, low-volume taper design was effective in maintaining or improving total blood volume, blood cell volumes, citrate synthase activity (an aerobic enzyme), muscle glycogen concentrations, muscle strength and running time to fatigue in groups of elite athletes. Thus, it is recommended that coaches maintain training intensity during taper to avoid de-training. It is through the reductions in the other variables (volume, frequency and duration) that recovery should be achieved.

Frequency of training

Reducing the frequency of practice (the number of training sessions per week) has been shown to improve performance more than maintaining pre-taper frequencies [5]. This reduction in training frequency must be balanced with the need to practise optimal motor patterns and technique. Thus, coaches should reduce training frequency to no less than 80 per cent of pre-taper values, to avoid de-training and ‘loss of feel’, especially in technique-dependent sports.

Duration of training

Studies that did involve performance assessment with tapering have reported improvements with tapers lasting from 7-21 days [3, 4, 5, 7]. However, Houmard et al. [6] suggests a taper lasting 21 days would only maintain, rather than improve, actual performance. In general, sprint and strength-based athletes should taper for longer than endurance athletes, but this should be highly individualised, based on how each athlete recovers and maintains their sport-specific physiological gains. Longer tapers are important for sprint and strength events, as the nervous system takes longer to recover and adapt. Males may require a longer taper than females due to differences in muscle mass. Also, older athletes require longer tapers than younger athletes.

Pattern of taper

Different types of taper have been described in previous research to include the linear taper, an exponential taper involving a fast or slow constant of reduction in training load, and a step taper [9]. It has been quite well demonstrated in the research that fast decay exponential reductions in total training stress (intensity, frequency, volume and duration) are more effective than linear reductions or step reductions [1, 9, 10] . This may be especially true for shorter tapers, or for very short ‘mini-tapers’ that coaches sometimes use mid-season for events of moderate importance.

Finally, the issue now for the coach is how we relate the above information to athletes travelling for competition. Commonwealth athletes are frequently required to travel across continental boundaries to compete. Crossing multiple meridians causes desynchronization of human circadian rhythms and leads to the syndrome known as jet lag, which can persist for some days [15]. Concomitant with the experience of jet lag, there is impairment in a range of performance measures until the endogenous 'body clock', located in the hypothalamus, is returned to the new local time. Decrements have been reported in muscle strength, reaction times, and subjective states indicative of arousal [11]. The timescale for adjustment of the body clock can be incorporated into the taper when competition requires travel across multiple meridians. It is logical that sufficient time is allowed for the athlete to adjust completely to the new time zone before competing [15]. There is also little point in training hard at home prior to embarkation, since arriving tired at the airport of departure may slow up the adjustment later [14]. Therefore, readjustment of the body clock should be harmonized with the moderations of training during the tapering. Athletes, coaches, managers and support staff should implement strategies to minimize the effects of travel stress prior to departure, during long haul international travel, and upon arrival at the destination.

In conclusion, tapering can be incredibly effective when used correctly. It is very important to note that every discipline within the sport science support base will have their model for the taper and peaking. It is essential that the team of coaches and scientists sit down together to plan each aspect of the taper and the time allocation to each. Everything helps and everything is effective. A good coach monitors every aspect, listens to their athletes and tries many different interventions to improve the Peaking process.

References

1. Banister, E. W., Cartner, J.B., & Zarkadas, P.C. (1999) Training theory and taper: Validation in triathlon athletes. *European Journal of Applied Physiology.* 79: 182 – 191.
2. Bosquet, L., Montpetit, J., Arvisais, D. & Mujika, I. (2007) Effects of tapering on performance: A meta analysis. *Medicine and Science in Sports and Exercise.* 39: 1358-1365.
3. Costill, D.L., Fink, W.J., King, D.S., Thomas, R. & Fielding, R. (1985) Muscle changes during de training. *Swimming technique*. 8: 15-18.
4. Costill, D.L., Thomas, R., Robergs, R.A., Pascoe, D., Lambert, C., Barr, S. & Fink, W.J. (1991) Adaptations to swimming training: Influence of training volume. *Medicine and Science in Sports and Exercise.* 23 (3): 371-377.
5. Johns, R.A., Houmard, J.A. & Kobe, K.W. (1992) Effects of taper on swim power, stroke distance, and performance. *Medicine and Science in Sports and Exercise.* 10: 1141–1146.
6. Houmard, J.A., Hortobagyi, T. & Johns, R.A. (1992) Effect of short term training cessation on performance measures in distance runners. *International Journal of Sports Medicine.* 13: 572-576.
7. Houmard, J.A. & Johns, R.A. (1994) Effect of taper on swim performance: Practical implications. *Sports Medicine.* 17: 224-232.
8. Mujika, I., Goya, A., Padilla, S., Grijalba, A. Gorostiaga, E. & Ibanez, J. (2000) Physiological responses to a 6-d taper in middle-distance runners: Influence of training volume and intensity. *Medicine and Science in Sports and Exercise.* 32: 511-517.
9. Mujika, I. & Padilla, S. (2003) Scientific bases for pre-competition tapering strategies. *Medicine and Science in Sports & Exercise.* 35: 1182-1187.
10. Mujika, I., Padilla, S., Pyne, D. & Busso, T. (2004) Physiological changes with pre event taper in athletes. *Sports Medicine.* 34: 891-927.
11. Reilly, T., Atkinson, G. & Budgett, R. (2001) Effects of low dose temazepam on physiological variables and performance following a westerly flight across five time zones. *International Journal of Sports Medicine.* 22: 166-174.
12. Reilly, T. & Maskell, P. (1989) Effects of altering sleep-wake cycle in human circadium rhythms and motor performance. In *proceedings of the First IOC World Congress on Sport Science* (p.106). Colorado Springs, CO: US Olympic Committee.
13. Thomas, L., Mujika, I. & Busso, T. (2008) A model study of optimal training reduction during pre-event taper in elite swimmers. *Journal of Sport Sciences.* 26: 643-652.
14. Waterhouse, J., Nevill, A., Edwards, B., Godfrey, R. & Reilly, T. (2003) The relationship between assessments of jet lag and some of its symptoms. *Chronobiology International.* 20: 1061-1073.
15. Waterhouse, J., Reilly, T., Atkinson, G. & Edwards, B. (2007) Jet lag: Trends and coping strategies. *Lancet.* 369: 1117-1129.

hpc
University of Pretoria

Sport Science and Medical Unit

Cycling, Running, Rowing & Canoeing Specific assessments

- VO2max testing - Maximal and submaximal VO2 assessments
- Max Heart Rate
- Lactate Measurements - Lactate profiling
- Peak Power Output
- Time Trial
- Functional Threshold Power
- Programme Design
- Gait Analysis

SPORT SCIENCE SERVICES

- Sport Specific Testing - muscle strength/ endurance, speed, agility, explosive power, flexibility and endurance testing
- Individualised Training Programmes
- Strength and Conditioning
- Athlete Rehabilitation
- Athlete Monitoring
- Expert Training Advice
- Body Composition Testing

BIKE SET-UP

- Injury Prevention
- Increased Power Output
- Ride Comfort

For more information contact:

Shona Hendricks:
012 362 9800 x1070
shona.hendricks@hpc.co.za

certified & tested by ISR performance science excellence

Institute for Sports Research
University of Pretoria