TRAINING FOR ENDURANCE RUNNING EVENTS

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Art & SCIENCE OF TRIATHLON

2012 INTERNATIONAL COACHING SYMPOSIUM

You must believe and adhere to the principle of UNENDING IMPROVEMENT and the setting and achieving of even higher goals.

The Biologic Law of Training

- The structure and performance capability of an organ/organ system determined by:
  - Its Genetic Constitution
  - Quality & Quantity of Work Carried Out
- The greater the demand/stress placed on a organ within its physiological limits, the more intensely it adapts and the more efficient it becomes.

Achievement Triangle

Adaptation

- **Adaptation to Training** is the sum of modifications brought about by systematic repetitions of exercise.
- The changes are a result of specific demands placed on the body by the specific activity pursued.

Adaptation, Cont'd.

- These changes are dependent on the:
  - Volume
  - Intensity
  - Frequency

  of the training.

- If the stimulus (or load) is not sufficient to challenge the metabolism, no adaptation will occur.

Training Variables

- Recovery
- Endurance
- Lactate Threshold
- VO_{2MAX} Intervals
- Aerobic Threshold

Energy System Continuum

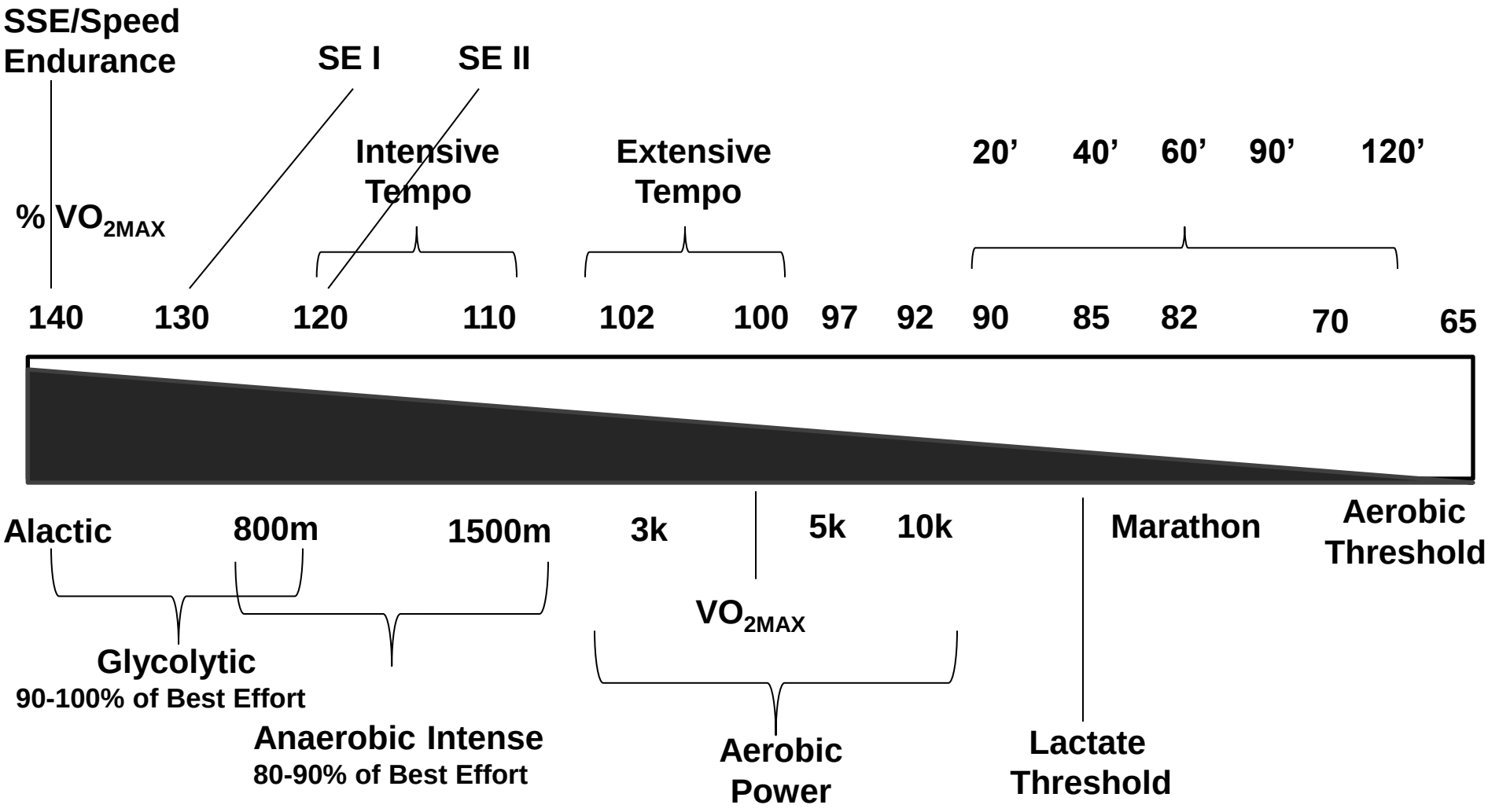


Chart of Values of VO_2

Table 1. VO_{2MAX} Values of Untrained & Moderately Trained Individuals & Elite Aerobic Athletes

	FEMALE			MALE		
	Untrained	Trained	Elite	Untrained	Trained	Elite
Absolute (L/min)	<3.0	3.0-3.5	>3.5	<3.5	3.5-4.5	>4.5
Relative (ml/kg/min)	26-42	40-60	55-70	36-52	50-70	60-85

Chart of Values of VO_2

Table 2. Typical Values for VO_{2MAX} of Elite Athlete From Different Sports (ml/kg/min)

SPORT	AGE	MALE	FEMALE
Basketball	18-30	40-60	43-60
Canoe/Kayak	22-28	55-67	48-52
Cycling	18-26	62-74	47-57
Racquetball	20-35	55-62	50-60
Rowing	20-35	60-72	58-65
Skiing: Alpine Cross Country	18-30 20-28	57-68 65-95	50-55 60-75
Soccer	22-28	54-64	---
Speed Skating	18-24	56-73	44-55

Chart of Values of VO_2

Table 2. Typical Values for VO_{2MAX} of Elite Athlete From Different Sports (ml/kg/min), Continued

SPORT	AGE	MALE	FEMALE
Swimming	10-25	50-70	40-60
Track & Field: Running	18-39	60-85	50-75
Triathlon: Cycling	16-33	57-83	46-68
Triathlon: Running	16-33	55-74	45-64
Volleyball	18-22	---	40-56
Weight Lifting	20-30	38-52	---
Wrestling	20-30	52-65	---

Source: Physiology of Sport and Exercise. USOTC Colorado Springs, CO

Training Intensities

Lactate Threshold and Training Zones

1. **RECOVERY**
   - Intensity: Very Low, 2-3 mmol/L Below LT, 30-50 bmp Below LT
   - Duration: 30-45 Minutes
   - Objective: To promote recovery following high intensity intervals or glycogen-depleting over-distance workouts. Maintenance of cardiovascular adaptations and muscle-skeletal system.

Training Intensities

Lactate Threshold and Training Zones

2. ENDURANCE

- Intensity: Moderate, 1-2 mmol/L Below LT, 10-30 bpm Below LT
- Duration: 30 Minutes – 3 Hours
- Objective: Develop Peripheral Training Adaptations:
  - Increase Fat Metabolism
  - Increase Number of Aerobic Enzymes
  - Increase Size/Number of Mitochondria
  - Increase Capillarization

Training Intensities

Lactate Threshold and Training Zones

3. LACTATE THRESHOLD

- Intensity: Moderate, TEMPO Just Below LT or at LT + 5 bpm

- Duration: TEMPO 20-60 Minutes Continuous or LT Intervals 5-15 Minutes With Equal or One-Half Recovery

- Objective: Increase LT (% VO_{2MAX} at LT) and Maximal Aerobic Capacity

Training Intensities

Lactate Threshold and Training Zones

4. VO_{2MAX} INTERVALS

- Intensity: High, 1-2 mmol/L Above LT, HR Associated With 95% VO_{2MAX}
- Duration: 3-5 Minute Intervals With Equal Amount of Rest
- Objective: Develop Central Training Adaptations:
  - Increase Stroke Volume
  - Increase Maximal Aerobic Capacity & Lactate Tolerance (Buffering Capacity)

Training Intensities

Lactate Threshold and Training Zones

5. INTENSE REPETITIONS

- Intensity: Very High 2-6 mmol/L Above LT
- Duration: SHORT: 30-60 Seconds With Complete Recovery
  LONG: 1-2 Minutes With Complete Recovery
- Objective: Increase Anaerobic Capacity and Buffering Capacity

Current Fitness

Because maximum velocity at VO_{2MAX} for most athletes corresponds very closely with race ability, we use that figure (mile time at VO_{2MAX}) to determine training paces.

Elite athletes use the 3000 meter time for VO_{2MAX}.

Training Paces For Distance Runners

Recovery Runs:

60-70% vVO_2 Speed

60-70% VO_{2MAX}

Aerobic Threshold Runs:

70-75% vVO_2 Speed

or add 60-70 seconds to vVO_2 Speed

Anaerobic Threshold Runs:

70-85% vVO_2 Speed

or add 40-50 seconds to vVO_2 Speed

Training Paces For Distance Runners

Marathon Pace Runs:

10 Seconds Slower Than Anaerobic Threshold Speed

Running Economy Runs:

Speeds of 85-100% of vVO_2 Speed

Supra-Max Runs:

Speeds Greater Than 100% vVO_2 Speed (102-120%)

Predictability Charts

Please Refer To

Predictability Chart Handouts

The Taper

The Taper has been defined as a decrease in work level that an athlete undergoes during practice in order to rest and prepare for a good performance in the key event of a season or year.

It is:

A specialized exercise technique designed to reverse training-induced fatigue without a loss of the training adaptations.

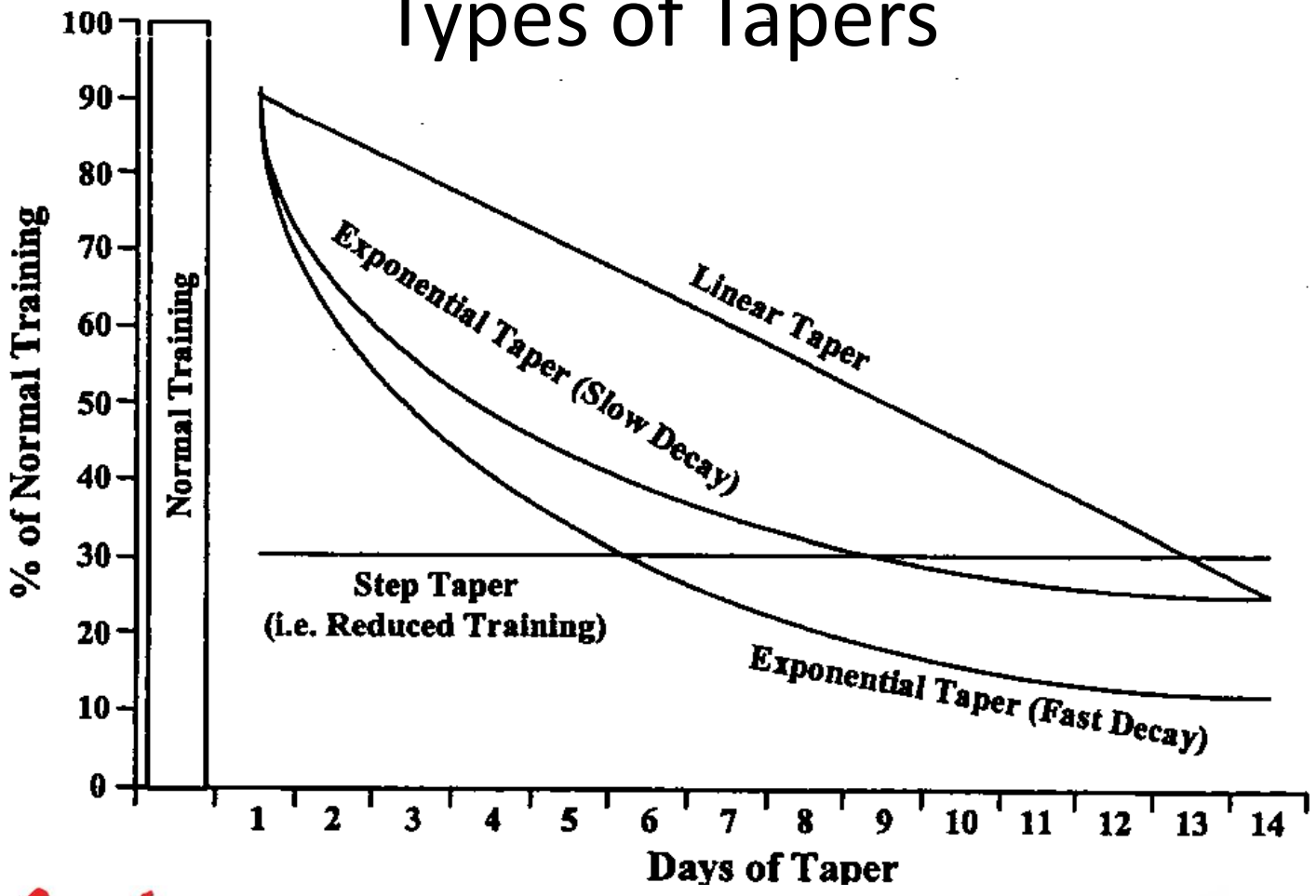
Reduction of the Training Load

- Training for endurance sports--running, cycling or swimming--involves volume, intensity and frequency.
- During the tapering phase, there is a marked decrease in volume (50-70%). The frequency of training can be reduced up to 50%.

Reduction of the Training Load, Cont'd.

- Training stimulus or intensity must be elevated to higher levels than practiced before the taper phase.
- The research has proven that following the above protocols will bring about performance improvement during key events.

Schematic Representation of the Different Types of Tapers



Types of Tapers

Linear Taper:
Implies a higher training load than exponential taper.

Exponential Taper (Slow Decay):
The training load is higher than the fast decay taper, as well as a slower decrease in volume.

Exponential Taper (Fast Decay):
Faster decrease in volume. Lower training load decreases faster in fast decay.

Step Taper:
Non-progressive standardized reduction of the training load.

Recommended Length of Taper

800 / 1500 ---------- 1 Week

3000 / 5000 ---------- 2 Weeks

10000 / Marathon ---------- 3 Weeks

Conclusions & Practical Applications

1. The primary aim should be to minimize accumulated fatigue, rather than to attain additional physiological adaptations or fitness gains. This goal should be achieved without compromising previously acquired adaptations and fitness levels.

Conclusions & Practical Applications, Cont'd.

2. The maintenance of training intensity (i.e., "quality training") is necessary to avoid detraining, provided that reductions in other training variables allow for sufficient recovery to optimize performance.

Conclusions & Practical Applications, Cont'd.

3. Reductions in training volume as high as 60%-70% appear to induce positive physiological, psychological and performance responses in highly trained athletes.

Conclusions & Practical Applications, Cont'd.

4. Higher training frequencies seem to be necessary to avoid detraining and/or "loss of feel" in the highly trained 80%. On the other hand, training-induced adaptations can be readily maintained with very low training frequencies in moderately trained individuals (30-50%).

Conclusions & Practical Applications, Cont'd.

5. Positive physiological and performance adaptations can be expected as a result of tapers lasting 4-28 days, yet the negative effects of complete inactivity are readily apparent in athletes.

Conclusions & Practical Applications, Cont'd.

6. Progressive, non-linear tapering techniques seem to have a more pronounced positive impact on performance than step taper strategies.

Conclusions & Practical Applications, Cont'd.

7. Tapering strategies are usually effective at improving performance, but they do not work miracles. A realistic performance goal for the final taper should be a competition performance improvement of about .5-3%.

Hematological Changes That Occur With Tapering

Red Blood Cell Volume	Increases
Haemaglobin Concentration	Increases
Hematocrit (%)	Increases
Erythropoietic Tendency	Increases
Complete Maturation of RCBs	Increases

- Greater Oxygen-Carrying Capacity

Psychological Changes That Occur With Tapering

- When training stress was reduced, mood state improved.
- Reduced rating of perceived exertion during a fixed exercise task.
- Vigor was significantly elevated & tension reduced.
- The combination of a reduced work load and maintained performance adds to elevated confidence in all athletes.

❖ Improved Athletic Performance

Enzymatic Changes That Occur With Tapering

Creatine Kinase	Decreases
Oxidtive Enzymes	Increases
$_{M}$at Pace	Increases

- Greater Energy Levels and Improved Running Economy and Power Output

Hormonal Changes That Occur With Tapering

Cortisol Production	Decreases
Testosterone	Increases
Testosterone/Cortisol Ratio	Increases

- Greater Facilitation of Anabolism and Decreased Levels of Protein Catabolism

Tapering Strategy

- Minimize Fatigue Without Compromising Fitness
- Slightly Increase Training Intensity
- Reduce Training Volume By 60-80%
- Maintain Training Frequency at >80%
- Individualize Taper Duration Between 4-28 Days
- Use Progressive Non-Linear Tapering Designs
- Expect Performance Improvements of .5-3%

Goal

- By the time tapering starts, athlete should have achieved most or all of the expected physiological adaptations, eliciting improved performance levels.
- As soon as accumulated fatigue fades away and performance-enhancing adaptations become apparent, you are ready to compete. At this point, you are at your physiological and psychological best.

What Is The Bottom Line

Get to the Starting Line:

- Healthy
- Energized
- Focused
- Fit

For The Most Important Competition of The Season, Year or Quadrennium