Training for Performance

What the research says
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The provided information is not designed to substitute for
individual instructions from a health care provider and is for
general information purposes only.

Topics

• Why is proper training important?
• Basic training principles
• Warm-up and Cool-down
• Types of training
• Determining training intensity: the role of Heart Rate
• Tapering… What’s it all about?
• Overtraining
• Questions

Why is training important?

• “I don’t have a coach!”
• The desire to perform well

• To be efficient with our time
  – Evidence-based practice

• Injury Prevention
  – Overtraining? Overuse
Basic training principles
(or not so basic)

- Individuality
- Specificity
- Disuse
- Progressive Overload
- Hard/Easy
- Periodization

Individuality

- Heredity
- Responders vs. non-responders

Training improvement generally greater in those who are less conditioned at the beginning of the training program.

Specificity

- Training adaptations are highly specific to the type of activity and to the volume and intensity of the exercise performed
- Interference between types of training

- Aerobic (uses oxygen) vs. anaerobic (bypasses oxygen, using glycolysis)
  - 1500m run derives 40% of ATP(energy) from anaerobic, and 60% ATP from aerobic pathways.
  - Training should be divided likewise 40%/60%
Disuse: “Use it or lose it”

- Reduction in cardiopulmonary endurance (heart and lung capacity) is much greater than reductions in strength, power, and muscular endurance for the same period of inactivity.

- Importance of cross training during time off from running

- The most highly trained lose the most from detraining, and take longer to regain initial fitness levels than less trained.

Disuse: How long can we take off before seeing a drop in performance?

- To maintain training-induced improvements in aerobic capacity, Hickson has suggested that training intensity must be at least 70% VO2max. (more to come on tapering)

- Decrease in performance after 2 wks is due primarily to ? in mitochondria’s oxidative enzymes.
  - After detraining for one week, it took one group of subjects 3-4 wks to regain prior levels of oxidative enzymes.

- Decrease in Cardiovascular function is seen in 2 wks, but decreases more slowly after this point.
  - ?Plasma volume ? Stroke Volume (the amount of blood the heart pumps with each beat) ? ?VO2max
Progressive Overload

• A system or tissue must be exercised at a level beyond which it is accustomed in order for a training effect to occur.

• The “Ten percent rule”
  – Increase training volume, intensity, or duration no more than 10% each week.
  – To prevent an overtraining injury

Hard/Easy(recovery)

• Developed by Bill Bowerman, Olympic and U of Oregon track coach, co-founder of NIKE
• We work hard! The body needs time to recover for adaptation to take place.
  – Follow 1 or 2 days of intense training by an equal number of easy, aerobic training days with little or no emphasis on anaerobic exercise.
    • For example, Day 1: high intensity interval workout
      Day 2: Slow 5 mile run
  – Follow 1 or 2 weeks of hard training should be followed by a week of reduced effort with little or no emphasis on anaerobic exercise

Periodization

• The gradual cycling of specificity, intensity, and volume of training to achieve peak levels of fitness for competition and avoid overtraining.

• Volume and Intensity
  – Cycle training by alternating easy, moderate, and hard periods of training.
  – Build your training periods so that you peak at the priority competition. Include base training, add high intensity training, and precede race with a period of taper.
Periodization Sample
Based on periodization model from:

<table>
<thead>
<tr>
<th>Weeks 1-6</th>
<th>Weeks 7-12</th>
<th>Weeks 13-18</th>
<th>Weeks 19-24</th>
</tr>
</thead>
<tbody>
<tr>
<td>Base - Increase Miles</td>
<td>Short Intervals and speed</td>
<td>Long Intervals</td>
<td>Longer and fewer intervals. Races</td>
</tr>
</tbody>
</table>

Training Session Components

- Warm-up
- Cool-down
- Types of Training

Warm-up
- A period of increased activity before main activity to attain the following physiological benefits:
  - ↑ blood flow to muscles
  - ↑ speed of nerve impulses
  - ↑ oxygen and energy substrate delivery and removal of muscle waste products
  - ↑ oxygen release from hemoglobin and myoglobin,
  - ↓ activation energy for cellular reactions and muscle viscosity.
Warm-up

• Performance Results:
  – ↑ mechanical efficiency
  – ↑ range of motion,
  – ↑ speed and force of muscle contraction
  – ↑ muscle’s elasticity, which decreases the likelihood of muscle tearing

Additional research is necessary to be certain whether warm-up and/or stretching actually reduces the possibility of mm injury due to pulls or strains.

Cool Down

• A period of reduced activity after a workout.
  – I.e. Light running or walking
• Objective
  – To return “pooled” blood from the exercised skeletal muscles back to the central circulation.

• For those people with cardiovascular risk factors, this can be especially important in preventing any adverse cardiovascular event.

Types of Training

• Long Slow Distance (LSD)
• High Intensity Intervals
• High Intensity Continuous
Long Slow Distance

- Performed at approximately
  - 70% of an individual’s max HR
  - 57% of VO2 max
  - (low intensity)
- Sustained for durations greater than the normal competition distance (high volume).
- Recovery run – not long, but may still be at 70% max heart rate.

LSD

- Longer is not always better!
  - In one study, athletes training 1.5hrs/day performed as well as athletes training 3hrs/day.
  - Another study, 25 miles/week increased VO2 max by 17%, 50miles/week increased it another 10%, and 75 miles/week only increased it another 2-4%.
- Evidence that high intensity exercise is a better method of improving VO2max and lactate threshold than low-intensity, long duration exercise
  - Total weekly mileage was found to be a poor predictor of marathon performance.
  - The better predictor was the speed at which the subjects ran their 6-10 mile training runs. The 88 runners in the study ran an average of 37miles/week over the last 12 weeks of training.

High Intensity Intervals

- Provides overload by modifying the work interval, rest interval, intensity, sets, and repetitions.
- Work intervals no less than 60 seconds will maximize aerobic ATP production rather than anaerobic ATP production.
- Rest interval consists of walking or light activity, and is usually at least as long as the work interval.
  - Work:rest intervals of 1:2 or 1:3 are optimal for anaerobic training.
  - Emphasize the aerobic system to a greater extent by emphasizing short rest intervals, and high repetitions of work intervals.
Evidence for a Taper

- Runners and swimmers have reduced their training load by approximately 60% for up to 21 days without a reduction in performance.
- A study of middle distance runners:
  - 7-d taper; *volume* was decreased while intensity and frequency of workouts remained constant.
  - Time to fatigue while running at 1500m race pace could be increased by 22%.
- Two studies by Mujika et al. of middle distance runners:
  - 6-d taper; *volume* was progressively decreased while intensity and frequency were maintained.
  - Significantly increased performance.
- Further research is needed:
  - To compare training methods (step vs progressive).
  - To look at multiple race distances - Tapering for long duration events such as the marathon have been studied to a lesser degree.

Overtraining

- **Its Cause**
  - too much *intensity* or *volume*, and not enough *rest*.

- **Its Effect**
  - Leads to a majority of training injuries from overuse.
  - Can ↓ performance.
  - Study of a college XC runner experiencing symptoms:
    - VO2max (aerobic capacity) stayed constant throughout season.
    - Beginning of season – ran at 70% maximum aerobic capacity.
    - End of season – ran at 80% maximum aerobic capacity.
  - Result - While consuming more oxygen, he ran a slower time!

Identification of Overtraining

- Classified by the presence of one or more symptoms:
  - loss in muscular strength, coordination, and maximal working capacity;
  - ✓ appetite and body wt
  - muscle tenderness
  - head colds, allergic reactions, or both
  - occasional nausea
  - sleep disturbances
  - ✓ resting HR and BP
  - loss in competitive desire and enthusiasm in training.
  The best predictor of overtraining syndrome is HR response to a standardized bout of work.
Treatment of Overtraining

- Complete rest for 3-5d or longer!
- Length of rest depends on
  - the severity of the syndrome
  - individual response of the athlete
- at the least training intensity should be decreased
  - Training intensity is more closely associated to overtraining than training volume
- Risk of future overtraining can be reduced by following principles of periodization
  - Cycle training by alternating easy, moderate, and hard periods of training.
Putting it all together

Sample 5k race training schedule:
- Weeks 1-12: Base training.
  - Mostly LSD, 70% max HR
  - 20-30 miles/week
  - Includes 1-2 d/wk of minimal high intensity training
    - I.e. Fartlek at 90% max HR, 5x(1 work:3 rest)

Putting it all together
- Week 18 during moderately intense period
  - Alternate easy and hard days
    - I.e. e H e H e e H,
    - I.e. e e H H e e H
  - May include High Intensity continuous and intervals.
    - High Intensity Continuous: >/= 90% HR max
      - LT or tempo runs 20-25min
    - High Intensity long duration Intervals: 85-100% HR max
      - Ladders, 800 repeats

Putting it all together cont.
- Week 24, week of priority competition
  - 6-7 day taper is effective for 1500m. Future research needed on prescription of taper volumes. See what’s best for you
  - Principle: Maintain frequency and intensity. Decrease volume.
    - Day 1: 2x1200m at race pace, 1 mile warm-up/cool-down
    - Day 2: easy 3 miles or rest
    - Day 3: 1200m, 800m, 400m, at race pace.
    - Day 4: 2x400m at race pace, 1/2 mile warm-up/cool-down
    - Day 5: easy 2 miles or rest
    - Day 6: easy 2 miles or rest
    - Day 7: Race!
Resources

- www.runningresearchnews.com
- www.mapmyrun.com
- www.partners.org/running
  - Online running log spreadsheet available
  - Gmaps pedometer
- Daniels’ Running Formula

References


References cont.