Strength Training for Rowing

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Contents

- Rationale
  - Sports science
  - Training modalities
- Exercise technique
- Principles of programme design
- Injury prevention
What is the training aiming to achieve?

- Importance of critical evaluation
  - Demands of sport (needs analysis)
  - Profile of athlete (needs analysis)
  - Characteristics of training

- Specify training goals
- Which facets of training are aimed at which goals?
- Is this the most efficient way to achieve these goals?
Needs analysis

- Analysis of rowing
  - 2 km (6-10 mins)
  - Aerobic
    - VO\(_2\) max
    - Lactate tolerance
  - Power endurance
    - Strength
    - Speed

- Athlete characteristics
  - Elite
  - Novice athlete
  - Junior
Why strength train?

- Performance enhancement
  - Power
    - Recruitment
    - Coordination
    - Hypertrophy
  - Posture
    - Strength
    - Kinaesthetic awareness/motor control
    - Flexibility
  - Strength
- Injury prevention
  - Strength
  - Posture
    - Strength
    - Kinaesthetic awareness/control
    - Flexibility
  - Flexibility
How strong do rowers need to be?

Strength to body mass ratios

<table>
<thead>
<tr>
<th>Lift</th>
<th>Men Club</th>
<th>Men Olympic</th>
<th>Women Club</th>
<th>Women Olympic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Squat</td>
<td>1.4</td>
<td>1.9</td>
<td>1.25</td>
<td>1.6</td>
</tr>
<tr>
<td>Deadlift</td>
<td>1.4</td>
<td>1.9</td>
<td>1.25</td>
<td>1.6</td>
</tr>
<tr>
<td>Bench Pull</td>
<td>1.05</td>
<td>1.3</td>
<td>0.95</td>
<td>1.2</td>
</tr>
</tbody>
</table>

Source: McNeely et al. (2005)
Force-velocity considerations

- **Strength components**
  - Max strength
  - Strength speed
  - Speed strength
  - Max speed

- **Examples**
  - Maximum squat
  - Olympic weightlifting
  - Medicine ball throws
  - Sprinting

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Zatsiorsky (1995)
Force-velocity considerations

- 3 curves
  - Untrained athlete
    - Slow gains at sub max force
  - Max strength trained
    - Faster gains at max levels
  - Explosive trained
    - Faster gains but no increase in max force

Zatsiorsky (1995)
Selection of training modalities

- Fitness is composed of many facets
  - Aerobic
  - Anaerobic
  - Strength
  - Power
  - Flexibility
- Many different modalities for each facet
- Need to evaluate each modality based on your goals
Rationale: Training modalities

**Metabolic training**

- Cardiovascular training
  - Aerobic
  - Anaerobic
    - Lactic
    - Alactic

- Many different modalities
  - Water
  - Ergo
  - Cross training
Rationale: Training modalities

Resistance training: Muscular Endurance

- Trained on the water
- And in the weight room (>12 reps)
- Correlation between 1RM and 12RM
  - But if load is less than 25% of 1RM no correlation
  - Must be careful to distinguish between muscular endurance, lactic tolerance and aerobic fitness
Rationale: Training modalities

Resistance training: Muscular Endurance

- Circuit training
  - Characterised by timed periods of activity punctuated by regular short rest intervals
  - Commonly involves the use of resistance exercise
  - Research supports
    - Increased cardiovascular fitness particularly lactic systems
    - Increased muscular strength/endurance
  - However, represents a compromise between pure cardiovascular and strength training
    - May be less useful for elite athletes
Resistance training: Strength

- Many modalities
  - Isotonic
  - Isometric
  - Isokinetic
  - Free weights
  - Machines

- Considerations
  - Sets and reps
  - Tempo
  - Rest

- Most commonly perform isotonic free weight activity
  - Best dynamic strength stimulus
  - Core control

- Technique
- Injury prevention
Rationale: Training modalities

Resistance training: Power

- Many modalities
  - Olympic weightlifting
  - Free weights
  - Plyometrics
- Importance of velocity
  - Reps
  - Rest
- Training power endurance
Core training: Strength, stability and control

- Importance of core training
  - Strength
  - Stability
  - Control
- Trunk strength
  - Abdominals
  - Back
  - Rotation
- Shoulder prehabilitation
- Free weight exercise involves a core component
  - Traditional exercises
    - Sit ups
    - Crunches
    - Hyperextensions
  - Medicine ball work
  - Control exercises
Rationale: Training modalities

Core training: Instability and isolation drills

- Instability training
  - Poor transfer of balance skills
  - Reduces chance to handle load
  - Dangerous

- TVA and multifidus drills
  - Research based on patient populations
  - Spinal stabilizers work in harmony (guy ropes)
  - Not performance enhancing

2. Chiu (2005)
4. Tse, McManus and Masters (2005)
### Repetition ranges and work/rest ratios

<table>
<thead>
<tr>
<th>Goal</th>
<th>Reps</th>
<th>Sets</th>
<th>Rest</th>
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<tbody>
<tr>
<td>Strength</td>
<td>1-6</td>
<td>2-6</td>
<td>2-5m</td>
</tr>
<tr>
<td>Power</td>
<td>1-5</td>
<td>3-5</td>
<td>2-5m</td>
</tr>
<tr>
<td>Hypertrophy</td>
<td>6-12</td>
<td>3-6</td>
<td>0.5-1.5m</td>
</tr>
<tr>
<td>Muscular Endurance</td>
<td>&gt;12</td>
<td>2-3</td>
<td>&lt;0.5m</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Energy System</th>
<th>Ratio</th>
<th>Time</th>
</tr>
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<tbody>
<tr>
<td>Phosphagen</td>
<td>1:12-20</td>
<td>5-10s</td>
</tr>
<tr>
<td>Anaerobic</td>
<td>1:3-5</td>
<td>15-30s</td>
</tr>
<tr>
<td>Anaerobic &amp; Aerobic</td>
<td>1:3-4</td>
<td>1-3m</td>
</tr>
<tr>
<td>Aerobic</td>
<td>1:1-3</td>
<td>&gt;3m</td>
</tr>
</tbody>
</table>

Baechle and Earle (2000)
Rationale

What is the training aiming to achieve?

- Importance of critical evaluation
  - What is the most efficient selection of training modalities to achieve my goals?

- My opinion
  - Elite athletes
    - Metabolic conditioning performed on water and the ergo, weight room is used for strength training
  - Club athletes
    - Individual specific
    - However, in many cases if an athlete is spending time in the weight room, it may be most efficient to pursue classic strength training.
Olympic Weightlifting: Rationale for its use

- Force vs Power
- Limited time available for the development of force
  - e.g. Ground contact time in sprinting is 0.08 – 0.12s
- Importance of speed
  - RFD
  - Power
  - Elastic energy

\[
F = ma
\]

\[
W = F \times d
\]

\[
P = \frac{\Delta W}{\Delta t}
\]

\[\Rightarrow P = \frac{\Delta F \times d}{\Delta t}\]

\[\Rightarrow P = F \times \frac{\Delta d}{\Delta t}\]

\[\Rightarrow P = F \times v\]
Olympic weightlifting: Power development

- Speed of execution
  - Clean/snatch pull – 0.8s\(^1\)
  - Jerk drive – 0.2s\(^1\)
  - Second pull – 0.2s\(^2\)
- Characterised by very high power outputs
  - e.g. peak power output of 6953W in the jerk\(^3\)
  - 1 horsepower = 746W
- RFD
  - e.g. acceleration

1. Garhammer and Takano (1991)
2. Garhammer, Kauhanen and Hakkinen (2002)
Exercise technique

Olympic weightlifting: Relevance to rowing

- Total body movement
  - Muscular involvement
  - Inter/intra muscular coordination
- Power position
- Hip extension
Olympic weightlifting: Technique

- Power clean technique
  - First pull
  - Scoop (transition)
  - Second pull
  - Catch
  - Recovery
Olympic weightlifting: Ground reaction force

  - Clearly illustrates first and second pulls
    - First pull is clearly longer
    - Second pull involves a greater application of force
    - Second pull results in a much greater power output
Olympic weightlifting: Summary

- Importance of technique
  - Second pull
  - Injury prevention
- Importance of good coaching
Olympic weightlifting: Alternatives

- Squat jumps
- Medicine ball throws
- Plyometrics
- Sprinting
- Other explosive activities
Squatting: What depth?

- **Caterisano et al (2002)**
  - Deeper squats involve more activation of the glutes and hamstring

- **Wretenberg, Feng and Arborelius (1996)**
  - Knee moment is 191Nm for deep versus 131Nm for parallel squat
  - But mass lifted is correlated with the hip moment
Exercise technique

Squatting: What depth?

- **Deep squat**
  - Safer
  - Greater hamstring and glute activation
  - Promotes flexibility

- **Shallow squat**
  - Often poor technique
  - Poorer leverage at start of ascent
Periodization: Rationale

- Systematic progression of phases will lead to greater return than pursuing the same programme year round
- Break the year into training phases
  - Macrocycle
  - Mesocycle
  - Microcycle
- Aim to peak for major competition

Baechle and Earle (2000)
Periodization: Linear and conjugate

- Linear
- Classic strength training periodization
  - Hypertrophy
  - Strength
  - Power
- Disadvantages

Baechle and Earle (2000)
Principles of programme design

Periodization: Conjugate

- Principle of training all qualities simultaneously
  - Hypertrophy
  - Strength
  - Power

- A series of conjugate mesocycles can be linearly periodized

- Variety of ways of utilizing a conjugate periodization
  - Within a workout
  - Within a week
  - Within a mesocycle (pendulum)
### Principles of programme design

**Periodization: Conjugate**

### Strength and Conditioning Annual Plan

**Week commencing**

| Date       | 05/09 | 12/09 | 19/09 | 26/09 | 03/10 | 10/10 | 17/10 | 24/10 | 31/10 | 07/11 | 14/11 | 21/11 | 28/11 | 05/12 | 12/12 | 19/12 | 26/12 | 02/01 | 09/01 | 16/01 | 23/01 | 30/01 | 06/02 | 13/02 | 20/02 | 27/02 | 06/03 | 13/03 | 20/03 | 27/03 | 03/04 | 10/04 | 17/04 | 24/04 | 01/05 | 08/05 | 15/05 | 22/05 | 29/05 | 05/06 | 12/06 | 19/06 | 26/06 | 03/07 | 10/07 | 17/07 | 24/07 | 31/07 | 07/08 | 14/08 | 21/08 | 28/08 |
|------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|

#### Competition Schedule

<table>
<thead>
<tr>
<th>Training Phase</th>
<th>Weekly Mileage</th>
<th>Session Emphasis</th>
<th>Strength and Conditioning Phase</th>
<th>Hypertrophy</th>
<th>Strength</th>
<th>Power</th>
<th>Drills</th>
<th>Plyometrics and Speed</th>
<th>Prehabilitation</th>
<th>Testing</th>
</tr>
</thead>
<tbody>
<tr>
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</table>

#### Key

- **Competition Priority**
  - Low
  - Medium
  - High

- **Training Phase**
  - GPP
  - SPP
  - Peaking
  - Race Pace

- **Weekly Mileage**
  - < 40
  - 40 - 60
  - Threshold

- **Session Emphasis**
  - None

- **Strength and Conditioning Priority**
  - Low
  - Medium
  - High

- **Testing**
  - Strength
  - Physiol.
  - Biomech.
Principles of programme design

Workout design

- Training phase will determine individual workouts
- Consider context of training week
- Vary exercise selection, sets and repetitions and emphasis within each week
Workout design: Exercise order and selection

- **Order**
  - High skill, high speed, high power movements
  - Lower body strength exercises
  - Lower body assistance exercises
  - Upper body exercises
  - Abdominals

- **Selection**
  - Physical properties
    - Power
    - Strength
    - Hypertrophy
  - Movement patterns
    - Pull and press
    - Upper and lower
    - Balance
Principles of programme design

Workout design: Exercise selection

- Hamstring exercises
  - Glute ham raise
  - RDL
  - Deadlift
  - SB Hamstring Curls
  - Russian Curls
  - Hamstring Curls
  - Reverse hyperextensions
  - Pull throughs
Workout design: Exercise selection

- **Upper body pulling exercises**
  - Bent over rows
  - Chin ups
  - Pull ups
  - Bench pull
  - T-bar rows
  - Seated rows
  - DB rows
  - Cable pull
  - Inverted row
  - Seated cable pull

- **Upper body pressing exercises**
  - Bench
  - Incline bench
  - Decline bench
  - Close grip bench
  - DB bench
  - DB incline
  - DB decline
  - Military press
  - Dips
  - Press ups
Workout design: General template

- General template
  - Olympic lifts/power exercises
  - Squats (lower body press)
  - Hamstring exercises (lower body pull)
  - Upper body press
  - Upper body pull
  - Abdominals/trunk

<table>
<thead>
<tr>
<th>Example Workout</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hang Clean</td>
</tr>
<tr>
<td>Back Squat</td>
</tr>
<tr>
<td>Glute Ham Raise</td>
</tr>
<tr>
<td>Bench</td>
</tr>
<tr>
<td>Chin Ups</td>
</tr>
<tr>
<td>Hyperextensions</td>
</tr>
<tr>
<td>Ab Circuit</td>
</tr>
</tbody>
</table>
Injury prevention

Water

- Part of needs analysis of athlete
- Understand the demands of the sport
  - Must be strong enough to train
  - Balance
- Key areas
  - Muscular endurance of low back
  - Rotation/abs
  - Strength in range
  - Upper body pressing
Injury prevention

Weight room

- Technique
- Appreciation of training outside weight room
- Programme considerations
  - Fatigue
  - Exercise order
- Equipment
- Attention
Injury prevention

Overtraining

- Consideration of all training variables
- How do you quantify and compare volumes and intensities?
  - Metabolic
  - CNS
- Weight room can provide variety
Summary

- Must critically evaluate
  - Sport
  - Athlete
  - Training methods
- Many tools available
- Must understand any tool employed
- Challenges involved in integrating modalities and rowing training
- Skill in coaching
References


Brandon, R. Weight training routines: What science has to say about circuit weight training routines. Downloaded from: http://www.pponline.co.uk/encyc/0106.htm on 24th October 2005.


References


