Evidence-Based Strategies for Weight-Making Sports

AIMS
- Introduction to Weight Making Sports
- Making Weight – Fat Loss
- Maximising power-weight ratio
  - Nutritional considerations for strength, power and speed (see WMW)
- Acute weight making strategies
- Post-Weigh In Considerations
  - Rehydration
  - Glycogen Replenishment
  - Supplementation – Creatine/Caffeine

Maximal vs Relative Strength, Power & Speed
Contextualising strength

- Maximal strength
  - The bigger the better

- Relative strength i.e. Strength:Weight
  - Huge neural component

TRAINING > NUTRITION

- So.... What dictates training well?
- Central Nervous System (CNS)
  - Rest / Recovery / Training Status
  - Stimulants
- Creatine stores
- Muscle Glycogen

Getting stronger and bigger

- More volume makes you bigger and stronger
  - Can you dictate it?
- Nutrition for optimal neural adaptations....
Cholesterol and skeletal muscle hypertrophy with resistance training

- Strong positive association of dietary cholesterol and skeletal muscle responses to resistance training – Riechman et al. (2007)
- RCT: Supplemented the diet with whole egg or egg white (control)
- “Our results confirm our previous finding that high dietary cholesterol contributes to strength gain with resistance training; however, lean mass gains were inconsistent.” – Reichman et al. (2008)

Carbohydrate Mouth Rinse

- Mouth Rinse Counters Fatigue Related Strength Reduction
  - 8% CHO or PLA mouthrinsed for 10s prior 3 x 5sec MVCs
  - 2.5% & 3.5% less attenuation in peak and average torque – Jensen et al. (2014)

‘Cherry Active’

- Antioxidants for maximising neural strength gains
  - i.e. In blocks of intensification / planned overreaching
  - Key to understand goal of phase – CherryActive
Supplementation

- **Creatine**
  - “Creatine monohydrate supplementation prevented the decrement in lower-limb muscle power in elite soccer players.” - Claudino et al. (2014)

- **Caffeine**
  - “…Acute ingestion of caffeine (6 mg.kg body weight) can reduce the level of muscle fatigue and preserved leg power during the test.” - Vianen et al. (2016)

- **Beta-Alanine**
  - “Changes in mean punch force and punch frequency were greater in the β-alanine-supplemented group.” - Donovan et al. (2012)

Improving Power-Weight Ratio
Advanced Fat Loss Strategies
Why do we ‘make weight’?

- Why not just compete wherever you ‘sit’?
- Why not just ‘sit’ at your weight class?

Energy Balance | A quick recap

- Making weight
  - Perform better with managing body fat not extreme methods. Inline with the ‘ethos of sport’
- Principle of weight loss = ENERGY DEFICIT

Periodisation of Fat Loss
Weight-Making Strategies

How much really needs to be lost?

Does 100% of the weight loss need to come from fat?

Where else can it come from?

- Creatine
- Glycogen + Water
- Water from your blood (Sodium)
- Water from ‘other’ places (Sodium, hormones)
- Fibre from your intestines
- Shave your head…

Creatine Removal

- Loading phase of 20g creatine daily for 6 days
- Took subjects ~28 days after stopping creatine supplementation for muscle creatine levels to return to near baseline

Hultman et al. (1996)
Sodium Restriction

- Short term restriction is likely not to have negative health impacts
- Restrict 1-2 days before to ALLOW extra fluid loss
  - You are in control of how much fluid is lost

Glycogen Depletion

- Potential weight loss:
  - Muscle glycogen (~400-800g)
  - Liver glycogen (~100g)
  - Water (potential to lose ~2700g)

Considerations...

- Effect on Performance (Anaerobic Training)
- How quickly can you regain muscle glycogen?
- Dehydration - vs - low glycogen trade off!

  "The glycogen exhaustion from both fiber types was associated with impaired maximal muscular strength produced during a single dynamic contraction, as well as with reduced muscle fatigue pattern” – Jacobs et al. (1981)
Glycogen Depletion Protocol – Practice!

- Restrict CHO for 2-4 days (6 weeks out) to deplete glycogen stores completely
- Measure WL as an estimate
  - This is your margin for AWL
- Potential BW loss of 2 – 3.6kg
- Considerations:
  - 1 molecule of glycogen pulls 3 molecules of water with it
  - Will depend on starting carbohydrate status e.g. if reduction in CHO intake was used as a method to create an energy deficit (fat loss) less weight can be manipulated as glycogen stores will be reduced

Fibre manipulation - Low Residue Diet

- Low fibre (>10-15g) / LCHO
- Why?
  - Reduces gastrointestinal content through fibre manipulation
  - Can reduce body weight by 0.5 – 1 kg
- When?
  - 2-3 days out from competition
- Considerations
  - Potentially only effective if athlete has adhered to a high fibre diet previously
  - Will have a limited effect if athlete is already severely restricting calories

What does a low residue diet look like?

<table>
<thead>
<tr>
<th>FOODS TO INCLUDE</th>
<th>FOODS TO AVOID</th>
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<tbody>
<tr>
<td>Eggs</td>
<td>Wholegrain Carbohydrates</td>
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<tr>
<td>Meat</td>
<td>Oats</td>
</tr>
<tr>
<td>Fish</td>
<td>Vegetables</td>
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<tr>
<td>Dairy/Whey</td>
<td>Whole Fruit/Dried Fruit</td>
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<tr>
<td>White Rice</td>
<td>Nuts</td>
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<tr>
<td>Low Fibre Veg?</td>
<td>Beans &amp; Pulses</td>
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</table>
In Reality

- Low fibre diet actually becomes...
  - Low fibre, Low Carbohydrate!
- Dairy is restricted to higher fat versions
  - i.e. Cheese, not whole milk
- Eggs, Meat, Fish, Cheese, Oils
- Increased energy availability in last 24-48 hours?

Vitamin C

- A natural laxative?
- Ascorbic acid (Vitamin C) used in clinical settings for bowel preparation prior to colonoscopy
- 2,000-5,000mg* a day, split doses
- Once vitamin C absorption is saturated, vitamin C remains in the gut & passes through the intestine which can cause osmotic diarrhoea and related GI disturbances
  - 2,000mg is equivalent to ~5 Berocca!

Water loading

- Who has used it?
- What is the premise behind it?
Water loading... In theory

Increase water intake - 75ml/kg
4.5 days out from comp.

Aldosterone + ADH

Urine output

Restric water intake - 150ml/kg
1-2 days out from comp.

Urine output still

Fluid intake

Greater fluid loss so BW

Water loading... In reality

Limited evidence...

EVIDENCE TO SUPPORT | EVIDENCE TO REFUTE
---|---
26ml/kg water + 0.1g/kg sodium chloride daily. Plasma renin activity and aldosterone decreased in the hyperhydrated group - Zorbas et al. (1995)

4 days of 8.8L/day. No significant changes in plasma renin activity or aldosterone - Shore et al. (1988)

37ml/L TBW which equated to ~1.8L in 30mins. ADH concentrations significantly reduced following hyperhydration - Freund et al. (1995)

2 hours of hyperhydration by glycerol ingestion (1.1g/kg) + fluid ingestion (21.4ml/kg). No significant changes in fluid regulating hormones - Melin et al. (2002)

Fluid balance is too tightly regulated!

You can’t ‘trick’ the system

Once you remove water, homeostasis is rapid

Increased water intake \(\rightarrow\) hypernatremia

• Easier to lose a little extra water

A well hydrated athlete has more to lose!
Dehydration - What is an appropriate level?

- Time interval between weigh-in & competition
- Individual sport – Combat vs Weightlifting
- Individual differences
  - Has dehydration been practiced?
  - Is it well tolerated?
- Starting hydration status

Differential effects on hydration status

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<thead>
<tr>
<th>Power</th>
<th>Accuracy/Skill</th>
<th>Endurance</th>
<th>Maximal/Isometric Strength</th>
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- Judelson et al. (2007)
  - 3%-4% loss in body mass on a boxing-related task - no significant main effect differences between euhydrated & dehydrated states. One subject maintained his performance over the two trials and a second improved 17.8%.

- Fogelholm et al. (2003)
  - No evidence that weight reduction equal to or less than 5% has a detrimental effect on anaerobic power performance.

- Smith et al. (2001)
  - No significant differences in vertical jump height, peak lower-body power or peak lower-body force between different hydration states: euhydrated, 2.5% & 5% dehydrated, respectively.

- Viitasalo et al. (1987)
  - Maximal isometric leg strength and the rate of isometric force development were decreased after sauna (inducing 3.4% weight reduction)

- Gamage et al. (2016)
  - Moderate-severe dehydration of 3.7% body mass loss significantly impairs motor skill performance among cricketers.

- Goulet, (2013)
  - Meta-analytic procedure (15 research articles) - compared with euhydration, exercise induced dehydration increased performance under time-trial exercise conditions and decreased performance under fixed intensity settings.

- Lambert and Jones (2010)
  - Dehydration of ~3-4% of body weight is not likely to impair maximal muscular power however is certainly going to hinder muscular endurance performance.

- Ebert et al. (2007)
  - Exercise-induced dehydration in a warm environment is detrimental to laboratory cycling hill-climbing performance despite reducing the power output required for a given speed.

- MacLeod & Sunderland (2010)
  - Decision-making time increased \( \left( P = 0.008 \right) \) in the HYPO trial and was significantly impaired compared with EUH. In elite female hockey players.

- Zouhal et al. (2010)
  - BW loss during the marathon was inversely related to race finishing time. Runner who lost >3% in BW completed the race in less than 3 hrs.

- Smith et al. (2001)
  - No significant difference in punching force between normal & restricted diets.

- Walsh et al. (1994)
  - Cycling time to exhaustion is impaired even at low (1.8%) levels of dehydration, and that this is associated with increases in RPE.

- Carvalho et al. (2011)
  - Fluid restriction during exercise was associated with a greater level of dehydration and increased perceived exertion but had no impact on basketball performance compared with ad libitum drinking of water or a CSB.

- Greiwe et al. (1998)
  - 1.5% loss of body mass via passive dehydration adversely affects bench press 1RM performance.

- Schoffstall et al. (2001)
  - Intermittent sauna exposure until 4% BM loss or intermittent sauna exposure + fluid replacement (0.4% BM loss) Isometric performance tests undertaken after 3.5 hours. Peak torque & time to fatigue not impaired in dehydration group compared to control & rehydration group.

- Goulet et al. (2006)
  - Intermittent passive dehydration (3.5% BM loss) decreases sprint time and fatigue onset.

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Dietary restraint & urinary cortisol excretion

- Difference in 24-h urinary cortisol excretion between women with high and low restraint scores.
- High restraint group (HRG)
  - Ate 300 calories less than the low restraint group
  - No % differences in PRO, CHO and Fat
- HRG - 15% increase in basal cortisol levels

Cortisol and Water Retention

- Established starvation (>14 days) study
- Mean weight losses between days (15, 22, 23, 30) were similar for males & females
- Wide individual variations - most apparent in females
  - Differences are thought to be due to variable but reversible water retention by the kidneys
  - Cortisol reacts with the aldosterone receptor

Menstrual cycle related water retention

- Track it...
- Contraceptive Pill use
  - Start new pack 5.7 days before you compete
Take Home Messages

- Get them to relax!
- Increase energy intake in final days?
- ‘Practise’ protocols may actually help stress levels!

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Effective Strategies
Post-Weigh-In

Important aspects to consider...

- How long is your recovery window?
- What is realistic?
- What needs to be done?
  - Rehydration (Fluid + Electrolyte balance restored)
  - Glycogen replenishment
Rehydration

- Gastric emptying - Rates are reduced by:
  - Increase in energy content
  - High osmolality of fluid relative to body fluids

Rehydration with...

- Added electrolytes: Min. [50mmol/L] Sodium
  - Equivalent to 3g NaCl/Litre of Fluid
- Sodium: 150% hydration achieved and less urine volume with 100 mmol/l sodium

<table>
<thead>
<tr>
<th>Drink Na (mmol/l)</th>
<th>Urine Output</th>
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<tbody>
<tr>
<td>0</td>
<td>25</td>
</tr>
<tr>
<td>25</td>
<td>30</td>
</tr>
<tr>
<td>50</td>
<td>800</td>
</tr>
<tr>
<td>100</td>
<td>578</td>
</tr>
</tbody>
</table>

Glycogen Replenishment

- Depleted stores now need to be replenished
- Why?
  - Increase BW
  - Maximising storage – maximising CHO availability to achieve optimal performance
- Glycogen replenishment strategy chosen is dependent on:
  - Period of time between weigh-in and fight / competition
Glycogen Replenishment Type & Timing

- Increase in muscle glycogen was greater with the high GI diet vs low GI diet during 24 hr recovery
  
<table>
<thead>
<tr>
<th></th>
<th>CHO</th>
<th>CAFF</th>
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<tbody>
<tr>
<td>LO GI</td>
<td>34.9</td>
<td>106.4</td>
</tr>
<tr>
<td>HI GI</td>
<td>26.3</td>
<td>132.4</td>
</tr>
</tbody>
</table>

- Form of CHO (solid/liquid) does not appear to affect glycogen synthesis
  - Practical consideration: 2hr vs 24 hr window
  
Burke et al. (1993)

Muscle glycogen re-synthesis when CHO is ingested with caffeine

- Subjects performed exhaustive exercise followed by a low CHO meal
- Crossover design:
  - 4g/kg CHO
  - 4g/kg CHO + 8mg/kg Caffeine
- Overall rate of resynthesis for the 4h recovery period was 66% higher in Caff compared with CHO

Pederson et al. (2008)

Muscle glycogen re-synthesis when CHO is ingested with caffeine

Adapted from Pederson et al. (2008)
Other Possible Aids...

- Creatine: Greater amount of glycogen storage – Nelson et al. (2001)
- Glycerol: “When consumed simultaneously with a substantial volume of fluid, there is a temporary retention of this fluid” – Burke et al. (2011)
  - 1g/kg
- Glutamine: Helps to increase water and sodium absorption – Coeffier et al. (2005)

Practical Programming

For Weight-Making Athletes

Practical Recommendations - 2 hr window

- Replenish glycogen stores
- Anything that will increase blood glucose quickly
  - Fast gastric emptying
  - Fast digestion
  - Fast absorption
- CHO containing drinks practical method to reduce risk of GI distress/discomfort
- CHO co-ingested with caffeine
Practical Recommendations - 24 hr window

- Low fat intake – Work towards high CHO intakes (24 hrs)
- 10 g/kg to fully replenish glycogen (24hr weigh-in) – Burke et al. (2004)
  - Creatine
  - Glutamine
- How can this be attained?
  - Frequent snacking
  - High CHO meals
  - Drink CHO containing fluids

SUMMARY

- Get the basics right
- Don’t rely solely on acute weight-making strategies to make weight
  - Diet sooner rather than later (or harder depending on training demands) – Fat loss
- Use glycogen depletion, fibre and water manipulation in the short-term
  - Magnitude of acute strategies will depend on the time between weigh-in and fight/comp.