Nutrition at Different Phases of the Training Program

**Outline**

- Introduction
- Current dietary recommendations for athletes
- Nutrition periodization
- Specific nutritional supplements commonly used by rowers

**Background**

MSc Clinical Nutrition  
University of Hohenheim, Germany  
ETH Zurich, Switzerland  
Registered nutritional therapist  
OÜ Nutrilligent  
Sports nutrition  
Nutritional therapy  
Amateur rower

**Traditional periodization**

Four main macro-cycles:
- General preparation phase
- Specific preparation phase
- Competition phase
- Transition phase

The training stimuli during these different phases can differ drastically in terms of intensity and volume

⇒ The types of fuels and the amount of energy during these phases need to be addressed through a periodized nutritional approach

**Goals of nutrition periodization**

- Body fat loss
- Weight loss/gain
- Support immune health
- Support physical periodization
- Improve performance

*To support the body’s energy needs associated with the different training volume and intensity stressors throughout the training year to elicit positive physiological responses*

**Athlete with periodized nutrition**

- Glycogen stores
- Pre Exercise  
During Exercise  
Post Exercise  
12-16 h
Athlete without periodized nutrition

- Glycogen stores
  - Pre Exercise
  - During Exercise
  - Post Exercise
  - Up to 24 h

“Recovery nutrition begins before a training session starts.”

B. Seehobhar

U23 rower

<table>
<thead>
<tr>
<th>Time</th>
<th>Meal</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.00</td>
<td>Breakfast: Bowl of porridge with jam Coffee</td>
</tr>
<tr>
<td>11.45</td>
<td>Lunch: Omelette (2 eggs, milk) Cheese (55 g) Chicken nuggets (42 g)</td>
</tr>
<tr>
<td>15.40</td>
<td>Snack: Banana-chocolate pastry</td>
</tr>
<tr>
<td>18.00-19.50</td>
<td>Training: Concept II (3 x 1000 m at AT)</td>
</tr>
<tr>
<td>21.30</td>
<td>Dinner: Quark Crème, 2.5% (200 g) Banana</td>
</tr>
<tr>
<td>22.00</td>
<td>Snack: Cheese (60 g)</td>
</tr>
</tbody>
</table>

Body fat 27%  
Poor recovery  
Often ill

Estimated energy stores in humans

- Male: 75 kg  
- Body fat 20%  
- (Male athlete max. 10% body fat)

- Adipose tissue: -80,000 kcal
- Muscle triglycerides: -2900 kcal
- Glycogen (liver): -400 kcal
- Glycogen (muscle): -7100 kcal
- Glucose (blood): -860 kcal
- Muscle protein: -30,000 kcal

The capacity of our body to store glycogen is limited

Energy delivering substrates

- ATP/CP
- Glycolytic Aerobic
- Lipolytic Aerobic

Carbohydrates (CHO)

Total carbohydrates

- Moderate volume intense training (3-5 h/d, 5-6 d/wk): 5 - 8 g/kg/d
- High volume intense training (3-6 h/d in 1-2 workouts, 5-6 d/wk): 5 - 10 g/kg/d
- Extreme volume intense training (4-6 h/d): 10 - 12+ g/kg/d

Carbohydrates before, during and after training

- 1-4 h before training session: 1 - 4 g/kg
- During training session: 0.5 - 1 g/kg
- After training session: 0.8 - 2 g/kg

75-80% complex carbohydrates and 20-25% simple carbohydrates (sucrose, fructose, glucose etc)

Kreider et al. 2000, JISSN 2010, 7:7
Protein (PRO)

- **General fitness program**
  - Moderate volume intense training: 0.8-1.0 g/kg/d
  - High volume intense training: 1.0-1.5 g/kg/d

- **Foods that provide approximately 10 g of protein**:
  - **Animal foods**
    - 2 small eggs
    - 30 g reduced fat cheese
    - 70 g cottage cheese
    - 1 cup low fat milk
    - 35 g lean beef, lamb or pork
    - 40 g chicken
    - 50 g fish
    - 200 g reduced fat yoghurt
  - **Plant foods**
    - 4 slices bread
    - 90 g whole grain cereal
    - 90 g reduced fat cheese
    - 70 g cottage cheese
    - 350 g cooked pasta
    - 50 g fish

Fat

- **Polyunsaturated fatty acids**:
  - 1 part Omega-3:
    - Chia and flax seeds
    - Hemp seeds and oil
    - Walnuts
    - Oily fish (salmon, herring etc.)
  - 1-2 parts Omega-6:
    - Sunflower oil
    - Grape seed oil
    - Corn oil
    - Meat

- **Saturated fatty acids**:
  - Chocolate
  - Meat
  - Dairy products
  - Coconut oil

- **Trans fatty acids (avoid)**:
  - Hydrogenated vegetable oil
  - Fast food
  - Processed food (cakes, pies)
  - Processed meat (hot dog)
  - French fries, chicken nuggets

- **Monounsaturated fatty acids**:
  - Omega-9:
    - Olive oil
    - Almond and sesame oil
    - Avocado
  - Omega-7:
    - Peanut, almonds

U23 rower

- **Time**
  - 7.00 Breakfast: Bowl of porridge with jam or berries
  - 11.45 Lunch: Omelette (2 eggs, milk)
  - 13.00 Lunch: Creamy chicken pasta with broccoli
  - 16.00 Snack: Bread with cheese
  - 21.30 Dinner: Lentils with salmon

- **Food calories**
  - ∼2600 kcal

- **Calories used**
  - ∼3100 kcal

- **Energy balance**
  - -500 kcal

Macronutrient distribution

<table>
<thead>
<tr>
<th>Training cycle</th>
<th>CHO</th>
<th>PRO</th>
<th>FAT</th>
</tr>
</thead>
<tbody>
<tr>
<td>(no weight loss)</td>
<td>5-7</td>
<td>1.2-1.7</td>
<td>0.8-1.0</td>
</tr>
<tr>
<td>(Weight loss)</td>
<td>3-4</td>
<td>1.8-2.0</td>
<td>0.8</td>
</tr>
<tr>
<td>Competition</td>
<td>7-12</td>
<td>1.4-1.6</td>
<td>0.8-1.5</td>
</tr>
<tr>
<td>Transition</td>
<td>3-4</td>
<td>1.6-2.0</td>
<td>0.8-1.0</td>
</tr>
</tbody>
</table>
**Preparatory cycle goals**

ENDURANCE / STRENGTH / FLEXIBILITY / ...

- Body fat loss
- Iron rich foods/supplements
- Get to know the gastrointestinal (GI) system
- Improvement of the metabolic efficiency

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**Training nutrition ranges: preparatory**

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Pre</th>
<th>During</th>
<th>Post</th>
</tr>
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<tbody>
<tr>
<td>Fluid</td>
<td>1-2 L/day</td>
<td>400-800 mL/h</td>
<td>150% for water lost</td>
</tr>
<tr>
<td>Carbohydrate</td>
<td>Meal/light snack</td>
<td>None (at least in the first part of Prep)</td>
<td>Snack</td>
</tr>
<tr>
<td>Protein</td>
<td>Meal/light snack</td>
<td>None</td>
<td>Snack</td>
</tr>
<tr>
<td>Fat</td>
<td>Meal/light snack</td>
<td>None</td>
<td>Snack</td>
</tr>
<tr>
<td>Sodium</td>
<td>Meal/snack</td>
<td>Just enough to promote hydration</td>
<td>Min of 500 mg for every pound lost</td>
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**Metabolic INefficiency**

- How efficient is the body in utilizing carbs and fat at different intensities and durations?
- Poor utilization of fat stores
  - Increased reliance on carbohydrate limited stores
  - Increased need for supplemental carbohydrates
  - Inability to properly feed during training/racing
  - Higher risk of GI distress

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**Training nutrition ranges: competition**

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<tr>
<td>Carbohydrate</td>
<td>Meal/light snack</td>
<td>30-90 g/l</td>
<td>Snack 0.8-1.2 g/kg</td>
</tr>
<tr>
<td>Protein</td>
<td>Meal/light snack</td>
<td>Debatable (gut response)</td>
<td>Snack 10-20 g</td>
</tr>
<tr>
<td>Fat</td>
<td>Meal/light snack</td>
<td>None</td>
<td>Snack</td>
</tr>
<tr>
<td>Sodium</td>
<td>Snack</td>
<td>500-700 mg/L of fluid</td>
<td>Minimum of 500 mg for every pound lost</td>
</tr>
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**Transition cycle goals**

- Manage emotions, manage intake
- Don’t eat like an athlete
- Prevent weight/fat gain

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**Competition cycle goals**

SPEED / POWER / ECONOMY / ...

- Build
  - Race simulation eating
  - Warm-up the gut
  - Electrolytes and hydration

- Race
  - Fine-tune for types/distances
  - Avoid temptation
  - Recovery!!!
## Training nutrition ranges: transition

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</tr>
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</tr>
<tr>
<td>Fat</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Sodium</td>
<td>X</td>
<td>X</td>
<td>Minimum of 300 mg for every pound lost</td>
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</table>

## Nutrient Pre During Post

### Carbohydrate
- Pre: X
- During: X
- Post: X

### Protein
- Pre: X
- During: X
- Post: X

### Fat
- Pre: X
- During: X
- Post: X

### Sodium
- Pre: X
- During: X
- Post: Minimum of 300 mg for every pound lost

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## Post-workout nutrition (within first 30 min)

### Long aerobic/endurance training
- CHO: ∼0.8-1.2 g/kg
- PRO: ∼0.2-0.4 g/kg
- FAT: Minimal requirements

### Intense short duration or prolonged resistance circuit training
- CHO: ∼0.8-1.2 g/kg
- PRO: ∼0.2-0.4 g/kg
- FAT: Minimal requirements

### Technical drills/short duration resistance training
- CHO: ∼0.8-1.2 g/kg
- PRO: Minimal requirements
- FAT: Minimal requirements

<table>
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<th>Situations of short recovery (&lt; 4h)</th>
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<tr>
<td>Sports drink or juice, protein recovery bar, milk</td>
</tr>
<tr>
<td>Dried figs, rice, water</td>
</tr>
<tr>
<td>Fruit smoothie (with protein powder) and 1 piece of fruit</td>
</tr>
</tbody>
</table>

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## Dietary supplements

### Group A
- Supported for use in specific situations in sport
  - Sports gels/drinks/bars
  - Sports drinks
  - Liquid meal
  - Calcium and iron
  - Multivitamins and vitamin D
  - Probiotics
  - Creatine
  - Caffeine
  - Bicarbonate

### Group B
- Deserving of further research
  - Carnitine
  - HMB
  - Fish oil
  - β-Alanine
  - Anti-oxidants C and E
  - Quercetin
  - Beetroot juice/Nitrate
  - Probiotics for immune support

### Group C
- No meaningful proof of beneficial effects
  - BCAA
  - Arginine
  - Magnesium
  - Chromium picolinate
  - Ribose
  - Coenzyme Q10
  - Pyruvate
  - Ginseng
  - Glucosamine

### Group D
- Banned or at high risk of contamination

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## Supplements

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## Dietary nitrates/Beetroot juice

- **Sources of dietary nitrates:**
  - Beetroot and green leafy vegetables
- **Physiological effects:**
  - Lower the oxygen cost of sub-maximal exercise
  - May enhance exercise (6-30 min) performance
  - Reduces resting blood pressure
- **The ‘dose’ of nitrates can be achieved through the consumption of 0.5 L of beetroot juice or an equivalent high-nitrate foodstuff**
- **It is recommended that nitrates is consumed ~2-3 h prior to competition**

---

## Sources of nitrate

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## Additional sources

Intra- and extracellular buffering

β-Alanine
meta-analysis 2012

Intracellular buffering
Increases muscle carnosine concentration in type I and II muscle fibres
Delays the onset of fatigue
Exercises lasting 60-240 s ($P = 0.001$) and >204 s ($P = 0.046$) were improved
The median overall effect was 2.85%
Best results with 6 g/d for 28 days

Sodium bicarbonate (NaHCO3) and citrate

• Extracellular buffering
• Leads to increased plasma bicarbonate and increased buffering
• Improves the rate of $H^+$ release from active skeletal muscle
  ⇒ Improves intense exercise performance lasting from 1 to 5 min or during repeated sprints
  ! Can cause significant gastrointestinal upset
• Sodium citrate ingestion is better tolerated but results in lower buffering and performance effects

Caffeine

• Endurance events lasting > 20 min and high intensity sports lasting 1-20 min
• A dose of intake- 3 mg/kg BM
  o Taken an hour prior to exercise
  o Spread throughout exercise
  o Late in exercise as fatigue is beginning to occur
• Reduces the perception of fatigue and allows optimal work outcomes to be maintained for a longer period
  ! Can cause increases in heart rate, anxiety, impairment of technique etc.

Summary

The interactions between training, competition, and nutrition need to be
• approached on an individual basis and
• continuously adjusted and adapted

<table>
<thead>
<tr>
<th>Time</th>
<th>Preparatory</th>
<th>Competition</th>
<th>Transition</th>
<th>Macrocycle</th>
<th>Microcycle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Free radical reduction, anti-inflammation, health</td>
<td>Macro-, micronutrient and fluid timing, quality and quantity</td>
<td>CHO types and frequency</td>
<td>Post-workout nutrition</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CHO emphasis</td>
<td>Energy control</td>
<td>Weight management</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The ingestion of beetroot juice, β-alanine, NaHCO3, and/or caffeine may offer a small increase in performance

Thank you!

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