Nutritional Challenges for High Performance Athletics

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Factors Affecting Dietary Needs

- exercise type/intensity/duration
- continuous vs intermittent
- rest/recovery time between sessions
- degree of adaptation (training)
- environment
- age
- gender
Nutrients Known to be Important

- energy intake

Activity & Energy Intake

Performance with/without 940kJ/d Supplement in Elite Female Rowers

**Protein**

- **Day 0**: 472.4
- **Day 19**: 467 *

**Fat**

- **Day 0**: 463.3
- **Day 19**: 461.4 *

* Bachman, Talyor, Lemon, 2000

* Lemon, 1998

* P<0.05 d0 vs d19 (n=8/treatment)
Nutrients Known to be Important

- CHO intake

**Chronic CHO Intake & Performance**

Bergstrom et al (1967)

- Low CHO (5% energy)
- High CHO (82% energy)

* P<0.05

**Time Trial Following 50 min @ 80% Aerobic max, n=8**


- Placebo
- CHO

<table>
<thead>
<tr>
<th></th>
<th>Time (min)</th>
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<tbody>
<tr>
<td>Placebo</td>
<td>10.9</td>
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<tr>
<td>CHO</td>
<td>10.2</td>
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6.4% faster

* P<0.05
Nutrients Known to be Important

- fluid intake

Performance time (min)


Low Fluid Vol (200 ± 10 ml)

Large Fluid Vol (1330 ± 60 ml)

* P<0.05

*(6.5% faster)
Controversial topics

- protein
- fat
- vitamins/minerals
- creatine
- variety of others, i.e., glutamine, ribose, HMB, prohormones, ephedrine, caffeine, CLA, etc
- other questions, i.e., timing of nutrient relative to training sessions, etc
Protein?

Protein Intake & Protein Synthesis

- Sedentary Controls
- Strength Athletes

0.9 1.4 2.4

Whole Body Protein Synthesis (mg/kg/h)

0 50 100 150 200 250

Protein Intake (g/kg/d)

*T P<0.05

Tarnopolosky et al (1992)
Post-ex Amino Acids Ingestion increases protein synthesis!

**Muscle Protein Synthesis**

(nmol ⋅ min⁻¹ ⋅ 100 ml leg volume⁻¹)

  - \(*P<0.05\)
  - \(\uparrow\) SE

- **500 ml Drink**
  - (6 g indispensable aa + 35 g sucrose)

- (>3 X increase)

**Post Exercise Time (h)**

- 0-1
- 1-2
- 2-3
- 3-4
Effects on Strength & Size? - yes

Leg Cross-sectional Area ($cm^2$)

- Pre-training
- Post 12 wk training
- SD

Esmarch et al (2001)
unlike letters P<0.01
SUPP = 420 kJ; 10 g CHO, 7 g PRO, 3.3 g FAT

5-repetition max (kg)

- Supplement (immediate)
- Supplement (2h post)
unlike letters P<0.05
Supp = 420 kJ, 10 g PRO, 7 g CHO, 3.3 g FAT

Esmarch et al (2001)
Creatine and protein may enhance muscle strength/size gains with training!

**Leg Press Endurance - Reps at 80% of 1-RM**

- **Pre**
  - Protein+CR: 10.0
  - Protein: 7.7
  - CR: 11.9
- **Post**
  - Protein+CR: 40.0
  - Protein: 23.9
  - CR: 29.8

**Whole Body Lean Mass (kg)**

- **Pre**
  - Protein+CR: 68.1
  - Protein: 66.4
  - CR: 69.0
- **Post**
  - Protein+CR: 70.8
  - Protein: 67.6
  - CR: 70.7

*P*<0.05 mean±SD
Beneficial for aged, muscle disease, etc?

Fractional Myofibrillar Protein Synthesis (% /h X 10000) following 3 months of training

- SE
- P<0.01 Older vs Younger


Age (years)
Challenge(s)?

- several
  - athletes: what product(s) to take?
  - scientists: provide the objective data to clarify picture
    - but traditional funding inadequate!
  - industry: credibility
  - regulators: quality control, safety

- solutions ????
  - partnership - science and industry (% of sales)
  - benefits ????
    - equip more laboratories
    - unbiased data collection; more speculative research
    - answers, new product ideas, and enhance credibility/
      marketability of products by verifying applicability of
      theory