Nutrition for recovery

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Recovery Menu:

1. Refuelling
2. Rehydration
3. Rebuilding/adaptation (protein)
4. Revitalisation (immune system, antioxidant defence)
An integrated approach to nutritional recovery

What needs to be recovered?
How much time is there to the next session?

Enhancing the process – is it possible? Is it valuable? Are there benefits from delaying recovery strategies?

Does the recovery plan integrate all goals?
Does it cater for individual needs?

What are the challenges/disadvantages of the recovery plan? Can I afford it?
1. Refuelling: Most important factors in refuelling are time and dietary carbohydrate

Early recovery:
(0-6 h)
Target = 1 g per kg BM/h

2004 Guidelines for carbohydrate intakes in the everyday training diet

“Athletes should aim to achieve carbohydrate intakes to meet the fuel requirements of their training program and to optimise restoration of muscle glycogen stores between workouts”

*International Olympic Committee*  
*2003 Consensus conference on Nutrition for Sport*

<table>
<thead>
<tr>
<th>Exercise Program</th>
<th>Carbohydrate Intake (g/kg/d)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moderate exercise program (i.e. ~1 hr per day)</td>
<td>5-7</td>
</tr>
<tr>
<td>Endurance program (e.g. 1-3 h/d mod-high intensity exercise)</td>
<td>7-10</td>
</tr>
<tr>
<td>Extreme commitment (i.e., &gt;4-5 h/d mod-high intensity exercise)</td>
<td>10-12</td>
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</tbody>
</table>

Guidelines are “ball park” figures  
(fine tune with individual consideration of total energy needs, specific training needs and feedback from training performance)

2010 Guidelines for carbohydrate intakes in the everyday training diet

“When it is important to train hard or with high intensity, daily carbohydrate intakes should match the fuel needs of training and glycogen restoration.”

International Olympic Committee
2010 Consensus conference on Nutrition for Sport

| Low intensity or skill-based activities: Moderate training program for athletes with large BM or energy restriction | 3-5 g/kg of athlete’s body mass (BM)/d |
| Moderate exercise program (i.e. ~1 hr per day) | 5-7 g/kg/d |
| Endurance program (e.g. 1-3 h/d mod-high intensity exercise) | 6-10 g/kg/d |
| Extreme commitment (i.e., >4-5 h/d mod-high intensity exercise) | 8-12 g/kg/d |

Terminology change: “High carbohydrate availability” rather than high carbohydrate *per se*

(a diet with high carbohydrate availability may not contain large amounts of carbohydrate)

2010 Strategies to promote muscle glycogen storage

But, if you can’t eat enough carbohydrate, there may be value in trying to get more glycogen storage from the same carbohydrate amount

- Use of high molecular weight glucose polymers (Piehl-Aulin et al., 2000)
- High doses of caffeine (Pedersen et al., 2008)
- Prior creatine loading (Robinson et al., 1999; van Loon et al., 2004)

(These strategies may not be practical for everyday use)
Protein added to (sub-optimal) carbohydrate in early recovery can enhance glycogen storage

Optimal amount of protein
= 0.3 g/kg (20-25 g)

Betts and Williams, Sports Medicine, 40, 941-959, 2010
Timing of carbohydrate intake and glycogen storage

Muscle glycogen storage (mmol/kg ww)

- Early feeding
  - 2 h: Rate of storage = 7.7 mmol/kg ww/h
  - 4 h: Rate of storage = 4.3 mmol/kg ww/h

- Delayed feeding (2 h)
  - 2 h: Rate of storage = 4.1 mmol/kg ww/h
  - 4 h: Rate of storage = 2.5 mmol/kg ww/h

Timing of carbohydrate intake and glycogen storage

Muscle glycogen storage (mmol/kg ww)

- **2 h**
  - Early feeding: 15
  - Delayed feeding (2 h): 5
  - *P < 0.05*

- **4 h**
  - Early feeding: 24
  - Delayed feeding (2 h): 13
  - *P < 0.05*

Carbohydrate Target = 1 g per kg BM per hour

Timing of carbohydrate intake and glycogen storage

Muscle glycogen storage (mmol/kg ww)

Early feeding

- 2 h: 15 ± 2 mmol/kg
- 4 h: 24 ± 5 mmol/kg

Delayed feeding (2 h)

- 8 h: 55 ± 2 mmol/kg
- 24 h: 94 ± 9 mmol/kg

P < 0.05

Windows of opportunity and scenarios of “withholding recovery”

Pros of pro-active recovery

• Window may be overstated, but carbohydrate intake is required to start effective recovery
• Time between exercise sessions is short (< 8 h)
• Event/session is glycogen dependent

Cons of pro-active recovery

Deliberate
• ? Prolong adaptation
• ? Train low strategies

Practical
• Poor appetite
• No access to (suitable) foods
• Better economy to wait until suitable foods are available
2. Rehydration – a balancing act

- Flavour
- Sodium
- Planned intake

DIURESIS

- Sodium
- Caffeine
- Alcohol

Sodium replacement and rehydration

Cumulative urine losses (ml)

<table>
<thead>
<tr>
<th>Sodium in drinks</th>
<th>100 mmol</th>
<th>52 mmol</th>
<th>26 mmol</th>
<th>2 mmol</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5 hours</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>1.5 hours</td>
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<tr>
<td>3.5 hours</td>
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<tr>
<td>5.5 hours</td>
<td></td>
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</tbody>
</table>
Sodium replacement and rehydration

Net fluid balance (ml)

Sodium in drinks:
- 100 mmol
- 52 mmol
- 26 mmol
- 2 mmol

## Windows of opportunity and scenarios of “withholding recovery”

### Pros of pro-active recovery

- There is no window but re-equilibration of fluids may take 2-6 h and fluid/electrolyte intake is required to start effective rehydration
- Time between exercise sessions is short (< 4 h)
- Event/session is in hot environment and dehydration will effect performance

### Cons of pro-active recovery

#### Deliberate
- ? Train low strategies to promote acclimatisation

#### Practical
- Late night: uninterrupted sleep is more important than rehydration
- Large volumes of fluid may cause gut discomfort
4. Immune system recovery

- Strenuous exercise is followed by a period of altered/reduced activity or status of immune system markers
- Illness is often “catastrophic” to an athlete
- It is difficult to extrapolate acute studies of alterations in immune system markers to alterations in risk of illness
4. Immune system recovery

- Impaired carbohydrate status/carbohydrate depletion is associated with disturbance of immune system markers.
- Poor energy availability is associated with a disturbance of immune system markers.
- Other nutrients might be important for immune health.
  - Timing of intake in relation to exercise is probably not as critical for immune health.
# Windows of opportunity and scenarios of “withholding recovery”

## Pros of pro-active recovery

- There appears to be a window after exercise where the immune system is at risk
- Energy and carbohydrate availability may be important in supporting the immune system
  - High training load/stress
  - High environmental risk of illness
  - High personal risk of illness

## Cons of pro-active recovery

- None
Alcohol and sport

• Among college athletes, drinking patterns and alcohol use
  – Wrestlers > team sports > track and field

• Among elite male athletes, alcohol intake
  – Team sport > endurance sports and strength sport

• Among Norwegian adults, men and women involved in team sports reported a higher intake of alcohol, particularly beer and liquor, than those involved in individual sports (Watten, Scan J Med Sci Sports 1995; 5: 364-368)
Alcohol practices of football players

Alcohol intake on game day by elite AFL players (n = 51)

<table>
<thead>
<tr>
<th>Intake</th>
<th>%Energy</th>
</tr>
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<tbody>
<tr>
<td>Mean</td>
<td>120 g</td>
</tr>
<tr>
<td>Range</td>
<td>27-368 g</td>
</tr>
</tbody>
</table>

Blood Alcohol Content at Sunday Morning training (n = 41)

- 14 players recorded a BAC
- Mean BAC = 0.035g/100ml
- 4 players > 0.05g/100ml

Alcohol and post-exercise recovery

• Refuelling - muscle and liver glycogen storage
• Rehydration
• Repair of muscle damage and injuries
• Adaptation to training stimulus
• Temperature regulation
• Other - high risk behaviour
Hard facts:
alcohol and recovery

>4% alcoholic drinks sub-optimal for rehydration

Alcohol may impair early glycogen storage, but main effect is displacement of carbohydrate from diet


Westham [English soccer team] defender Hayden Foxe has reportedly been fined two weeks’ wages [$A40,000] by the club for urinating on a bar in a drunken night out with teammates in London this week. Fox . . . had earlier dismissed reports that the players had behaved like “animals” and “appallingly” before they were thrown out of the bar after racking up a $5200 drinks bill.

Collingwood Football Club was in mourning today for its star, Darren Millane, killed in an early morning car crash. He was six times the legal alcohol limit for driving when he died. . . .Police sources confirmed yesterday that Millane’s blood-alcohol level was 0.322.

Collingwood players Ben Roarty and Danny Williams have been involved in an end-of-season brawl that left Roarty in need of medical care and Williams’ future at the club in doubt. . . . Storm’s CEO Chris Johns said . . . “we are not dealing with choir boys here. We are dealing with footballers. . . .while I am not condoning what they did, these things do happen . . . .This can happen when the boys have had a few drinks under their belts.”
Issues with alcohol research

- Variability of individual response
- Difficulty finding a placebo/control
- Difficulty getting ethics approval for research on real-life issues
- No difficulty finding subjects
- (Difficulty managing subject interaction)
Summary: Recovery eating

- Following strenuous intake, recovery is enhanced by intake of key nutrients (protein, carbohydrate, fluid, electrolytes)
  - In many cases, effective recovery is stalled until nutrient intake occurs

- Goals and nutrient targets for recovery are specific to the individual athlete
  - Choice of foods/products influenced by many factors

- If there is a lengthy time between the end of exercise and nutrient intake, there may not be opportunity for full recovery
  - Loss of period of enhanced recovery
  - Reduced time of effective recovery
  - Lack of opportunity to meet nutrient targets with reduced period of intake
Summary: Recovery eating

- It may be useful to have an eating/drinking plan to maximise nutrient intake and any benefits of clever timing of intake.
- If your eating times are fixed, it may be useful to change exercise times to better coincide with opportunities to consume nutrients.
- Sometimes it is unnecessary to undertake special recovery eating.
- Sometimes, there may be advantages to withholding recovery nutrition.