Presented by Chris Hudd

**Study design dot point:**
- fatigue/limiting factors and recovery rates associated with active and passive recoveries.
Muscle glycogen is the preferred fuel source during aerobic activities. Unfortunately the stores of glycogen are limited, and deplete around the 90-120 minute mark of prolonged, submaximal exercise.
Aerobic system fatigue

Fatigue in action – Women’s triathlon

- Physiological change
- Physiological impact
- Impact on Performance

Note:
Swim leg = 18-20 minutes
Cycle leg = 64-66 minutes
Aerobic system fatigue

Thermoregulatory fatigue

Theory summary

Heat is a major metabolic by-product of endurance activities that utilise the aerobic system for energy. When exercising for prolonged periods of time, or in conditions of high heat and humidity, it is common for the body’s core temperature to rise. A variety of fatigue factors can be linked to prolonged exercise. These factors are all related to body temperature. They include:

- Elevated core temperature;
- Redistribution of blood towards the skin’s surface;
- Increased rate of dehydration;
- Decreased plasma levels;
- Increased blood pressure;
- Electrolyte imbalance;
- Nervous fatigue
Aerobic system fatigue

Thermoregulatory fatigue

- Elevated body temperature
- Body redistributes a higher percentage of cardiac output to the skin’s surface
- Body cools down via evaporation
- Increased rates of dehydration
- Decreased plasma levels
- Increased blood pressure
- Electrolyte imbalance
- Nervous fatigue

© Chris Hudd & Edrolo 2017
Aerobic system fatigue
Thermoregulatory fatigue - Dehydration

Theory summary
The diagram below highlights the relationship between fluid loss (% of body weight) and varying effects on the body.

- Increase in core body temperature
- Decrease in aerobic ability and muscular endurance
- Muscle spasms & cramping
- Susceptibility to heat stroke
- Decrease in muscular strength and anaerobic power.
- Excessively high core body temperature
Aerobic system fatigue

Thermoregulatory fatigue - Central nervous system fatigue

Theory summary

Central Governor
The theory of the central governor mechanism states that the power output by muscles during exercise is continuously adjusted according to calculations made by the brain regarding a safe level of exertion.

When fatigue is detected by the brain, weaker neural signals are sent. This will ultimately impact on performance, by reducing the force and speeds of contractions.
Aerobic system fatigue

Thermoregulatory fatigue - Electrolyte loss

Theory summary
Electrolytes are salts found in the body that serve a variety of specific roles to help us maintain the balance of fluids inside and outside of the cellular environments. This balance is critically important for things like hydration, nerve impulses, muscle function, and pH levels.

Some major electrolytes and their specific roles are displayed in the following table:

<table>
<thead>
<tr>
<th>Electrolyte</th>
<th>Role</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium</td>
<td>This extracellular (outside of cell) electrolyte is responsible for fluid and electrolyte balance throughout the body. It regulates blood volume, and maintains muscle and nerve function.</td>
</tr>
<tr>
<td>Potassium</td>
<td>This intracellular (inside the cell) electrolyte, along with the extracellular sodium, form an electrical pump that allows conductivity between cells, ie the transmission of nerve signals and ultimately muscle contractions.</td>
</tr>
<tr>
<td>Calcium</td>
<td>Rapidly changing concentrations of calcium within the muscle cells allows the contraction and relaxation of muscles to occur.</td>
</tr>
</tbody>
</table>
Aerobic system fatigue

Thermoregulatory fatigue

Fatigue in action - Tennis

Physiological change
Physiological impact
Impact on Performance

Source: https://www.youtube.com/watch?v=ALHObkStA0
**Recovery strategies**

**Consumption of High GI carbohydrates**

**Link to fatigue factor:**
Fuel Depletion (Glycogen)

**Explanation:**
The consumption of high GI carbohydrates is recommended as quickly as possible during recovery. Glycogen restoration rates vary depending on the period of time before ingestion takes place. Exercise is known to improve the muscles responsiveness to insulin resulting in a greater uptake of glucose by the muscles. This window of insulin response is further prolonged by the consumption of protein and carbohydrates together.

<table>
<thead>
<tr>
<th>Timing of ingestion</th>
<th>Glycogen restoration time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Within 1 hour</td>
<td>24 hours</td>
</tr>
<tr>
<td>1-2 hours</td>
<td>48 hours</td>
</tr>
<tr>
<td>5+ hours</td>
<td>Up to 5 days</td>
</tr>
</tbody>
</table>

Source: https://www.youtube.com/watch?v=Plq-iiwVeBs
Recovery strategies

Rehydration

Link to fatigue factor:
Dehydration

Recommendations:
To maximise recovery the following guidelines should be followed with regards to rehydration:
- Include water (hydration), carbohydrates (refuel), and electrolytes (salts) in post-exercise drinks;
- Consume fluids throughout the first two hours of post-exercise time;
- Consume 1.5 litres of fluid for each kilogram of fluid loss.

https://pxhere.com/en/photo/945339
Other than depletion of muscle glycogen stores, what are the main causes of fatigue for endurance athletes?

A. CP Depletion and lactic acid accumulation
B. Dehydration and elevated body temperature
C. Pyruvic acid accumulation and dehydration
D. Increased levels of ADP and hydrogen ions
E. I don’t know.
Multiple choice – Response

Other than depletion of muscle glycogen stores, what are the main causes of fatigue for endurance athletes?

A. CP Depletion and lactic acid accumulation

B. Dehydration and elevated body temperature *(58% correct)*

C. Pyruvic acid accumulation and dehydration

D. Increased levels of ADP and hydrogen ions

E. I don’t know.
The most effective and appropriate recovery strategy to use within 30 minutes of an Australian Rules football match would be:

A. an ocean plunge.
B. contrast therapy.
C. passive stretching.
D. consuming sports drinks.
E. I don’t know

(2014 VCAA Exam Section 1 Q10)
Multiple choice – Response

The most effective and appropriate recovery strategy to use within 30 minutes of an Australian Rules football match would be:

A. an ocean plunge.
B. contrast therapy.
C. passive stretching.
D. consuming sports drinks. *(44% correct)*
E. I don’t know
Which of the following statements is correct with regards to the graph below?

A. Blood lactate disappearance rates are enhanced through an active recovery at 65% HR max

B. Blood lactate disappearance rates are enhanced through an active recovery at 35-65% HR max

C. Blood lactate disappearance rates are enhanced through a passive recovery

D. The benefits of an active recovery are inclusive

E. I don’t know.
Multiple choice – Response

Which of the following statements is correct with regards to the graph below?

A. Blood lactate disappearance rates are enhanced through an active recovery at 65% HR max

B. Blood lactate disappearance rates are enhanced through an active recovery at 35-65% HR max (44% correct)

C. Blood lactate disappearance rates are enhanced through a passive recovery

D. The benefits of an active recovery are inclusive

E. I don’t know.
We do our best to make these slides comprehensive and up-to-date, however there may be errors. We’d appreciate it if you pointed these out to us!