FISIOLOGIA DELLO STRETCHING

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INTRODUCTION

Acute passive stretching:

• Increases joint range of motion
• Reduces risks of injuries
• Improves performance
Stretching and anaerobic performance

✓ decreases maximum force and power
✓ reduces performance

Fowles, J Appl Physiol (2000)
Kokkonen, Res Q Exerc Sport (2001)
Two main mechanisms:

Neural changes:

- Decreased moto-neuron excitability (pre- and post-synaptic mechanisms)

Muscle-tendon unit changes:

- Increased muscle-tendon unit compliance, reduction in passive tension, alteration of muscle elasticity and tension/length relationship

Mainly type II motor units
AIM

To assess stretching-induced effects on maximum aerobic power and endurance
METHODS

- Ten active males (age 23±5 yrs; body mass 69±7 kg; stature 171±9 cm; mean±SD)
- Ten tests (5 with and 5 without stretching) on a cycle ergometer (100 ± 3 rpm), in a random order
  - Two square-wave maximum incremental tests
  - Two ramp maximum incremental tests
  - Six tests at 85% VO₂ max (W₈₅), until exhaustion
- Stretching routine: 5 x (45 s on / 15 s off)
- Measurements: gas exchange, cardio-respiratory parameters, lactate concentration
Exercise duration

- Controls: Time (s)
- Stretching: Time (s)

Graph showing a comparison between Controls and Stretching for exercise duration.
Net efficiency

![Graph showing net efficiency over time with error bars and significant markers.](image-url)
<table>
<thead>
<tr>
<th></th>
<th>Controls</th>
<th>Stretching</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>min 3</td>
<td>last min</td>
</tr>
<tr>
<td>VO₂ (ml/min)</td>
<td>2831 ± 73</td>
<td>3175 ± 87 *</td>
</tr>
<tr>
<td>VE (l/min)</td>
<td>83 ± 2</td>
<td>119 ± 5 *</td>
</tr>
<tr>
<td>Vₜ (l)</td>
<td>2.46 ± 0.15</td>
<td>1.97 ± 0.10 *</td>
</tr>
<tr>
<td>RR (b/min)</td>
<td>34.7 ± 1.5</td>
<td>62.3 ± 4.1 *</td>
</tr>
<tr>
<td>HR (bpm)</td>
<td>155 ± 4</td>
<td>176 ± 5 *</td>
</tr>
<tr>
<td>[La⁺] (mM)</td>
<td>4.80 ± 0.25</td>
<td>8.81 ± 0.67 *</td>
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CONCLUSIONS

With acute passive stretching:

✔ Maximum aerobic power is not affected
✔ Endurance time of a high-intensity exercise is significantly reduced
✔ Exercise efficiency is decreased
✔ Type II motor units are impaired
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