OPTIMISING PHYSICAL PERFORMANCE:
TRAINING FEMALE SOLDIERS FOR ARDUOUS ROLES

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10 SEPT 19
Women vs Men

Body composition
• 25 - 30% more fat
• 40 - 45% less muscle
• Smaller skeleton

20 - 30% lower aerobic fitness
• 25 - 30% smaller hearts and lungs
• 40 - 45% lower muscle mass
• Lower blood volume
• Lower Hb concentrations

20 - 50% lower anaerobic power and capacity
• 40 - 45% less muscle
• Lower percentage of FT fibres

20 - 50% less muscle strength and endurance
• 40 - 45% less muscle
• Higher percentage of ST fibres
SEX DIFFERENCES IN PHYSICAL PERFORMANCE

- **Male**
  - Total fat: ~15%
  - Muscle: 44.8%
  - Bone: 17%
  - Remainder: 25.3%

- **Female**
  - Total fat: ~27%
  - Essential Storage: 14%
  - Sex specific Storage: 5.9%
  - Muscle: 37%

- **Comparison**
  - Male: 70 kg
  - Female: 56.7 kg

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SEX DIFFERENCES IN PHYSICAL PERFORMANCE

F:M Ratio

Bone Mass | Lean Mass | Fat Mass

0.0 | 0.2 | 0.4 | 0.6 | 0.8 | 1.0 | 1.2 | 1.4
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SEX DIFFERENCES IN AEROBIC CAPACITY (1.5 MILE RUN TIME)

Women: 2956
Men: 17843

Minutes:ss
On average, women work harder than men during military tasks, which increases their musculoskeletal injury risk by 2 to 3-fold.
<table>
<thead>
<tr>
<th>Training Mode</th>
<th>Effect Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upper &amp; lower body resistance training with aerobic training and load carriage exercise</td>
<td>1.69</td>
</tr>
<tr>
<td>Upper and lower Body resistance training with aerobic training</td>
<td>1.18</td>
</tr>
<tr>
<td>Field based training with load carriage exercise</td>
<td>1.11</td>
</tr>
<tr>
<td>Linear upper and lower body resistance training with aerobic training</td>
<td>1.03</td>
</tr>
<tr>
<td>Upper and lower body resistance training with aerobic training</td>
<td>0.81</td>
</tr>
<tr>
<td>Upper body resistance training with aerobic training</td>
<td>0.79</td>
</tr>
<tr>
<td>Upper and lower body resistance training only</td>
<td>0.75</td>
</tr>
<tr>
<td>Aerobic training only</td>
<td>0.29</td>
</tr>
</tbody>
</table>

*Knapik et al 2012*
6 months progressive resistance training in women
(Kraemer et al. 2001)
### SEX DIFFERENCES IN OCCUPATIONAL PERFORMANCE ADAPTATIONS TO PHYSICAL TRAINING

<table>
<thead>
<tr>
<th>Training Type</th>
<th>Women (n = 15)</th>
<th>Men (n = 15)</th>
</tr>
</thead>
<tbody>
<tr>
<td>12 weeks strength training</td>
<td>Women (n = 15)</td>
<td>Men (n = 15)</td>
</tr>
<tr>
<td>12 weeks hybrid training</td>
<td>Women (n = 15)</td>
<td>Men (n = 15)</td>
</tr>
<tr>
<td>24 weeks strength + endurance and load carriage training</td>
<td>Women (n = 15)</td>
<td>Men (n = 15)</td>
</tr>
<tr>
<td>24 weeks hybrid + endurance and load carriage training</td>
<td>Women (n = 15)</td>
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SEX DIFFERENCES IN ADAPTATIONS TO PHYSICAL TRAINING
• Weakened pelvic floor;

• Reduced aerobic fitness;

• Reduced in muscle strength;

• Increased ligament laxity;

• Reduction in bone mass;

• Increased risk of musculoskeletal injury.

(Bo et al. 2017)
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PROJECT PERFORM: PHYSICAL TRAINING POST-PARTUM

24 weeks maternity leave

12 weeks strength + high-intensity internal training
18 weeks core reconnection training

Pregnancy
Week 0  Week 6  Week 12  Week 18  Week 24
Testing Point 1  Testing Point 2  Testing Point 3  Testing Point 4

Military specific physical performance and musculoskeletal health

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• Military tasks require muscle strength and aerobic capacity.

• On average, women have lower muscle strength and lower aerobic capacity than men.

• Targeted progressive resistance and endurance training improves performance in occupational roles.

• Requirement for sex-specific training for performance and resilience in military roles is under investigation.

• Physical performance is reduced, and injury risk is increased in the postpartum period.

• Our research aims to optimise training for women in arduous military roles, and on return to work from pregnancy.