Comparison of Physical and Physiological Characteristics based on Injury History

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ABSTRACT

INTRODUCTION: US Marines perform extremely demanding training and tactical tasks that come with inherent musculoskeletal injury risk. These injuries limit the physical and tactical readiness required of Marines. Recovery from musculoskeletal injuries is not only critical to optimizing resiliency and well-being, but tactical performance and recurrent injury mitigation. PURPOSE: To compare physical and physiological characteristics in Marines based on a retrospective analysis of injury history. METHODS: A cohort of 71 Marines completing rutting for architectural strength (flexibility, body composition, aerobic capacity/lactate threshold, and anaerobic power/capacity). Marines were stratified based on self-reported injury history for the past 12 months (Previously Injured = N = 15, Age: 28.0 ± 7.0 years, Height: 179 ± 6.6 cm, Mass: 84 ± 7.3 kg; Non-Injured = N = 58, Age: 27.5 ± 4.8 years, Height: 179 ± 6.1 cm, Mass: 84 ± 6.9 kg). Mann-Whitney U Tests were used to analyze the data between cohorts of Marines (p = 0.05). RESULTS: A prior musculoskeletal injury were reported in 18.3% of Marines and regionally reported at 53.9% for the critical low region, 38.5% for the hip, and 7.6% for the upper extremity. No significant differences existed between the cohorts for demographics (p = 0.338 – 0.491) or years of experience (p = 0.446). The previously injured Marines demonstrated significantly weaker torso extension (Previously Injured: 323.8 ± 65.3 %BW, Non-Injured: 398.8 ± 90.0 %BW, p = 0.038, Table 1). The previously injured Marines also demonstrated significantly weaker torso extension and knee flexion strength may be critical to prevent the recurrence of musculoskeletal injury. This is essential given the frequency of injury to the lower and lower extremity and the importance of these muscles to transfer load through the kinetic chain during multi-joint movements. Future research should consider a prospective analysis of Marines to determine injury risk associated with physical and physiological characteristics.

EXPERIMENTAL DESIGN AND METHODS

SUBJECTS

Table 1. Subject Demographics

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Age (years)</th>
<th>Height (CM)</th>
<th>Weight (KG)</th>
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</thead>
<tbody>
<tr>
<td>Previously Injured</td>
<td>12</td>
<td>27.5 ± 5.8</td>
<td>179.1 ± 6.6</td>
<td>85.7 ± 7.1</td>
</tr>
<tr>
<td>Non-Injured</td>
<td>58</td>
<td>28.5 ± 7.0</td>
<td>179.1 ± 6.1</td>
<td>84.7 ± 5.9</td>
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PROCEDURES

- Laboratory testing was completed to determine physical and physiological characteristics of subjects
- Body composition Test
- Torso body composition was assessed with The BodPod Body Composition System (Cosmed, Cosmed, IL) through air displacement
- Knee flexion/extension (Figure 1)
- Body mass (kg) and percent body fat (%BF) were used for final analysis
- Ananerobic Power/Capacity Test
- Aerobic power/capacity was measured utilizing an electromagnetical cycling ergometer and Wingo protocol (Racermate Inc, Seattle, WA) (Figure 2)
- Anaerobic power and anaerobic capacity were normalized to body mass and reported as the peak and average wattage generated during the entire 30 seconds of the test, respectively
- Normalized aerobic power/capacity (watts/kg) were used for final analysis
- Strength Tests
- Isokinetic knee flexion/extension (Figure 3), torso flexion/extension (Figure 4), and shoulder internal/external rotation (Figure 5) were measured using an isokinetic dynamometer (Biomedix Medical Systems, Inc, Shirley, NY) at 40°/sec
- Aerobic Capacity
- Aerobic capacity and lactate threshold were calculated from an incremental treadmill protocol using a metabolic cart (Parvo Medics, Sandy, UT) and a portable lactate analyzer (Lactate Pro, Arkay, Inc, Tokyo, Japan) (Figure 6)
- Flexibility
- Flexibility of the hip flexors, hamstrings, and shoulders were measured using the digital inclinometer (Figures 7-8)

TABLE 2: Laboratory Results

<table>
<thead>
<tr>
<th></th>
<th>Previously Injured</th>
<th>Non-Injured</th>
<th>p-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Torso Extension (%BW)</td>
<td>323.8 ± 65.3</td>
<td>398.8 ± 90.0</td>
<td>0.038</td>
</tr>
<tr>
<td>Knee Flexion (%BW)</td>
<td>114.1 ± 22.2</td>
<td>128.9 ± 29.6</td>
<td>0.043</td>
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</table>

RESULTS

- Although limited differences in physical and physiological characteristics exist, restoration of trunk extension and knee flexion strength may be critical to prevent the recurrence of musculoskeletal injury. This is essential given the frequency of injury to the lower and lower extremity and the importance of these muscles to transfer load through the kinetic chain during multi-joint movements. Future research should consider a prospective analysis of Marines to determine injury risk associated with physical and physiological characteristics.

SUMMARY AND CONCLUSIONS

- A prior musculoskeletal injury was reported in 18.3% of Marines (Figure 9)
- Previously injured Marines also demonstrated significantly weaker torso extension, and knee flexion (Table 2)
- Future research should consider a prospective analysis of Marines to determine injury risk associated with physical and physiological characteristics.

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