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Influence of Gluteus Medius Strength on Interlimb Asymmetry in Female Recreational Runners.

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INTRODUCTION

- Approximately 74% of runners experience an injury each year with women being twice as likely to develop running injuries around the hip and the knee as men. [1]
- Gluteus Medius (GM) plays a significant role in lower limb alignment, especially in the frontal and transverse planes by its influence on the pelvis and the femur. [2] The GM, posterior chain muscles, and pelvis work together to provide stability and allow for forward propulsion in walking and running. [3]
- Previous studies have determined that GM weakness contributes to abnormal lower limb kinematics and kinetics during dynamic tasks like running and jumping. [2,4] These deficits include increased peak hip adduction angle (HA), hip internal rotation angle (HI), knee abduction moment (KA), and rearfoot eversion angle (RE). [2,4] (Figure 1A)
- Running-related injuries are most often single-sided and are partially attributed to lower limb movement and loading asymmetries. [5]
- Symmetry Angle (SA) is a commonly used, robust measure of determining symmetry. [6]
- Previous studies have suggested that clinicians should consider screening female athletes related injuries are most often single-sided and are partially attributed to lower limb movement and loading asymmetries. [5]
- No study has evaluated the role of unilateral GM strength on interlimb asymmetry for peak HA, HI, KA, and RE during running.

PURPOSE AND HYPOTHESIS

- The purpose of this study was to determine if GM strength has an influence on the interlimb asymmetry calculated using SA during running in female recreational runners.
- We hypothesized that female runners with stronger GM would demonstrate decreased interlimb asymmetry for HA, HI, KA, and RE during running.

SUBJECTS

- Thirty healthy female recreational runners running at least 10 km per week participated in this study. (Table 1)

Table 1

<table>
<thead>
<tr>
<th>Group</th>
<th>Age (years)</th>
<th>Height (m)</th>
<th>Weight (kg)</th>
<th>Miles/Week (km)</th>
<th>Strength (N/m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stronger</td>
<td>32.47±10.13</td>
<td>1.67±0.06</td>
<td>64.68±8.31</td>
<td>21.07±9.64</td>
<td>25.85±2.30</td>
</tr>
<tr>
<td>Weaker</td>
<td>38.33±10.09</td>
<td>1.65±0.06</td>
<td>58.44±4.35</td>
<td>25.54±12.19</td>
<td>16.77±1.45</td>
</tr>
</tbody>
</table>

RESULTS

- Female runners with weaker GM demonstrated significantly increased asymmetry for HA (18.80±24.11 vs 12.20±24.11 %, p=0.02), HI (18.47±24.11 vs 12.53±24.11 %, p=0.03), and KA (18.33±24.11 vs 12.67±24.11 %, p=0.04).
- For RE, the weaker group had greater asymmetry (16.13±24.11 vs 14.87±24.11 %, p=0.35), but the relationship was not significant.

METHODS

- Isometric GM strength was measured using a handheld dynamometer (Lafayette Instrument Co., Lafayette, IN) for the right lower limb (Figure 2A).
- Participants were divided into two groups of stronger and weaker using group mean and standard deviations with 15 participants in each group.
- Retoreactive markers were bilaterally placed on the lower extremity using the modified Cleveland clinic model (Figure 2B).
- Three dimensional (3D) gait analysis was performed during a 30 second treadmill run on an instrumented treadmill (Treadmetrix, Park City, UT) at a speed of 2.98 m/s.
- Kinematic data was collected using a 5-camera motion analysis system (Qualysis, Goteborg, Sweden) at 120 Hz.

ANALYSIS

- Visual 3D software (C-Motion, Bethesda, MD) was used to generate peak HA, HI, KA, and RE for the bilateral lower extremities.
- The SA is the angle formed by the vector of two values (left and right) when plotted in a Cartesian coordinate system where values of the right leg are plotted on the x-axis and values of the left leg on the y-axis. (Figure 3A)
- SA was computed using the peak HA, HI, KA, and RE values from both the limbs. To calculate SA for HA, X_L was the peak HA of the left lower limb and X_R was the peak HA of the right lower limb during that running trial. 
- SAS (Version 9.3 - Copyright © 2014, SAS Institute Inc., Cary, NC) was used for all statistical analysis with an alpha level of 0.05 being considered statistically significant.
- A Shapiro-Wilk test for normality was conducted and it showed that all variables were not normally distributed.
- Wilcoxon Two-Sample Test was performed to look at differences between the two groups for HA, HI, KA, and RE.

REFERENCES