The Effects of Static Versus Dynamic Stretching on Vertical Jump Performance

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**BACKGROUND**

- There has been debate through the years regarding the best method of warming up prior to activity that would not only potentially reduce injury risk but also enhance athletic performance.
- Previous research looks at the effects of warm-up type on range of motion (ROM) but neglect to study the effects on a key biomechanical mechanism called the stretch shortening cycle.¹
- Static warm-up: a slow and constant stretch that is held at the end range of motion for 15 to 30 seconds. Static stretching does not activate the stretch reflex of the muscle due to its slow nature and duration.²
- Dynamic warm-up: a functional based warm-up that may be a better choice for explosive exercise. This type of stretching actively moves a joint through an entire range of motion that would be encountered in whatever event the body is preparing for.³

**PURPOSE/HYPOTHESIS**

**Purpose:** To investigate the effects of warm-up type on measures associated with the vertical jump test (maximum height of the jump, maximum knee flexion angle, the total foot contact time).

**Hypotheses:**
1. Maximum vertical jump height (VJH) (Fig. 2) will have a greater positive change (increase) following the Dynamic warm-up compared to the Static Warm-up and Control.
2. Maximum Knee Flexion angle (Fig. 1) will have a greater negative change (decrease) following the Static and Dynamic warm-ups compared to the Control.
3. Foot Contact time will have a greater negative change (decrease) following the Dynamic warm-up compared to the Static Warm-up and Control.

**METHODS**

**Study Design:**
- Randomized controlled trial
- Independent variable: Group (Control, Static, and Dynamic)
- Dependent variables: Change Score (Post-Pre)

**Participants:** (Table 1)

**Exclusion criteria:** any lower extremity or lumbar spine musculoskeletal injury in the past six months that kept them from participating in physical activity for at least 2-days, any issues effecting balance

**Inclusion criteria:** males or females being at least 18 years and members of the Daemen College community

**Instrumentation:**
- The Vertec (Sports Imports, Columbus, OH)
- Two Apple iPads (2, Apple, Cupertino, CA)
- The Coach’s Eye motion analysis application (TechSmith Corporation, Okemos, MI)

**RESULTS**

**Table 2. VJH (cm) Change Score (Post – Pre). Positive value indicates performance improvement.**

<table>
<thead>
<tr>
<th>Group</th>
<th>Change Score (Δ)</th>
<th>± SD</th>
<th>Group Size (n)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>-0.64</td>
<td>0.89</td>
<td>2</td>
</tr>
<tr>
<td>Static Warm-Up</td>
<td>1.13</td>
<td>1.49</td>
<td>3</td>
</tr>
<tr>
<td>Dynamic Warm-Up</td>
<td>5.09</td>
<td>2.95</td>
<td>3</td>
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</table>

**DISCUSSION/CONCLUSION**

**Hypothesis 1**
- Dynamic Warm-Up yielded a greater positive change in VJH when compared to Static Warm-Up and Control → supporting Hypothesis 1.

**Hypothesis 2**
- Dynamic Warm-Up yielded a greater positive change in Knee Flexion Angle when compared to Static Warm-Up and Control → contradicting Hypothesis 2.

**Hypothesis 3**
- Dynamic Warm-Up yielded a greater negative change in Foot Contact Time when compared to Static Warm-Up and Control → supporting Hypothesis 3.

May be due to several factors:
- Dynamic Warm-Up may enhance movements utilizing the stretch shortening cycle.
- Dynamic Warm-Up may target the elastic component of muscles allowing for greater force production.
- Static Warm-Up may not activate the stretch reflex of muscles, which may hinder the SSC.

Duration of foot contact time (speed) may be more important to vertical jump performance than knee flexion angle (range of motion).

**Limitations:**
- This study was limited by the sample size.
- Also limited by researcher error → measuring knee flexion angle and foot contact time in Coach’s Eye app.

**BIBLIOGRAPHY**


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<table>
<thead>
<tr>
<th>Table 1. Participant demographics, reported as Means ± SD. Demographics include pre-intervention measures on all dependent variables to determine the effectiveness of the randomization procedures.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Group</strong></td>
</tr>
<tr>
<td>-----------</td>
</tr>
<tr>
<td>Control</td>
</tr>
<tr>
<td>Static</td>
</tr>
<tr>
<td>Dynamic</td>
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</tbody>
</table>

**PROCEDURE**

- **Intake Information**
- **Group Assignment**
- **Vertical Jump Instructions**
- **Pre Test Measurements**
- **Perform Intervention Protocol**
- **Group Intervention Instructions**
- **Post Test Measurements**

**Stretching Protocol:** Each stretch performed twice for 20 seconds with 20 seconds rest in between. Stretches were performed on 4 major muscle groups associated with the vertical jump (quadriceps, hamstrings, gastrocnemius, and glutes).

**Static:**
- Quadriceps
- Hamstrings
- Gastrocnemius
- Glutes

**Dynamic:** Performed over a pre-measured distance of 10 yards.

**Control:** The control group sat for 8 minutes (the approximate time to complete either stretching protocol) between pre and post trials.