Compari#n of shorttern strength adaptations in trained and untrained young adults elicited by minimal and overload resistance training intensities

Sandro Dorgo, Ph.D., CSCS, Rebecca J. Reed-Jones, Ph.D., Nicholas G. Murray, M.Sc., Pradeep V. N. Ambati, M.Sc.; The University of Texas at El Paso, El Paso, TX

Abstract

Previous research showed that morphological changes affect muscular strength only after six weeks of training and that short-term strength increases are primarily due to neuromuscular adaptations. It is hypothesized that early strength increases may be elicited through the practice of resistance training movements with minimal overload. Purpose: To compare the short-term strength changes between three groups of untrained young adults training with: (a) overload resistance (OR); (b) minimal resistance (MR); and (c) no active training (Control). Methods: Thirty-nine untrained adults (mean ± SD age: 23 ± 5.6; BMI: 25.4 ± 4.5; 25 males) with no experience in resistance training were assigned to the OR, MR, or Control groups using blocked randomization. The experiment focused on two multi-joint exercises: the bench press and the back squat. Subjects’ strength was assessed by a one-repetition maximum (1RM) test and a PeakForce isometric bench press test. For the bench press test, a fatiguing warm-up and subject usage of optimal effort were required. Subjects completed two training sessions weekly with three sets of ten repetitions of each of the exercises they performed. For the OR group, subjects used resistance weights of 75% of 1RM, while the MR group used weights 5% below their 1RM. Subjects in the control group were instructed to refrain from any training during the experiment. Follow-up tests were administered every two weeks. Strength data were analyzed using a general linear mixed model, and alpha level was set at p < 0.05. Results: There were no initial strength differences between the groups for the 1RM bench press (p > 0.05). A significant main effect of time (p < 0.0001) and a significant main effect of group (p < 0.0001) were observed on the 1RM bench press and 12.1% improvement. A significant main effect of time (p < 0.0001) was observed on the PeakForce isometric bench press test for the OR group (p < 0.0001). The OR group improved 5.4% (p < 0.0001), while the control group showed only minimal (2.4%) and non-significant improvement. A significant group by time interaction (p < 0.0001) was observed suggesting a different improvement pattern across the groups. For the 1RM bench press test, the OR group improved 13.1% (p < 0.0001), while the MR group improved 10.2% (p < 0.0001), and the control group showed only minimal (5.2%) but significant (p < 0.0001) improvement. A significant group by time interaction was not significant (p = 0.2388), suggesting a similar response pattern across the groups. CONCLUSION: According to our results training with overload intensities appears to be superior even in the initial short time-period of neuromuscular adaptation. Further, practicing resistance training movements without any training load appears to provide sufficient strength stimulus to elicit initial strength changes in untrained subjects. It appears that strength improvements in test-specific as improvements in 1RM bench press did not transfer to significant isometric bench press strength improvements. However, the overload resistance group showed a positive trend. PRACTICAL APPLICATION: Practicing proper exercise technique – particularly for multi-joint movements – with minimal or no resistance overloads may provide a safe and effective method of achieving initial strength adaptations in untrained individuals.

INTRODUCTION

• Resistance training induced rapid initial strength gains observed in untrained subjects are mainly due to neuromuscular factors.
• It is theorized that muscular strength improvements may be elicited by simply practicing resistance training movements with minimal resistance and initial gains may be comparable to gains achieved through using an overload.

PURPOSE

• To compare the short-term strength changes between three groups of untrained young adults: a) a group training with overload resistance (OR); b) a group training with minimal resistance (MR); and c) a group with no active training (Control).

METHODS

• Six-week training intervention with pre-test and three follow-up tests.
• 39 untrained young adults were randomly assigned to OR, MR, or Control groups using blocked randomization.
• Two multi-joint exercises performed: Bench Press and Back Squat.
• Subjects in TR group used resistance of approximately 75% of 1RM.
• Subjects in MR group used very low (i.e., < 10% 1RM) resistance.
• Subjects in Control group did not perform any physical activity.

METHODS

• Three sets of ten repetitions were performed for each exercise twice per week for 6 weeks.
• 1RM strength tests were used for both exercises; also force plate data were collected via an isometric bench press test for additional upper body strength assessment.
• Data were analyzed using a general linear mixed model.
• Alpha level was set at p < 0.05.

RESULTS

Table 1. Descriptive characteristics of the subjects.

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Age (years)*</th>
<th>Height (cm)*</th>
<th>Weight (kg)*</th>
<th>BMI (kg/m²)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>OR</td>
<td>13</td>
<td>23.72 ± 4.49</td>
<td>167.45 ± 9.70</td>
<td>67.32 ± 20.00</td>
<td>23.65 ± 4.51</td>
</tr>
<tr>
<td>MR</td>
<td>13</td>
<td>22.92 ± 3.38</td>
<td>167.78 ± 8.99</td>
<td>71.48 ± 20.88</td>
<td>25.16 ± 5.89</td>
</tr>
</tbody>
</table>

Mean (± SD) pre-training subject descriptive characteristics. *p > 0.15 between groups.

CONCLUSION

• Overload intensities appear to be superior even in the initial short time-period of neuromuscular adaptation.
• Modest initial strength improvements may be elicited in untrained subjects by the mere practice of the training movement using minimal training load.
• Strength improvement appears to be test-specific: 1RM bench press improvements did not transfer to isometric bench press strength improvement for any group.

PRACTICAL APPLICATIONS

• During the initial program period practicing proper exercise technique particularly for multi-joint movements – with minimal or no resistance overloads may provide a safe and effective method of achieving initial strength adaptations in untrained individuals.