Effects of Acute Stretching on Resistance Training Performance


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ABSTRACT

Abstract. Marek, Shaun J., Wolfarth, Jon M., Dettinger, Luke J., Kelley, Darin C. Effects of Acute Stretching on Resistance Training Performance. J. Undergrad. Kin. Res. 2005;1(1):9-15. The purpose of this study was to examine the effects of resistance training performance on a 1 RM bench press test using a stretching routine vs. no stretching routine. Ten healthy male students took part in this study. The mean values for age, height, and body mass were 26 yrs, 71.5 in, and 192 lbs. Each subject performed a 5 minute warm-up and 5 upper-body static stretches that were held for 20 seconds each. The subjects also performed a 5 minute warm-up with no static stretching before a 1 RM bench press. All subjects were independent in performing stretching vs. no stretching before the 1 RM bench press test. No significant difference was found (p>0.05) between subjects who stretched (253.0 lbs) before the 1 RM bench press test and subjects who did not perform a stretching routine (252.5 lbs). These results suggest that static stretching before resistance training neither improves nor reduces muscular performance. Therefore, stretching should be used only to maintain or increase flexibility, range of motion, and prevention of injuries.

Key Words. Stretching, Resistance Training, 1 RM, No Stretch, Performance, Warm-Up

Introduction

Flexibility is an important component of physical fitness which is generally performed before physical activity to increase range of motion, flexibility, and prevent injury. There are four main techniques used for stretching the muscles of the body: static, ballistic, PNF and dynamic stretching. Stretching activities are designed to enhance performance, increase R.O.M. and decrease the risk for injury; therefore stretching activities are regularly included in pre-activity warm ups.

The use of stretching programs have been widely accepted and practiced within health, rehabilitation and performance fields. Recent research however, has indicated an adverse affect in near maximal muscle strength and performance with prior static stretching. Research conducted by (8), has indicated that static stretching significantly decreased overall force developed in the quadriceps in the vertical jump (9.4%). The study suggests that static stretching alters the muscle length and muscle-tendon stiffness, which may decrease maximal force production. The opposition to this study was concluded in a study conducted by (10), which found that 30 seconds of static stretching prior to maximal leg extension did not decrease maximal power, but did find that dynamic stretching improved overall leg extension power.
More research has proven that static stretching inhibits force production. Evetovich and Nauman (2003) tested maximal isokinetic forearm flexion strength with the non-dominant arm on two occasions, one with static stretching and one without static stretching. The results show a decrease in torque producing capabilities with a pre-event static stretching. The reasons attributed to this cause were less musculotendinous stiffness and reduced ability to recruit motor units.

Current research leads us to believe that static stretching prior to near maximal strength activities decreases performance. Currently, stretching programs are widely used in performance programs to prevent injury and improve performance. With studies showing that static stretching decreases maximal strength performances, coaches and athletes may want to weigh the options between injury prevention and overall performance to decide whether to stretch or not stretch prior to strength activities.

Our team of researchers will further research this topic of maximal performance based upon a stretch or no stretch routine. The purpose of this study is to determine if static stretching increases or decreases maximal strength performance during a one repetition max bench press. It is hypothesized that static stretching will decrease maximal strength performance during a one repetition max bench press test.

Methods
In order to determine validity of our hypotheses that static stretching for 20 seconds before strength activities reduces muscular performance, we examined the effects of both stretching and nonstretching routines on muscular performance using upper body strength as an index of muscular performance. Upper body strength is similar to the strength produced while pushing an object such as when blocking in football. Yamaguchi et al and Schilling et al reported that static stretching neither improves nor reduces muscle performance. However, based on our hypotheses, upper body strength with 20 seconds of static stretching will be reduced.

Prior to the experiments, the 4 primary investigators visited the lab to receive instruction and for a preliminary trial to measure upper body strength. Subjects then performed static stretching and nonstretching in a randomized order on separate days, and upper body strength was measured after each of these trials. The target muscles for static stretching were 5 muscle groups in the upper body: Shoulder (deltoids), Arms (triceps, biceps), Chest (pectoral), Back (rhomboid, latisimus dorsi).

Subjects
Ten male college students took part in this study. The mean variables of the subjects in this study had a height of 71.5 inches, weight of 192 pounds, and age of 26. All subjects were free of injury. The subjects were moderately active and had a training history including weight training and aerobic activity. However, the subjects were not performing stretching and weight training when this study began. All subjects were informed of the methods to be utilized as well as the risks and purposes of this study.
Finally, informed consent was obtained from all subjects prior to beginning this study and it was approved by the University IRB.

**INSTRUMENTS**

Upper body strength was measured by a 1RM bench press testing protocol using a Magnum System Bench Press. Each subject was instructed on the 5 point bench press technique: head, back and hips must be in contact with the bench pad at all times and both feet must be touching the ground at all times through out the repetition. At least 1 spotter was used during testing for safety. Subjects were instructed to warm-up for 5 minutes at 3 mph and 0% grade using a Star Trac Pro S treadmill.

The subjects were instructed to warm-up on the bench press with a light resistance that easily allows 5 to 10 repetitions with a 1 minute rest period after exercise. An estimated warm-up load that will allow the subject to complete 3 to 5 repetitions, was used by adding: 10 to 20 lb or 5 to 10 percent more weight being placed on the bench press bar with a 2 minute rest period after exercise. A conservative estimate of near max load that will allow the subject to complete 2 to 3 repetitions, was used by adding: 10 to 20 lb or 5 to 10 percent more weight on the bench press bar with a 2 to 4 minute rest period after exercise. A load increase of 10 to 20 lb or 5 to 10 percent more weight being placed on the bench press bar and instructed the subject to attempt a 1 RM. If the subject was successful, a rest period of 2 to 4 minutes was taken and a load increase of 10 to 20 lb or 5 to 10 percent more weight being placed on the bench press bar, instructing the subject to attempt another 1RM. This procedure was done until failure. When the subject failed to complete a 1RM, a rest period of 2 to 4 minutes was taken and a decrease in load was subtracted by: 5 to 10 lb or 2.5 to 5 percent less weight taken from the bench press bar. The subject was instructed to attempt a 1RM and this process was done until the subject completed a repetition and was recorded as the subjects 1RM.

**PROCEDURES**

The experimenter took the subjects through a static stretching routine. The target muscle was held for 20 seconds by the subject. There was no rest in between stretches. The target muscles for static stretching were 5 muscle groups in the upper body. First the Shoulder (deltoids) muscle group was held for 20 seconds; right then left. Second, the Arm (triceps, biceps) muscle group was held for 20 seconds right then left. Third, the Chest (pectoral) muscle group was held for 20 seconds. Finally, the Back (rhomboid, latisimus dorsi) muscle group was held for 20 seconds. The procedures for the static stretching routine are shown in Table 1. For non-stretching, each subject went through their warm-up and went directly into the 1RM testing protocol.

**STATISTICAL ANALYSES**

A paired t-test was used to examine the differences between the stretching conditions and the non-stretching conditions. Relationships between the upper body strength after stretching or non-stretching were examined by Pearson’s correlation coefficient test. All values were expressed as means and standard errors, and the significance level was: p less than or equal to 0.05.
Results
There was no significant difference \( (p > 0.05) \) in Bench press 1-RM between the stretch group (253.0 lbs) and non-stretch group (252.5 lbs), \( t(9) = 0.287, p = 0.78 \).

<table>
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<th>Subjects</th>
<th>Stretch</th>
<th>No Stretch</th>
<th>Age</th>
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<th>Weight (lbs)</th>
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</table>

Table 1: Stretch & No-Stretch Results

Discussion
The results of the study did not support our hypothesis that static stretching will decrease in maximal strength performance. The results show that there is no significant difference in the 1-RM bench press for a pre-workout stretch routine and a no stretch routine. Previous literature (3,4,6,8) has reported that strength decreases with static stretching in
near maximal and maximal performances. Reasons stated for this phenomenon have been largely attributed to two factors: i) alter muscle length and muscle tendon stiffness & ii) reduced ability to recruit motor units.

Our research team concluded that there was no significant difference between the stretch and no-stretch routines which is inconsistent with the findings of previous research (3,4,6,8). Our results show that individuals vary in their performance by performing a stretch or a no-stretch routine. Neither pre-determined routine was found to have a significant difference (stretch m = 253.0, no-stretch m = 252.5) (p > .05) on the participants overall strength performance as a group. Rather, each participant’s maximal performance varied independently. Therefore, the findings suggest that individual differences (physiologically) determine whether a static stretch or no static stretch should be conducted before a maximal strength exercise for optimal performance.

Possible limitations due to physiological, psychological, and environmental factors may have affected the results of the study. Limitations may have included muscle soreness, fatigue, nutrition deficiencies, dehydration, stress, anxiety, motivation, and the presence of other individuals. These limiting factors may be due to inconsistency in administering the test and/or subjects adhering to the guidelines.

In conclusion, our team of researchers believes that no significant benefits in strength performances are gained by a pre-stretch routine. However, we deem it important to perform a stretching routine on a regular basis to reduce the risk of injury and to increase flexibility.
Figure 2. Abdominal stretch

Figure 3. Back Stretch

Figure 4. Shoulder Stretch

Figure 5. Chest/Biceps Stretch

Figure 6. Triceps Stretch
References