

# Effects of Elastic Bands on Force and Power Characteristics During the Back Squat Exercise

Brian J. Wallace, Jason B. Winchester, and Michael R. McGuigan.

Department of Exercise and Sport Science, University of Wisconsin-La Crosse, La Crosse, WI

## Abstract

Strength athletes commonly use elastic bands as a training method to increase performance. The purpose of this study was to investigate the effect of elastic bands on force, power, and rate of force development (RFD) during the back squat exercise. Ten recreationally resistance trained subjects (4 women, 6 men, mean age 21.3 yrs.  $\pm$  1.49) were tested for 1RM squat weight (mean 117.64  $\pm$  48.17 kg) on a Smith Machine. Subjects were tested on two separate days, with two sets of three repetitions being performed for each condition. Testing was conducted at 60% and 85% of 1RM with and without using elastic bands (BNS Bungee Band system, Power-Up USA, Inc, Milwaukee, WI). In addition, two elastic band loading conditions were tested (B1 and B2) at each of the two resistances. B1 represents where 20% of the total resistance was acquired from bands, and B2 represents where 35% was acquired from bands. The subjects completed the back squat under each condition, while force, power and RFD was recorded using a force platform (Quattro Pro, Kistler). There was a significant increase in peak force between NB-85 and B2-85 of 16% ( $P < 0.05$ ). There was also a significant difference of 5% between B1-85 and B2-85. There was a significant increase in peak power between NB-85 and B1-85 of 24%. No significant differences were observed in RFD during the 85% conditions, or for any of the variables during the 60% conditions. The results suggest that the use of elastic bands can significantly increase peak power and force output during the back squat. However, the greatest differences are observed during the higher loading conditions. These results indicate that higher degrees of force and power can be generated without the use of additional resistance. Further research is required to determine the long-term efficacy of this training technique.

## Introduction

Elastic bands have become a mainstay in many strength athletes' training routines over the past several years. Although there is anecdotal evidence to support the claim that elastic band resistance used in conjunction with barbell resistance can help improve strength over barbell resistance alone, few studies have been done to support this claim. Moreover, no studies have compared objective performance characteristics while using and not using elastic bands at different resistances. The purpose of this study was to investigate the effect of elastic bands on peak force, power, and rate of force development (RFD) during the back squat exercise.

## Methods

**Subjects.** This study was comprised of ten college-aged (4 women, 6 men, mean age 21.3 yrs.  $\pm$  1.49) recreationally resistance trained (>6 months) subjects (Table 1). All participants signed an informed consent form before participating in the study. The subject's height and weight were recorded prior to participation. Their weight was measured electronically using a force platform (Quattro Pro, Kistler).

**Training.** This study consisted of three training sessions per subject, with at least 48 hours between sessions. The first session was used to determine 1RM and familiarize the subjects with the elastic bands. Subjects performed two sets of three repetitions at each of the six conditions, and were instructed to exert as much force as possible against the bar for each condition (Behm and Sale, 1993). Testing was conducted on day two at 60% of 1RM, and on day three at 85% of 1RM with and without using elastic bands (BNS Bungee Band system, Power-Up USA, Inc, Milwaukee, WI). One free-weight, and two combination free-weight and elastic band loading conditions were tested (NB, and B1 and B2 respectively) at each of the two RM resistances. B1 represents where 20% of the total resistance was acquired from bands, and B2 represents where 35% was acquired from bands. Force, power, and RFD were recorded using the force platform.

## Results

TABLE 2: Mean ( $\pm$  Standard Deviation) Values for Objective Outcome Variables

Measure	Peak Power (W/kg)	Peak Force (N)	Peak RFD (N/s)
NB-60	1490.4(1049.6)	2168.4(713.0)	28690(2823)
B1-60	1414.8(1114.7)	2050.2(890.6)	29250(2264)
B2-60	1609.0(1361.0)	2073.1(859.8)	34010(2819)
NB-85	2297.4(1644.4)	2249.3(810.1)	30970(2165)
B1-85	2847.5(1910.8)	2494.7(814.9)	31920(2377)
B2-85	2484.9(2088.5)	2613.6(857.2)	35190(2743)

TABLE 1: Subject characteristics; Mean ( $\pm$  Standard Deviation)

	n	Ht (cm)	Mass (kg)	Age (yrs.)	Squat 1RM (kg)
Men	6	155(6)	94.8(18.8)	21.6(1.8)	146.6(37.3)
Women	4	149(6)	70.1(8.5)	20.8(0.9)	74.2(21.1)
<b>Total</b>	<b>10</b>	<b>153(6)</b>	<b>84.9(19.6)</b>	<b>21.3(1.5)</b>	<b>117.6(48.2)</b>

The data analysis (Table 2) showed that there was no significant ( $p < 0.05$ ) difference in peak force or power in any of the 60% conditions. Peak RFD was increased between NB-60 and B2-60, and NB-85 and B2-85, but neither increase was statistically significant.

There were significant differences between the 85% conditions in peak force and power. Peak force was increased by 16% between the NB-85 and B2-85 conditions. There was also a significant difference of 5% between B1-85 and B2-85. Peak power was increased by a statistically significant 24% between NB-85 and B1-85. Between B1-85 and B2-85 there was a decline of 13% in peak power.

## Discussion

The major finding of this study is that elastic bands in conjunction with free-weight resistance had a positive effect on strength performance characteristics, specifically peak force and peak power. It appears that a load at or near 85% of 1RM is preferable to bring about these changes. It also appears that elastic bands are best utilized when at or near 20% of the overall resistance is from them, since force was only slightly increased, and power decreased when bands were used as 35% of the overall resistance. These findings support the claim that using bands at less than 20% of the overall resistance is ineffective (Ebben and Randall, 2003); although they do not support using them as a high percentage of overall resistance, which is a technique often used by strength athletes. These findings support the claim that using elastic bands in conjunction with free-weight resistance may improve strength and power.

## Summary

- > The results of this study suggest that peak force and peak power are increased when elastic bands are used in conjunction with free-weight resistance in the back squat.
- > It appears that the B1-85 condition (85% 1RM, 20% overall resistance from bands) is optimal for force and power increases.
- > This study showed that when elastic bands are used properly as part of the overall training protocol, strength and power may be increased.

For further information contact:

Brian Wallace  
Undergraduate Student  
University of Wisconsin-La Crosse  
[wallace\\_bj2@students.uwlax.edu](mailto:wallace_bj2@students.uwlax.edu)  
[wallyuwl@yahoo.com](mailto:wallyuwl@yahoo.com)