

# COMPARISON OF POTENTIATION POST-ACTIVATION RESPONSES IN TWO DOMINANT HIP STRENGTH EXERCISES

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## Abstract

Positive potentiation post-activation (PAP) responses in broad jump (BJ) has been reported in rugby players after box squat alternated with standing broad jumps (Seitz et al., 2016). However, use of back squat did not generate PAP in vertical jump in comparison to hex-bar deadlift (DL) (Scott et al., 2017). Therefore, it is important to evaluate which movement derived from resistance exercise is more similar to BJ and possibly would generate a specific PAP response. The aim of this study was to evaluate the effect of an anterior-posterior movement (hip thrust [HT]) on PAP levels by BJ, in comparison to an axial-component exercise (DL). Fifteen resistance-trained rugby players participated in this study (age, 22.7 ± 1.6; body weight, 89.9 ± 10.6; height, 181.8 ± 6.5; BMI, 27.2 ± 2.3; 1RM DL 1RM, 117 ± 20.6; 1RM HT, 133.3 ± 21.5. Subjects attended four sessions to the laboratory with seven days between each session. Anthropometric measurements and one-repetition maximum (1-RM) estimations for HT and DL (grip width 72 cm) were performed in the first and third sessions, while PAP tests for both exercise protocols were performed during the second and fourth sessions (subjects performed two repetitions at 90% 1-RM with 8 minutes of recovery between HT and DL exercises, and then the BJ was performed). Data were analyzed by a general lineal model (GLM) with repeated measures and a delta analysis ( $\Delta = \text{post} - \text{pre}$ ) was performed to determine the 95% confidence interval (95% CI) for the mean. The GLM showed both significant difference and large effect size on BJ per Time [pre vs. post] ( $P > 0.001$ ;  $\eta^2 = 0.990$ ), but no differences on Time x Protocol interaction ( $P = 0.452$ ;  $\eta^2 = 0.020$ ) or per Group (0.748;  $\eta^2 = 0.004$ ) were found. There were significant changes [ $X \pm SD$ , CI 95%] on BJ after HT (5.2 ± 5.6, 2.1–8.3;  $P = 0.03$ ) and DL (6.9 ± 5.3, 4.0–9.9;  $P < 0.001$ ); however, no difference was found between the exercise protocols ( $P = 0.748$ ). Our results suggest that DL and HT provided with large effects on PAP to improve the BJ outcomes, but there was no difference between these exercises.

**KEYWORDS:** Impulse, Conditioning Activity, Warm-Up Exercise, Muscle Power, Strength Training

## Rationale

Few studies have focused on the BJ test to express PAP in the past; therefore, the aim of this study was to compare the effects of performing a PAP protocol on the BJ test using exercises with axial-emphasis force vector predominance such as the DL compared to an anteroposterior-emphasis force vector exercise such as the HT. The initial hypothesis is that when the anteroposterior component predominates over the axial one, the HT exercise that presents more similarities will obtain more significant PAP effects on the BJ than an exercise with axial force vector predominance such as the DL.

## Experimental Design

- Subjects were informed as to the experimental procedures and signed informed consent statements in adherence with human subject guidelines of approved by the Research Ethics Committee of the University of Málaga (code: 38-2019-H).
- 15 healthy man, rugby players, with more than two years of continuous experience in overload training participated in this study.
- This study examined the effects of PAP on horizontal jump using the Deadlift (DL) and Hip Thrust (HT).
- To determine the effects, participants conducted four experimental sessions, with seven days between each visit to the laboratory.
- In the first and third sessions, the anthropometric measurements of all of the participants were evaluated.
- The measurement of the one-repetition maximum (1RM) in the DL or the HT was carried out randomly, with one exercise per session.
- In the second and fourth sessions, the PAP test was performed with a previous DL or HT exercise.

## Methods & Procedures

### Subjects and intervention

- All of the measurements were performed on an elevated platform with an Olympic barbell and competition discs of different weights (Taurus, Buenos Aires).
- A 72 cm barbell grip was used in the DL both in the 1RM evaluation and in the PAP session.
- The technical aspects in the execution of the DL followed those in Andersen et al., (2018), indicating that the movement is carried out with the weight on the platform, considering the end when the hip was extended over 180 degrees (trunk-thigh angle).
- In the HT, participants began the movement lying, resting their backs on a bench with a 49 cm height (Professional Gym, Buenos Aires).
- Three consecutive BJ with a 20-seconds rest period between them were performed, recording the scores obtained once the strength protocol was concluded.
- Participants were instructed to land with both feet, and trying to maintain the position, staying upright to facilitate measurements. The nearest mark to the starting line, coinciding with the heels, was measured in cm with a Class I (0.1 mm of accuracy) measuring tape (Tornado Tools, China).
- After a five-minute rest the second set of measurements was carried out, by means of two repetitions at 90% 1RM of the corresponding exercise. For this, an expert in resistance training supervised the exercise technique throughout the full, and another expert performed relevant annotations. movement
- An eight-minute pause was established and three BJ's were carried out to verify if the PAP effect was displayed.

## Statistical Analysis

Results were expressed as mean and standard deviation. The comparison between the intragroup results was performed with the Wilcoxon signed-rank test, and the effect size was calculated with the Cohen's d test. Data were processed in the SPSS Program version 25 (Chicago, IL), and the graph for paired mean comparison analysis was performed through the Stats Beta estimation application. ([www.estimationstats.com](http://www.estimationstats.com)). The normality and homogeneity of the data were contrasted with the Shapiro Wilk and Levene test, respectively. The level of significance assumed for all tests was 0.05.

## Results

According to the data analysis, a significant difference was found in the BJ in both protocols, DL ( $p = 0.001$ ) and HT ( $p = 0.05$ ), with a small effect size observed in DL ( $d = 0.3$ ), being slightly higher than the effect size observed in HT ( $d = 0.2$ ); however, the repeated measures analysis of variance (ANOVA) showed that there were no significant differences between protocols ( $p = 0.665$ ) or the Time x Protocol interaction ( $p = 0.394$ )

Considering the  $\Delta$  analysis, BJ increased  $6.9 \pm 5.3$  (4.0 - 9.9) % after the DL and  $5.2 \pm 5.6$  (2.1 - 8.3) % after the HT protocol, also reflecting a significant change.

## Conclusions

- Our descriptive analysis of the PAP effects on the BJ outcome using the DL or the HT exercise shows that performing those exercises with a high load, eight minutes before, increases subsequent BJ performance in a similar magnitude. Thus, strength coaches and practitioners may select both exercises for inducing PAP indistinctly, according to their personal preferences or specific sport skill similarities.

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