Post-Activation Potentiation

Honors Thesis

Brya D'Abrosca
Spring 2018

Introduction

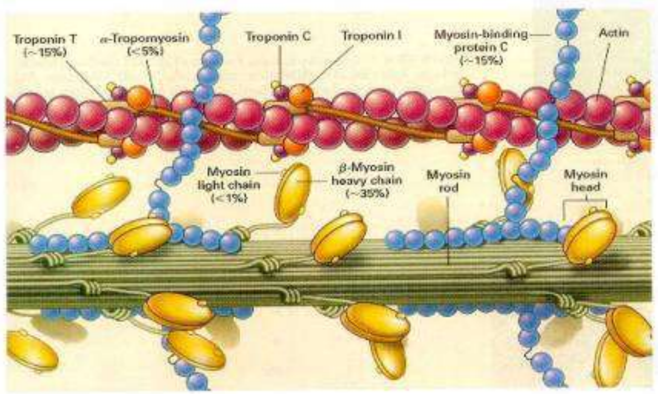
What is it?

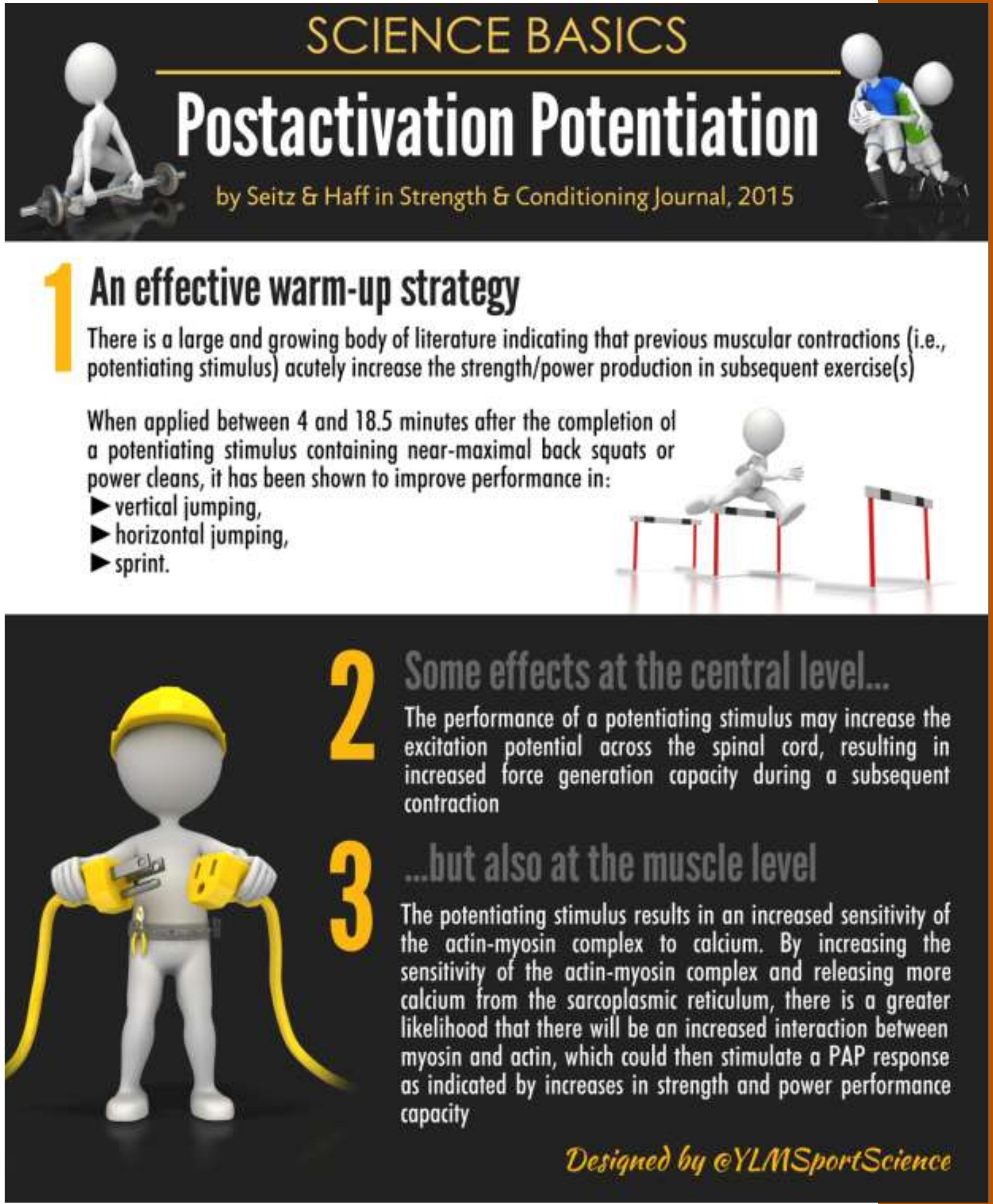
- Post-Activation Potentiation
  - **Post** following *complex training*
  - **Activation** voluntary contraction of muscle
  - **Potentiation** increase in strength of nerve impulses along pathways that have been used previously, either short-term or long-term
- A phenomenon that can cause short term gains in **POWER** after *heavy muscle preloading*
- **Complex training** is a set-for-set combination of heavy resistance exercise (preload) & a biomechanically similar plyometric exercise

Where does it work?

1. **Central**
   - Spinal cord
   - Increase excitation potential

2. **Peripheral**
   - Muscle
   - Increase sensitivity actin-myosin complex to calcium





How does it work?

- Depends on the balance between **FATIGUE** and **POTENTIATION**

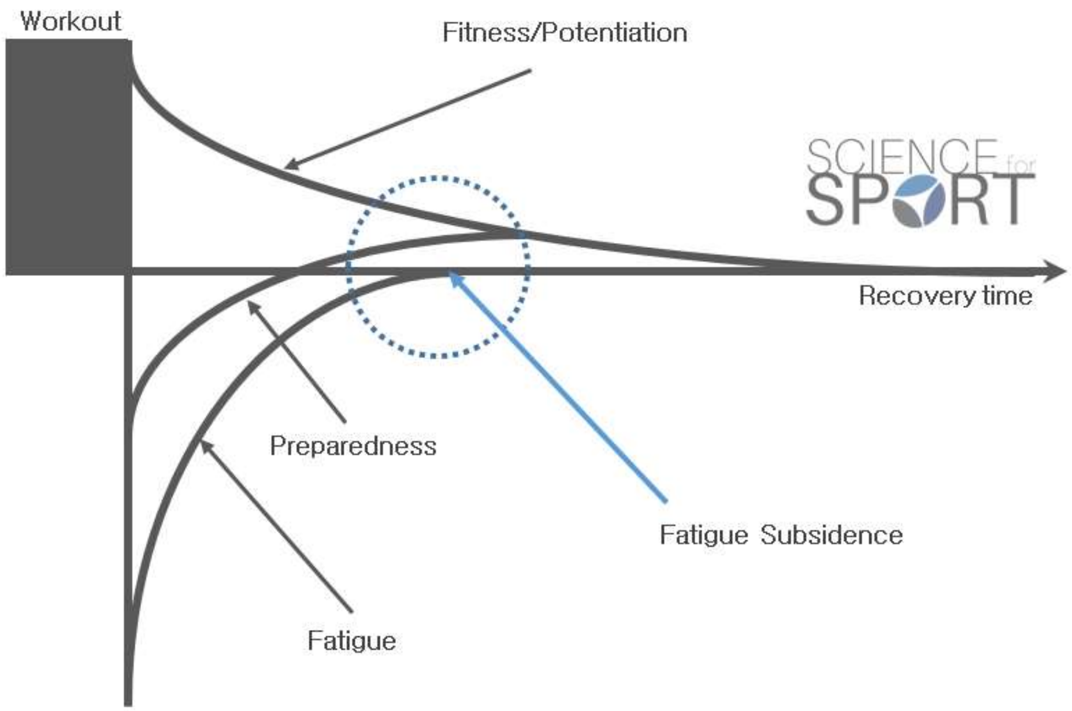
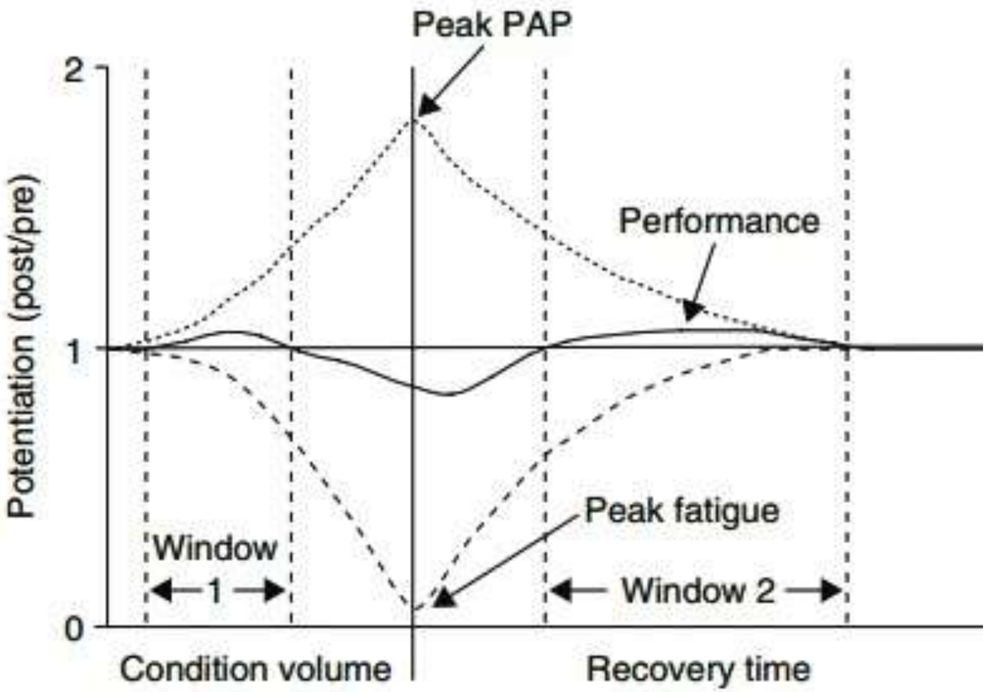
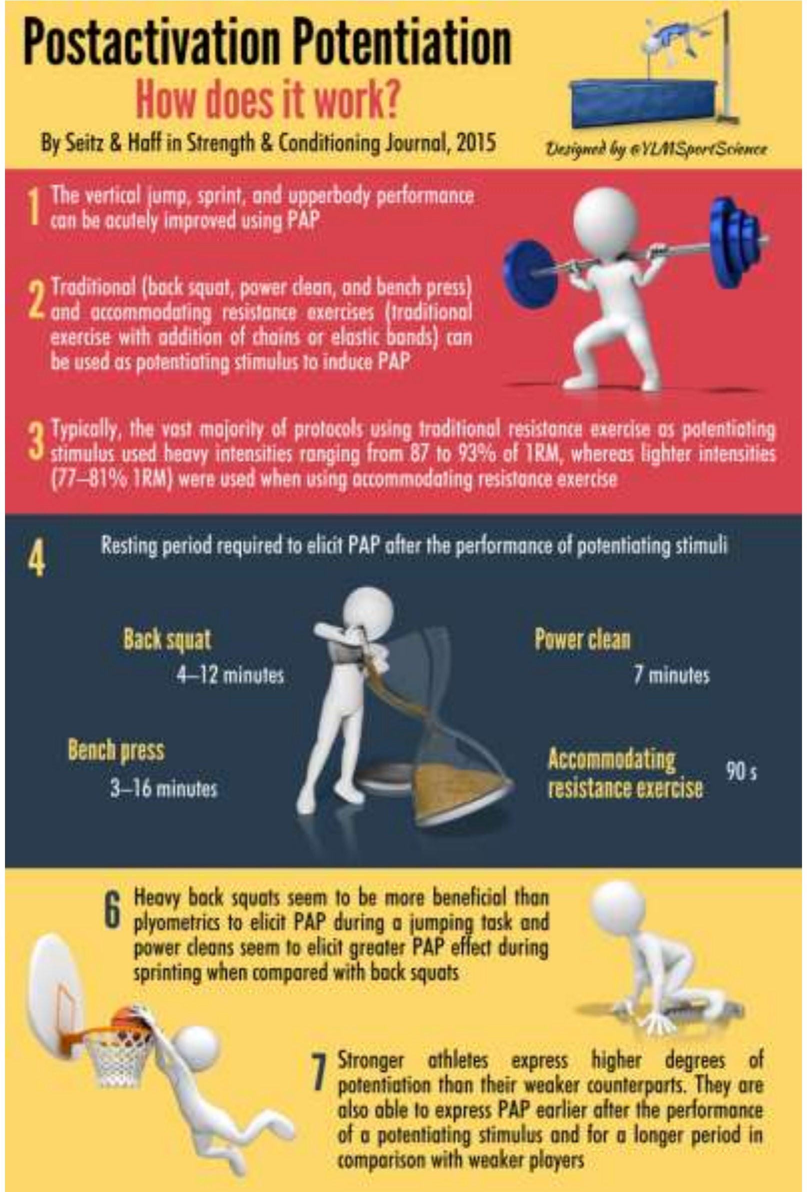


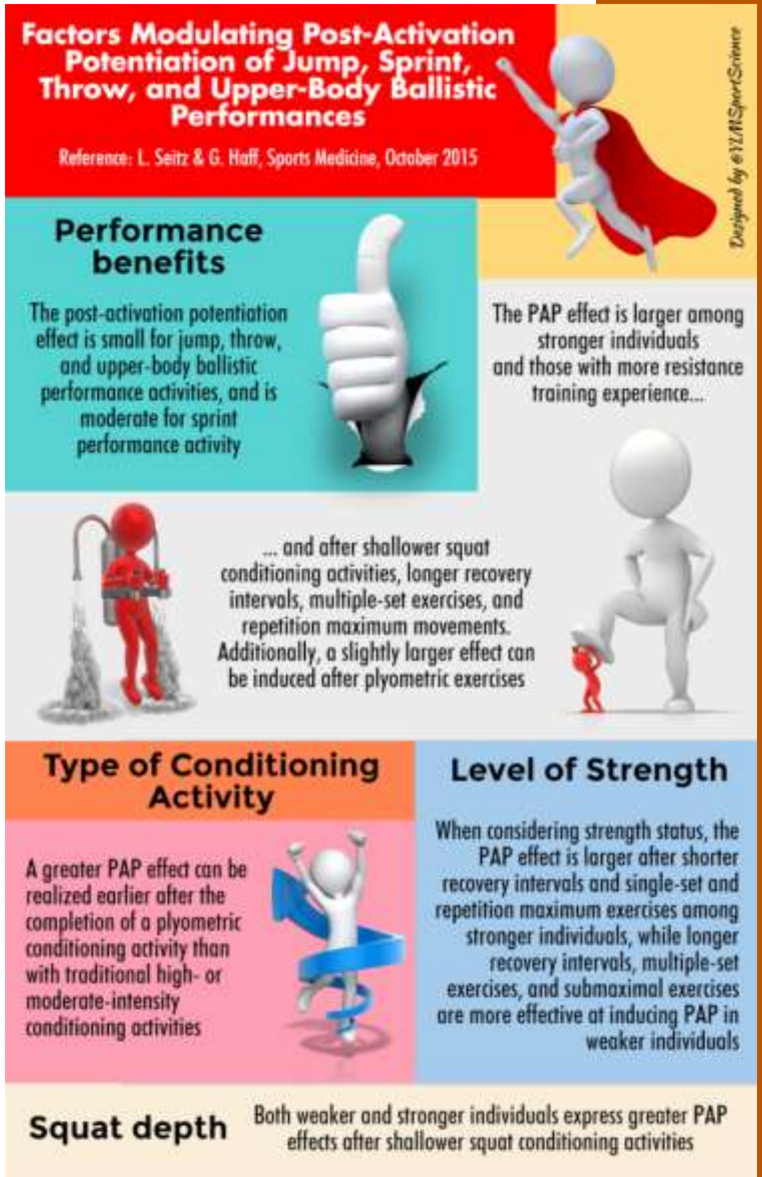
Figure 1. Fitness-Fatigue Model (Potentiation vs. Fatigue)



What does research say?

- This balance is affected by:
  - Training status
  - Volume
  - Conditioning activity
  - Rest period length
  - Intensity of conditioning activity
  - Gender





Previous Research

Acute Effects of Heavy-Load Squats on Consequent Squat Jump Performance

Kurt R. Weber, Lee E. Brown, Jared W. Coburn, & Steven M. Zinder

Human Performance Laboratory, California State University, Fullerton California

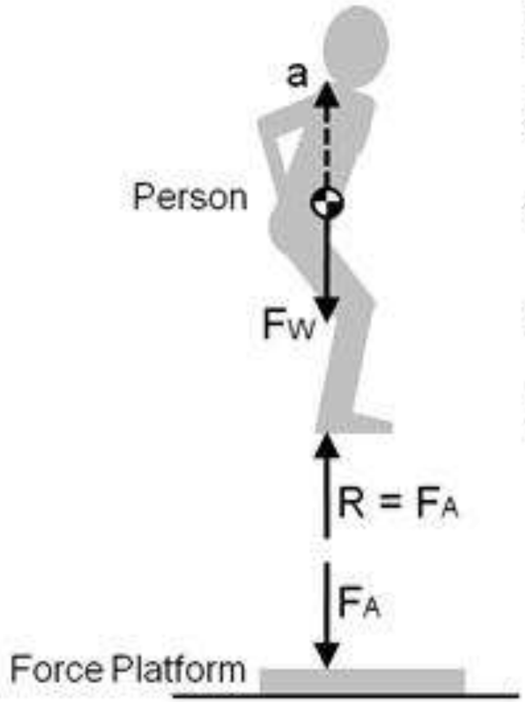
Abstract

Postactivation potentiation (PAP) and complex training have generated interest within the strength and conditioning community in recent years, but much of the research to date has produced confounding results. The purpose of this study was to observe the acute effects of a heavy-load back squat [85% 1 repetition maximum (1RM)] condition on consecutive squat jump performance. Twelve in-season Division I male track-and-field athletes participated in two randomized testing conditions: a five-repetition back squat at 85% 1RM (BS) and a five-repetition squat jump (SJ). The BS condition consisted of seven consecutive squat jumps (BS-PRE), followed by five repetitions of the BS at 85% 1RM, followed by another set of seven consecutive squat jumps (BS-POST). The SJ condition was exactly the same as the BS condition except that five consecutive SJs replaced the five BSs, with 3 minutes' rest between each set. BS-PRE, BS-POST, SJ-PRE, and SJ-POST were analyzed and compared for mean and peak jump height, as well as mean and peak ground reaction force (GRF). The BS condition's mean and peak jump height and peak GRF increased 5.8% ± 4.8%, 4.7% ± 4.8%, and 4.6% ± 7.4%, respectively, whereas the SJ condition's mean and peak jump height and peak GRF decreased 2.7% ± 5.0%, 4.0% ± 4.9%, and 1.3% ± 7.5%, respectively. The results indicate that performing a heavy-load back squat before a set of consecutive SJs may enhance acute performance in average and peak jump height, as well as peak GRF.

Key Words complex training, postactivation potentiation, plyometric training

Methods

- **Experimental Design**
  - One group
  - Pre- & post- test measurements
- **Dependent Variables:**
  - Vertical Jump Height (JH)
  - Ground Reaction Force (GRF)



$$\Sigma F = ma$$

$$\Sigma F = R - F_W$$

$$ma = R - F_W$$

$$a = \frac{R - F_W}{m}$$

Where:

F_W = Weight of the person

F_A = Force applied by person to platform

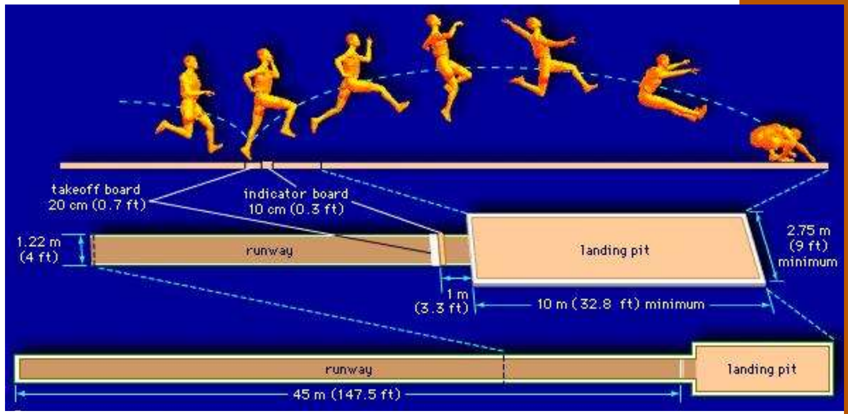
R = Ground reaction force

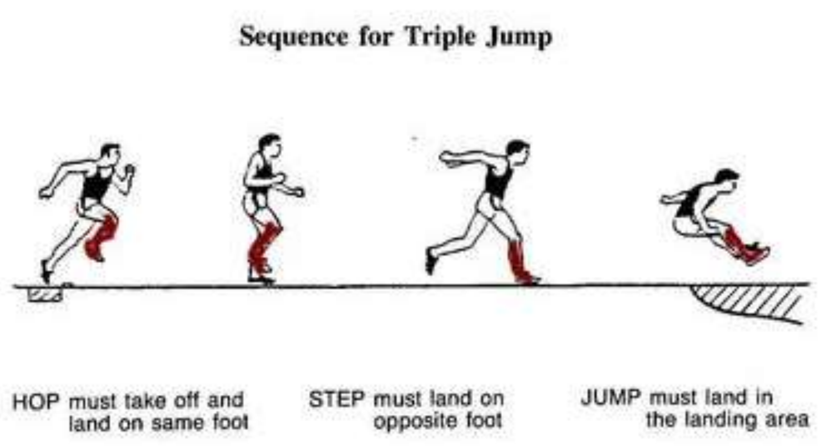
m = Mass of the person

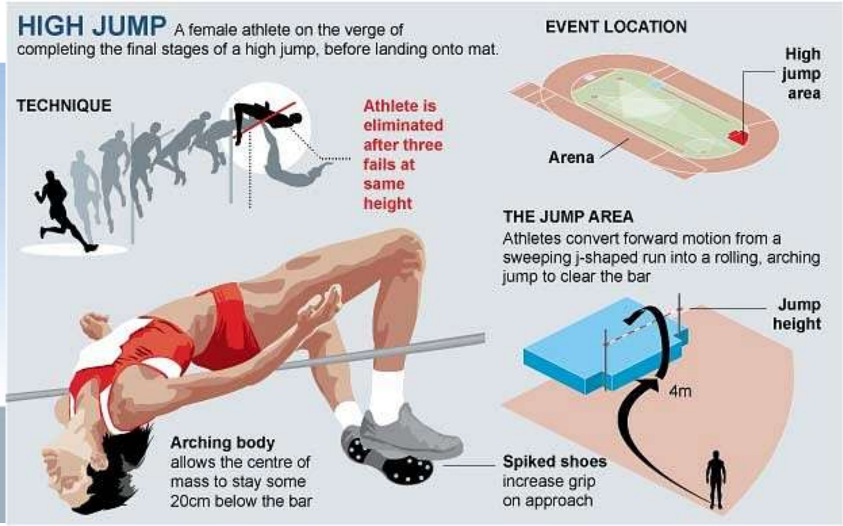
a = Acceleration of the person's COM

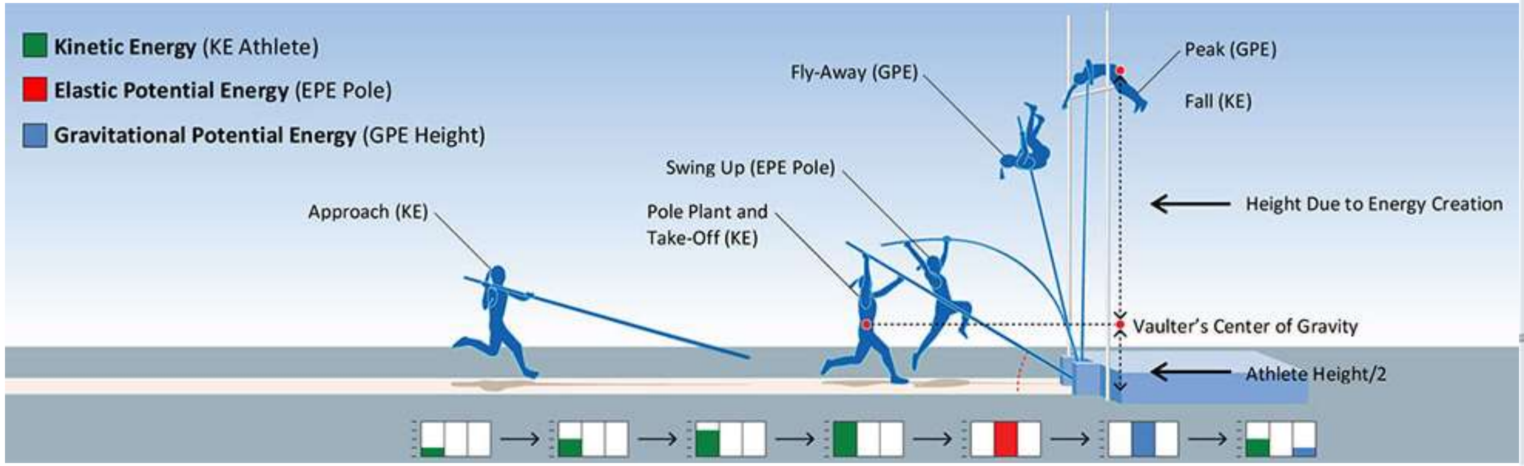
Methods

- **Subjects**
  - 12 male in-season NCAA DI track and field athletes
    - **Age** 20.3 ± 1.7 yr
    - **Height** 180.1 ± 8.8 cm
    - **Weight** 72.9 ± 8.1 kg
  - 100/200/400 m, long/triple/high jump, pole vault
  - Anaerobic nature of complex training
  - ≥ one year experience with S&C training program









Procedure

1 Week Before Testing

- 1RM back squat familiarization
- 5RM estimated (85% 1RM)

Two Randomized Testing Conditions:

Warm Up

5 min cycle ergometer → 10 repetitions of back squat (50% of estimated 5RM)

5 Rep Back Squat (BS)

- 7 squat jumps (pre)
  - 5RM back squat
    - 7 squat jumps (post)

5 Rep Squat Jump (SJ)

- 7 squat jumps (pre)
  - 5 squat jumps
    - 7 squat jumps (post)

Statistical Analyses

- 4 separate 2x2 (condition x time) repeated-measures ANOVAs
- Significance pre- to post-test differences in:
  - Peak JH
  - Mean JH
  - Peak GFR
  - Mean GFR
- One-way ANOVAs for interactions

Results

- **JUMP HEIGHT**
  - 2x2 (condition X time) RM ANOVA
  - Significant interaction BS & SJ

- **Back Squat**
  - Peak & Mean JH
    - Increase

- **Squat Jump**
  - Peak & Mean JH
    - Decrease

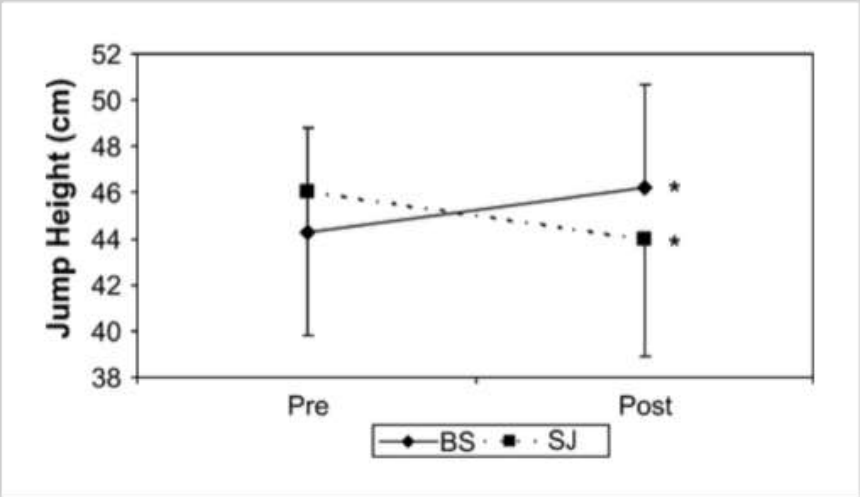


Figure 1. Comparison of peak jump height (cm) between back squat (BS) and squat jump (SJ) conditions. *Significantly different than pretest ($P < 0.05$).

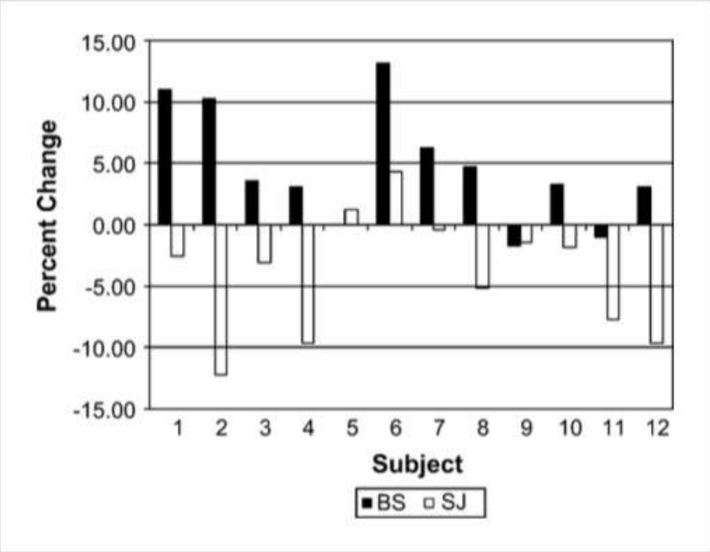


Figure 3. Intersubject percent change in peak jump height between pre and post conditions.

Results

- GROUND REACTION FORCE
  - 2x2 (condition X time) RM ANOVA
  - Significant interaction BS & SJ

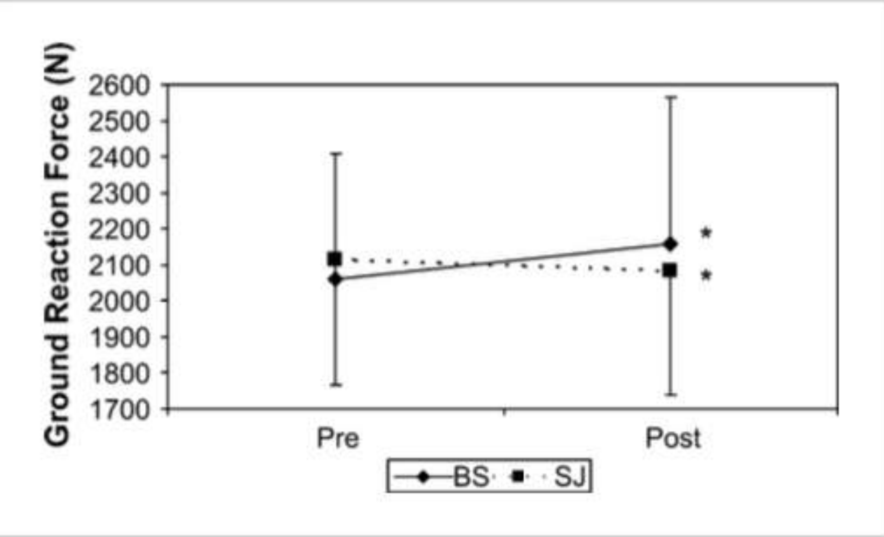


Figure 2. Comparison of peak ground reaction force (N) between back squat (BS) and squat jump (SJ) conditions. *Significantly different than pretest ($P < 0.05$).

- **Back Squat**
  - Mean & Peak GRF
    - Increase

- **Squat Jump**
  - Peak GRF
    - No change
  - Mean GRF
    - Increased

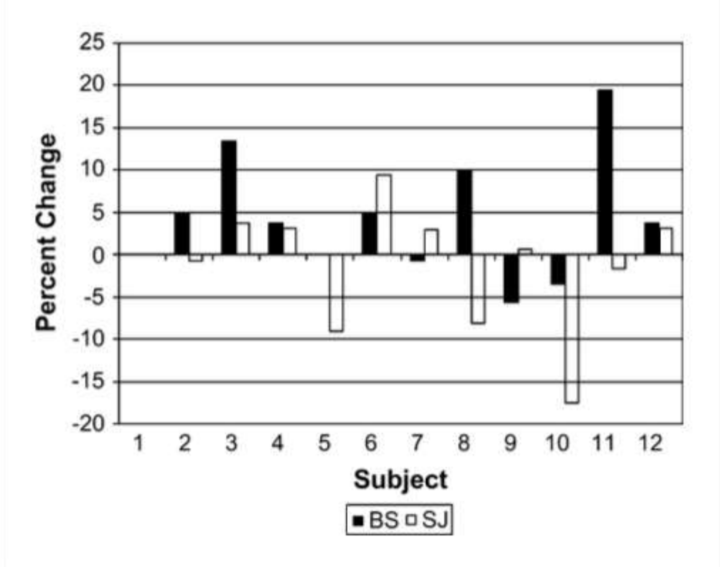


Figure 4. Intersubject percent change in peak ground reaction force between pre and post conditions.

Discussion

BACK SQUAT

- **IMPROVED** all D.V.
- Why? **OPTIMAL** conditions for PAP
- Sprinters/jumpers → **FAST-TWITCH FIBERS** (type II a/x)
- Anaerobic training adaptations
- **ENHANCED NEURAL ACTIVATION** (Docherty et al., 2005)
    - Increase motor unit stimulation/recruitment
    - Enhanced motor unit synchronization
    - Decreased presynaptic inhibition
- Results in greater **CROSS-BRIDGE** attachments → generate **MORE FORCE**

Discussion

SQUAT JUMP

- **DECREASED** performance in all D.V. but one
  - Mean GRF
- **NO RECOVERY** set to set
  - 3 min rest between sets not enough?
- **FATIGUE** existed in both conditions
  - 5RM in BS created enough potentiation to **override** the fatigue response observed in SJ

Practical Applications

- Performing heavy-load back squat may enhance acute potentiation of muscular power (JH & GRF) in the lower extremities
- Template for **complex training** for S&C programs
- May be an effective type of protocol for **chronic adaptations**
- **Participants, modes, intensities, volumes, and rest intervals** should be chosen with greatest amount of practical use in mind

Limitations & Future Research

- **Little correlation between GRF and JH**
  - As GRF increased, JH decreased (in SJ condition)
    - Explore relationship and reliability of GRF as it applies to vertical jumps
- **Rest interval did not allow recovery between SJ sets**
    - Compare rest interval lengths on consecutive maximal plyometric exercises
- **Investigate same complex pair of exercises over multiple sets**

Postactivation Potentiation Response in Athletic and Recreationally Trained Individuals

Loren Z.F. Chiu[1], Andrew C. Fry[2], Lawrence W. Weiss[2], Brian K. Schilling[2], Lee E. Brown[3], And Stacey L. Smith[2]

[1]Department of Biokinesiology and Physical Therapy, University of Southern California, Los Angeles, California, [2]Musculoskeletal Dynamics Laboratory, The University of Memphis, Memphis, Tennessee, [3]Kinesiology & Health Promotion, California State University, Fullerton, California

ABSTRACT

To determine if training status directly impacted the response to postactivation potentiation, athletes in sports requiring explosive strength (ATH; n = 7) were compared to recreationally trained (RT; n = 17) individuals. Over the course of 4 sessions, subjects performed rebound and concentric-only jump squats with 30%, 50%, and 70% 1 RM loads. Jump squats were performed 5 minutes and 18.5 minutes following control or heavy load warm-ups. Heavy load warm-up consisted of 5 sets of 1 repetition at 90% 1 RM back squat. Jump squat performance was assessed with a force platform and position transducer. Heavy load warm-up did not have an effect on the subjects as a single sample. However, when percent potentiation was compared between ATH and RT groups, force and power parameters were significantly greater for ATH ($p < 0.05$). Postactivation potentiation may be a viable method of acutely enhancing explosive strength performance in athletic but not recreationally trained individuals.

Key Words: explosive strength, warm-up, resistance training

Introduction: Warm-Up

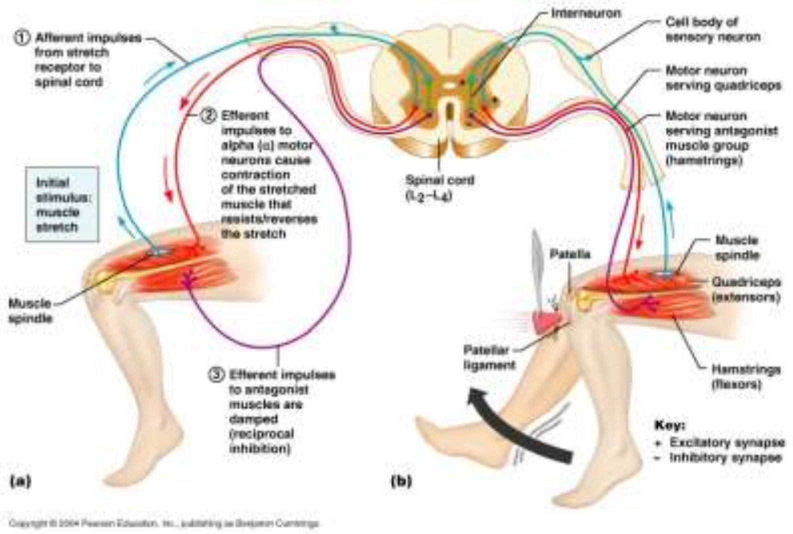
- Wide variety exist for PRACTICE, TRAINING, & COMPETITION of athletes
- **PURPOSE**
  - To acutely maximize performance and reduce risk of injury *in the given sport*
- **TRADITIONAL WARM-UP PARADIGM**
  - Brief low intensity *aerobic-type* activity → *static* stretching & activity specific movements
- **TYPE of warm-up = physiological requirements**
- **SPECIFIC to the task demands**
  - E.g. sports requiring **explosive strength**
    1. Optimal stiffness of series elastic component
    2. Rapid activation of the contractile apparatus

Introduction: Resistance Training

- **HEAVY RESISTANCE TRAINING**
  - A key component of *long-term* preparation of athletes for competition
- **PURPOSE**
  - To increase muscle **force production**, and subsequently **velocity** and **power**
- **LONG-TERM EFFECTS**
  - HRT performed maximally → ***long-term*** improvements in **power** and **explosive** force
- **ACUTE EFFECTS?**
  - Excessive volume/load → fatigue
  - Enhanced immediate performance? **PAP**

Introduction: **Post-Activation Potentiation**

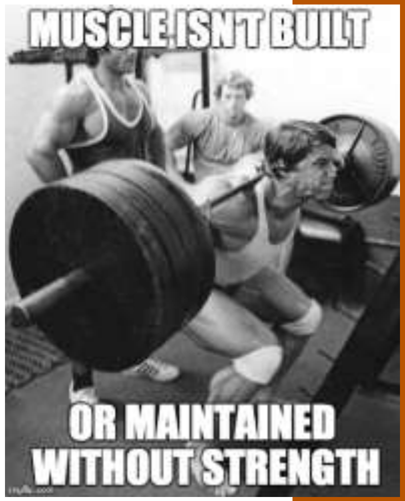
- **PAP:** *potentiation induced through voluntary activation*
  - Both **isometric** and **dynamic** test conditions
  - Between **5 to 20 min** post stimulus
  - Results in ↑ **rate of force development** (RFD), **jump height**, **sprint** performance
- **2 MECHANISMS** to explain this phenomenon
  - 1) Phosphorylation of regulatory myosin light chain **(peripheral)**
    - Faster contraction rates & rate of tension development (RTD)
  - 2) H-reflex electrical activity in the spinal cord **(central)**
    - Increase signal to activate muscle



- **TRAINING LEVEL** may affect the response to post-activation potentiation

Introduction: Training Level

- **STRONG VS. WEAK**
  - 5RM back squat ↑ vertical jumping performance for stronger individuals
  - 3RM back squats ↑ peak power and peak force in stronger individuals, ↓ weaker
  - Acute HRT → ↑ performance during low load tasks (> 30% 1RM?)
  - Potentiation is greatest in muscles involved in subject's sport (Hamada et al.)
- **HIGH POWER SPORTS**
  - The Stretch-Shortening Cycle
  - Concentric-Only actions
- **PREVIOUS RESEARCH**
  - Role of PAP between these conditions?



Research Question

- Does **training status** directly impact the response to post-activation potentiation?

Hypothesis

- Sports requiring explosive strength, a **heavy resistance warm-up** may elicit greater PAP, and in turn, explosive performance

Purpose

- Determine if heavy bout of resistance exercise acutely enhances force, velocity, & power production in high power activity under both **stretch-shortening cycle** and **concentric-only** conditions
- The effect of **training status** and the **time-course** of adaptations

Methods: Subjects

- **Subjects**
  - 24 subjects (M=12; F=12)
  - ≥ 6 months back squat experience
  - ≥ squat load (M: 1.5x; W: 1x BM)

- **Athletic** (ATH; n = 7)
  - Currently training/competing in a sport
    - DI NCAA soccer
    - Ironman triathlete
    - USAW

- **Recreational** (RT; n = 17)

Table 1. Descriptive statistics of subjects (mean ± *SD*).

Age (y)	Height (cm)	Weight (kg)	% Fat	1 RM (kg)	1 RM: Weight
23.42 ± 2.89	170.15 ± 6.75	70.60 ± 16.06	16.80 ± 6.50	109.38 ± 48.91	1.50 ± 0.45

Methods: Experimental Approach

- **Warm-Up Conditions**
  1. Rebound Jump Squat (RJS)
     - **Stretch-Shortening Cycle**
  2. Concentric-Only Jump Squats (CJS)

- **Training Status**
  1. Athletically trained (ATH; n=7)
  2. Recreationally trained (RT; n=17)

- **Time Course**
  1. Short (S1) – 5 minutes
  2. Long (S2) – 18.5 minutes

- **Squat Performance** (D.V.)
  - Peak/Average FORCE
  - Peak/Average POWER
  - Rate of Force Development (RFD)
  - Percent Potentiation

$$\%\ \text{Potentiation} = \text{Potentiated Variable} \div \text{Unpotentiated Variable} \times 100$$

Procedure

(2) Practice Sessions

1. RJS & CJS at **self-reported** 1RM back squat
2. Tested for 1RM back squat

(4) Testing Sessions

- **Control Warm-Up**
  - 2x5 unloaded BS, 2x3 VJ
- **Heavy Resistance Training Warm-Up**
  - 5x1 BS (90% 1RM), 2 min rest

(2) Time Series

- **S1**: 5-min post-activation
- **S2:** 18.5-min post-activation

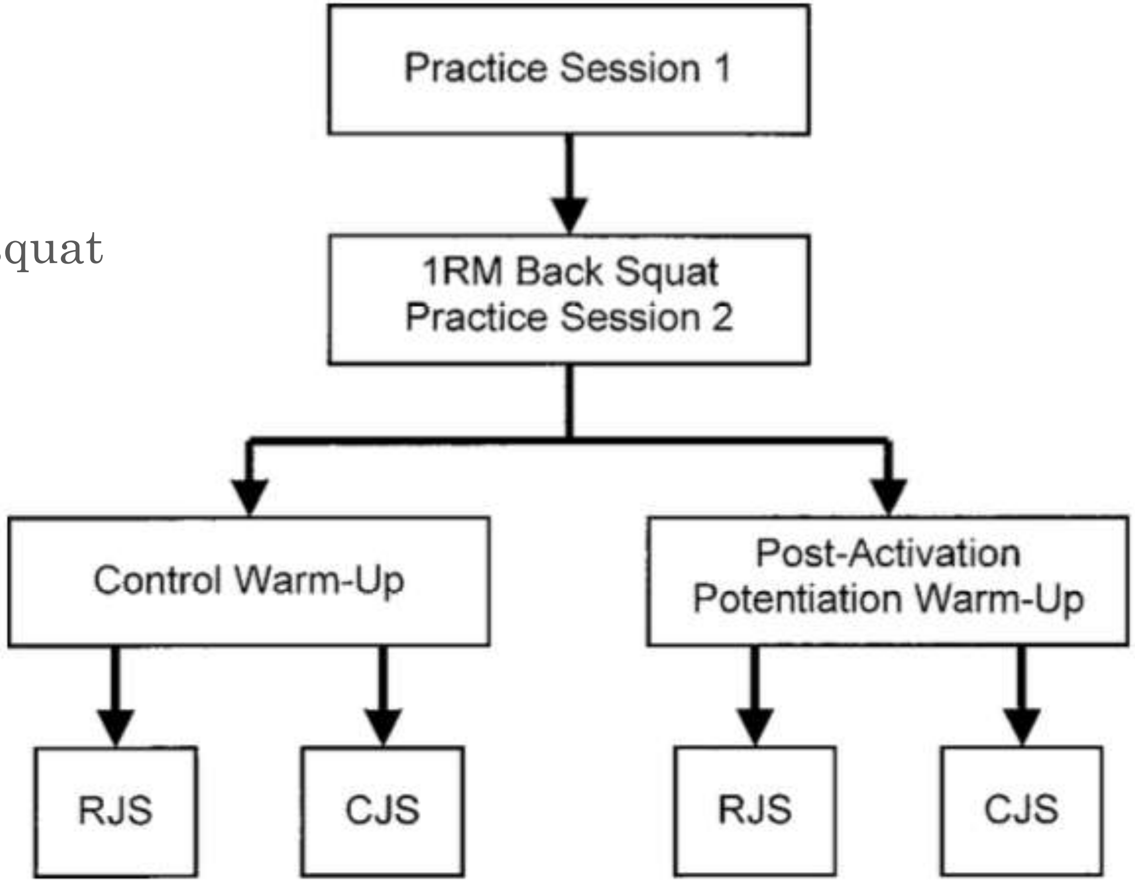


Figure 1.—Project design timeline. RJS = rebound jump squats, CJS = concentric-only jump squats.

- Maximal effort RJS or CJS (30%, 50%, and 70% 1RM) at 1-minute intervals

Measurement

- **Instruments**
  - Force platform
  - Linear position transducer
- **Dependent Variables**
  - Force & displacement
  - RFD & velocity
  - Power
- $$\% \text{ Potentiation} = \text{Potentiated Variable} \div \text{Unpotentiated Variable} \times 100$$
  - 100% = no potentiation
  - > 100 = PAP
  - < 100 = PAP depression

Procedure

- **RJS and CJS**
  1. Remove loaded barbell from power rack
  2. Squat to depth (elastic cord @ 10% of the subject's height)
  3. Explosively jump, maximal effort
- **Jump Squat Conditions**
  - **Rebound SJ**
    - Changed direction immediately, concentric portion
  - **Concentric-Only JS**
    - Paused at bottom, 4 sec count, concentric portion

Figure 2.—Custom testing platform.

Measurement

- **Trial Phases**
  - Eccentric
  - Isometric (lowest position + 5 cm)
  - Propulsion*

- **Propulsion**
  - **RJS:** point of take-off, where force was equal to zero
  - **CJS:** point of noticeable increase in force

- https://youtu.be/xJOjtwzdch0

Statistical Analyses

- A **2x2 (warm-up x time)** RM univariate ANOVA
  - Difference between warm-up conditions during different time periods (S1 & S2)
- A **2x2 (group x time)** RM multivariate ANOVA
  - Percent potentiation of each training status
- **Tukey post-hoc** for significant interactions

Results: Warm-Up x Time

- **Significant Interactions**
  - CJS none at all loads
  - RJS at 30% - AF, AP, & PP
  - RJS at 70% - AF
- **Post-hoc**
  - Significant warm-up effect for RJS AP at 30% only
  - Performance was greater at 18.5-min post-activation than 5-min post-activation

Table 2. Post hoc analyses for significant warm-up by time interactions (mean ± *SD*).

		Series 1			Series 2		
Condition	Measure	Control	PAP	ES	Control	PAP	ES
30% RJS	Peak power (W)	3974.36* ± 1401.20	3855.60 ± 1618.20	0.485	3927.67 ± 1465.86	4053.91 ± 1465.86	0.516
30% RJS	Average power (W)	1757.80 ± 1465.86*	1651.35 ± 1558.02	0.616	1717.39 ± 619.95	1764.53 ± 716.47	0.273
30% RJS	Average force (N)	1581.23 ± 497.92	1540.53 ± 505.91	0.667	1560.11 ± 505.93	1578.23 ± 507.73	0.298
70% RJS	Average force (N)	1923.10 ± 630.07	1940.21 ± 631.84	0.406	1929.07 ± 633.26	1907.27 ± 640.48	0.517

* Denotes significant warm-up effect ($p < 0.05$).
RJS = rebound jump squat; PAP = postactivation potentiation; ES = effect sizes.

Results: Group x Time

- Significant Between Subject Effects
  - RJS at 30% load
  - CJS at 30% & 50% loads
- Significant Interactions
  - RJS at 70% load
  - CJS average power %P at 30% load (Fig. 3)
  - CJS peak power %P at 30% and 50% loads (Fig. 4)

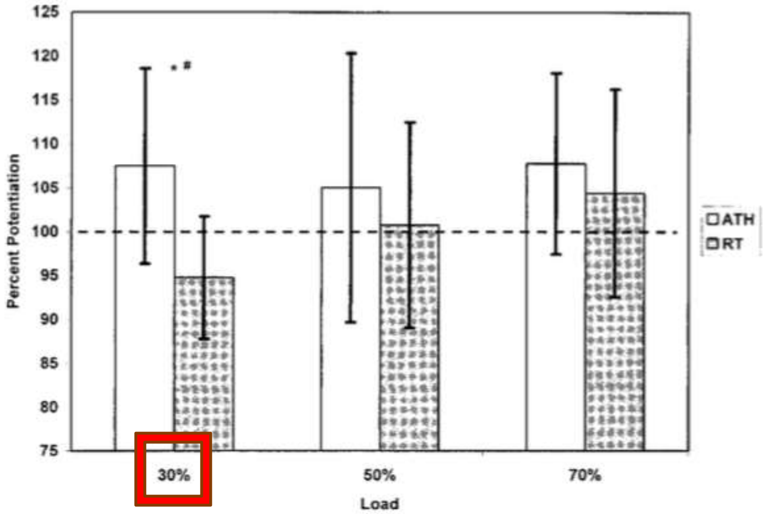


Figure 3.—Concentric-only jump squats average power percent potentiation. ATH = athletic, RT = recreationally trained. * Denotes athletic significantly different from recreationally trained $p < 0.05$. # Denotes large η^2.

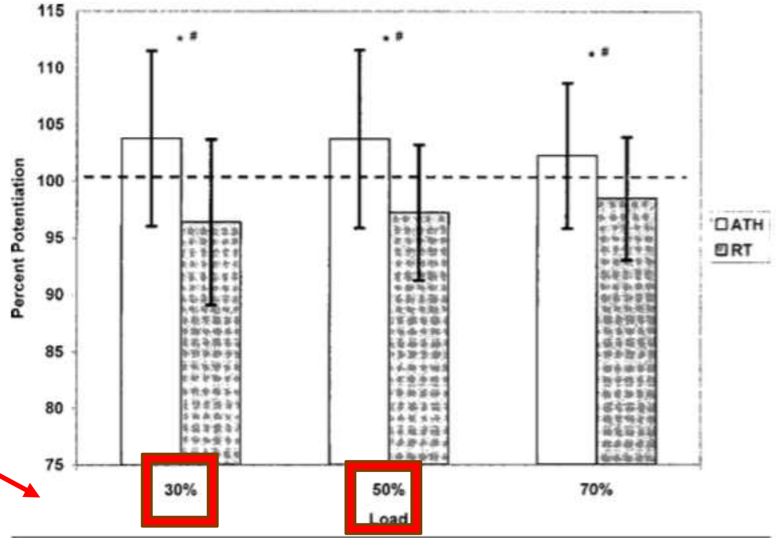


Figure 4.—Concentric-only jump squats peak power percent potentiation. ATH = athletic, RT = recreationally trained. * Denotes athletic significantly different from recreationally trained $p < 0.05$. # Denotes large η^2.

Discussion

- **WARM-UP (control vs. heavy resistance)**
  - **TOGETHER:** minimal differences between warm-up conditions
  - **ATH vs. RT:** HR warm-up improved performance

- **TRAINING STATUS (athletic vs. recreational)**
  - **ATH:** HR warm-up > 100% at all loads
  - **RT:** near or below 100%

- **SQUAT JUMP CONDITION (rebound vs. concentric-only)**
  - **RJS:** similar in both
  - **CJS:** largest difference with lower loads**

- **TIME SERIES (5 min vs. 18.5 min)**
  - **S1:** excess fatigue
  - **S2:** no time effect for ATH group

Practical Applications

- **TRAINING LEVEL**
  - Power-type athletes (weightlifters, sports with sprinting, jumping, throwing)
  - High-load training adaptation: **fatigue resistance**
- **TYPE OF WARM-UP**
  - PAP was same for **stretch-shortening cycle** and **concentric-only** conditions
  - HR warm-up may extend to a wide variety of high power activities
- **TIME EFFECT**
  - HR stimulus → fatigue at 5 minutes…fatigue subsides.
  - Time effect did not exist for the ATH; 5 min was sufficient for fatigue to subside

Practical Applications

- **INTERESTING FINDING**
  - Jump squat performance did not decrease post BS
  - Low volume, high load may not result in the same fatigue as high volume, high load

- **S&C APPLICATION**
  - Common to perform power-type exercises *prior* high load exercises
  - Alternate approach to power-type exercises *always* performed first

Key Points: Take Home

- PAP → **positive** effect on performance
- PAP of HR exercise depends on **training status** (stronger = better)
  - **ATH:** respond better to PAP than RT
  - **ATH:** greater PAP, less fatigue following HR → enhanced performance
- **Recreationally trained:** exhibit fatigue 5 min post acute HR exercise stimulus
- **Athletically trained:** stimulus enhances power performance for 5 to 18.5 min
- Viable PAP method for **athletes**, but not recreationally trained
- **Power** sports with brief, discrete, maximal efforts

Limitations & Future Research

- **Practice Session Day 1: self-reported 1RM**
- **Only variables that were found reliable were analyzed**
  - Included: peak and average force, power, and RFD
  - Excluded: peak and average velocity, and peak displacement
- **Kinematic measures may be more sensitive indicators of the post-activation potentiation phenomenon than kinetic parameters**

Current Study

Effects of Heavy-Load Squats on Subsequent Vertical Jump Performance

Hypothesis

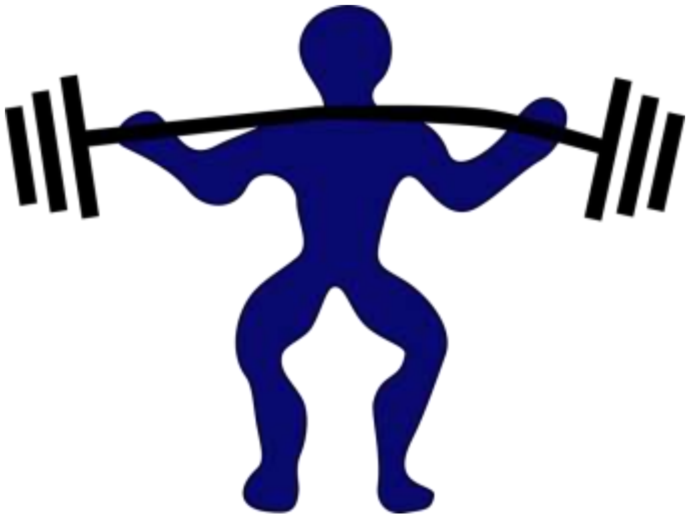
- Weight lifting will induce PAP
- Enhance performance of the subsequent (explosive) movements

Purpose

- **OBSERVE** acute effects of a heavy-load back squat (5RM) condition on consecutive squat jump performance
- **DESCRIBE** explosive performance of athletes
- **INVESTIGATE** neuromuscular potentiation effect
- **DETERMINE** number of repetitions of a 5RM back squat that displays greatest potentiation

Participants

- Male and female cheerleaders
- 24 participants
  - Males (n = 14)
  - Females (n = 10)
- Mean $\pm$ SD
  - Age: 21 $\pm$ 2
  - Height (cm): 165 $\pm$ 11
  - Weight (kg): 69 $\pm$ 18

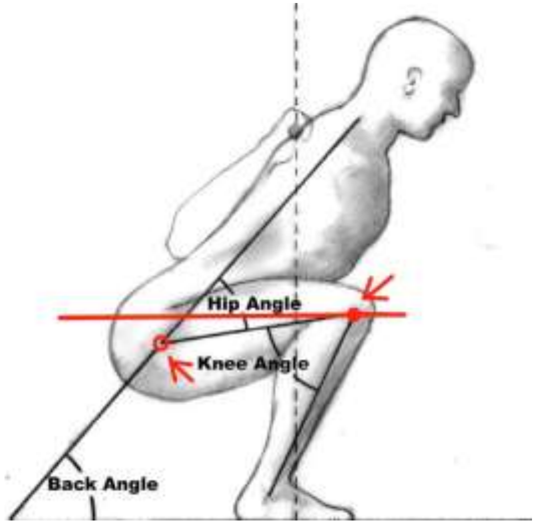


Procedure- 1st Visit

- **Informed Consent**
  - Explain purpose, risks, and benefits
- **Body Composition**
  1. **Anthropometric Measurements**
     - Record height and weight
  2. **Ultrasonography Measurements**
     - Diagnostic ultrasound device measures the muscle architecture of the quadriceps and hamstrings
     - Probe connected to ultrasound device placed on skin at site of each muscle to view and capture images in transverse and longitudinal planes
  3. **Bioimpedance Analysis**
     - Noninvasive device scans frequencies to estimate body composition by estimating/determining total body water, extracellular fluid, and intracellular fluid

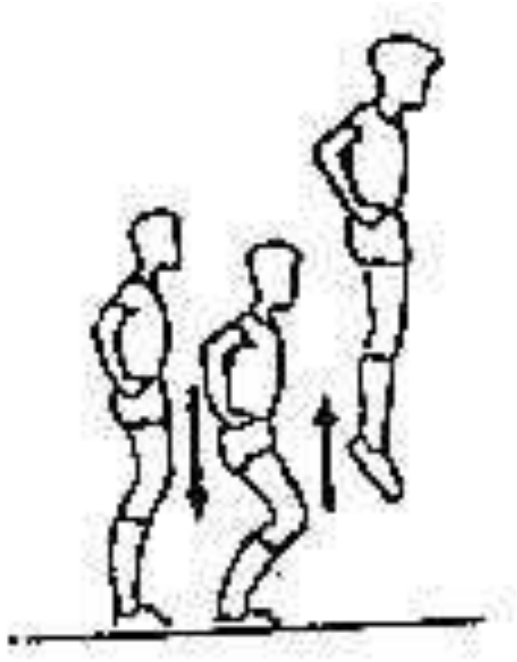
Procedure: Repetition Maximum Assessment

1. Begin with 12 unloaded back squats
2. Progress to 50%, 70%, 80%, and 90% of estimated 5RM
3. Load incremented 2-5% until unable to complete 5 repetitions



- **Technical execution:**
  - Descend under control (2 second tempo) to a depth where the femur is parallel to the floor (or 90° angle at the knees determined by investigator via visual inspection)
  - Immediately reverse the movement and maximally accelerate the bar during the concentric phase
  - Repetition is successful if participant completed concentric phase in ≤*2 s.*

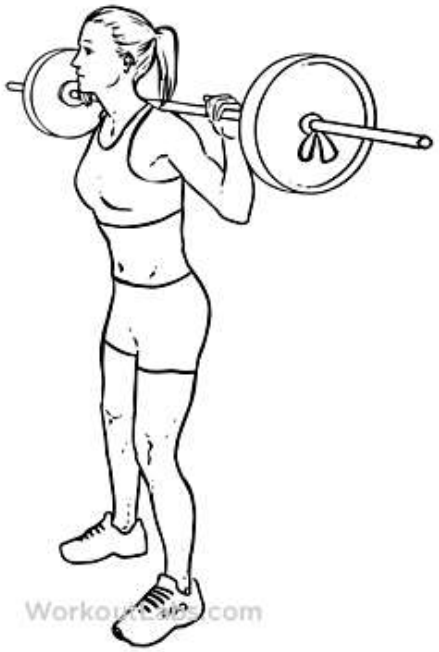
Procedure: Vertical Jumps



- During familiarization, also perform maximal-effort vertical jumps
- Perform jumps as explosively as possible to achieve maximal power output
- Reset position between each jump effort
- Jump trials performed on a force plate linked with a linear position transducer that allows direct measurement of jump height, peak and mean force, velocity, and power output

Procedure: 2nd, 3rd, & 4th Visit

1. 2 minute warm up on bike
2. Perform a baseline of 2 maximal-effort vertical jumps to a self-selected depth with 30 seconds of rest between jumps
3. 12 unloaded back squats
4. Gradual warm-up to predetermined 5RM
5. Perform either 1, 3, or 5 repetitions of predetermined 5RM
6. Immediately after squatting, perform 2 back-to-back maximal effort vertical jumps every minute for 8 minutes
7. A total of 16 maximal-effort jumps performed following the conditioning stimulus



Results: 1 Rep (5RM)

Table 1. Mean vertical jump performance values following 1 repetitions of 5RM.

Vertical Jump	Baseline			1 MIN		2 MIN		3 MIN	
Peak Power	1765.17	1758.29	SQUAT	1759.58	1779.46	1755.42	1759.46	1765.5	1781.96
Peak Velocity	2.52	2.49		2.49	2.53	2.48	2.49	2.5	2.52
Avg. Power	1002.54	967.04		967.54	985	980.67	996.58	981.29	998.17
Avg. Velocity	1.39	1.37		1.38	1.39	1.39	1.41	1.39	1.42
Jump Height	18.89	18.68		18.93	18.71	18.99	19.18	18.95	19.24

	4 MIN		5 MIN		6 MIN		7 MIN		8 MIN	
Peak Power	1769.17	1769.88	1764.71	1762.71	1779.08	1805.75	1801.71	1810.42	1775.79	1803.04
Peak Velocity	2.5	2.5	2.5	2.49	2.52	2.55	2.54	2.55	2.5	2.54
Avg. Power	983.38	993.88	982.58	988.17	991.83	989.38	977.75	999.75	1000.63	992.04
Avg. Velocity	1.39	1.41	1.39	1.4	1.4	1.4	1.39	1.41	1.42	1.41
Jump Height	18.9	19.02	18.95	19.1	19.01	18.94	18.85	18.8	18.88	18.94

Units: Peak and average power (W); peak and average velocity (m/s); jump height (in)

*Averages

Results: 3 Reps (5RM)

Table 1. Mean vertical jump performance values following 3 repetitions of 5RM.

Vertical Jump	Baseline		SQUAT		1 MIN		2 MIN		3 MIN	
Peak Power	1834.88	1809.58			1745.21	1742.08	1780.92	1775.04	1756.38	1807.42
Peak Velocity	2.58	2.55			2.47	2.47	2.51	2.51	2.48	2.55
Avg. Power	943.29	940.88			942.33	959.5	969.71	974.88	980.71	983.88
Avg. Velocity	1.35	1.35			1.34	1.37	1.38	1.38	1.39	1.39
Jump Height	18.53	18.63			18.42	18.54	19.05	18.85	19	19.06

	4 MIN		5 MIN		6 MIN		7 MIN		8 MIN	
Peak Power	1781.13	1781.54	1768.13	1758.5	1769.63	1752.33	1794.67	1760.88	1789.88	1793.83
Peak Velocity	2.52	2.51	2.49	2.48	2.49	2.48	2.53	2.48	2.52	2.52
Avg. Power	973.42	979.83	964.21	978.08	975.63	971.33	974.33	978.96	969.21	991.17
Avg. Velocity	1.38	1.39	1.37	1.39	1.39	1.38	1.39	1.39	1.38	1.4
Jump Height	19.1	19.09	18.74	18.65	18.95	18.84	18.92	18.75	19.08	19.01

Units: Peak and average power (W); peak and average velocity (m/s); jump height (in)

*Averages

Results: 5 Rep (5RM)

Table 1. Mean vertical jump performance values following 5 repetitions of 5RM.

Vertical Jump										
	Baseline		SQUAT		1 MIN		2 MIN		3 MIN	
Peak Power	1787.13	1774.42			1722.17	1707.67	1735.13	1752.58	1759.38	1778.79
Peak Velocity	2.52	2.51			2.44	2.42	2.49	2.49	2.48	2.53
Avg. Power	981.71	975.54			940.42	944.63	979.71	981.38	990.04	982.46
Avg. Velocity	1.39	1.38			1.33	1.34	1.39	1.39	1.4	1.4
Jump Height	19.2	19.14			17.78	18.48	18.82	18.8	18.73	19.09

	4 MIN		5 MIN		6 MIN		7 MIN		8 MIN	
Peak Power	1774.83	1768.67	1764.46	1755.46	1752.08	1771.42	1780.5	1790.46	1798.13	1766.63
Peak Velocity	2.51	2.5	2.5	2.48	2.48	2.51	2.52	2.54	2.55	2.51
Avg. Power	999.17	989.71	988.83	994.33	992	993.29	995.83	997.38	996.17	1001
Avg. Velocity	1.41	1.4	1.4	1.41	1.41	1.41	1.41	1.41	1.41	1.42
Jump Height	19.21	19.3	19.05	19.15	19.11	19.11	19.18	19.02	19.28	19.01

Units: Peak and average power (W); peak and average velocity (m/s); jump height (in)

*Averages

Conclusion

- 5 rep condition elicited the greatest fatigue & decreased vertical jump performance immediately after squatting
- However, none of the conditions elicited an increase in vertical jump performance
- Performing a heavy-load back squat may not enhance subsequent vertical jump performance

Future Research

- Examine decreased in volume, increases in rest interval, and individuals with greater training adaptations associated with anaerobic training

Additional Thoughts?

References

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