



# Effects of a Post Activation Potentiation Stimulus Coupled with Plyometric Training Program on the Swimming Start Performance of Collegiate Swimmers

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## Abstract

- ❖ 30 collegiate swimmers from Division 1 universities in the south east United States took part in this study
- ❖ Testing group completed plyometric training coupled with post-activation potentiation (PAP) stimulus as well as structured aquatic training
- ❖ Control group completed only structured aquatic training
- ❖ Pre and post program data was gathered from both groups to compare the effects of the training
- ❖ Both groups were assessed on vertical jump height, swim start velocity, time to the 15m marker, and peak horizontal force
- ❖ After the training program concluded and the resulting data from the two groups was compared

## Introduction & Review of Literature

- ❖ Swimming start directly correlated to swimming performance
- ❖ Up to 26.1% of total time in 50m race (Karpiński et al., 2020)
- ❖ Sprint swimmers need to take advantage of start to increase performance
- ❖ Studies have shown plyometric training can increase swim start performance related factors (Bishop et al., 2009; Potdevin et al., 2011; Rebutini et al., 2016; Sammoud et al., 2019)
- ❖ Studies also show that PAP stimulus can increase swim start performance in the same way (Killduff et al., 2011)
- ❖ Several division 1 universities agreed to incorporate plyometric training coupled with a PAP stimulus into their training to test their effectiveness

## Purpose

- ❖ The purpose of this study was to determine the effects of a post-activation potentiation stimulus coupled with a plyometric training program on swim start performance
- ❖ It was hypothesized that the addition of both a PAP stimulus and a plyometric training program will significantly improve swim start performance in terms of velocity coming off the blocks as well as time to 15m



Figure 1

## Methods

### Participants

- Informed consent was gathered from all participants
- Both a testing and a control group were used (N = 30)
- Ethics consent was granted through each of the Universities ethics committees

### Intervention

- Testing group implemented plyometric training with a PAP stimulus
- Control group completed regular aquatic training
- Pre- and post-training program data was collected
- Plyometric training program shown in Table 1

### Instruments

- A Vertec was used to measure vertical jump height
- Cameras were placed at the 5m and 15m markers to measure velocity and time to 15m
- A force plate was used to measure peak horizontal force
- All aquatic testing used the Omega OSB-11 starting block (Figure 1)

### Data Analysis

- Independent sample t-tests were used
- Pre and post program assessment data was compared
- Significant differences between groups aid in the identification of benefits

Table 1

Plyometric Training Program (recovery in secs)								
Exercise	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8
Two-foot ankle hops	2 x 5 (60)	3 x 5 (60)						
Back Squat (80% of 1RM)	1 x 3	2 x 3	3 x 3	3 x 3	4 x 3	4 x 3	5 x 3	5 x 3
Squat Jumps	1 x 4 (60)	2 x 4 (60)	3 x 4 (60)	3 x 4 (60)	4 x 4 (60)	4 x 4 (60)	5 x 4 (60)	5 x 4 (60)
Power Clean Pulls (70% of 1RM)	1 x 2	2 x 2	3 x 2	3 x 2	4 x 2	4 x 2	5 x 2	5 x 2
Standing Long Jumps	1 x 1 (60)	2 x 1 (60)	3 x 1 (60)	3 x 1 (60)	4 x 1 (60)	4 x 1 (60)	5 x 1 (60)	5 x 1 (60)
Squat Jumps (50% of 1RM)	1 x 3	2 x 3	3 x 3	3 x 3	4 x 3	4 x 3	5 x 3	3 x 3
Hurdle Hops	1 x 4	2 x 4	2 x 4	2 x 4	3 x 4	3 x 4	3 x 4	3 x 4
RFE Split Squats (30% of 1RM)	1 x 3 each side	2 x 3 each side	2 x 3 each side	2 x 3 each side	3 x 3 each side			
Split Squat Jumps	1 x 3 (60) each side	2 x 3 (60) each side	2 x 3 (60) each side	2 x 3 (60) each side	3 x 3 (60) each side			

\*All non-resistance exercises are completed 15seconds prior to the completion of the resistance exercises

\*RFE Split Squats completed with dumbbell at 30% of 1RM

## Operational Definitions

- ❖ **Plyometrics:** exercises which increase power output through stretch followed by contraction
- ❖ **Swim Start:** a full body movement with the goal of getting off the block and into the water in a quick and powerful manner
- ❖ **Post-Activation Potentiation (PAP):** mode of training involving a heavy resistance exercise followed by a high velocity movement
- ❖ **Vertical Jump:** a movement involving jumping perpendicular to the ground

## Conclusion

- ❖ Limitations included swimming start technique variations, length of training program, and small sample size
- ❖ Assumed that the aquatic training was of similar intensity across universities, and both males and females would respond similarly
- ❖ Further research should examine difference between gender adaptation among collegiate swimmers

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## References

- Bishop, D. C., Smith, R. J., Smith, M. F., & Rigby, H. E. (2009). Effect of Plyometric Training on Swimming Block Start Performance in Adolescents. *Journal of Strength and Conditioning Research*, 23(7), 2137-2143. <http://doi.org/10.1519/JSC.0b013e3181b866d0>
- Karpiński J, Rejdych W, Brzozowska D, Golaś A, Sadowski W, Swinarew AS, et al. (2020). The effects of a 6-week core exercises on swimming performance of national level swimmers. *Plos One*, 15(8), e0227394. <https://doi.org/10.1371/journal.pone.0227394>
- Potdevin, F. J., Alberty, M. E., Chevutschi, A., Pelayo, P., & Sidney, M. C. (2011). Effects of a 6-week plyometric training program on performances in pubescent swimmers. *Journal of Strength and Conditioning Research*, 25(1), 80-86. <http://doi.org/10.1519/JSC.0b013e3181fe720>
- Rebutini, V. Z., Pereira, G., Bohrer, R. D., Ugrinowitsch, C., & Rodacki, A. F. (2016). Plyometric long jump training with progressive loading improves kinetic and kinematic swimming start parameters. *Journal of Strength and Conditioning Research*, 30(9), 2392-2398. <http://doi.org/10.1519/JSC.0000000000000360>
- Sammoud, S., Negra, Y., Chaabene, H., Bouguezzi, R., Moran, J., & Granacher, U. (2019). The effects of plyometric jump training on jump and swimming performances in prepubertal male swimmers. *Journal of Sports Science & Medicine*, 18(4), 805-811. Retrieved from <https://www.jssm.org/>