

# The Effects of Footwear on Isometric Squat Force

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## Introduction

The purpose of this study was to determine if there is a difference in force production when comparing a self-selected shoe condition and a no shoe condition. 10 Douglas College students performed two Maximal Voluntary Isometric Contractions (MVIC) in both a self-selected shoe and in socks. The results of this research showed that there is a difference between a person's maximal squat in socks compared to shoes, but not a significant difference ( $p > .05$ ).

## Purpose

In a commercial gym, it is common to see people squatting in different footwear forms, as well as barefoot. For beginner lifters, these observations could influence whether someone decides to purchase \$200 weightlifting shoes, or if they decide to squat barefoot. This study aims to determine if there is a difference in force production while performing a maximal isometric front squat in an athlete's self-selected shoes compared to in their socks.

## Methods

The Participants were 10 Douglas College Students (Male 7, Female 3), who were recruited via convenient sampling. The research methods of this study were a quantitative, quasi-experimental design. Each participant was asked to come to the Douglas College Lab and bring shoes they most commonly wear while working out. Upon completion of a 5 minute warm-up, the researcher randomly assigned participants as either starting with a self-selected squat condition or a barefoot condition. Participants were then instructed to perform an isometric front squat at 90° of knee flexion at maximal intensity with both self-selected footwear or in socks.

## Procedure

Participants stood on a platform with a weight-lifting belt around their hips that was attached to a force transducer connected to the platform (see Figure 1). The participants started in a front squat position with 90 degrees of knee flexion, with the chain of the force transducer fully extended. On the "GO" cue shouted out by the researchers, the participants began to push against the bumper plates with maximal intensity for five seconds.

## Results

Percentage Difference In All Participants: The sum of the average force for the self-selected shoe condition was 478.46 KG, whereas the sum of the average force for socks was 506.51 KG. Participants on average performed 13.9% better in self-selected shoes compared to socks (See Figure 1).

Percentage Difference From Socks to Shoes in Males: Male Participants performed on average 22.22% higher in shoes compared to socks.

Percentage Difference of All Participants in Runners: Participants in runners performed on average 46.22% higher in shoes compared to socks



Figure 1  
Image of the procedure and setup

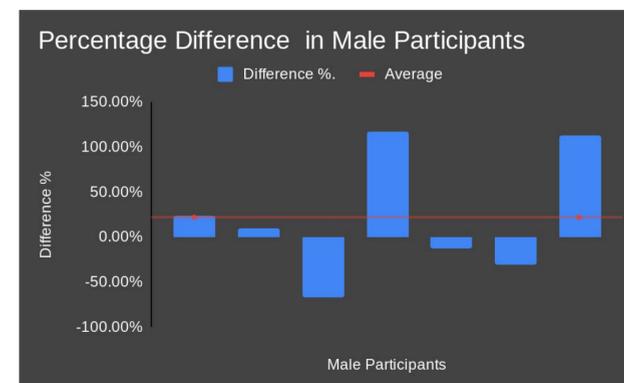


Figure 3  
Percentage difference in Male participants

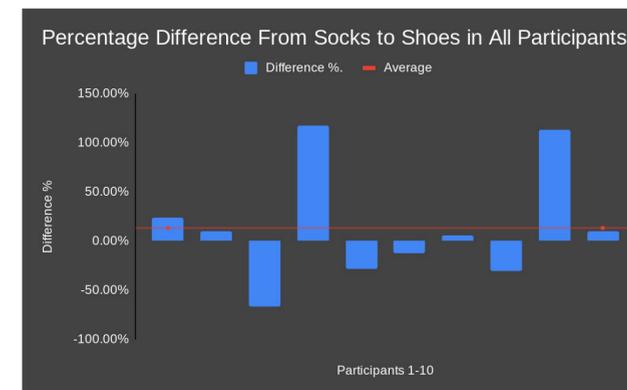


Figure 2  
Note: Each point of data represents one of the ten participants

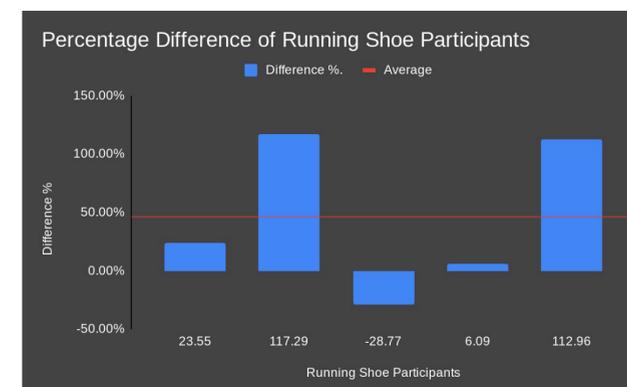


Figure 4  
Percentage difference in running shoe participants

## Discussion

A variety of shoe selections is what is most common in public athletic clubs used by college-aged adults, and both a running shoe and a flat-heeled shoe could be justified for squatting. It is also important to note that there are safety concerns with being in a weight room barefoot, as weights regularly fall off the racks, which could injure barefoot participants. For the participants who self-selected running shoes, the overall greater force displayed is comparable to research conducted by Sinclair et al., who found that mean muscle activation of the rectus femoris to be higher in running shoes than in barefoot (2015). Further, squatting in running shoes allows participants to reach a high position of parallel to the floor faster than without shoes (Sato et al., 2013). Based on these findings that supplement our research, we recommend to all new lifters to squat in running shoes, as these are the only shoes necessary for both aerobic and anaerobic exercise.

## Conclusion

When considering the percentage difference of all participants, the mean force of self-selected shoes was 13.9% higher compared to socks. Male participants displayed a mean increase of 22.22% in shoes compared to socks, while female participant displayed a mean decrease of 11% in shoes compared to socks. Further, participants in runners displayed a mean increase of 46.22% in shoes compared to socks, whereas participants in flat shoes displayed a mean decrease on 10.58% compared to socks. Regarding force production being influenced by shoe selection, our research is not yet strong enough to provide fitness enthusiast with that information. However, we now understand the process of conducting field research and learned that narrowing the variables is the most efficient way to reveal significant findings.

## References

- sinclair, J., McCarthy, D., Bentley, I., Hurst, H. T., & Atkins, S. (2015). The influence of different footwear on 3-D kinematics and muscle activation during the barbell back squat in males. *European Journal of Sport Science*, 15(7), 583–590. <https://doi.org/10.1080/17461391.2014.965752>
- Sato, K., Fortenbaugh, D., Hydock, D. S., & Heise, G. D. (2013). Comparison of back squat kinematics between barefoot and shoe conditions. *International Journal of Sports Science & Coaching*, 8(3), 571–578. <https://doi.org/10.1260/1747-9541.8.3.571>