

Comparison of Olympic and Safety Bar Barbells on Force, Velocity, Power, and Rating of Perceived Exertion During Acute High-Intensity Back Squats



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ABSTRACT

The back squat is a widely used exercise to develop lower body strength and the most evidence-based barbell used is the traditional Olympic barbell. Many barbell variations, such as the safety squat bar, have grown in use without establishing their efficacy compared to a traditional Olympic barbell during back squat variations. Further, no studies have examined if any differences exist between a traditional Olympic and safety squat bar barbell during a single session of high-intensity resistance training on measures of perceived exertion, force, velocity, and power output. **PURPOSE:** To test the hypothesis that, compared to a traditional Olympic barbell, a safety squat bar barbell will result in no differences in force, velocity, power, and perceived exertion during an acute session of high-intensity back squats in recreationally trained adults. **METHODS:** Twelve recreationally trained (resistance trains at least 2x/week for over 1 year) men (age: 23.0±2.6 years; mass: 88.3±19.1 kg; 1RM back squat/body weight: 1.78±0.34 kg) participated in 3 sessions separated by at least 48-72 hours. Session 1 involved familiarization with an Olympic barbell (Rogue) and safety squat bar barbell (Rogue) back squats, determining participants back squat 1RM with an Olympic barbell, and establishing anchor points for the rating of perceived exertion (RPE) scale. Then, in Sessions 2 and 3, participants randomly completed 3 sets of 6 repetitions at 80% 1RM (Olympic barbell 1RM) using either the Olympic barbell or safety squat bar barbell. Inset RPE was assessed using the OMNI-RES RPE 0-10 scale. Peak force (N), peak Velocity (m/sec.), and peak power output (Watts) for every repetition was determined by participants squatting on a force plate (Bertec). Averages across all repetitions were analyzed for every dependent variable using a paired samples t-test (p<0.05) between both barbells. **RESULTS:** Compared to a traditional Olympic barbell, using a safety squat bar barbell resulted in no significant (p>0.05) differences in average repetition peak force, peak velocity, peak power, and average set RPE during an acute multi-set high-intensity back squat session (Table 2). Further, no differences were observed in the percent change from first to last repetition averaged across multiple sets for all variables (Table 2). **CONCLUSIONS:** In recreationally resistance-trained adults interested in developing lower body strength and power using the back squat exercise the acute use of either a traditional Olympic barbell or safety squat bar barbell similarly develops force, velocity, and power, and exertion feels similar. **PRACTICAL APPLICATIONS:** Practitioners working with adult athletes or clients to develop lower body strength and power with the back squat exercise can interchangeably use the safety squat bar barbell and traditional Olympic barbell to similarly train force, velocity, and power across multiple sets.

INTRODUCTION

- There are many barbell variations that are anecdotally used without scientific evidence during a back-squat exercise in a variety of training settings to develop lower body muscular strength (1). Therefore, there is a need to rigorously test these barbell variations across resistance exercises, including the back squat, to see how they compare to the well-established kinetics and kinematics (2) of the traditional Olympic barbell.
- One such barbell variation that is commonly anecdotally used during the back squat exercise is the safety squat bar barbell, and there is very limited evidence (1,3-4) on its efficacy. No studies have examined if any differences exist between a traditional Olympic barbell and the safety squat bar barbell during a single session of heavy resistance training on measures of perceived exertion and force, velocity, and power.
- The findings from this investigation will help to provide the strength and conditioning profession knowledge on the appropriate use of the safety squat bar barbell compared to the traditional Olympic barbell during the back squat exercise for achieving desired goals.

PURPOSE AND HYPOTHESIS

- The *purpose* of this study was to determine the differences between a traditional Olympic barbell and the safety squat bar barbell during an acute back squat session on perceived exertion and peak force, velocity, and power in recreationally trained adults.
- We *hypothesized* that the safety squat bar, when compared with a traditional Olympic barbell, would yield no differences in force, velocity, power and perceived exertion during an acute session of high intensity back squats in recreationally trained male adults.

METHODS

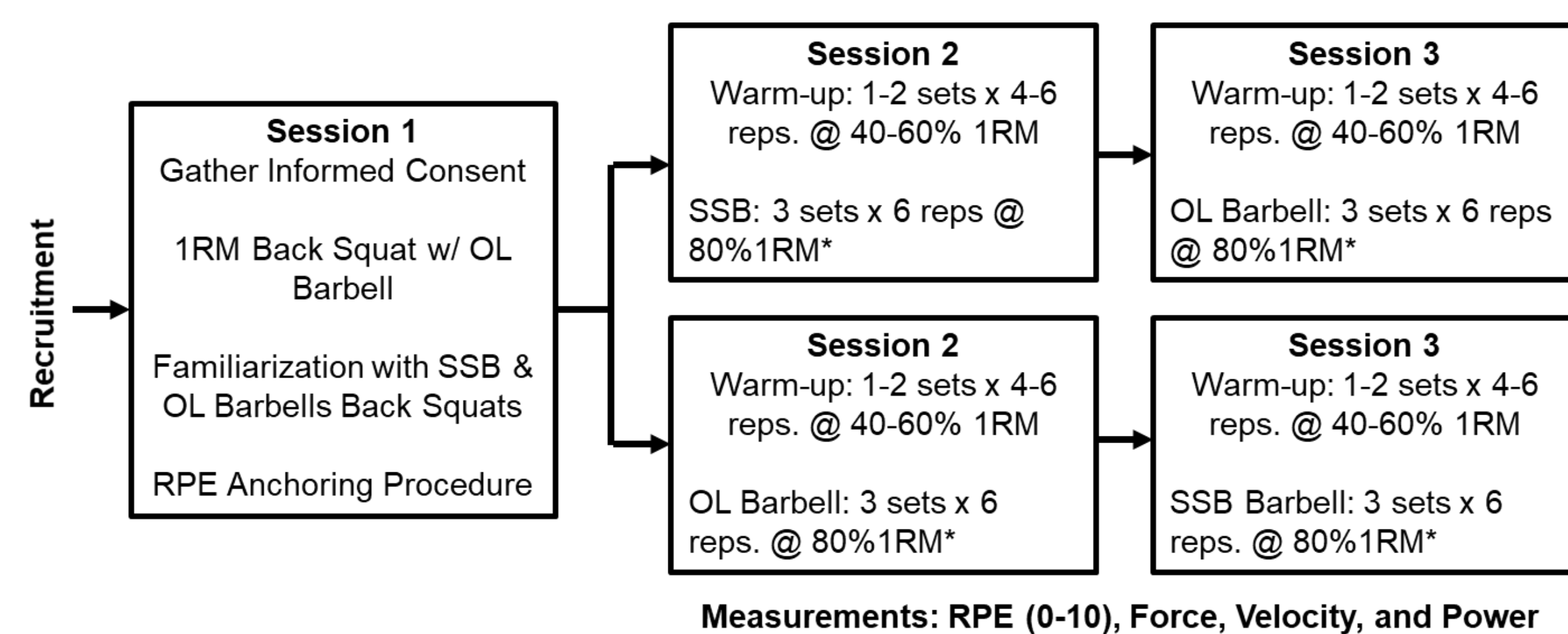
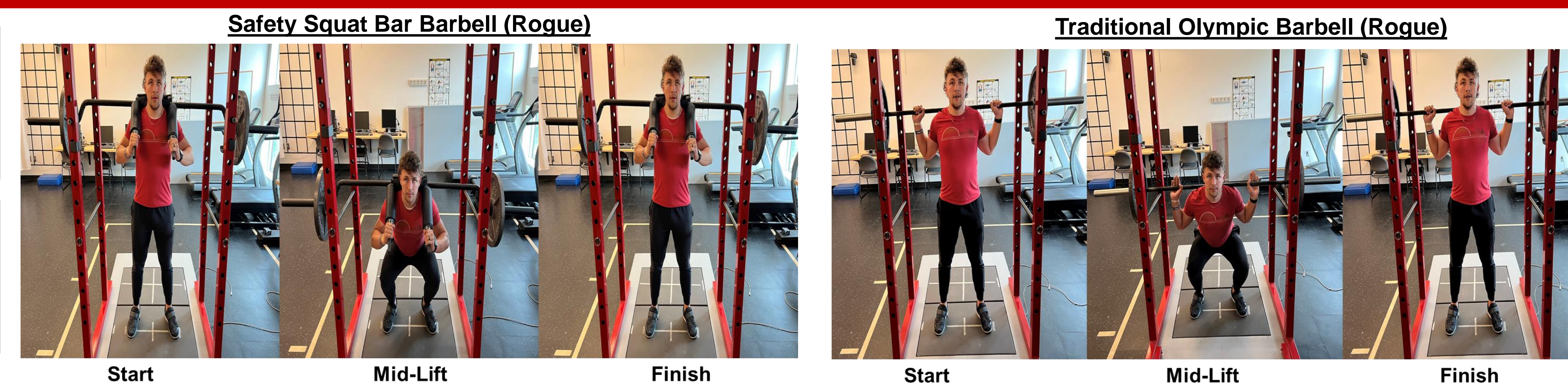


Figure 1. Overview of experimental within-subjects cross-over design. Recreationally resistance trained (1-5+ years experience) men (n=12) performed an initial familiarization session (1) where a 1 Repetition Maximum (1RM) back squat was determined using the traditional Olympic barbell (OL). In a randomized order, participants completed a second session using either the OL barbell or a Safety Squat Bar (SSB) barbell for 3 sets of 6 reps. @ 80% 1RM in the back squat (OL barbell 1RM). For session 3, whichever barbell the participant hadn't completed was done (i.e., if session 2 = OL, session 3 = SSB).



Familiarization/Session 1: SSB and OL barbells were familiarized for participants during the back squat exercise, a 1RM back squat with the OL barbell was completed (NSCA 1RM protocol), and an anchoring RPE procedure was used to establish "0" as "Extremely easy" and "10" as "Extremely hard".

Session 2/3: In a randomized fashion, participants completed 1-2 warm-up sets followed by 3 sets of 6 reps. at the same absolute load (80% 1RM of OL barbell 1RM) using either the SSB or OL barbells during the back squat. At least 48 hours later participants did the same exercise with the opposite bar.

Measurements: During session 2 and 3, RPE using the OMNI-RES 0-10 scale was taken following each set. Peak force, peak velocity, and peak power were taken during each repetition and averaged for each set using a force plate (Bertec 6080D) that participants squatted on.

RESULTS

Table 1. Recreationally trained male lifter (n=12) participant characteristics.

	Mean ± SD
Age (yrs)	23.0 ± 2.6
Height (cm)	177.2 ± 8.3
RT Experience (yrs)	4.0 ± 2.7
Body Mass (kg)	88.3 ± 19.1
Back Squat 1RM (kg)	155.6 ± 34.4
Back Squat 1RM/BM	1.78 ± 0.34

Variable	Traditional Olympic Barbell	Safety Squat Bar Barbell	p Value
Average Rep. Peak Force (N)	2832.4 ± 526.0	2461.3 ± 766.0	0.57
Average Rep. Peak Velocity (m/s)	0.85 ± 0.33	1.01 ± 0.31	0.37
Average Rep. Peak Power (Watts)	1774.6 ± 676.8	2172.4 ± 774.2	0.36
First to Last Rep % Change Interset Average Peak Force	0.05 ± 2.61	0.92 ± 3.73	0.93
First to Last Rep % Change Interset Average Peak Velocity	-4.62 ± 19.72	-0.15 ± 10.53	0.87
First to Last Rep % Change Interset Average Peak Power	-2.79 ± 21.39	2.23 ± 12.50	0.86
Average Set RPE (0-10)	7.8 ± 0.4	7.9 ± 1.2	0.75
First to Last Set % Change RPE Average	15.3 ± 12.0	12.9 ± 0.3	0.86

Table 2. Values for barbell variation on force, velocity, power, and RPE outcomes during high-intensity back squats by male recreational athletes. Averages across all repetitions were analyzed for each dependent variable. These were measured using a paired samples T-test (p<0.05) between both barbell variations. Using a safety squat bar barbell resulted in no significant (p>0.05) differences in average repetition peak force, peak velocity, peak power, and average set RPE during an acute multi-set high intensity back squat session. Further, no differences were found in the percent change from first and last repetition, averaged across multiple sets of all variables.

CONCLUSIONS AND PRACTICAL APPLICATIONS

CONCLUSIONS:

- In recreationally resistance-trained adults interested in developing lower body strength and power using the back squat exercise the acute use of either a traditional Olympic barbell or safety squat bar barbell similarly develops force, velocity, and power, and exertion feels similar.

PRACTICAL APPLICATIONS:

- Practitioners working with adult athletes or clients to develop lower body strength and power with the back squat exercise can interchangeably use the safety squat bar barbell and traditional Olympic barbell to similarly train force, velocity, and power across multiple sets.

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