FORCE-TIME DIFFERENCES BETWEEN THE STATIC HEXAGONAL BARBELL JUMP AND SQUAT JUMP IN RESISTANCE-TRAINED MEN

S.M. Camacho[1], C-T Ho[1], N.C. Raatz[1], S.M. McKeever[2], J.P. Lake[3,4], T.J. Suchomel[1]
[1]Carroll University, Waukesha, WI
[2]Divine Savior Holy Angels High School, Milwaukee, WI
[3]University of Chichester, Chichester, UK

Introduction

The execution of a static jump involves jumping from a 90-degree knee angle without a countermovement. Static jumps are commonly used as methods of training and testing and monitoring purposes. The propulsion phase of the exercises improves the rate of force development an athlete can produce (3). However, the load placement of the different static jumps may differ. Researchers have shown that the 0HEXJ has a greater mechanical advantage as a result of the resistance being arm's lengths away (2). The hexagonal barbell jump (HEXJ) and squat jump (SJ) may enhance lower body power output in resistance trained male athletes (1-2); however, there is a lack of research comparing force-time characteristics between HEXJ and SJ in male athletes using percentages of their body mass. Hence, the purpose of this study was to examine the differences in force-time characteristics between the HEXJ and SJ in male athletes.

Results

Table 1. HEXJ and SJ propulsion force-time characteristics.

Load (% BM)	Net Mean Force (N/kg)			Duration (s)			Net Impulse (Ns)		
	HEXJ	SJ*	g	HEXJ#	SJ	g	HEXJ	SJ	g
0	8.7 ± 1.1	8.7 ± 1.2	0.01	0.35 ± 0.03	0.32 ± 0.04	0.74	235.8† ± 33.2	217.9 ± 32.1	0.54
20	9.1 ± 1.1	10.0 ± 1.3	0.64	0.35 ± 0.03	0.30 ± 0.03	1.60	257.5† ± 42.8	238.4 ± 37.5	0.48
40	9.3 ± 1.1	10.0 ± 1.4	0.51	0.38 ± 0.03	0.33 ± 0.04	1.38	277.6† ± 41.6	257.8 ± 39.8	0.49
60	8.9 ± 1.4	9.6 ± 1.5	0.47	0.41 ± 0.03	0.36 ± 0.04	1.38	292.0† ± 49.3	271.5 ± 42.0	0.44
80	8.4 ± 1.1	9.2 ± 1.6	0.61	0.45 ± 0.04	0.39 ± 0.06	1.23	296.2† ± 47.9	278.7 ± 41.2	0.38
100	8.0 ± 1.3	8.5 ± 1.6	0.35	0.46 ± 0.06	0.43 ± 0.07	0.52	291.4† ± 48.7	284.0 ± 40.8	0.15

BM = body mass; g = Hedge's g effect sizes comparing HEXJ and SJ values; *= significantly greater than HEXJ average ($p = 0.01$), # = significantly greater than SJ average ($p < 0.001$); † = significantly greater than SJ value at the same load ($p < 0.05$).

Methods

- 20 men participated in two separate testing that required the subjects to perform either static HEXJ or SJ repetitions using 0, 20, 40 60, 80 and 100% of their BM as loads.
- Age = 23.5 ± 3.0 years, height = 175.1 ± 8.7 cm, BM = 79.6 ± 11.8 kg)
- HEXJ and SJ repetitions were performed on a force platform from a static starting position with the respective barbells resting on the floor or on boxes, respectively.
- Subjects either squatted down to the barbell (HEXJ) or under the barbell (SJ) to assume a knee angle of approximately 90° ± 5° and held a quiet standing period of at least one second before receiving a countdown prior to each jump trial.
- Each jump was performed on a force platform and the raw force-time data were used to calculate propulsion net (above system weight) relative mean force (NETRELMF), duration (DUR), and net impulse (NETIMP).
- A series of 2 (exercise) x 6 (load) repeated measures ANOVA with Bonferroni post hoc tests were used to compare the force-time characteristics produced during the HEXJ and SJ performed at each BM load.
- Hedge's g effect sizes were calculated to provide a measurement of the magnitude of the difference between exercises.

Conclusions

- The SJ produced greater NETRELMF compared to the HEXJ.
- HEXJ DUR on average were greater than the SJ.
- Greater NETIMP were produced during the HEXJ compared to the SJ across the entire loading spectrum, ;however, the differences were trivial to small.

Figure 1. Hexagonal barbell jump sequence.

Figure 2. Squat jump sequence.

Practical Applications

- Both the HEXJ and SJ may provide an effective training stimulus for resistance-trained men. However, if the training goal is to maximize rapid force production, the SJ may be a superior alternative to the HEXJ.
- The load prescribed can have a significant impact on the force production characteristics of the HEXJ and SJ exercises and thus, loads should be chosen based on the sought after performance characteristic.
- Practitioners should however consider the limitations of using percentages of BM when prescribing loads as individuals may respond differently based on their relative strength characteristics.

References

1. Suchomel TJ, McKeever SM, Sijuwade O, Carpenter L, McMahon JJ, Loturco I, Comfort P. The effect of load placement on the power production characteristics of three lower extremity jumping exercises. J Hum Kinet 68:109–122, 2019.
2. Swinton PA, Stewart AD, Lloyd R, Agouris I, Keogh JWL. Effect of load positioning on the kinematics and kinetics of weighted vertical jumps. J Strength Cond Res 26: 906–913, 2012.
3. Van Hooren B, Zolotarjova J. The difference between countermovement and squat jump performances: A review of underlying mechanisms with practical applications. J Strength Cond Res 31: 2011–2020, 2017.

smcmcho@gmail.com

National Strength and Conditioning Association National Conference
Baltimore, MD, July 10-13, 2024