Effects of Weightlifting vs. Kettlebell Training on Vertical Jump, Strength, and Body Composition

William H. Otto, III, Jared W. Coburn, Lee E. Brown, and Barry A. Spiering

Exercise Physiology Laboratory and Center for Sport Performance, Department of Kinesiology, California State University, Fullerton, Fullerton, California

Abstract

Otto, III, WH, Coburn, JW, Brown, LE, and Spiering, BA. Effects of weightlifting vs. kettlebell training on vertical jump, strength, and body composition. *J Strength Cond Res* 26(5): 1199–1202, 2012—The present study compared the effects of 6 weeks of weightlifting plus traditional heavy resistance training exercises vs. kettlebell training on strength, power, and anthropometric measures. Thirty healthy men were randomly assigned to 1 of 2 groups: (a) weightlifting (n = 13; mean ± SD: age, 22.92 ± 1.98 years; body mass, 80.57 ± 12.99 kg; height, 174.56 ± 5.80 cm) or (b) kettlebell (n = 17; mean ± SD: age, 22.76 ± 1.86 years; body mass, 78.99 ± 10.68 kg; height, 176.79 ± 5.08 cm) and trained 2 times a week for 6 weeks. A linear periodization model was used for training; at weeks 1–3 volume was 3 × 6 (kettlebell swings or high pull), 4 × 4 (accelerated swings or power clean), and 4 × 6 (goblet squats or back squats), respectively, and the volume increased during weeks 4–6 to 4 × 6, 6 × 4, and 4 × 6, respectively. Participants were assessed for height (in centimeters), body mass (in kilograms), and body composition (skinfolds). Strength was assessed by the back squat 1 repetition maximum (1RM), whereas power was assessed by the vertical jump and power clean 1RM. The results of this study indicated that short-term weightlifting and kettlebell training were effective in increasing strength and power. However, the gain in strength using weightlifting movements was greater than that during kettlebell training. Neither method of training led to significant changes in any of the anthropometric measures. In conclusion, 6 weeks of weightlifting induced significantly greater improvements in strength compared with kettlebell training. No between-group differences existed for the vertical jump or body composition.

Key Words muscular strength, power, back squat, power clean, goblet squat

Address correspondence to Jared W. Coburn, PhD, CSCS,*D, FNSCA, jcoburn@fullerton.edu

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Introduction

Weightlifting exercises, including the snatch and clean and jerk exercises and their variations, have been around for a long period. A number of studies have examined how weightlifting exercises can contribute to improved vertical jumping ability (1,5,8). Vertical jumping ability is believed to be a key performance indicator for athletes in many sports and is widely used in testing protocols for power (4,9). There are key similarities between weightlifting and vertical jump movements and how they relate to strength, power, and athletics (1,5). When performed correctly the snatch, clean and jerk, and related exercises resemble vertical jump movement patterns (4,8), as they consist of quick explosive movements. These similarities are important because both Olympic weightlifting movements and vertical jumping are specific to many athletic skills (6,10).

A relatively new form of training for athletic conditioning is kettlebell training. Kettlebell training is believed to provide many of the same benefits as weightlifting. However, research on kettlebell training is limited. To our knowledge, there has been only one study that has examined the effects of performing kettlebell exercises, specifically an examination of the oxygen cost of a particular movement (swings) with the kettlebell (7). Anecdotal reports of the benefits of using kettlebells over weightlifting movements include ease of teaching, less expense than purchasing a whole weight set, and less intimidating to use. Coaches may have an interest in using kettlebells; if space is limited, there is a lack of funding for Olympic bars or weights, or to assist athletes who have never lifted weights in gaining a foundation in the fundamentals of similar movements relating to strength and power (squat, press, clean and jerk, snatch). Therefore, the purpose of the present study was to compare the effects of 6 weeks of weightlifting and traditional heavy resistance training vs. kettlebell training on strength, power, and anthropometric measures. By directly comparing the results of traditional resistance training methods to kettlebell training, practitioners will be able to compare the relative effectiveness of the 2 training methods.

Methods

Experimental Approach to the Problem

The relationships between weightlifting exercises and strength, power, and vertical jumping ability are reasonably well established (5). However, less is known about the effects of kettlebell training. Therefore, we randomly assigned subjects to perform 6 weeks of either (a) weightlifting and traditional heavy resistance exercises or (b) kettlebell training to compare the effects of these different forms of training on strength, power, and anthropometric measures. Because of the high velocity and explosive nature of these lifts, we chose to achieve progressive overload by increasing volume and emphasizing the speed of movement to allow the subjects to concentrate on improving their technique while learning these complex lifts.

Subjects

Thirty healthy men (19–26 years) with at least 1 year of resistance training experience (no subjects had extensive experience with weightlifting or kettlebell exercises) volunteered to participate in this resistance training program. All procedures were approved by the University Institutional Review Board for Human Subjects, and the subjects signed a written statement of informed consent before testing and training. After a 1-week orientation period to familiarize subjects with the technique of the various exercises (typically 2–3 exercise sessions until proper technique was achieved), the subjects were randomly assigned to 1 of the 2 groups: (a) weightlifting ($n = 13$; mean $\pm$ *SD*, age: 22.92 ± 1.98 years; body mass: 80.57 ± 12.99 kg; height: 174.56 ± 5.80 cm) or (b) kettlebell ($n = 17$; mean $\pm$ *SD*: age, 22.76 ± 1.86 years; body mass, 78.99 ± 10.68 kg; height, 176.79 ± 5.08 cm). Each subject trained twice per week for 6 weeks with at least 72 hours between training sessions. In addition, each subject was tested on the dependent variables before (pretest) and after (posttest) the 6 weeks of training. Subjects were encouraged to continue with their normal dietary habits throughout the study. Pretesting and posttesting were conducted at the same time for each subject.

Procedures

Vertical Jump. An EPIC Jump Station apparatus (EPIC Athletic Performance, Inc., Colorado Springs, CO, USA) was used to assess vertical jump height. Subjects performed 3 countermovement vertical jumps with arm swings with 30-second rest between jumps. The best of 3 trials was used to represent vertical jump ability.

One Repetition Maximum Testing. Before beginning the training program, participants performed 1 repetition maximum (1RM) tests for the power clean and back squat in accordance with the National Strength and Conditioning Association (NSCA) guidelines (2). For the power clean, the lift was started with the weight bar on the platform. Subjects approached the bar and, with their hips and knees flexed, grasped the bar with a pronated grip, torso at approximately a 45° angle in relation to the floor. From that position, they raised the bar by forcefully extending their hips and knees. After the bar passed the knees, there was a slight rebending of the knees, followed by a second rapid extension of the hips and knees. Once the hips and knees were fully extended and the shoulders shrugged, the elbows were flexed to pull the body under the bar. Simultaneously, the hips and knees were flexed to a quarter squat position. After catching the barbell at the shoulders, the subjects then stood up by extending the hips and knees to a fully erect position. The researcher estimated the initial load subjectively, and from that, heavier weights were added until the maximum load was achieved in no more than 4 attempts. In case the movement was not fully performed to completion, the load previous to the failure was considered representative of the maximum strength.

For the back squat exercise, subjects began in an upright position with the barbell resting on the upper back and shoulders. While maintaining a flat back, subjects then slowly flexed the hips and knees, continuing downward until the hamstrings were parallel to the ground. Once the downward motion was completed, subjects extended the hips and knees to return to the initial position. The researcher visually assessed the degree of knee flexion, and verbal feedback was provided to the subjects. The initial load was subjectively estimated by the researcher, and from such estimates, heavier weights were added until the maximum load was achieved in no more than 4 attempts. In case the movement was not fully completed, the previous load was considered representative of the subject's maximum strength. A previous measure of the intraclass reliability coefficient for strength measurements in our laboratory was $R = 0.96$.

Anthropometrics. Participants were assessed for height (in centimeters), body mass (in kilograms), and percent body fat using a 3-site skinfold at the chest, abdomen, and thigh (11).

Kettlebell Training. For the kettlebell group, participants trained with a 16-kg (approximately 1 pood) kettlebell (Dragon Door Kettlebells, Torrance, CA, USA). Exercise selection included kettlebell swings, accelerated swings, and goblet squats. During weeks 1–3, sets and repetitions for each exercise consisted of 3×6 (kettlebell swings), 4×4 (accelerated swings), and 4×6 (goblet squats), respectively. Weeks 4–6, the volume increased to 4×6 (kettlebell swings), 6×4 (accelerated swings), and 4×6 (goblet squats), respectively. Progressive overload was achieved through a combination of increased volume and an emphasis on the technique and speed of movement.

Table 1. Comparison of mean (*SD*) pretest and posttest results between the 2 groups.

Test	Kettlebell (n = 17)		Weightlifting (n = 13)	
	Pre	Post	Pre	Post
Body mass (kg)	78.99 (10.68)	79.34 (11.43)	80.57 (12.99)	80.96 (12.45)
Vertical Jump (cm)	22.79 (3.28)	22.97 (2.92)*	23.44 (3.57)	24.37 (3.36)+
Back squat (kg)	124.24 (31.20)	129.82 (27.88)*	133.08 (30.38)	151.15 (32.41)*†
Power clean (kg)	78.53 (18.69)	81.88 (17.83)*	84.23 (22.35)	91.92 (22.22)*
% Body fat	12.90 (5.23)	13.15 (5.32)	13.00 (4.35)	13.45 (4.29)

*Posttest value greater than pretest value ($p < 0.05$).
†Significantly greater than kettlebell ($p < 0.05$).

Weightlifting Training. For the weightlifting group, a certified weightlifting bar with Olympic plates was used for training. Exercises consisted of high pulls, power cleans, and back squats. During weeks 1–3, sets and repetitions for each exercise consisted of 3 × 6 RM (high pull), 4 × 4 RM (power clean), and 4 × 6 RM (back squat), respectively. Weeks 4–6, the volume increased to 4 × 6 RM (high pull), 6 × 4 RM (power clean), and 4 × 6 RM (back squat), respectively. The choice of 80% of 1RM for the high pull, power clean, and back squat exercises was based on the NSCA 1RM table (2). As with kettlebell training, progressive overload was achieved by increasing training volume and emphasizing improved technique and the speed of movement.

Statistical Analyses

All data for the dependent variables (vertical jump, body composition, and 1RM) were analyzed using 2 (time; pre, post) × 2 (training group; weightlifting, kettlebell) mixed factor analysis of variances. Post hoc follow-up tests consisted of *t*-tests. An alpha of 0.05 was used for all analyses to determine statistical significance.

Results

The results for all dependent variables are presented in Table 1.

Vertical Jump

The results for the vertical jump indicated no significant group by time interaction, but there was a significant main effect for time. Vertical jump height increased significantly from pretest to posttest ($p < 0.05$).

One Repetition Maximum Testing (Power Clean and Back Squat)

The results for the power clean indicated no significant group by time interaction, but there was a significant main effect for time. Using the combined data indicated that power clean 1RM increased significantly from pretest to posttest ($p < 0.05$). There was a significant 2-way interaction ($p < 0.05$) for back squat strength. The results indicated that there were significant increases in 1RM back squat strength for the kettlebell and weightlifting groups; however, gains for the weightlifting group were greater than those for the kettlebell group ($p < 0.05$).

Anthropometrics

There were no significant changes in percent body fat or body mass for either group ($p > 0.05$).

Discussion

The principle finding of the present study was that short-term kettlebell training (12 training sessions for more than 6 weeks) significantly increased vertical jump height and that the gain in vertical jump performance (2.17%) was equivalent to that achieved with a combination of weightlifting and traditional heavy resistance training exercises. To our knowledge, this is the first study to document the effectiveness of kettlebell training in improving performance during a lower-body power movement, such as the countermovement vertical jump. It is well known that weightlifting can increase vertical jump performance (3,4,8), but it appears that kettlebell training can be just as effective in improving jumping performance. This might be explained by the similar movements of powerful ankle, knee, and hip extension done as quickly as possible while performing various kettlebell exercises.

Both kettlebell training and weightlifting increased back squat 1RM strength. As with the vertical jump, this is the first study to show that kettlebell training has the ability to increase 1RM strength, despite the emphasis of kettlebell training on explosiveness and the speed of movement rather than strength development. However, the gain in back squat 1RM strength following weightlifting (13.6%) was greater than that following kettlebell training (4.5%). One explanation for the discrepant results is that subjects who participated in the weightlifting group trained with heavier loads than those in the kettlebell group. Then, it is not surprising that the heavier training loads associated with weightlifting would provide a greater stimulus for strength gains for the back squat lift. The gains in 1RM back squat strength in the present study were significantly less than those reported by others (13) following weightlifting (43.7%) and vertical jump (47.8%) training programs. However, participants in our study trained for only 12 training sessions (twice per week for 6 weeks), whereas the subjects in the study by Tricoli et al. (13) participated in 24 training sessions (3 times per week for 8 weeks). In addition, subjects in our study reported that they were more physically active than those in the study by Tricoli et al. (13), where lower-body exercise was restricted for 3 months before training.

For the power clean, there were significant increases in 1RM (6.5%), with no difference between the groups. One possible reason for the lack of group differences for the 1RM power clean results, but not the 1RM back squat, is the similarity of both kettlebell training and weightlifting movements with the physical requirements of the power clean. The power clean, more than the back squat, requires power, the optimal combination of force and velocity. However, a 1RM back squat is characterized by heavy resistance and a lower power output because of the comparatively slow movement velocity during maximal lifts.

Body fat percentage and body mass did not change significantly with either form of training. This might be explained by the short-term nature of the training program. Moritani and deVries (1979) (12) found increases in muscle activation, but not muscle size, following the first 2 weeks of an 8-week resistance training program. Significant changes in muscle size are not typically observed after such short-term training programs. The limited resistance training experience of the subjects may also have stimulated nervous system adaptations more than muscle development because of the lack of familiarity with the various exercises used. The subjects in the present study reported little or no experience performing the weightlifting and kettlebell exercises. Thus, it is to be expected that the primary mechanism of improved performance be via neural adaptations.

Practical Applications

The results of the present study indicated that both weightlifting and kettlebell movements are effective in improving back squat and power clean 1RM, as well as vertical jump ability; however, weightlifting exercises are more effective for strength development. Neither method of training appears effective in altering body composition after 6 weeks of training. These findings support the use of kettlebell exercises as an alternative form of training for strength and conditioning coaches who are interested in improving the strength and power of their athletes.

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