TRANSFERENCE OF KETTLEBELL TRAINING TO STRENGTH, POWER, AND ENDURANCE

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ABSTRACT

Manocchia, P, Spierer, DK, Lufkin, AKS, Minichiello, J, and Castro, J. Transference of kettlebell training to strength, power, and endurance. *J Strength Cond Res* 27(2): 477–484, 2013—Kettlebells are a popular implement in many strength and conditioning programs, and their benefits are touted in popular literature, books, and videos. However, clinical data on their efficacy are limited. The purpose of this study was to examine whether kettlebell training transfers strength and power to weightlifting and powerlifting exercises and improves muscular endurance. Thirty-seven subjects were assigned to an experimental (EXP, $n = 23$; mean age = 40.9 ± 12.9 years) or a control group (CON; $n = 14$; mean age = 39.6 ± 15.8 years), range 18–72 years. The participants were required to perform assessments including a barbell clean and jerk, barbell bench press, maximal vertical jump, and 45° back extensions to volitional fatigue before and after a 10-week kettlebell training program. Training was structured in a group setting for $2\ \mathrm{d \cdot wk^{-1}}$ for 10 weeks. A repeated measures analysis of variance was conducted to determine group × time interactions and main effects. Post hoc pairwise comparisons were conducted when appropriate. Bench press revealed a time × group interaction and a main effect ($p < 0.05$). Clean and jerk and back extension demonstrated a trend toward a time × group interaction, but it did not reach significance ($p = 0.053$). However, clean and jerk did reveal a main effect for time ($p < 0.05$). No significant findings were reported for maximal vertical jump. The results demonstrate a transfer of power and strength in response to 10 weeks of training with kettlebells. Traditional training methods may not be convenient or accessible for strength and conditioning specialists, athletes, coaches, and recreational exercisers. The current data suggest that kettlebells may be an effective alternative tool to improve performance in weightlifting and powerlifting.

INTRODUCTION

Weightlifting exercises and powerlifting exercises (squat, bench press, and deadlift) singularly and in combination elicit improvements in power, strength, and other indices of performance (11,16,19), which have been shown to be directly associated with training adaptations (5,6). Weightlifting and powerlifting are also implemented in strength and conditioning programs performed by recreational exercisers and nonathletic populations (albeit with reduced loads) to improve function in activities of daily living such as walking and stair climbing. Additionally, these exercises incorporate a larger muscle mass and require substantial central and peripheral nervous system involvement (9,10). However, these methods of training do have their limitations in nonathletic populations. Major restrictions include the substantial amount of time that must be dedicated to learning proper technique, and the availability of the required equipment and the presence of qualified personnel to ensure the safety of such lifts.

As an alterative, other methods of training have been evaluated and implemented to improve performance and function (4,18,19). One such instrument, which has increased in popularity across a wide spectrum of exercise populations, but is yet to be researched extensively, is the kettlebell. A kettlebell is a cast iron weight that resembles a cannonball with a handle and is often used to achieve gains in strength, power, and overall conditioning. A kettlebell's design allows its center of mass to extend beyond the hand. This facilitates full body ballistic movements, similar to movements found in the snatch and clean and jerk in weightlifting. Common kettlebell exercises involve swings, lifts, and presses, but unlike weightlifting or powerlifting, kettlebell training can be performed bilaterally and unilaterally in all planes.

A limitation of kettlebell training, it can be argued, is the acclimation period that may be needed to perform the exercises with proper technique and intensity. However, kettlebells come in various weights, and kettlebell exercises can be progressed from simple full body movements to exercises that are unilateral or more complex involving rotation. In addition, kettlebells are smaller, require less physical space, are more accessible and are perhaps less intimidating than barbells and weight plates. These qualities

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may make kettlebells more available to more diverse populations with vast ranges of lifting experience. Kettlebells are currently used across a broad spectrum of strength and conditioning programs, from recreational to elite levels.

A comprehensive search of OVID Medline, National Library of Medicine (PubMed), Sportdiscus, CINAHL, and a search on Google Scholar using the keywords "kettlebells," "kettlebells and exercise," and "ketttlebell training" resulted in 3 peer-reviewed articles focused on the efficacy of the kettlebell use. One article reported kettlebell-derived strength gains in a work setting (12), another focused on cardiovascular responses and oxygen uptake (7), and most recently an examination of back, and hip muscle activation, motion and low back loads during kettlebell exercise was conducted (15). Despite the scarcity of scientific publications on the topic, there are many self-published books, videos and sport-specific programs, which prescribe kettlebell use for enhanced performance and rehabilitation (2).

Although it is important to provide peripheral and anecdotal evidence that kettlebells make an effective exercise tool, controlled long-term investigations can assist in determining the efficacy of kettle training programs to more accurately prescribe appropriate protocols and applications. If kettlebells are going to be used as an alternative implement to induce increases in strength and power, studies to determine whether kettlebell training transfers strength and power to traditional lifting activities are warranted. Thus, the purpose of this study was to quantify the effectiveness of kettlebell training on how it transfers strength and power to traditional lifts and muscular endurance. The main hypothesis set forth was that a progressive 10-week kettlebell training program will result in improved performance in weightlifting, powerlifting, and muscular endurance activities.

METHODS

Experimental Approach to the Problem

This interventional study was designed to investigate the effects of a 10-week kettlebell training intervention on strength, power, and muscular endurance. To address this, we conducted assessments of our participants' performance with 4 basic movements (dependent variables), which could be easily tested before and after the intervention and represented a cross-section of movements related to strength, power, and endurance. Assessments included a 3-repetition maximum (3RM) bench press, 3RM Clean and Jerk, a maximal vertical jump and repeated 45° back extensions to volitional fatigue. To ensure proper form and minimize the risk of injury, before entering the 10-week program, the participants were instructed through 2 one-hour sessions on the proper technique and use of kettlebells. Individual criterion, on which assigned weight during the training program was based, was derived from participants' rating of perceived exertion (RPE) and the amount of weight lifted for 10 repetitions with proper form and technique. All assessments (after the introductory sessions), excluding the back extensions, were tested for reliability. Kettlebell training was implemented in a progressive and phasic fashion and was designed for varied levels of experience and ability. A repeated measures analysis of variance was used to determine group × time interactions followed by paired *t*-tests when statistical significance was reached.

Subjects

Thirty-seven physically active male and female participants were studied. Before entering the study, the participants reported they were active through the use of individualized cardiovascular, strength training and flexibility exercise programs 2–3 times per week for at least 6 months. Nutritional intake was not controlled; however, the participants were asked to maintain their normal diet during the study. The subjects were assigned to 2 groups; an experimental group (EXP; $n = 23$; mean age $= 40.8 \pm 12.9$ years, mean weight 76.6 ± 14.4 kg) and a control group (CON; $n = 14$; mean age $= 39.6 \pm 15.8$ years, mean weight 76.8 ± 15.8 kg).

Before the 10-week training intervention, the participants underwent 2 one-hour orientation sessions with a certified kettlebell instructor to ensure that proper technique was being executed and that a comfort level with the equipment was achieved. All sessions, including the 2 instructional sessions for the EXP, were conducted indoors in a controlled environment at the same time of day, midmorning. The CON participants were also assessed at the same time of the day, were instructed to continue their daily activities and nutritional habits but were precluded from participating in any structured kettlebell training program.

The training intervention was administered through group classes. EXP met for 2 kettlebell training sessions per week for 10 weeks and were limited to aerobic and flexibility activities outside of class. The intervention was divided into 5 microcycles of 4 days each. Each microcycle began with a dynamic warm-up and was characterized by mode, volume, and intensity as follows:

The first microcycle (days 1–4) focused on swing cadence, use of momentum and neuromuscular coordination (acceleration and deceleration). The participants performed bilateral swings, unilateral swings, high pulls, push presses, squats and bilateral presses, side squats and transfers, iso–push-ups and unilateral hip extension and push ups. Each exercise was performed for 2 sets of 15–20 repetitions at an intensity commensurate with 60–65% (6–6.5/10) using a 0–10 RPE scale.

The second microcycle (days 5–8) focused on more complex movements requiring upper and lower extremities. Exercises included those in the first microcycle with additional unilateral cleans, single arm rows, and iso–push-ups. Endurance patterns were also emphasized during this microcycle. The participants were required to exercise at 70–75% of their RPE (7–7.5/10) for 2 sets of 20–15 repetitions for each exercise.

The third microcycle (days 9–12) consisted of larger and more full body movement including oblique exercises, woodchoppers, walkovers, and windmills. In addition, emphasis was also placed on the control of the kettlebell with a single arm and participants performed exercises for 2–3 sets of 15–10 repetitions at an RPE of 75–80% (7.5–8/10).

The fourth microcycle (days 13–16) incorporated similar movements to that of the third microcycle; however, the participants performed movements with a faster swing cadence for 2–3 sets of 10–5 repetitions at an RPE of 80–85% (8–8.5/10) and the fifth microcycle (days 17–20) focused on complex movements such as the "Turkish Get-Up," the "Wood Chopper" and the "Clean and Press" for 2–3 sets of 8–4 repetitions while maintaining an RPE of 85–95% (8.5–9.5/10). Attendance during the invention was approximately 80%. Of the 24 EXP participants, only 3 missed >3 classes, and no adverse events or injuries were reported. A detailed outline of the entire intervention including repetitions, sets and microcycle emphasis is given in Table 1.

To ensure that the participants met inclusion criteria, an intake form was provided before testing to screen for personal or family history of cardiac, pulmonary, or neurologic conditions that might preclude participation in the study. All the participants were informed in detail about the risks and benefits involved, and they signed an informed consent approved by the Long Island University Institutional Review Board.

Procedures

Performance evaluations for EXP and CON began with measurements of resting vital signs (blood pressure) and anthropometrics. The participants were instructed to sit in a quiet room for 10 minutes to help ensure that resting vital signs could be accurately measured. Body mass (kilograms) was determined with the use of impedance analysis technology (Tanita Body Composition Analyzer, Model TBF300A, Tokyo, Japan). Anthropometric measures performed with a retractable tape measure (Sammons Preston Rolyn Tape Measure, Bolingbrook, IL, USA) included chest, hip, and waist circumferences. These measures were chosen for their relevance to overall physical change (i.e., bench press) and for their relation to overall health status (i.e., waist-to-hip ratio). To maintain intertester reliability, the same tester conducted anthropometric measures for all the participants.

After resting values were acquired, EXP and CON participants completed assessments of muscle strength, power, and endurance. Because of the involved nature of these assessments, the participants were instructed on lift techniques by trained professionals. Although all the participants reported having at least 6 months of weightlifting experience, the subjects were allowed to practice the lifts until a subjective comfort level was achieved.

The lifting assessments (3RM bench press and the 3RM clean and jerk) were conducted to determine the maximum amount of weight lifted with proper form for three repetitions. Each subject was given 3 separate trials for these assessments, for which the test-retest reliability was collected. After the completion of the lifting assessments, the participants were given a short rest (10 minutes) before being introduced to the vertical jump and the back extension assessments. The amount of weight lifted for 10 repetitions with proper form was used as the criterion on which assigned weight for the training program was based. Weights were assigned as follows: RPE of 1–3 = 65%, RPE of 4–6 = 75%, and RPE of 7–9 = 85%. The participants performed 3 trials of a vertical jump, each separated by a 60-second rest period, followed by a 45° Cybex back extension (Cybex, Inc., Medway, MA, USA) to volitional fatigue.

The EXP participants completed a 10-week kettlebell training program consisting of 1-hour sessions, 2 times per week. Each session began with basic warm-up exercises to facilitate neuromuscular conditioning and increase blood flow before strenuous exercise (13). The warm-up was followed by 45 minutes of ballistic and dynamic kettlebell exercises, after the previously outlined progressive program. The training program was divided into 3 phases of progression involving combinations of bilateral and unilateral lifts, such as squats, overhead shoulder presses, and lunges. Classes incorporated movements using power and plyometric efforts such as swings, cleans, and high pulls. Class progressions used a standard periodization model for strength development. The participants used lower weight and higher repetitions (15–20) for days 1–8, progressing to exercises requiring heavier weight and lower repetitions (8–4) during days 17–20.

Intracorrelation coefficients (ICCs) were conducted on the 3 trials performed in the clean and jerk, bench press, and vertical jump to determine test-retest reliability. Pretraining R and p values and posttraining R and p values for each the EXP and CON are the following: Preclean and jerk; EXP ($R = 0.73$, $p < 0.01$), postclean and jerk; EXP ($R = 0.91$, $p < 0.01$). Preclean and jerk; CON ($R = 0.62$, $p < 0.01$), postclean and jerk CON ($R = 0.77$, $p < 0.01$). Prevertical jump; EXP ($R = 0.98$, $p < 0.01$), postvertical jump EXP ($R = 0.97$, $p < 0.01$). Prevertical jump; CON ($R = 0.98$, $p < 0.01$), postvertical jump; CON ($R = 0.99$, $p < 0.01$). Prebench press; EXP ($R = 0.95$, $p < 0.01$), postbench press; EXP ($R = 0.94$, $p < 0.01$). Prebench press CON ($R = 0.75$, $p < 0.01$), postbench press CON ($R = 0.85$, $p < 0.01$). Back extension activity was performed for 1 set to failure and was not included in this analysis.

Statistical Analyses

To investigate whether a 10-week kettlebell training program produces a transference of strength and power during weightlifting activities, data analysis was undertaken to determine if significant differences exist within or between the 2 conditions (EXP or CON). Training effects were analyzed using a 2-way analysis of variance with repeated

Table 1. Ten-week kettlebell training program.

Microcycle	Days	Sets	Reps	Intensity % (rating of perceived exertion)	Exercises	Focus
First	1–4	2	15–20	60–65% (6–6.5/10)	1. Dynamic range of moment warm-up (med ball)/planks	Swing cadence
					2. Bilateral swing	Demonstrate each exercise
					3. Unilateral swing	Use of momentum
					4. High pull	Plyometric coordination (decelerate to accelerate)
					5. Push press bilateral	
					6. Squat and press bilateral	
					7. Side squat and transfer	
					8. Iso–push-up and uni hip ext	
					9. Push-up	
Second	5–8	2	20–15	70–75% (7–7.5/10)	1. Dynamic warm-up	Endurance patterns
					2. Bilateral swings	Swing cadence
					3. Uni swings	Demonstrate each exercise
					4. Push press	Use of momentum
					5. High pull	Plyometric coordination (decelerate to accelerate)
					6. Uniclean (props)	
					7. S. arm row alt	
					8. S. leg H. ext. (iso–push-up on kettle)	
					9. Push-ups	
Third	9–12	2–3	15–10	75–80% (7.5–8/10)	1. Dynamic warm-up	Full body movement
					2. DBL arm swing	Single arm control
					3. SGL arm swing	Control of momentum
					4. Circular clean (uni)	Plyometric coordination (decelerate to accelerate)
					5. Push press–full	
					6. Wood chopper	
					7. KB straight arm pullover	
					8. Windmills	
Fourth	13–16	2–3	10–5	80–85% (8–8.5/10)	1. Dynamic warm-up	Faster swing cadence with coordination and control through momentum
					2. DBL swings (1KB)	Complex movements with rotation
					3. Rev. lunge and Single arm "Snatch" (1KB)	
					4. Clean and press (full) (2KB)	
					5. Side squat and transfer (1KB)	
					6. KB Chest Press (2KB)	
					7. Windmill	
Fifth	17–20	2–3	8–4	85–95% (8.5–9.5/10)	1. Dynamic warm-up	Putting it all together
					2. DBL swings (1KB)	Complex movements
					3. Clean and press (2KB)	Unilateral and bilateral control of momentum
					4. Uni-Snatch (1KB)	Rotational movements with speed and efficiency
					5. Wood chopper (1KB)	
					6. DBL Ch press (2KB)	
					7. Turkish get-up	

*Although not explicitly stated in the focus column, each progressive microcycle included the aspects and techniques from the previous phase. DBL= Double, SGL=Single.

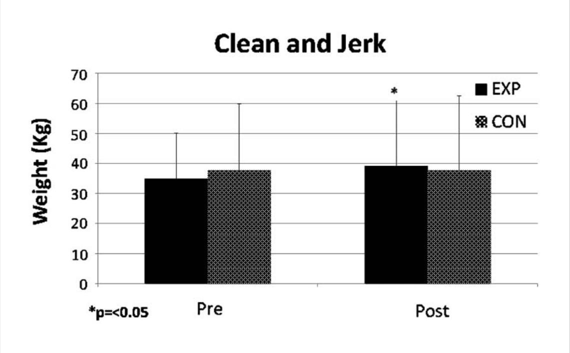

Figure 1. Clean and jerk comparison of preclean and postclean and jerk strength after 10 weeks of training intervention. $*p < 0.05$.

measures (group × time). Data were processed using a statistical analysis software package (SPSS v. 17.0, SPSS Inc., Chicago, IL, USA). For those variables in which significant group × time interactions were demonstrated, post hoc paired *t*-tests were conducted. A power calculation was conducted a priori to determine sample size. A mean difference of 5 kg, 15 repetitions, and 10 cm for the lifting activities, back extensions, and vertical jump, respectively, indicated that a minimum of 10 subjects were required to have 80% power for detecting a medium effect size. During the 3RM procedures, the maximal weight lifted was used for analysis. However, during the vertical jump, the highest value of 3 trials was recorded and analyzed. Statistical significance was set a priori at an alpha level of $p \leq 0.05$.

RESULTS

A significant group × time interaction was found in the bench press. A post hoc pairwise comparison revealed that the magnitude of improvement was significantly different in EXP (39.9 ± 22.6 to 54.1 ± 30.3 kg) as compared with that of CON (54.5 ± 28.8 to 58.2 ± 36.5 kg, $p < 0.05$). Additionally, a main effect for time was found for the clean and jerk (EXP; 34.9 ± 3.6 to 39.1 ± 3.8 kg vs. CON; 40.1 ± 5.4 to 40.9 ± 5.8 kg, $p < 0.05$).

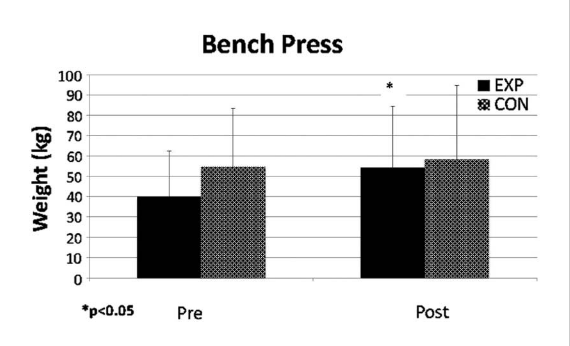

Figure 2. Bench press comparison of prebench press and postbench press strength after 10 weeks of training intervention. $*p < 0.05$.

Notably, a group × time interaction for the clean and jerk and the back extension approached statistical significance ($p = 0.53$). No significant changes were observed in any group for the vertical jump ($p =$ NS). The range of weight lifted for the bench press across all the subjects was 45–215 and 20–79 kg for EXP and CTRL, respectively. The range of weight lifted for the clean and jerk varied across all the participants from 30–145 and 9–59 kg for EXP and CON, respectively. Group results are presented in Figures 1 and 2.

The ICCs between trials represented strong test-retest reliability for all tests except the postclean and jerk in the EXP and preclean and jerk and the prebench press in the CON. Despite the lower than expected relationship of these trials, correlations were significant for all the variables in both groups as stated previously.

DISCUSSION

The present data support the hypothesis that kettlebell training can produce a transference of strength and power to weightlifting and powerlifting activities in a demographically wide range of participants. After 10 weeks of a structured kettlebell training class, the participants experienced significant improvements in 3RM clean and jerk and 3RM bench press. Although the back extension was not significantly different between groups after 10 weeks, the positive trend toward a difference suggests that larger sample sizes in similar training programs may produce a transference of muscular endurance as well. To our knowledge, this is the first study to look at potential and transferable performance improvements of kettlebell training in an adult, recreationally trained population as compared with controls.

Kettlebell exercises are ballistic in nature, and training through ballistic type movements have been reported to increase maximal power output and increase the rate of force development (8,17,20). The large muscle groups used to perform the explosive exercises in this training intervention may help explain the transference of strength and power demonstrated. The idea that a 10-week kettlebell intervention results in significant improvements in clean and jerk and bench press highlights the fact that peak forces during kettlebell training may effectively transfer to a variety of explosive movements.

This may be the first study to examine whether kettlebell training can transfer strength and power into other lifting styles. However, in a similar fashion to the transference examined in this study, there are data to support that improvements in lifting are highly correlated to improvements in other types of activities (1,5,14). Canavan reported similarities in maximal power, time to maximal power, relative power, maximal force, and time to maximal force between the hang power snatch and vertical jump in collegiate athletes (3). Others have shown that weightlifting improvements are highly associated with assessments of power (19). Therefore, although the notion of transference of ability or performance is not unique, using kettlebell training to transfer indices of strength and power to other types of lifts is new and may point to kettlebells as a viable alternative to traditional lifting methods.

Although the mechanism by which kettlebell training transfers strength and power was not examined, improvements over time were observed in the participants during various activities. For example, the kettlebell swing, which involves substantial concentric force followed by an eccentric contraction to decelerate the weight at the end of the up-phase of the swing transferred to an increase of 4.5 kg (11.4–15.9 kg) in the clean and jerk in a 72-year-old participant. This may suggest that even in older populations training with kettlebells over a prolonged period may develop new neuromuscular patterns resulting in more efficient and precise afferent and efferent signals used to control the weight. Overall, EXP participants improved their clean and jerk by approximately 4 kg (10%) and their bench press by 13 kg (~30%). Other work on kettlebell exercise has found similar results. Previous work by Jay et al. (12) reported that subjects assigned to an 8-week intervention of kettlebell exercise significantly improved muscle strength. In the current study, the duration of the training program exceeded the program length conducted in previous studies (7,12); however, it is interesting to note a shorter training period of 8 weeks can still have a profound effect. The effectiveness of a shorter-term (8-week) intervention further supports the argument for kettlebells as an effective implement in a weight training or powerlifting program.

The improvement in bench press and clean and jerk observed in this study may be owed to the unique design of the kettlebell and the way that kettlebell activities are performed. Most weightlifting or powerlifting activities incorporate heavier weight closer to the center of mass and are not rhythmic; thus, they do not represent a cyclical, repetitive activity. In contrast, the kettlebell, because of its unique architecture, the handle distal to the center of mass may aid in the generation of more rapid and rhythmic contractions. More focused on eccentric loading, the kettlebell provides a longer lever arm where the center of mass is not fixed. The current findings support that this ballistic, cyclic and repetitive style, germane to kettlebell training, results in a transference of strength and power during traditional lifts.

In other studies on the effectiveness of kettlebell exercise, Farrar et al. (7), measured oxygen cost in 10 college-aged men during 12 minutes of 2-handed kettlebell swings using one 16-kg kettlebell. Results suggest that the intensity of this exercise protocol could present a sufficient metabolic stimulus to increase maximal oxygen uptake to stimulate cardiovascular adaptations. Jay et al. (12), by contrast, through 8 weeks of training with kettlebells, did not demonstrate a sufficient stimulus to increase maximal aerobic capacity. The reduced cardiorespiratory response was attributed to the incorporation of momentum along with the size of the kettlebell that was used (male participants 8 kg; female participants 4 kg). The contrast in the findings of these 2 studies highlights the need for more scientific data to determine what type of training volume and load is most appropriate during kettlebell training.

Because of the scarcity of research on the subject of kettlebell training, little information exists with respect to the optimal kettlebell training protocol. Owing to the complex and ballistic nature of kettlebell exercise, great variability in biomechanics, force production, and other measurements of movement may exist as compared with other movements involving single joints or fixed machines. Currently, the recommended weight for kettlebell training is based more on anecdotal information rather than direct measurements. This is illustrated by studies that have assigned weight for male and female participants without taking in account individual variability. Unlike previous work, this study incorporated exercises where the assigned weight was based on participants' RPE on a 0–10 scale during the 2-hour instructive period and was progressively increased with each phase of the training program. Although this may not be the most optimal way of determining a proper starting weight, as many other methods could be suggested, this method normalized the intensity to the individual's RPE. This was done to enhance the effectiveness of the program while helping to ensure participants' safety during the lifts.

The current investigation has strengths and limitations. The unique design of the progressive and phasic kettlebell training program and the incorporation of highly skilled fitness professionals who supervised the participants throughout the group sessions helped to make the program effective and safe. The inclusion of a control group and the overall adherence to the training program (~80%) was unexpectedly high and added to the strength of the study design. Although the average age of the participants was closely matched between EXP and CON, there was a large age range within each group. Subsequently, this may be viewed as a negative aspect of the study because the subjects within groups were not matched optimally. However, the positive results demonstrating the transference of strength and power in the wide age range of the participants trained in this study, suggest the importance and significance of kettlebells as an alternative training implement. Similar to their younger counterparts, the participants of advanced age still showed improvement in both the clean and jerk and bench press. This suggests that kettlebells may provide a necessary and convenient method for improving everyday muscle and enhancing performance during activities of daily living. Further research is needed to stratify the participants by age to specifically determine the efficacy of kettlebell training in varied populations.

Other limitations of this study are related to the inclusion criteria. Specific inclusion criteria may have limited the generalizability of the data. Although we did have a control group, the small number of participants in the study ($n = 37$) may have limited the detection of differences between the EXP and CON in some of the assessments, such as the back extension and the vertical jump.

Practical Applications

The results of this study provide evidence that kettlebell training can be effective as an alternative method to enhance strength and power during traditional weightlifting exercises. Although there is a plethora of information on kettlebell training programs, many do not have data to support their efficacy because the majority are based on anecdotal information. This study demonstrates that kettlebell training over a 10-week period may be beneficial to coaches, athletes, and recreational exercisers alike because it outlines, very clearly, a progressive and effective way to increase strength and power.

Traditional weightlifting equipment (e.g., barbells, weight plates, and benches) may be costly, take up a large footprint in a gymnasium, and may be intimidating to novice users. To this end, the use of kettlebells in strength training programs for the general population and for athletes may obviate the need for traditional equipment in some cases. The longitudinal, controlled design of this study (albeit with a small sample) may provide, for coaches and trainers, necessary evidence that kettlebells can be used as an effective adjuvant method to plyometrics and other techniques used to enhance strength and power. In addition, because of the broad demographic examined in this study, the data suggest that kettlebells can be used in a safe and effective manner with individuals of varied ages who possess minimal lifting experience.

This study supports kettlebell training to be used by coaches in climates of restricted spaces and budgets. The notion that kettlebells are more easily accessible, require less physical space, and can be used when traditional lifting is not possible may be very attractive to strength conditioning specialists. However, caution should be exercised when training with kettlebells, because their use requires proper technique and appropriate intensity.

For future training studies and programs using kettlebells, it is important to consider valid and appropriate methods to determine the relative intensity among participants. To do this, this study used 3RM testing, and a 2-hour kettlebell instructional period during which the participants reported their RPE.

Because of the phasic nature of the program outlined in this study, the RPE appeared to be an appropriate way of assigning weight. By doing this, individual variability including, age, gender, and experience could be taken into account, and each participant could exercise at an appropriate intensity for their capability. It would appear that the outcomes of this study support the use of a phasic, progressive training program based on RPE. In the 24 participants involved in the training program, there were no injuries or adverse events reported. Although the RPE method is not optimal, it remains a convenient and practical method to help ensure the safety of athletes and clients. Practitioners should remain cognizant of how important the assigned weight is when embarking on a kettlebell training program. Thus, strength and conditioning specialists are advised to consider using the RPE as a subjective measure to develop progressive training programs using kettlebells.

To add to the scientific literature, more randomized controlled study designs should be carried out to fully examine the effectiveness of kettlebells. Studies that limit the participants to those who are experienced in performing kettlebell exercises may decrease the inherent variability found in a more novice population. However, results and generalizability from such studies must be tempered given that people with extensive experience in the use of kettlebells does not truly represent the majority of kettlebell users. For coaches and trainers working with novice kettlebell users, a preintervention familiarization period is suggested to help account for differences in exercise proficiency and other individual variability.

Although the findings in this study suggest that kettlebells can be used by strength coaches and trainers to effectively improve weightlifting and powerlifting performance, more controlled scientific investigations on kettlebell training may help strength and conditioning specialists better understand the performance benefits that kettlebells confer to more effectively develop training protocols for populations that require a broad range of training priorities. As with any training study, better control for nutrition, training experience, age, and gender is recommended to produce valid findings.

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