SCIENTIFIC
JOURNAL OF
SPORT AND
PERFORMANCE

ORIGINAL ARTICLE

Inclusion of a connected adaptive resistance exercise machine in a 6-week training regimen with collegiate basketball players: A double-blind randomized controlled trial

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ABSTRACT

In this study, we aimed to determine the effects of incorporating connected adaptive resistance exercise (CARE) into a training regimen with collegiate basketball players on lower body performance metrics. Thirty-two male participants (aged 18-26) with collegiate basketball experience trained thrice weekly for 6 weeks with a periodized training program that included CARE and were randomized 1:1 and blinded to an intervention group (n = 16; where the CARE used accentuated eccentric loading (AEL)) or an active control group (n = 16; where the CARE did not use accentuated eccentric loading (ACTL)). Standard anthropomorphic measures along with one repetition maximum (1-RM) back squat, vertical jump height, and peak power were assessed prior to and following completion of the training regimen. Both groups demonstrated significant increases in 1-RM back squat, jump height, and peak power (both $p < .001$). However, AEL yielded significantly greater improvements compared to ACTL across these measures ($p < .001$, g = 0.91; $p < .001$, g = 0.89; $p < .001$, g = 0.92, respectively). The findings of the present study demonstrate that the inclusion of CARE may be a superior strategy for improving performance variables of lower-body strength, peak power and jump height for male collegiate basketball players.

Keywords: Performance analysis of sport, Eccentric, Power, Jump height.

Cite this article as:
Yamamoto, T., Pandit, B., Viggiano, M., McCabe, C., Mickelsen, E., Geralds, C., Jeon, M., Ulitsky, I., Kim, A., Mologne, M. S. & Dolezal, B. A. (2023). Inclusion of a connected adaptive resistance exercise machine in a 6-week training regimen with collegiate basketball players: A double-blind randomized controlled trial. *Scientific Journal of Sport and Performance*, *2*(4), 540-552. https://doi.org/10.55860/YBCW4009

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Submitted for publication August 06, 2023.
Accepted for publication September 05, 2023.
Published September 12, 2023.
Scientific Journal of Sport and Performance. ISSN 2794-0586.

doi: https://doi.org/10.55860/YBCW4009

INTRODUCTION

Resistance training is widely used by many facets of the population with the goal of enhancing athletic performance, preventing injuries and maintaining a healthy lifestyle. As the fitness industry continues to develop within the mainstream culture, new technologies are integrating with long-established resistance training modalities (e.g., free weights, machines, bodyweight) to augment training, convenience, efficiency, and accessibility to developed fitness regimens. Those who use these novel technology-driven machines have claimed to demonstrate their potential for improved training through continuous maximal load-bearing movements and heightened eccentric resistance.

Eccentric-biased training protocols are long-established (Vogt et al., 1985) and routinely used in protocols involving sports performance enhancement, athletic rehabilitation, injury prevention, and management of tendinopathies (Lorenz and Reiman, 2011). Incorporating eccentric resistance within workout routines has been demonstrated to increase strength, as greater maximum force – almost 50% more – can be developed during maximal eccentric muscle action with each repetition (rep) (Higbie et al., 1985). Subsequently, when compared to concentric or concentric-eccentric training, it possesses unique neural, molecular, and metabolic responses that potentiate a greater adaptation in muscular strength and power (Merrigan et al., 2022).

Eccentric overloading methods began with plyometrics (Wilt, 1978) and over the years burgeoned, sprawling out to the likes of tempo eccentric training (Suchomel et al., 2019), flywheel inertial training (Fiorilli et al., 2020), accentuated eccentric loading (Moore and Schilling, 2005), forced eccentric repetitions (Paddon-Jones and Abernethy, 2001), supramaximal eccentric loading (Mike et al., 2015), and, more recently, stepwise load reduction training (SLRT) (Ozaki et al., 2020). These forms of training can be particularly useful for basketball players. Based on their high frequency of high impact vertical jumping, basketball players have an increased risk of developing chronic patellar tendinopathy (Lian et al., 2005), commonly referred to as "*jumper's knee*" (Blazina et al., 1973). Eccentric training is often used to treat chronic patellar tendinopathy, in addition to other basketball-related injuries such as Achilles tendinopathy, lateral elbow tendinopathy, and rotator cuff tendon disorders (Murtaugh and Ihm, 2013). Beyond its utility for tendinopathy treatment and prevention, eccentric training can also be useful from a performance standpoint. A weekly eccentric overload squat training regimen with basketball and volleyball players was able to elicit significant improvements in countermovement jumping and eccentric and concentric squat test performance without aggravating patellar tendon complaints (Gual et al., 2016). Furthermore, a systematic review conducted by Younes-Egana et al. (2023) found that eccentric overload training via inertial flywheel can confer significant improvements in vertical jump height, change of direction, and running speed.

However, despite these benefits, many forms of eccentric-biased training have been limited to being performed through isolated, non-standard resistance-training exercises that make it challenging to incorporate into routine workout sessions (Harris-Love et al., 2021). For example, SLRT requires constant adjustments in weight, that often are inaccurately measured leading to sub-maximal load-bearing movement. Moreover, the broad implementation into training regimes has not been feasible for most people for a variety of reasons such as lacking a training partner who can assist with lowering weights in a safe manner, the inability of adapting certain exercises to perform in eccentric form, and lack of knowledge of how to implement eccentric overloads, among others.

In this context, a whole new generation of training devices are pushing the eccentric-biased training further. Recently, a novel connected adaptive resistance exercise (CARE) machine (Vitruvian Form; Perth, Australia), was developed that employs the use of a supercharged electro-magnetic motor along with a cable-drawn mechanism that allows for both concentric and eccentric movement. The machine-learning device utilizes neural networks, and other classification algorithms to constantly adjust the resistance based on velocity, force and displacement during the movement and can make minor adjustments to the load, ensuring the user is performing at their maximal load (Nuzzo and Nosaka, 2022). Furthermore, the ability of the AI mediated algorithm to adapt and progress resistance within and between exercise sets accentuates eccentric loading while maintaining concentric loading.

It is speculated that CARE machines are able to overcome the limitations of traditional resistance training modalities by providing different resistances within a given repetition as fatigue occurs (Nuzzo and Nosaka, 2022). Moreover, the addition of the different resistances and the algorithmic load-switching may confer greater strength and power than resistance training alone, which requires further scientific scrutiny. We elected to select elite calibre basketball players to evaluate the efficacy of this novel CARE device, as it was hypothesized that this specific population would be able to maximize intervention-induced benefits.

To the best of our knowledge, no published literature exists on the utilization of CARE devices as an adjunct form of exercise intervention, or the subsequent effects of the different types of resistance on physical/sports performance outcome measures. This study investigated, using a double-blinded, randomized controlled study design, the effects of a novel CARE device during a 6-week training regimen on muscular strength, vertical jump and lower body peak power in collegiate-level male basketball players. We hypothesized that participants who received the accentuated eccentric loading as part of their conditioning program would demonstrate greater improvement in all three performance variables than those engaged in the conditioning program without accentuated eccentric loading.

METHODS

Participants

Thirty-two male volunteers (aged 18-26 years) were recruited by word-of-mouth in the Los Angeles community that met the following inclusion criteria: (i) apparently healthy men, (ii) 18-26 years of age, (iii) collegiate-level basketball player (i.e., Junior college, Division 1-3 college) and (iv) history of exercising >2 workouts/weekly the past 12-months. Exclusion criteria included the presence of musculoskeletal, cardiovascular, pulmonary, metabolic, or other disorders that would preclude moderate-to-high intensity exercise participation and testing and (ii) use of any drug or supplement known to enhance anabolic responses. All volunteers completed a pre-participation physical activity readiness questionnaire (PAR-Q) (Bredin et al., 2013) and an exercise history questionnaire. Sample size of n = 32 was calculated based on a pre-hoc power analysis using the vertical jump reported in a previous study of similar design (Baum et al., 2020) assuming a = 0.05 and b = 0.2. The study was performed in accordance with the ethical standards of the Helsinki Declaration and was approved by the UCLA Institutional Review Board. All participants provided written informed consent.

Study design

This was a prospective, double-blinded, randomized placebo-controlled trial. Using a parallel research design and an online random number generator, 32 participants all trained for 6 weeks with periodized training program that included CARE and were randomized 1:1 and blinded to *(i)* an intervention group (n = 16; where the CARE used accentuated eccentric loading (AEL) or *(ii)* an active control group (n = 16; where the CARE did not use accentuated eccentric loading (ACTL). To guarantee investigator blinding, the provider of the intervention, data collector and data assessor were separate individuals that were masked from knowing those assigned to the intervention and active control groups. All assessments and training were administered off-site (at a sports conditioning facility) by trained research personnel under the direction of the lab director from the UC Fit Digital Health – Exercise Physiology Research Laboratory. Dietary intake and macronutrient portions were not controlled apart from the requirement of not starting a dietary supplement or weight loss/gain diet that might affect fat and fat-free body mass.

CARE Machine

The CARE machine consists of motorized winches on a platform that applies forces to two independent cables with attached handles that exit the top. A mobile application and integrated machine software control the winches. During the exercise, participants exert force against the cables as the winches retract them. The machine's proprietary algorithm adjusts the resistance between 0 to 100 kg per cable in real time at 50 Hz. Herein, the term 'adaptive resistance' will be defined as the magnitude of this resistance adjustment, which is dependent on the participant's force generating capacity, movement velocity, exercise mode, and initial resistance selected (Nuzzo and Nosaka, 2022). Each participant had their own account set up beforehand and only a user's own account was used during each training session. This allowed for the individualized adjustments to be incorporated for all of the participants.

Figure 1. The connective adaptive resistance exercise machine consisting of motorized winches on a platform that are controlled by integrated machine software.

Procedures

To ensure accuracy, reliability and consistency in test administration, all pre-and post-testing occurred in the same location and time of the day (*i.e.*, early evening to optimize diurnal effect on strength) by the same investigator. Based on energy system requirements and the skill demand of the tests, the following sequence was followed (Bredin et al., 2013):

1. *Anthropometrics:* Height was determined using a precision stadiometer (Seca, Hanover, MD). Body mass and percentage body fat (BF%) was measured using a validated (Dolezal et al., 2013) octipolar, multi-frequency, multi-segmental bioelectrical impedance device (270; InBody Co., Seoul, South Korea). Since hydration state has a marked influence on bioelectrical impedance analysis (BIA) results, participants were instructed to remain hydrated and avoid caffeine and heavy exercise during the 12-hour period before testing. Data were collected after at least three hours of fasting and voiding.
2. *Muscle strength:* Lower-body isotonic muscle strength was measured by determining 1-repetition maximum (1-RM) of a free-weight back squat using standardized procedure (Grgic et al., 2020). The 1-RM is defined as the highest weight lifted through one full range of motion after reaching volitional or momentary failure. Briefly, subjects performed a light warm-up including whole body exercise on a treadmill or cycle ergometer, followed by light stretching. Participants were allowed several practice

trials of each exercise with minimum resistance to ensure good form, full range of motion, and good breathing technique. The resistance was progressively increased by trained researchers following standard procedure, leading to an attempt to complete 1–2 repetitions at a load estimated to be near maximum. Subsequently, the participant rested for 2 minutes and then attempted to achieve the 1-RM. For each 1-RM trial, participants attempted 2 repetitions. If participants were able to complete 2 repetitions, they were given a 2-minute rest and the load was increased. If participants failed the 1-RM attempt at the given weight, 2-minute rest was provided, and the load was decreased to the midpoint between the last successful lift and the failed lift.

3. *Jump height and lower-body peak power:* Leg power was estimated using a previously validated (Leard et al., 2007) electronic jump mat (Just Jump; Probotics, Inc., Huntsville, AL, USA). To minimize the effects of fatigue from the strength and endurance test, a 30-minute rest period was implemented prior to this testing. Participants stood on the mat with feet at hip width and then performed a countermovement jump (CMJ) for maximal height. Jump height was recorded with a handheld computer interfaced with the jump mat. Three trials were given with 30-second rest between trials. The best trial was used to calculate peak and average leg power using published equations that required jump height and the subject's body mass (Harman et al., 1991). Jump height (Wright et al., 2012) was determined from "*hang time*" defined as time (s) from the feet leaving the mat to their return and the following equation: Ht = t^2 x 1.227, where t is hanging time in seconds and 1.227 is a constant derived from the acceleration of gravity.

Supervised, periodized, lower-body strength-power resistance training regimen

The six-week training provided to all randomized participants integrated portions of an evidenced-based lower-body strength-power resistance training program that is effective for increasing muscular strength, jump height and lower-body power output (Schoenfeld et al., 2021). Table 1 describes the typical workout sequence and exercises performed in circuit totalling approximately 20 min, three times weekly on non-consecutive days for 6 weeks (18 sessions). Participants were given a brief, standardized description and demonstration of each exercise prior to study commencement. The participants were instructed before each session to perform all exercises at maximal intensity with correct form throughout. Trainers supervised each workout session individually and recorded workout data as well as training compliance.

Both study research arms performed identical training programs with the exception of the CARE accentuated or non-accentuated eccentric loading in order to directly assess the potential improvements in performance associated with the inclusion of two CARE exercises, the Bulgarian split squat and Bilateral deadlift. For every repetition performed, the AEL group performed 'accentuated eccentric' loads at 1:1.5 (or 150%) of the concentric load while the ACTL group performed normal eccentric loads at 1:1 (or 100%). The CARE machine was connected via Bluetooth to an iPad. The app (Vitruvian Form) tracked the Bulgarian split squat and Bilateral deadlift as well as 'set' the starting loads depending on concentric and eccentric loads from the prior warm-up session performed a day earlier. An unblinded investigator at the study start set the appropriate mode for the AEL and ACTL groups and assigned the first session load according to 1-RM back squat at baseline testing. Thereafter, the machine AI set new starting loads for subsequent workouts to adjust to training adaptations. Although the exercises are shown synchronously on the iPad app as the participant performs the movement, it was not utilized for this study.

Table 1. 6-week lower-body strength-power resistance training circuit including CARE.

Warm-Up	**Tempo/Timing**
• Forward and Back Leg Swing • Side to Side Leg Swing • Jog-in-Place w/High Knees	• 20 Repetitions each, 1 circuit • Performed at a comfortable tempo
Circuit	**Tempo/Timing**
1. Squat Jumps w/15-25 lb vest 2. **Bulgarian Split Squat @ wt = 60-150% 1-RM concentric-eccentric (CARE Machine)** 3. Plyometric Box Jumps w/15-25 lb vest 4. **Bilateral Deadlift @ wt = 60-150% 1-RM concentric-eccentric (CARE Machine)** 5. Split Lunges w/15-25 lb vest 6. Deadmill Sprints	• Work-to-rest ratio; wk. 1-2 was 30 s work, 20 s rest and wk. 3-5 was 40 s work, 20 s rest and wk. 6 was 60 s work, 20 s rest • 2 circuits with 3-minute rest period between circuit • Performed at maximum effort • Under control, slowly complete the CARE during the eccentric component
Cool Down	**Timing**
• Brisk walk for ~2 min	• 2 minutes

Note. lb = pound; s = second; CARE = Connected Adaptive Resistance Exercise; 1-RM = 1-Repetition Maximum.

Statistical analysis

Descriptive statistics are presented as mean ± standard deviation (SD). Statistical significance was determined based on $\alpha = .05$ and all tests were two-tailed. Continuous variables were first assessed for normality via Shapiro-Wilk tests. Within-group comparisons at baseline and after 6 weeks were made by paired *t*-tests and Wilcoxon signed-rank tests for normally and non-normally distributed variables respectively. Changes between groups after 6-weeks of training were made by Welch's *t*-tests if data were normally distributed and Wilcoxon rank-sum tests if data deviated significantly from normality. A Holm-Bonferroni correction to control the familywise error rate was applied. Effect sizes were measured by Hedges' *g*. Analysis was performed in Excel (Microsoft Corporation, Redmond, Washington) and R (version 3.5.1; R Foundation for Statistical Computing, Vienna, Austria).

RESULTS

All thirty-two participants successfully completed the 6-week training program with no missed sessions. Demographic and performance measures were collected at both baseline and post-training for all participants (Table 2). No significant change in body mass or body fat percentage was detected within either group or between groups. In contrast, both groups demonstrated significant increases in 1-RM after 6 weeks (both $p < .001$), with AEL showing a significantly greater increase compared to the ACTL group ($p < .001$, $g = 0.91$). Both groups showed significant increases in jump height (both $p < .001$) and peak power (both $p < .001$). For all performance variables, AEL demonstrated significantly greater increases compared to ACTL ($p < .001$, $g = 0.89$; $p < .001$, $g = 0.92$; for jump height and peak power, respectively).

DISCUSSION

This study serves as the first of its kind in assessing the efficacy of CARE technology on lower body strength and power measures in elite-level basketball athletes. Although conventional eccentric overload training (EOT) protocols have been proven to increase lower body hypertrophy, power as well as eccentric and concentric force (Harris-Love et al., 2021), to our knowledge, there are no performance studies available examining the implementation of EOT via CARE technology. Therefore, this study provides a preliminary

Table 2. Demographic and performance variables at baseline and after 6 weeks for all participants.

	Control Group (n = 16)				**Intervention Group (n = 16)**					
	Baseline	**Post**	**Change**	***p*-within†**	**Baseline**	**Post**	**Change**	***p*-within†**	***p*-between†**	**Hedges *g***
Age (y)	20.5 ± 2.0	-	-	-	19.8 ± 2.1	-	-	-	-	-
Height (cm)	187.9 ± 2.7	-	-	-	188.2 ± 4.2	-	-	-	-	-
Body mass (kg)	84.1 ± 6.3	84.3 ± 5.7	0.2 ± 0.4	1.000	83.4 ± 4.3	83.3 ± 6.7	0.1 ± 0.7	1.000	1.000	0.13
Body fat (%)	8.4 ± 3.1	8.3 ± 2.2	-0.1 ± 0.6	1.000	8.7 ± 3.2	8.5 ± 4.8	-0.1 ± 0.2	1.000	1.000	0.10
1-RM (kg)	84.1 ± 11.5	103.1 ± 8.3	21.3 ± 2.4	<.001	85.4 ± 7.1	115.8 ± 10.9	30.4 ± 8.5	<.001	<.001	0.91
Jump height (cm)	59.8 ± 5.4	71.4 ± 6.2	11.6 ± 3.2	<.001	60.2 ± 4.5	78.6 ± 6.5	18.4 ± 3.2	<.001	<.001	0.89
Peak power (W)	4866 ± 334	5716 ± 275	850 ± 237	<.001	4655 ± 255	6635 ± 217	1980 ± 120	<.001	<.001	0.92

Note. Values are mean ± SD. No significant differences were observed at baseline between groups. 1-RM = one repetition maximum; †after correcting for multiple comparisons.

understanding of the viability of utilizing CARE training to enhance lower body strength and power. As expected, there were significant increases across all of the performance measures from the 6-week training regimen in both ACTL and AEL groups, including 1-RM back squat, CMJ height, and peak power. However, the intervention group produced significantly greater increases than the control group across all performance variables.

The increases in 1-RM back squat may be attributed to the greater eccentric overload occurring during the training. With the use of CARE technology, the electro-mechanic motor in conjunction with a proprietary AI-based software alters the eccentric and concentric force based on the rep number, concentric speed, and eccentric speed. This allows for each rep to be utilized for its maximum force and hypertrophy benefit, with varying weights used throughout the rep for the concentric and eccentric phases (Nuzzo and Nosaka, 2022). Optimal training requires variation in the weight throughout the set to maximize both phases of the movement, with the eccentric force being substantially greater than the concentric force. In the present study, this form of training incorporated through CARE set the initial load at the maximum for the eccentric and reduced the load throughout the concentric, allowing for maximum effort throughout each repetition. Conversely, traditional weights cannot alter the load throughout the set, which limits their overall hypertrophic benefits. Since eccentric force significantly contributes to muscle growth, in this study, CARE training may have provided a hypertrophic advantage through an actively changing eccentric overload without the typical concentric limitation. In turn, this may have resulted in benefits often associated with eccentric overload training, such as increased muscle excitability and activation due to greater muscle fibre utilization, that translated into the 1-RM back squat increases (Douglas et al., 2017).

Furthermore, CARE training yielded promising improvements in total jump height and peak power metrics. Recent research has shown that lower extremity strength serves as a strong contributor to jump height, with increases in lower body hypertrophy translating into improvements in jump height and power (Stephenson et al., 2015). Consequently, a potential mechanism for the increases in jump height and power metrics within the AEL group may be the increased muscle hypertrophy, which acts secondary to optimized eccentric exercise. The stretch-shortening cycle (SSC), which refers to the eccentric phase prior to an explosive concentric action (Turner and Jeffreys, 2010), has been shown to increase jump height and lower body power in response to eccentric overload training. In comparison to an eight-week SSC exercise training regimen conducted by Malisoux et al. (1985), the present study produced a significantly higher increase in peak power (42.5% versus 9%, respectively). Although other training studies differed in terms of training protocol (*i.e.*, Duration, frequency, volume, etc.), when compared to these results, previous results yielded lower jump height and peak power improvements than those associated with the present study (Tomioka et al., 2001). This finding suggests that CARE training has the potential to induce performance improvements greater than SSC training alone through the use of eccentric overload for greater hypertrophic benefits and power production.

CARE draws upon the benefits of both supramaximal EOT as well as stepwise load reduction training (SLRT). While supramaximal EOT has shown slight improvements in lower body 1-RM performance, there are several limitations of this method. A study by Buskard et al. (2018) found no significant differences between supramaximal EOT and traditional resistance training, even noting increased injury risk, soreness, muscle damage, and temporarily reduced force-production capacity associated with supramaximal EOT. The CARE system addresses this by including a concentric element at a submaximal load followed by a greater load through the eccentric phase, drawing upon the effects of supramaximal EOT. Furthermore, invoking the benefits of CARE technology is possible due to the utilization of a key principle of SLRT. SLRT requires an individual to begin an exercise set near or at their maximal load, complete as many repetitions as possible in a given time frame, then progress to additional sets at lighter loads in a stepwise manner (Nuzzo and Nosaka, 2022). Utilizing a CARE device provides two distinct advantages, the first of which augments this principle of SLRT by reducing resistance within a set to compensate for the force generation loss caused by volitional fatigue. In doing so, this can allow the user to exercise with their maximal effort at every moment during the set. The second benefit connects to the first, as the ability for the CARE device to adapt the resistance to a user's force-generating capacity allows a user to perform an optimal multi-movement exercise in a single repetition. For instance, a user has the ability to perform a deadlift, transition to a bicep curl, then complete the movement with a front squat while at or near maximal resistance throughout each component of the repetition. Such a unique capability enables a user to perform a diverse range of movements and exercises at an optimal resistance throughout.

In comparison to previously established eccentric-focused training protocols, the CARE protocol in the present study produced higher increases in selected outcome measures. Compared to a six-week eccentric overload program examining the effects of a unilateral and bilateral training approach using an inertial flywheel, increases in power in the present study were higher than those corresponding to the unilateral and bilateral training regimens (43% compared to 19% and 39%, respectively) (Nunez et al., 2018). Additionally, an eight-week isokinetic resistance and eccentric overload training protocol utilizing a customized Smith machine yielded a lower increase in post-training 1-RM squat performance in comparison to the present study (12.6% versus 35.6%) (Horwath et al., 2019). Varying the tempo of the eccentric training in a six-week protocol, whether it be through completing fast or slow repetitions, also produced less of an improvement in 1-RM squat performance in comparison (14.5 ± 7.0% and 5.4 ± 5.1% versus 35.6%, respectively) (Stasinaki et al., 2019). Beyond this, unloaded and loaded plyometric training has been shown to produce far less of an improvement in CMJ height (3.5 ± 4.0 cm and 1.9 ± 4.1 cm, respectively versus 18.4 ± 3.2 cm associated with CARE) (Kobal et al., 2017).

There are several limitations pertaining to this study. In the present study, the training protocol only integrated two CARE exercises into a proven battery of other exercises that can increase jump height in addition to strength and power in the lower body (Table 1). Although the results may be partially attributed to the inclusion of CARE training, they may be confounded with the other exercises as a whole in the overall training program. Future research should be conducted to determine if CARE exercise can induce the same benefits on its own or if it is best suited to complement established training regimens. Furthermore, in contrast to our results, a systematic review on AEL by Ojasto and Häkkinen (2009) noted decreases in 1-RM performance and concentric force production during supramaximal AEL. This decline in performance was partially attributed to fatigue, which led to the proposition that supramaximal loads may be suboptimal in practice (Wagle et al., 2017). Additionally, the trade-off between the increased time under tension and reduced involvement of the SSC associated with supramaximal EOT has been posited to limit the development of explosive lower body power (Harden et al., 2018). The potential for reduced engagement of the SSC and exercise-induced constraints of fatigue may have affected the performance of the participants in the present study. Although the participants yielded considerable improvements, the true extent of these may not have been shown due to these limitations. These potential drawbacks warrant further investigation as CARE technology evolves. Another limitation is the makeup of the cohorts, which consisted of young elite-level male basketball players. Given that these individuals were highly motivated, and both completed the workout in a timely manner and strongly adhered to it, the results of this study may not be generalizable to common populations (i.e.. Females, sedentary individuals, etc.). These study results suggest that continued research with CARE technology in the field of athletics and sports conditioning may be beneficial, especially for those with an emphasis on lower body performance metrics. Lastly, conducting further research with more participants would help substantiate these findings and add statistical power.

CONCLUSION

The findings of the present study demonstrate that CARE training can induce the same benefits associated with other conventional eccentric overload training regimens but to an even larger degree among elite male basketball players. With notable improvements across jump height, lower-body peak power, and muscle strength, the efficacy of CARE training warrants consideration for being implemented in EOT protocols and training regimes.

AUTHOR CONTRIBUTIONS

The study was conceived and designed by T.Y., B.P., M.V., C.M., M.S.M., and B.A.D. B.A.D., T.Y., B.P., E.M., C.G., M.J., I.U., and A.K. performed data collection. T.Y., B.P., and B.A.D. completed data analysis. T.Y., B.P., and B.A.D. interpreted data and composed the manuscript while M.S.M. and B.A.D. made crucial edits. All authors have read and agreed to the published version of the manuscript.

SUPPORTING AGENCIES

No funding agencies were reported by the authors.

DISCLOSURE STATEMENT

No potential conflict of interest was reported by the authors.

ETHICS COMMITTEE APPROVAL

This study was performed in accordance with the ethical standards of the Helsinki Declaration and was approved by the UCLA Institutional Review Board (#11-003190). All participants provided written informed consent.

ACKNOWLEDGEMENTS

We are grateful to the researchers from the UCFIT Digital Health- Exercise Physiology Research Laboratory for their dedication to the study, as well as the participants that gave their time, energy, and full effort.

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