SESNZ
SPORT & EXERCISE SCIENCE
NEW ZEALAND

The Journal of Sport and Exercise Science, Vol. 5, Issue 4, 246-253 (2021)

www.sesnz.org.nz

JSES
ISSN: 2703-240X

The use of lower-body compression garments during high-intensity exercise performance in basketball athletes

Matthew W. Driller[1 *], Zanz Dixon[2], Christopher M. Beaven[2], Wing-Kai Lam[3, 4 ,5]

[1]*Sport and Exercise Science, School of Allied Health, Human Services and Sport, La Trobe University, Melbourne, Australia*
[2]*Te Huataki Waiora School of Health, University of Waikato, Tauranga, New Zealand*
[3]*Li Ning Sports Science Research Center, Li Ning Sports Technology (Shenzhen) Company Limited, Shenzhen, China*
[4]*Li Ning Sports Science Research Center, Li Ning (China) Sports Goods Company Limited, Beijing, China*
[5]*Department of Kinesiology, Shenyang Sport University, Shenyang, China*

A R T I C L E I N F O

Received: 16.03.2021
Accepted: 26.07.2021
Online: 30.08.2021

Keywords:
Fatigue
Vertical Jump
Oscillation
Sprint
Power

A B S T R A C T

This study examined the effects of lower-body compression garments worn during anaerobic and repeated-effort performance in basketball athletes. In a randomised, crossover design, 20 trained, male basketball athletes (mean ± SD age: 22 ± 5 years) performed a control (CON, loose-fitting clothing) and experimental trial (COMP, lower-body compression garments) where they completed dynamic, intense exercise, including a Margaria-Kalamen stair climb test (SCT) and countermovement jumps pre and post a basketball exercise simulation test (BEST). There were no significant condition (CON v COMP) x time (pre and post BEST) interactions for any measures ($p > 0.05$). There was a small ($d = 0.21 – 0.34$) difference in SCT power both pre and post BEST, in favour of COMP over CON. During the BEST, there was a significant ($p = 0.03$), small ($d = -0.37$) difference between trials in average repeated-sprint time in favour of COMP, but no differences for any other measures. Compression garments were associated with small improvements in lower-body power during a stair-climb task and faster 6-m sprint times during a basketball-specific exercise circuit but did not benefit other performance measures or allow for maintenance of performance in trained basketball athletes.

1. Introduction

Originating from the medical setting to treat various circulatory and lymphatic insufficiencies (Amaragiri & Lees, 2000), the use of compression garments has become common place in the sport and exercise setting over the past decade, both during exercise and for subsequent recovery from exercise (Atkins et al., 2020; Driller & Brophy-Williams, 2016; Gill et al., 2006). While it seems that the use of compression garments as a recovery strategy is generally favourable in the research literature (Brown et al., 2017), the use of compression garments during exercise is less clear (Beliard et al., 2015). In addition to improved blood flow, potential mechanisms that may influence exercise performance when wearing compression garments appear to be related to a myriad of variables. Some of these potential ergogenic factors include enhanced proprioception (Ghai et al., 2016), improved oxygen delivery and perfusion (Bochmann et al., 2005), and reduced muscle oscillation during exercise (Kraemer et al., 1998). There is some evidence to suggest that wearing compression garments during exercise may also aid in subsequent physical performance (Brophy-Williams et al., 2019) while decreasing subsequent muscle soreness (Ali et al., 2007).

In review articles by MacRae et al. (2011) and Beliard et al. (2015) the authors assessed studies investigating the effects of wearing compression garments either during exercise or following exercise, as a recovery tool. Related to wearing the garments during exercise, both review articles reported few ergogenic effects, but concluded that they may aid aspects of vertical jump performance in some situations. There was also some indication for physical and physiological responses, including attenuation of muscle oscillation, improved joint awareness, perfusion augmentation and altered oxygen usage at

*Corresponding Author: Matthew W. Driller, School of Allied Health, Human Services and Sport, La Trobe University, Australia, M.Driller@latrobe.edu.au

sub-maximal intensities. Both review articles suggested that one of the possible reasons for inconsistencies in the findings on compression garments during exercise could be varying methodologies (e.g., different modes of exercise, range of participants used, reliability of tests implemented) and lack of information describing the applied pressures of the garments. Indeed, the applied pressure of the garments has been shown to be highly variable with changes in garment sizing and posture of the participants (Brophy-Williams et al., 2015). Furthermore, the optimal pressure of compression garments is yet to be established, however, previous research has suggested that levels >18mmHg are required to instigate improved haemodynamics (Liu et al., 2008).

The majority of research on compression garment use during exercise seems to be focused on endurance or aerobic-based activities such as cycling (Driller & Halson, 2013) and running (Ali et al., 2007; Ali et al., 2010). Less research has focused on anaerobic and intermittent team-sport types of activities where dynamic movements such as jumping, bounding and sprinting are interspersed with jogging and walking. Basketball is one of these team sports that has received little attention in the compression literature when it comes to wearing the garments during exercise. Basketball is a sport predicated on repeated power-driven movements (Wen et al., 2018), with athletes performing various high-intensity movements such as multi-directional acceleration, deceleration, and jumping manoeuvres (Stojanović et al., 2018), interspersed with short recovery periods of either total rest, jogging or walking. Recent research has shown that upper-body and full-body compression garments may aid kinematic movement mechanics via decreased range of motion (ROM) and improved proprioception during basketball shooting tasks, with ~5% increases in accuracy compared to a control (Wong et al., 2020).

While not in basketball, a study by Higgins et al. (2009) investigated compression garments using Global Positioning System (GPS) tracking to examine the effects on key physiological and performance measures in a simulated game-specific circuit for netball. Using traditional statistical analysis, performance enhancing effects of compression garments were non-significant (p > 0.05). However, effect size analysis (using Cohen's d) revealed a large (d = 0.86) improvement in distance travelled at a fast pace (>3.5 m.s-1), a moderate decrease in blood lactate concentration (d = 0.63), and small improvements for mean sprint time (d = 0.23) and counter-movement jumps (d = 0.24), in favour of the compression intervention.

Given the lack of published data assessing the efficacy of compression garment wear during basketball-specific exercise, alongside the inconsistencies in methodologies and garments used, despite some promising initial findings (MacRae et al., 2011), further research is clearly warranted. Therefore, the aim of the current study was to evaluate the effect of wearing lower-body compression garments during dynamic exercises as well as during a basketball-specific circuit on performance and perceptual ratings in male basketball athletes.

2. Methods

2.1 Participants

Twenty trained male basketball athletes (mean age: 22 ± 5 years, height: 179 ± 5 cm, body mass: 72 ± 7 kg) volunteered to take part in the study. Inclusion criteria required the participants to be free from lower-limb injury for the previous 6 months prior to participation, be playing competitive basketball at the regional club level in Beijing, and pass a Physical Activity Readiness Questionnaire (PAR-Q) and medical clearance. The study took place during the pre-season phase of the basketball competition. Participants were recruited from different local universities and their average basketball training experience was 6 ± 5 years and they were performing basketball-specific training on average 3 times (± 1) per week. Written informed consent was obtained from each participant, and ethical approval was approved by the University of Waikato Human Research Ethics Committee.

2.2 Experimental Design

Implementing a randomized, crossover study design, participants performed an experimental trial (COMP) and a control trial (CON) separated by 48-72 hours (Figure 1). Participants were to refrain from performing any vigorous exercise in the 24 h leading up to the testing session. On arrival at the laboratory, participants performed a standardised 10-minute warm-up and were familiarised with the Basketball Exercise Simulation Test (BEST) (Scanlan et al., 2014) and a run-through of each of the testing protocols. Participants then completed countermovement jump testing and stair-climb testing, followed by 12-minutes of the BEST and further countermovement jump and stair-climb testing (Figure 1). The purpose of performing the jump and Margaria-Kalaman stair-climb testing before and after the BEST was to evaluate not only performance in COMP vs. CON at those specific time points, but also to investigate if there were any differences between trials with respect to performance maintenance pre to post the exercise simulation.

For the entire testing session (~45 minutes), participants wore either loose-fitting clothing (CON) or full-length, lower-body compression garments (COMP; Li-Ning, PowerShell AULM043-I, Beijing, China). The size of compression garments was selected based on the height and body mass of each individual, according to the manufacturer's sizing guidelines, where one size smaller than the suggested size was used, based on previous research using the same garments (Atkins et al., 2020). The garment pressures were recorded at the ankle, calf, and thigh immediately after they were put on (Atkins et al., 2020). Testing was completed at the same time each day for both trials to account for diurnal variations in performance. Participants were also asked to record and repeat their same diet in the <12 hours prior to testing for each intervention.

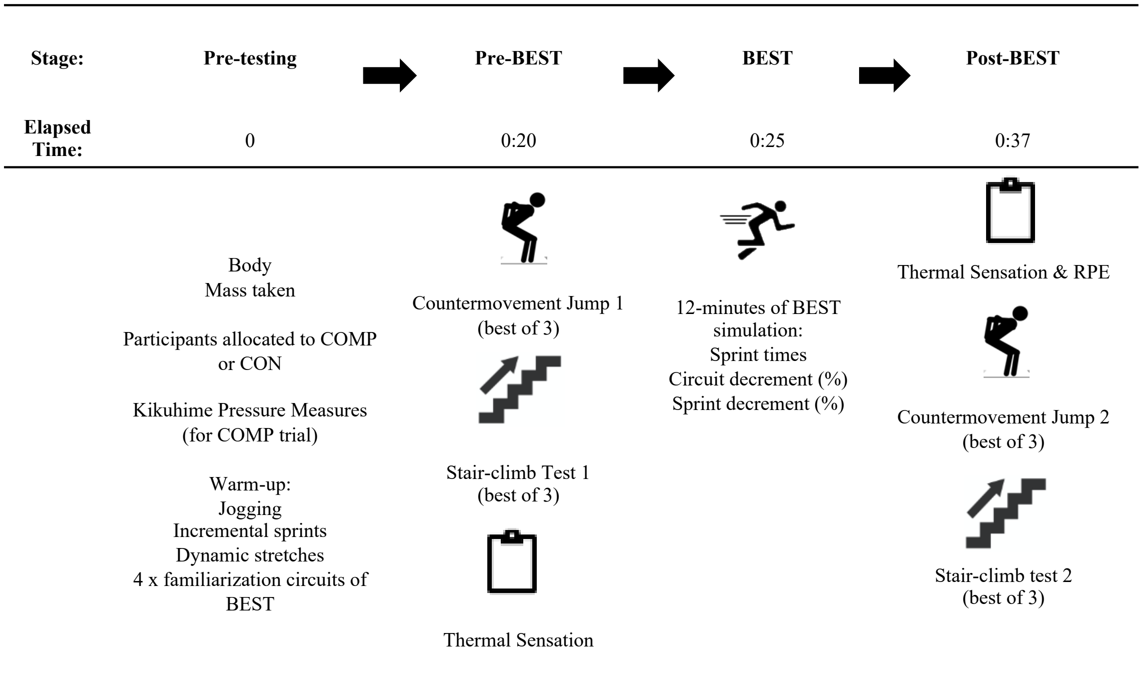

Figure 1: Timeline of study design. BEST = Basketball Exercise Simulation Test; COMP = compression trial; CON = control trial; RPE = Rate of Perceived Exertion.

2.3 Procedures

The standardised warm-up (~10 minutes) consisted of moderate-intensity jogging (5 minutes), running/sprinting efforts of increasing intensity (2 minutes) across the length of the basketball court and a range of dynamic stretches (3 minutes). Furthermore, three submaximal- and one maximal-effort circuits of the BEST were completed as part of the warm-up/familiarisation of the test (see Figure 1). All testing was performed indoors, inside a climate-controlled indoor stadium.

2.4 Countermovement jump

A countermovement vertical jump was used to assess lower-body power. Outcome measures gathered included jump height using a Vertec apparatus (Sports Imports, Columbus, OH, USA) as well as vertical jump power (W) using a force plate sampling at 1000 Hz (AMTI, Watertown, NY, USA). Three countermovement jumps were performed pre and post BEST (Countermovement Jump 1 and Countermovement Jump 2) involving participants initially standing with feet shoulder-width apart on the force plate (Lam et al., 2020). Participants were asked to jump as high as possible using a self-selected squat depth. Participants jumped from both feet and were permitted to use a swinging arm movement. Prior to the first jump at each time-point, the hand reach height (baseline) was measured when the participant displaced the vanes of the Vertec apparatus with their fingertips. This jump test was performed by participants while adopting a relaxed shoulder position. At the peak of the jump, participants had to displace the Vertec vanes lightly with their fingertips to indicate maximum jump height. Jump height was then calculated by subtracting the participant's baseline reach height from the maximum jump height. The jumps were performed with ~5 s between each jump. The highest jump of the three trials was used for analysis at each time point. Excellent reliability of both Vertec apparatus and force plate for measuring jump height has been reported previously, with ICC values >0.99 (VanderZanden et al., 2010) and test-retest intrasession coefficient of variations (CV's) of ~5% (Nuzzo et al., 2011).

2.5 Margaria-Kalamen stair climb test (SCT)

Unilateral power was estimated using the Margaria-Kalamen stair-climb test (SCT). The test involves sprinting up a staircase of specified height from a specific distance (6 m from the base of the staircase), stepping only on the third, sixth, and ninth steps. The test is performed on a series of stairs with a rise of 17 cm per step. The time started at initial contact with the third step and stopped at contact with the ninth step. Participants were instructed to complete the sprint up the stairs with maximum velocity. The total power produced during the test was calculated using the following formula: [Power (W) = mass (kg) x 9.8 $m \cdot s^{-1}$ x distance (m) / time (s)]. All participants were weighed without shoes and in minimal clothing prior to testing so that power could be calculated. The test was performed three times at each time point (pre and post BEST), with 20 s rest between trials and the fastest time was used for subsequent analysis. Timing was performed using a high-speed video camera (Casio EX-F1, Casio, Japan) set at a recording rate of 300 Hz and perpendicular to the stair/movement plane. The SCT has been shown to be a good predictor of lower-body power and has good levels of test-retest reliability, with CV's of 2% being reported in healthy males (Margaria et al., 1966).

2.6 The Basketball Exercise Simulation Test

The BEST (Scanlan et al., 2014) was used to simulate the movement patterns and intensities performed during basketball game-play. Participants completed a 12-min trial of the BEST to represent the average playing time of basketball athletes during one quarter of basketball. During the test, participants were required to complete repeated circuits of basketball-specific activity, with each circuit being allotted a 30-s timeframe (24 circuits in total - Figure 2). When athletes finished before the 30-s period, they waited at the starting point before commencing their next circuit. Participants were instructed to maintain similar speed/intensity during the running, jogging and walking segments of the circuit, but to focus on sprinting as fast as they could during each 6 m sprint. The following measures collected during the BEST circuit were used for subsequent analysis; average sprint time (6 m), circuit time decrement (%) and sprint time decrement (%) (Scanlan et al., 2014). The sprint times were measured using instrumented timing lights (Smart Speed Timing Gates, Coopers Plains, Australia). The test-retest reliability of these measures during the BEST in male basketball athletes expressed as a coefficient of variation (CV) are 1.7% for average sprint time (TEM = 0.03 s). The CV's for circuit decrement (16.8%) and for sprint decrement (14.6%) are somewhat less-reliable (Scanlan et al., 2014), and should be interpreted with caution.

The Borg's 6-20 Rate of Perceived Exertion (RPE) scale was also used immediately following the BEST to determine whether compression garments influenced perceived exertion during exercise.

2.7 Compression garment pressure measurement

The applied pressure of the compression garments was tested using the Kikuhime device (MediGroup, Melbourne, Australia) at the medial malleolus of the ankle, and maximal circumference of the calf and thigh. These landmarks have been used previously when measuring the pressure of full-length compression garments (Atkins et al., 2020). Garment pressure measurements were taken when the garments were first put on at the start of the COMP trial. The Kikuhime pressure monitor has been shown to be a valid (ICC = 0.99, CV = 1.1%) and reliable (CV = 4.9%) tool for compression measurement in sports settings (Brophy-Williams et al., 2014).

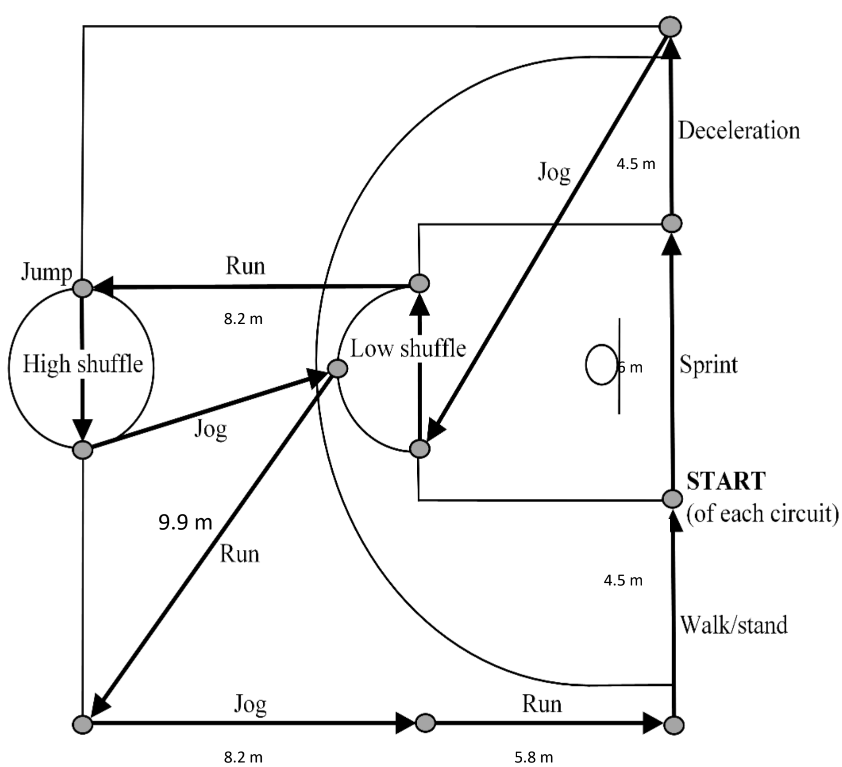

Figure 2: The Basketball Exercise Simulation Test (BEST), adapted from Scanlan et al. (2014).

2.8 Statistical analysis

Descriptive statistics are shown as means ± standard deviations. Statistical analyses were performed using IBM SPSS statistics (Version 22, IBM Corporation, Armonk, NY) and effect sizes were calculated using Microsoft Excel. Statistical significance was set at $p \leq 0.05$ for all analyses. To examine the differences between COMP and CON trials, a two-way repeated-measures ANOVA, with 2 (condition: CON, COMP) x 2 (time: pre-BEST, post-BEST) factors was performed for countermovement jump and SCT variables. Analysis of the studentised residuals was verified visually with histograms and also by the Shapiro-Wilk test of normality. Sphericity for the interaction was assessed by Mauchly's test of sphericity ($p > 0.05$). Bonferroni post-hoc tests were applied if significant effects were detected. To examine the differences between COMP and CON trials during the BEST, a Student's Paired *t*-test was used. Effect size statistics (Cohen's *d* with 90% confidence intervals) were also calculated to quantify the sizes of mean differences between COMP and CON groups. The magnitude of each effect size was interpreted using thresholds of 0.2, 0.5 and 0.8 for small, moderate, and large, respectively. An effect size of <0.2 was considered trivial. Where the 90% confidence limits overlapped the thresholds for small positive and small negative values, the effect was considered unclear.

3. Results

The mean level of pressure exerted by the compression garments in the COMP trial were; 7.6 ± 2.6, 14.0 ± 2.6 and 8.3 ± 1.8 mmHg at the ankle, calf, and thigh, respectively.

There were *small* effect size differences between conditions for SCT power 1 and SCT power 2, in favour of the COMP over CON (Table 1). There were no significant condition (CON vs. COMP) x time (pre and post BEST) interactions for vertical jump height; $F(1,38)$, $p = 0.26$, vertical jump power; $F(1,38)$, $p = 0.13$ or SCT power, $F(1, 38)$, $p = 0.83$, (Table 2), all resulting in *unclear* or *trivial* effect sizes (Table 2).

During the BEST, there was a significant ($p = 0.03$), *small* (d = -0.37) difference between trials for average sprint time in favour of COMP, but no differences for sprint and circuit decrement measures (Table 3).

4. Discussion

This study examined the efficacy of lower-body compression garments worn during high-intensity, basketball-specific exercise in trained basketball athletes. The main findings in this study were that despite no significant interactions between trials for pre to post measures ($p > 0.05$), compression garments were associated with small differences in lower-body power during two stair-climb tasks and small but significantly faster repeated-sprint times over 6 m during the exercise circuit, in trained basketball athletes. Our repeated-sprint results are consistent with the study by Higgins et al. (2009), who reported small to large effect sizes in favour of a compression trial for high-speed distances and sprint times during a netball-specific circuit. The small ($d = -0.37$, $p = 0.03$) improvement in average sprint time for COMP over 6 m during the basketball circuit is greater than the previously reported CV for this measure of 1.7% (Scanlan et al., 2014). Furthermore, our results are similar to those reported in the earlier studies of Kraemer et al. (Kraemer et al., 1996; Kraemer et al., 1998), who reported enhanced repetitive jump power in volleyball, basketball and track athletes when wearing compression shorts. While the current study did not include a repeated jump test, and our results were not statistically significant ($p > 0.05$), the stair-climb test, which resulted in small (d = 0.21 to 0.34) improvements during the COMP trial, could be considered a similar test of neuromuscular function and lower-body power. Our improvements with compression garments in the stair-climb test of 50-60 W (~4%) at both time points (pre and post) are also greater than the previously reported reliability of ~2% (Margaria et al., 1966). However, it should be noted that these studies used compression shorts, and that different lower-body compression garments (e.g., socks, shorts, leggings, stockings) will likely exert different levels of pressure on different muscle groups and possible physiological responses (Brophy-Williams et al., 2015; Brophy-Williams et al., 2020).

Table 1: Mean ± SD for performance measures for control (CON) and compression (COMP) conditions. SCT = Magaria-Kalamen stair climb test. * significant difference between trials ($p \leq 0.05$).

Measure	ΔCOMP – ΔCON (mean ± 90% confidence interval)	P-value (ANOVA)	Effect size (*d*) ±90% confidence interval
Countermovement jump height change (cm)	0.1 ± 0.2	0.26	0.10 ± 0.16 *trivial*
Countermovement jump power change (W)	-57 ± 61	0.13	-0.12 ± 0.13 *trivial*
SCT power change (W)	6.8 ± 53	0.83	0.04 ± 0.31 *unclear*

Table 2: The raw change (mean ± SD) in measures pre to post BEST (test 1 – test 2) for the two conditions. CON = control, COMP = compression. BEST = basketball exercise simulation test. SCT = Magaria-Kalamen stair climb test.

Measure	**Condition**	**Mean ± SD**	**Effect size (*d*) ±90% confidence interval**
Countermovement jump height 1 (cm)	CON	52 ± 1	0.02 ± 0.07 *trivial*
	COMP	52 ± 1	
Countermovement jump power 1 (W)	CON	4152 ± 446	-0.02 ± 0.65 *unclear*
	COMP	4144 ± 464	
SCT power 1 (W)	CON	1326 ± 158	0.21 ± 0.14 *small*
	COMP	1378 ± 183	
Countermovement jump height 2 (cm)	CON	50 ± 1	0.11 ± 0.12 *trivial*
	COMP	51 ± 1	
Countermovement jump power 2 (W)	CON	4153 ± 448	-0.14 ± 0.68 *unclear*
	COMP	4089 ± 479	
SCT power 2 (W)	CON	1303 ± 167	0.34 ± 0.19 *small*
	COMP	1362 ± 165	

Although purely speculative, the mechanisms responsible for improvements in these previous studies, along with the repeated-sprint performance in the current study are likely due to a number of factors. As suggested by Higgins et al. (2009), the compression garments may facilitate the role of the circulatory system during low to moderate activity, reducing energy expenditure and therefore assisting in the conservation of high energy phosphates for the short anaerobic bursts required in the power activities during the exercise circuits (e.g., sprinting). MacRae et al. (2011) also suggested that the influence of compression becomes more apparent as physical fatigue develops. Lastly, the psychological or psychophysical effect of wearing compression should also be considered. While RPE following the exercise circuit in the current study was not significantly different between trials, previous research has shown that perceived benefits of wearing compression are common during short, powerful tasks such as jumping and sprinting (MacRae et al., 2011).

In addition to no differences in RPE between trials, the current study failed to find significant interactions between interventions across pre to post BEST trials. Countermovement jump performance (height and power) was not significantly different between COMP and CON trials ($p > 0.05$, unclear or trivial effects), and the pre to post change in performance for both trials was less than the smallest worthwhile change or CV of the test (~5%). This result is actually similar to the earlier work of Kraemer et al. (1996) who, despite finding significant improvements in mean power during repeated-jump performance (10 countermovement jumps on a force-plate), did not find any benefit of compression in the best single-jump performance. As mentioned previously, the authors would speculate that the possible benefits of improved proprioception and reduced oscillation with compression garments may have had more benefit to repeated high-intensity movements (e.g., stair-climb and sprint) than to one-off performance.

Interestingly, the compression levels were lower in the current study (~14 mmHg at the calf) than many of the previous studies on compression garments (Beliard et al., 2015). While the optimal pressure of compression garments is yet to be determined, Liu and colleagues (2008) suggested that a pressure >18 mmHg was required to instigate positive responses in haemodynamics. Conversely, Hill and colleagues (Hill et al., 2017) suggested that >14 mmHg was more effective than <14 mmHg for strength and power measures, while a meta-analysis of 23 studies by Beliard et al. (2015) suggested that there is no relationship between the effects of compression and the pressures applied.

There are a number of limitations that need to be acknowledged in the current study. The lack of a placebo trial meant that psychological factors could not be discounted for the positive effects associated with the compression garment intervention. Previous research has shown that belief in the benefit of compression garments may positively influence results (Brophy-Williams et al., 2017). However, we would also suggest that it is difficult to design a placebo garment in compression studies and any attempt to do so can be disingenuous. Accounting for their beliefs on the effectiveness of compression garments prior to participating in the study would have been beneficial and should be considered in future research. Furthermore, it would have been advantageous to use a longer exercise simulation task to determine whether compression garments would help to maintain physical performance pre to post a more fatiguing exercise bout. The duration of the BEST (12 minutes, the equivalent to a quarter of a basketball match) in the current study was not likely to cause adequate levels of fatigue. The inclusion of strength and endurance measures to the battery of tests would have also helped to elucidate the effects of compression garment use during exercise.

Table 3: Measures taken during the basketball exercise simulation test (BEST) for control (CON) and compression (COMP) trials. * significant difference between trials ($p \leq 0.05$).

Measure	Condition	Mean ± SD	P-value	COMP – CON Effect size (*d*) ±90% confidence interval
Average 6 m sprint time (s)	CON	1.52 ± 0.09	0.03*	-0.37 ± 0.28 *small*
	COMP	1.48 ± 0.07		
Sprint decrement (s)	CON	0.325 ± 0.102	0.65	0.11 ± 0.53
	COMP	0.337 ± 0.131		*unclear*
Sprint decrement (%)	CON	24 ± 8	0.96	0.01 ± 0.55 *unclear*
	COMP	24 ± 10		
Circuit decrement (s)	CON	2.773 ± 1.295	0.47	-0.17 ± 0.50
	COMP	3.007 ± 1.348		*unclear*
Circuit decrement (%)	CON	15 ± 7	0.37	0.21 ± 0.48 *unclear*
	COMP	17 ± 8		
RPE	CON	15 ± 3	0.57	-0.09 ± 0.26 *trivial*
	COMP	15 ± 3		

Conclusion

Wearing lower-body compression garments during short, anaerobic/power activities and basketball-specific exercise were associated with small improvements during a stair climb task and in repeated-sprint times, but largely negligible benefits to performance maintenance when compared to a control condition in trained basketball athletes. Future research on the use of compression garments during longer simulated basketball exercise, utilising additional measures of strength and endurance, is warranted.

Conflict of Interest

Wing-Kai Lam is an employee of Li Ning Company Limited, which supplied the compression garments in the current study. Li Ning was not involved in decisions regarding experimental design, data collection, data analyses, and data dissemination/publication. All other authors declare no conflict of interests.

References

Ali, A., Caine, M. P., & Snow, B. G. (2007). Graduated compression stockings: physiological and perceptual responses during and after exercise. *Journal of Sports Sciences, 25*(4), 413-419.

Ali, A., Creasy, R. H., & Edge, J. A. (2010). Physiological effects of wearing graduated compression stockings during running. *European Journal of Applied Physiology, 109*(6), 1017-1025.

Amaragiri, S. V., & Lees, T. A. (2000). Elastic compression stockings for prevention of deep vein thrombosis. *Cochrane Database Systematic Reviews, 3,* CD001484. https://doi.org/10.1002/14651858.CD001484.

Atkins, R., Lam, W.-K., Scanlan, A. T., Beaven, C. M., & Driller, M. (2020). Lower-body compression garments worn following exercise improves perceived recovery but not subsequent performance in basketball athletes. *Journal of Sports Sciences, 38*(9), 961-969.

Beliard, S., Chauveau, M., Moscatiello, T., Cros, F., Ecarnot, F., & Becker, F. (2015). Compression garments and exercise: no influence of pressure applied. *Journal of Sports Science & Medicine, 14*(1), 75-83.

Bochmann, R. P., Seibel, W., Haase, E., Hietschold, V., Rödel, H., & Deussen, A. (2005). External compression increases forearm perfusion. *Journal of Applied Physiology, 99*(6), 2337-2344.

Brophy-Williams, N., Driller, M., Kitic, C., Fell, J., & Halson, S. (2017). Effect of compression socks worn between repeated maximal running bouts. *International Journal of Sports Physiology and Performance, 12*(5), 621-627.

Brophy-Williams, N., Driller, M. W., Halson, S. L., Fell, J. W., & Shing, C. M. (2014). Evaluating the Kikuhime pressure monitor for use with sports compression clothing. *Sports Engineering, 17*(1), 55-60.

Brophy-Williams, N., Driller, M. W., Kitic, C. M., Fell, J. W., & Halson, S. L. (2019). Wearing compression socks during exercise aids subsequent performance. *Journal of Science and Medicine in Sport, 22*(1), 123-127.

Brophy-Williams, N., Driller, M. W., Shing, C. M., Fell, J. W., & Halson, S. L. (2015). Confounding compression: the effects of posture, sizing and garment type on measured interface pressure in sports compression clothing. *Journal of Sports Sciences, 33*(13), 1403-1410.

Brophy-Williams, N., Fell, J. W., Halson, S. L., Kitic, C. M., & Driller, M. W. (2020). Pressure gradient differences between medical grade and sports compression socks. *The Journal of The Textile Institute*, *112*(2), 187-191.

Brown, F., Gissane, C., Howatson, G., Van Someren, K., Pedlar, C., & Hill, J. (2017). Compression garments and recovery from exercise: a meta-analysis. *Sports Medicine, 47*(11), 2245-2267.

Driller, M., & Halson, S. (2013). The effects of wearing lower-body compression garments during a cycling performance test. *International Journal of Sports Physiology and Performance, 8*(3), 300-306.

Driller, M. W., & Brophy-Williams, N. (2016). The use of compression garments in elite Australian athletes: A survey. *Journal of Athletic Enhancement, 5*(3), 1-4. https://doi.org/10.4172/2324-9080.1000228

Ghai, S., Driller, M. W., & Masters, R. S. W. (2016). The influence of below-knee compression garments on knee-joint proprioception. *Gait & Posture*, *60*, 258-261.

Gill, N. D., Beaven, C. M., & Cook, C. (2006). Effectiveness of post-match recovery strategies in rugby players. *British Journal of Sports Medicine, 40*(3), 260-263.

Higgins, T., Naughton, G. A., & Burgess, D. (2009). Effects of wearing compression garments on physiological and performance measures in a simulated game-specific circuit for netball. *Journal of Science and Medicine in Sport, 12*(1), 223-226.

Hill, J., Howatson, G., van Someren, K., Gaze, D., Legg, H., Lineham, J., & Pedlar, C. (2017). The effects of compression-garment pressure on recovery after strenuous exercise. *International journal of Sports Physiology and Performance, 12*(8), 1078-1084.

Kraemer, W. J., Bush, J. A., Bauer, J. A., Tripleft-McBride, N. T., Paxton, N. J., Clemson, A., . . . Newton, R. U. (1996). Influence of compression garments on vertical jump performance in NCAA Division I volleyball players. *Journal of Strength and Conditioning Research, 10*, 180-183.

Kraemer, W. J., Bush, J. A., Newton, R. U., Duncan, N. D., Volek, J. S., Denegar, C. R., . . . Sebastianelli, W. J. (1998). Influence of a compression garment on repetitive power output production before and after different types of muscle fatigue. *Research in Sports Medicine: An International Journal, 8*(2), 163-184.

Lam, W.-K., Jia, S.-W., Baker, J. S., Ugbolue, U. C., Gu, Y., & Sun, W. (2020). Effect of consecutive jumping trials on metatarsophalangeal, ankle, and knee biomechanics during take-off and landing. *European Journal of Sport Science, 21*(1), 53-60.

Liu, R., Lao, T. T., Kwok, Y. L., Li, Y., & Ying, M. T. (2008). Effects of graduated compression stockings with different pressure profiles on lower-limb venous structures and haemodynamics. *Advanced Therapies, 25*(5), 465-478.

MacRae, B. A., Cotter, J. D., & Laing, R. M. (2011). Compression garments and exercise: garment considerations, physiology and performance. *Sports Medicine, 41*(10), 815-843.

Margaria, R., Aghemo, P., & Rovelli, E. (1966). Measurement of muscular power (anaerobic) in man. *Journal of Applied Physiology, 21*(5), 1662-1664.

Scanlan, A., Dascombe, B., Reaburn, P., Tucker, P., & Dalbo, V. (2014). The development of the Basketball Exercise Simulation Test. *Journal of Science and Medicine in Sport, 9*(13), 700-712.

Stojanović, E., Stojiljković, N., Scanlan, A. T., Dalbo, V. J., Berkelmans, D. M., & Milanović, Z. (2018). The activity demands and physiological responses encountered during basketball match-play: a systematic review. *Sports Medicine, 48*(1), 111-135.

VanderZanden, T., Wurm, B., & Hopkins, W. (2010). *Comparison of jump height values derived from a force platform and vertec.* Paper presented at the ISBS-Conference Proceedings Archive.

Wen, N., Dalbo, V. J., Burgos, B., Pyne, D. B., & Scanlan, A. T. (2018). Power testing in basketball: Current practice and future recommendations. *Journal of Strength and Conditioning Research, 32*(9), 2677-2691.

Wong, D. W.-C., Lam, W.-K., Chen, T. L.-W., Tan, Q., Wang, Y., & Zhang, M. (2020). Effects of upper-limb, lower-limb, and full-body compression garments on full body kinematics and free-throw accuracy in basketball players. *Applied Sciences, 10*(10), 3504. https://doi.org/10.3390/app10103504