Adidas® TechFit Shorts and Their Effect on Anaerobic Power Output and Sports Enhancement

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ABSTRACT

The purpose of this study was to determine if the Adidas® TechFit short tights enhanced anaerobic power output and running speed. Eleven male collegiate track and field athletes (M±SD age: 20±1.3 yrs, weight: 75.5±6.2 kg, height: 181.3±3.1 cm) completed a vertical jump test (VJ), Margaria-Kalamen test (MK), and a 40 m sprint test under two conditions. The two conditions were wearing the Adidas® TechFit shorts (Tights) and regular workout attire (Control). Subjects ran 3 trials for each condition and the best performance of the three trials was used for data analysis. The VJ ($p > 0.05$), and 40 m sprint test ($p > 0.05$) showed no difference between conditions, the M±SD were 67.32 cm ± 3.35 cm for the Control and 67.14±3.81 cm for the Tights and the Control was 5.07±0.11 s and the Tights was 5.06±0.09 s, respectively. There was a statistically significant increase in relative power for the Tights condition during the MK test ($p < 0.05$), the M±SD were 176.76 kg•m/s±17.18 for the Tights condition and 169.88 kg•m/s±10.80 for the Control. While speed or VJ height does not appear to be greater when using the Adidas® Techfit shorts, the power output increased approximately 4% during the MK test. In conclusion, horizontal and vertical anaerobic power were not influenced by the use of Adidas® TechFit shorts. However, when combining vertical and horizontal displacement the Adidas® TechFit shorts appear to influence anaerobic power output.

Keywords: Compression shorts; Margaria-Kalamen test; Sprinting; Vertical jump

Traditionally, compression garments have been used to keep the working muscles warm in an attempt to decrease musculoskeletal injuries. As time progressed and science improved, compression garments changed as well. Compression apparel has been incorporated into most athletic events as a performance enhancer. Possible reasons for the improvement could be that they reduce muscular fatigue and injuries, which lead to more successful training (Doan *et al*. 2003). One of the most recognized uses of compression shorts in the world of sports is found among professional cyclists. The tight fitting compression shorts provide separation of the groin and thigh muscles. This design is similar to other compression garments worn by athletes in other sports such as basketball, and track and field. Doan *et al*. (2003) reported anecdotal information related to style and reduced chaffing and research-supported evidence of performance enhancement and injury prevention as reasons for wearing compressive garments. The idea behind compression garments is to eliminate friction and vibration within the musculature to preserve energy and enhance performance with power output (Doan *et al*. 2003).

Previous research has examined the effects of standard lower body compression garments on exercise performance and power output in various sports. Duffield *et a*l. (2009) found no difference between peak power or mean sprint times when rugby players performed intermittent 20 m sprints on back to back days while wearing compression shorts. In another study prophylactic compression shorts were worn by active subjects in order to measure the range of motion (ROM) at the hip, and other performance variables (Bern-

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hardt and Anderson 2005). The compression shorts used in this study produced tension around the hip and upper thigh by the placement of several elastic bands that crossed over and around the hip and upper legs. The subjects completed two randomized testing sessions, one wearing the compression garment and one not wearing the compression garment. The performance measures included tests for balance, vertical jump (VJ), agility, and aerobic capacity. Hip flexion during active ROM was significantly decreased while wearing this compression garment. However, the results yielded no significant difference in performance variables. The findings suggest compression shorts may not affect performance, but may be beneficial for injury prevention and recovery (Bernhardt and Anderson 2005).

Recently, compression garments have been investigated as a method to enhance recovery from training and competitions, as they are used widely within the clinical setting for the treatment of inflammation. Compression garments are thought to improve recovery via increasing venous return and removal of waste products (Ali et al. 2007; Davies et al. 2009). In addition, research has reported decreases in perceived muscle soreness following a recovery period while wearing compression garments, leading to speculation that a decrease in muscle soreness should allow an athlete to perform longer and at higher levels than if the athlete wore no compression garment (Bernhardt and Anderson 2005; Davies et al. 2009).

Ali et al. (2007) examined 14 recreational runners wearing compression garments during intermittent shuttle running and a continuous 10-km run. The subjects reported a significant decrease in delayed onset muscle soreness during the 10-km run, but no difference for intermittent running. However, performance did not significantly improve for either the intermittent or continuous run. These research findings support those of Davies et al. (2009). It was also reported that agility and VJ were not enhanced, but there was a reduction in perceived muscle soreness after wearing lower body compression garments.

Scanlan et al. (2008) reported that when subjects wore the lower body compression garments during cycling, their absolute and relative power output increased by 4.2% and 5.7%, respectively. Cyclists also demonstrated an increase in vastus lateralis muscle oxygenation and oxygen uptake (VO2) during the initial 15 min of a cycling test performed at 90 to 100 revolutions per minute.

Further research has also investigated athletic performance of track athletes and the mechanical properties of custom-fit lower body compression garments (Doan et al. 2003). The variables measured were 60 m sprint time, VJ power, muscle oscillation, and skin temperature. Ground reaction forces and compression garment elasticity were also investigated. The results of this study found sprinting performance was not enhanced when wearing the compression garment. However, there was a significant reduction in hip ROM during sprinting, and skin temperature increased faster while wearing the compression garment. The compression garment also significantly increased VJ height and significantly decreased muscle oscillation upon landing from the VJ. The compression garment reduced the impact force by 27% and the elasticity of the garment improved torque at the end ROM of the hip. Thus, Doan et al. (2003) felt compression garments affect athlete performance and may reduce injuries.

Kraemer et al. (1996) studied the influence of compression garments on VJ height in 36 NCAA Division I volleyball players. The volleyball players were of both genders and were tested for VJ endurance performance over 10-repeated vertical jumps while jump force and power were recorded. This study showed no significant difference in maximal power or force output over the 10 VJ's. However, mean force and power production over the 10 VJ's were significantly greater when compression garments were worn. These findings suggest compression garments may improve repetitive jumping power performance (Kraemer et al. 1996).

Recently, Adidas® produced a TechFit PowerWeb compression short. This garment was designed to decrease muscle vibration and improve stability and posture via a compressive material in addition to Thermoplastic Polyurethane power bands. According to the Adidas® website, this new type of compression garment, "…will help focus your muscles energy to generate maximum explosive power, acceleration and endurance."

The aim of this study was to examine whether Adidas TechFit PowerWeb compression shorts (Tights) would have an effect on anaerobic performance. The researchers hypothesized that the use of the Adidas TechFit compression shorts would significantly improve the 40 m sprint time, VJ height, and Margaria-Kalamen (MK) anaerobic power output. Additional research in this area might aid runners, strength and conditioning specialists, and athletic trainers in gaining the most of training programs designed to enhance running physiology and performance (Kemmler et al., 2009).

METHODS

Subjects

The subjects included 11 collegiate anaerobic athletes, sprinters and jumpers, from a Division II men's track team (Table 1). All subjects signed an informed consent and completed a health history questionnaire and a Physical Activity Readiness Questionnaire (PAR-Q). These questionnaires

Table 1. Subject characteristics (N = 11)

	Minimum	Maximum	Mean	SD
Age (yrs)	18	23	20	1.3
Height (cm)	177.5	185.5	181.3	3.1
Weight (kg)	63.8	85.2	75.5	6.2

were used to assess general health and to exclude subjects from the study. Any "yes" answers on the PAR-Q and any lower body injuries in the past year disqualified the volunteer from the study. Shippensburg University Committee on Research on Human Subjects approved this study. One subject did not complete both testing conditions; thus, their data were not used for statistical analysis.

Procedures

Prior to testing, height (cm) and weight (kg) of the subjects were measured. All subjects completed the three anaerobic tests for each condition over a 3-week span. For each condition the VJ and MK were performed on the same day and the 40 m sprint was performed on a separate day on an indoor track surface. The control condition was performed while wearing athletic attire that excluded other forms of compression garments and the Tights condition was performed while wearing the Adidas® TechFit compression shorts. The subjects completed the control condition during the first week and then one week later they performed the Tights condition. The three anaerobic tests each subject completed were the 40 m sprint, VJ test and the MK stair test and the order of the tests was the same for all subjects. All tests were performed three times with at least 2 minutes of recovery time between each trial. Prior to collecting data, the assessment protocol was explained and an instructional demonstration of all the assessments was given. Finally, the subjects were given a chance to practice the three anaerobic power tests.

All testing sessions started with a 3-5 min active warm-up such as a light jog, followed by a dynamic warm-up. The dynamic warm-up included high-knees, butt-kicks, right and left leg crossovers, high skips and karaokes. Subjects were given additional time to perform self-selected static stretches. The subjects were instructed to follow the same warm-up protocol before each testing session.

40 m sprint. The Speed Trap II (Brower Timing Systems, Draper UT) timing system was used for the 40 m sprint. A 40 m straight away was marked on a standard indoor track surface and adequate room was provided for the follow-through at the end of the sprint. Subjects were positioned at the start line in a 3-point stance with their dominant hand on the timing pad. The timing of the 40 m dash began when the subject removed their hand from the timing pad and the timer stopped after the subject passed the 40 m mark.

Vertical jump (VJ). VJ height was measured using the Vertec (Sports Imports, Columbus, OH). The subject's standing vertical reach was subtracted from their jump height to calculate the vertical displacement achieved during each trial. Subjects were given one warm-up jump to get the feel for the apparatus. For the VJ test, the subjects were instructed to jump with both feet and without a step using a counter-movement while striking the horizontal vanes with their dominant hand (Baechle and Earle 2000).

Margaria-Kalamen stair test (MK). The MK stair test was administered with digital timing pads (Lafayette Instrument Co., Lafayette, IN). The timing pads were placed on the 3rd and 9th stairs of a stair well. The protocol consisted of sprinting up 9 steps while landing only on the 3rd, 6th, and 9th step. The subject started to run 6 m from the base of the stairs and bounded up the stairs taking three steps at a time and ending on the 12th step. The time from the 3rd to the 9th step was used for calculations of power (Powers and Howley 2009). The equation used to calculate anaerobic power was Power = Force x Distance / Time, where Force equals body weight (kg), Distance (m) equals the vertical distance between steps 3 and 9 (height of one stair times 6), and Time (s) equals the time elapsed from steps 3 to 9.

Data Analysis

The best score for each anaerobic test was used for data analysis. Data were analyzed using descriptive statistics and a dependent t-test with SPSS (Chicago, IL, v. 16.0) statistics software ($\alpha = 0.05$).

RESULTS AND DISCUSSION

The purpose of this study was to measure anaerobic power output and performance in male collegiate track athletes, while wearing the Adidas® TechFit PowerWeb shorts. The data analysis revealed that there were no significant differences in short distance running speed or VJ height. However, there was a significant increase in relative anaerobic power output when subjects performed the MK stair test while using the Adidas® TechFit PowerWeb shorts.

40 m Sprint

The short distance running speed of 40 m showed a 0.2% increase in mean sprint times between the Control and Tights conditions (Table 2), but this increase was not statistically significant ($p > 0.05$, $t = -0.12$). In Duffield et al. (2009), rugby players performed intermittent sprints over 20 m on back to back days without producing a measurable decrease in mean sprint times. In another study, athletes per-

Table 2. Dependent t-test results of three anaerobic tests for two conditions: control and experimental of collegiate male track athletes (N = 11)

Condition	Mean	SD	*df*	*p*
40 m Sprint Times (s)				
Control	5.07	0.11	10	0.9
Tights	5.06	0.09		
Vertical Jump Height (cm)				
Control	67.32	3.35	10	0.85
Tights	67.14	3.81		
Margaria-Kalamen Test (kg·m/s)				
Control	169.88	10.8	10	0.02*
Tights	176.76	17.18		

formed a battery of tests, including a 20 m sprint, while wearing compression shorts that produced tension around the hip and upper thigh using special placement of elastic bands. The results indicated there was no difference in overall performance by the athletes when wearing compression garments (Bernhardt and Anderson 2005). In addition, there was no significant improvement in 60 m sprint times of track athletes (Doan et al. 2003). Finally, Ali et al. (2007) found that there was no significant decrease in short-intermittent sprinting times while wearing compression shorts. Our findings and previous research suggest the use of compression shorts do not enhance sprinting performance.

Vertical Jump

Our study found no significant difference ($p > 0.05$, $t = -0.20$) between the Control and Tights groups in the VJ height of male collegiate anaerobic athletes (Table 2). The percent change between conditions was 0.3%. This finding was not supported by Doan et al. (2003). They reported a significant increase during a countermovement VJ when track athletes wore lower body compression garments. Another study found mean VJ power and force of Division I volleyball players significantly increased over the course of 10 repeated jumps when the subjects wore compression shorts (Kraemer et al., 1996). However, this study also revealed that there was no difference in maximal force or power over the same 10 jumps when wearing compression shorts. The researchers concluded that compression shorts do not increase maximal force and power but over multiple jumps there was a significant improvement in mean power and force production.

Previous research has suggested VJ performance may be enhanced while wearing compressive shorts. There may be a few possible explanations as to why there was not a significant enhancement in VJ in this study. First, the Vertec was not used in the Kraemer et al. (1996) investigation as subjects completed the repeated VJ on a force plate. Doan et al. (2003) also used a force plate and the subjects were not able to use their arms. The VJ test was the only test conducted in this study where body placement may make the difference in a subject's jump height. Body placement is important for this test when jumps are measured with a Vertec device. If a subject did not stand directly under the device, they may not hit the Vertec with a fully extended overhead arm at their maximum jump height. However, all subjects in the present study were able to practice the VJ prior to data collection. Another factor that may have been a limitation in this study was the VJ was completed from a stand still position, and both legs were used during the push-off. Track and field jumpers run or take several steps prior to jumping and usually jump off one leg.

Margaria-Kalamen (MK) Step Test

The results of the dependent t-test yielded a significant increase in relative anaerobic power during the MK test when the subjects wore the compression shorts ($p < 0.05$, $t = -2.70$). The means were 176.76 kg•m/s ± 17.18 for the Tights condition and 169.88 kg•m/s ± 10.80 for the Control (Table 2). Relative anaerobic power output notably increased by 5.8% when wearing the Adidas® TechFit shorts. A study on cyclists reported similar findings regarding power output. When cyclists wore lower body compression garments, they produced higher relative and absolute power outputs, 4.2% and 5.7%, respectively (Scanlan, et al. 2008).

Limitations and Conclusion

One limitation in this study included no randomization of conditions. All subjects completed the Control tests at least one week prior to the Tights condition. This may have influenced the findings of the MK test. Subjects may have experienced a learning effect associated with repeating the test multiple times. By performing the test repeatedly, the subjects may have improved naturally and this may not have been related to performing the MK test while wearing the Adidas® TechFit compression garments.

The 40 m sprint was completed on an indoor surface, in which the subjects reported decreased traction. The subjects were not informed about the surface prior to testing. Prior knowledge would have allowed them the opportunity to select specific footwear for the testing conditions. Only male collegiate track athletes were recruited to participate in this study since the female and male shorts are designed differently. Thus, the results of the study only apply to male track athletes.

Future studies of the Adidas® TechFit PowerWeb compression shorts should be used to verify the findings of this study. The MK test should be examined further to determine if there is a significant increase in performance while wearing these compression shorts. In addition, biomechanical data should be collected to investigate if there are changes in sprinting mechanics while wearing this garment. Additional research could also examine the use of compression garments for female athletes and provide insight into potential performance enhancement. Future research can investigate newly designed compression garments that could help an athlete achieve better performance, reduce injuries, and aid in recovery.

In conclusion, while the Adidas® TechFit shorts did not improve sprint speed or VJ height, they did improve relative anaerobic power output during the MK test. Adidas® has not claimed that these shorts significantly improve power and performance; however, their website suggests Adidas® TechFit shorts could improve overall power up to 5%, sprint speed by 1%, and jump power by 4%. This study showed a 5.8% increase in anaerobic power via the MK test, and less than a 1% change in sprint and VJ performance. Horizontal and vertical anaerobic power were not influenced by the use of Adidas® TechFit shorts. However, when combining vertical and horizontal displacement the Adidas® TechFit shorts appear to influence anaerobic power output.

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