THE EFFECTS OF COMPRESSION GARMENTS ON SPORTS PERFORMANCE AND FATIQUE

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This study is to explore the effects of compression garments on sports performance and fatigue. Testees performed 20-meter sprints in normal shorts and compression garments. Following the sprints, the testees performed vertical jumps before and after the fatigue test. Fatigue test is based on the Opto Jump 60-s CMJ test. Fatigue indices were then calculated. Biomechanics data were collected through two AMTI force plates and an eight-camera motion analysis system. Our research findings indicate that the average sprint times for normal shorts and compression garments are not statistically different, that the fatigue indices for compression garments are significantly lower than those for normal shorts, and, finally, that the jump performance pre- and post- fatigue test for compression garments did not differ statistically. This implies that compression garments can ease fatigue and, consequently, lead to better performance.

KEYWORS: vertical jump, compression garments, moment

INTERDUCTION: Faced with fierce competition, athletes have been seeking ways to better their performance. In addition to training, athletes have always been taking advantage of various kinds of assistive equipment. In recent years, athletes have been putting on compression garments in hopes of heightened performance and lowered fatigue. Many research findings pointed out, that the mean power outputs for testees in compression garments are statistically greater than those for testees in normal shorts (Kraemer et al., 1996; Higgins, Naughton, & Burgess, 2009). Previous studies have focused on the recovery strategies after fatigue test and concluded that cold water immersion was more effective than both carbohydrate plus stretching and compression shorts (Davies, Thompson, & Cooper, 2009), suggesting that compression shorts were ineffective as far as fatigue recovery is concerned; however, if the occurrence of fatigue can be delayed in a competition, improved performance can be reasonably expected. Generally speaking, the functionalities needed for a sport vary based on its respective nature. Take sprinters and runners for example, delayed fatigue benefits runners more than sprinters.
In recent years, improving manufacturing technologies and user needs have been driving compression garments to evolve in terms of material and designs in order to not only provide protection towards lower extremity joints and muscle but also maintain correct postures for athletes in lengthy competition. In short, the main purpose of this study is to explore the effects caused by compression garments on fatigue and performance. It was hypothesised that there is a significant difference in fatigue and sports performance between athletes in compression garments and normal shorts.

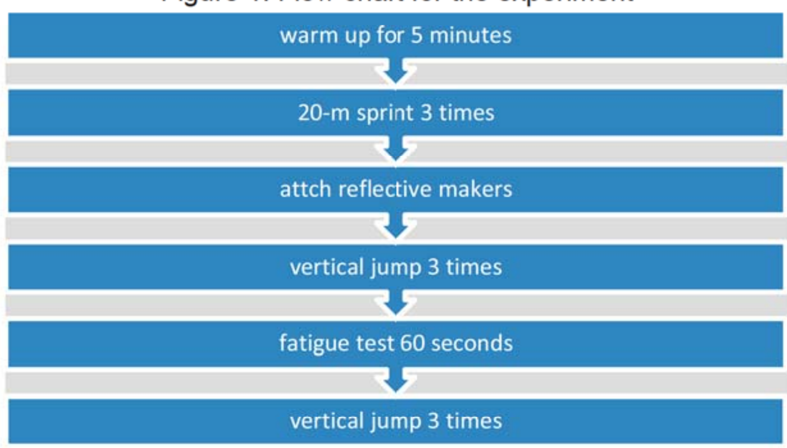
METHODS: 11 healthy female college students (height: 1.62±0.06m, mass: 54.85±6.8kg) who had not suffered from serious lower extremity injuries in the last six months were selected as testees in this study. The biomechanics data were collected through two AMTI force plates (BP600900,AMTI Inc., Watertown, MA, USA) and an eight-camera motion analysis system (Qualisys Track Manager, Oqus 100, Sweden) during the tests.22 reflective markers were attached to each testee. Specifically, these markers were located on both sides of sacrum, anterior superior iliac spine, greater trochanter, thigh, shank, medial femoral epicondyle center, lateral femoral epicondyle center, lateral malleolus, medial malleolus, metatarsal head II, and heel. Each testee was tested twice in normal shorts (NS) and compression garments (CG). To ensure full recovery from fatigue, two tests were conducted 7 days apart. Figure 1 shows the test procedure. First, testees were to perform three 20-meter sprints. Between sprints, testees had a one-minute rest. Following the sprints, testees did three maximal vertical jumps with their hands placed at the waist and feet on the force plates. Afterwards, fatigue test was conducted based on the Opto Jump 60-s CMJ test (Bosco, Luhtanen & Komi, 1983). Testees were required to do continuous vertical jumps for the period of 60 seconds. Testees then had a 3-minute rest after the fatigue test. Finally, testees returned to the force plates to do another three maximal vertical jumps.The data of ground reaction force and inverse dynamic (Winter,2005) were processed using TMM to calculated the peak ground reaction force in the push-off phase, peak power, and peak extensor moment. Fight time (T) was substituted into CMJ's formula jump height (H): H=(4.9X)/4.

Fatigue index (FI):

FI=[(top 10% jump height-bottom 10% jump height)/(bottom 10% jump height)X100] (Dal Pupo et al., 2013).

We used SPSS 14.0 to perform t-test to examine whether the 20-meter sprint times and FI for NS and CG were statistically different. Two-way repeated measures ANOVA, on the other hand, enabled us to examine whether the difference between CMJ performance for NS and CG were significantly different. If the interaction prevails, further comparison can be done via LSD.

Figure 1. Flow chart for the experiment



RESULTS: Our statistical analysis shows that the difference between 20-meter sprint times for NS and CG were statistically insignificant (p>.05) and that the FI for CG were significantly lower than that for NS (p<.05).

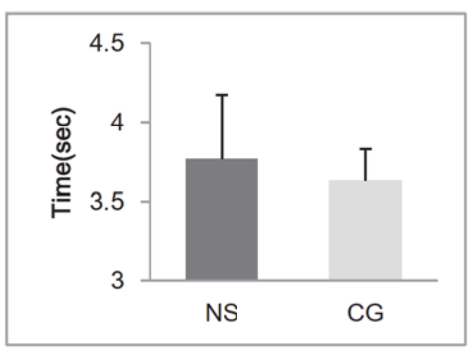


Figure 1. The time of 20-m sprint

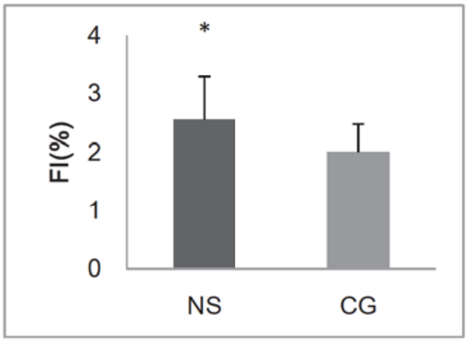


Figure 2. The FI of 60-s CMJ test

The results of jumping performance (pre- and post-test) are displayed in Table 1. Our findings indicate that the jump height for NS after fatigue test was statistically lower than that before fatigue test and that the jump height for CG after fatigue test was not statistically different than that before fatigue test. In addition, the results also show, in the push-off phase, that the peak ground reaction force, peak extensor moment, and peak power for NS (pre- and post-fatigue test) were all statistically different ($p<.05$), whereas the differences for the peak ground reaction force, peak extensor moment, and peak power for CG (pre- and post-fatigue test) were statistically insignificant ($p>.05$).

Table 1. The results of jumping performance (pre- and post test)

	NS-Pre	NS-Post	CG-Pre	CG-Post
Vertical Jump Height (m)	0.29±0.03*	0.27±0.04	0.28±0.04	0.27±0.03
Push-off Phase				
Peak Force (N)	633.32±32.82*	615.46±37.42	626.43±34.35	624.10±39
Peak Extensor Moment (Nm)	84.28±21.22*	78.84±20.75	70.68±18.48	71.74±15.98
Peak Power (W)	420.09±110.04*	366.6±109.94	375.97±114.99	392.36±99.22

Note: * Iindicates a significant difference ($p<.05$) between pre- and post test.

DISSCUSSION: Jumping and sprinting are crucial abilities in many sports; for example, spikes in volleyball and fast breaks in basketball require both of them. Our findings reveal no direct link between compression garments and sports performance as far as jump height and sprint speed are concerned, which conforms to the conclusion by previous scholars, such as Bernhardt and Anderson (2005). As a sports competition progresses, repeated muscle loadings are inevitably bound to cause lower extremity fatigue, which, in turn, leads to reduced performance. Fatigue brings negative effects mostly on maximal muscle strength, explosive power, and movement velocity (Buttelli, Seek, Vandewalle, Jouanin, &Monod, 1996). In some cases, it even causes injury. As a result, how to lessen negative effects associated with fatigue has become a critical issue for athletes. Our research findings indicate that testees who went through 60-s CMJ test in compression garments showed significantly lower FI compared to testees in normal shorts. This suggests that compression shorts effectively reduce fatigue and that testees in compression garments did not experience significantly negative effects as far as jump height, lower extremity power, and explosive power are concerned. As for testees in normal shorts, reduced jump performance after the fatigue test has been recorded. This corresponds to conventional wisdom that compression shorts enable testees maintain power output when performing repeated jumping (Kraemer et al., 1998).

CONCLUSION: To sum up, this study has confirmed the positive effects of compression garments on lessening the extent to which fatigue affects performance. What is worth further exploring is its effect on injury prevention. Moreover, realizing compression garments' positive effects, further study can be targeted on the design of compression garments based on the specific requirements of a sport.

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