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Do Fit Flops™ increase muscle activity in the lower extremity whilst walking?

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Background: Fit Flop™ shoes are widely available commercial products which are advertised with the strap line 'get a work out while you walk™' (Fit Flop™, from http://www.fitflop.com/). The basis for this product is the inbuilt Microwobbleboard technology™ which effectively provides an unstable contact surface with the foot. One of the advertised advantages of Fit Flops™ is that they increase leg and gluteal muscle activity in comparison to a control shoe. However, to the authors' knowledge there are currently no published independent studies which report these findings. With obesity and sedentary lifestyles on the increase, novel ways of promoting and enhancing 'exercise' levels in the general population are of paramount importance.

Purpose: To investigate the effects of wearing Fit Flops™ on lower extremity muscle activity whilst walking.

Methods: Twelve females aged 21 ± 1 years, height 165.8 ± 6.3 cm, mass 63.7 ± 13.3 kg participated in the study. The investigation was approved by the institutions research review group and all participants gave written informed consent to participate. Following site specific skin preparation, two surface electromyography (EMG) silver/silver chloride bipolar electrodes were placed over the muscle bellies of the tibialis anterior, gastrocnemius, biceps femoris and gluteus maximus of the right leg with a 20 mm inter-electrode distance (centre to centre). Participants were required to walk on a treadmill at 5 km/hr for two minutes in each of three different footwear conditions; 1) barefoot, 2) Fit Flops™ and 3) thong style flip flops (the order of which was randomised). During the second minute of walking for each of the footwear conditions EMG was recorded for three, ten stride periods. The electro-myographic signals were captured at 2000 Hz and high and low pass filtered between 20 and 500 Hz respectively (Aurion Zerowire EMG). EMG signals were rectified using a moving root mean square (rms) over 100 ms epochs, with average rms-EMG determined for each of the trials of ten strides (a mean of the three trials for each shoe condition was then calculated). Mean rms-EMG was subsequently normalised by expressing as a percentage of the peak rms-EMG obtained during the barefoot condition. Repeated measures one-way ANOVAs were performed to determine the effects of changing shoe condition on each muscle investigated (P S 0.05). Bonferroni adjusted post-hoc t-tests were performed when significant main effects were found.

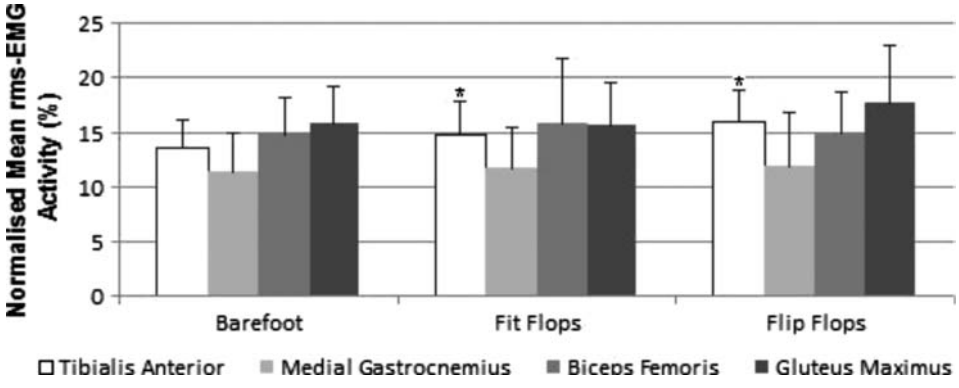

Figure 1. Normalised mean rms-EMG activity recorded for the four studies muscles in the three footwear conditions. Data are mean ± s, *indicates significantly greater than the barefoot condition.

Results: There were no differences found in the normalised mean rms-EMG activity between the three shoe conditions for the gastrocnemius (P = 0.575), biceps femoris (P = 0.771) or gluteus maximus muscles (P = 0.127) (see figure 1 for values). However, a difference was apparent for the tibialis anterior ($P < 0.001$). Normalised mean tibialis anteror rms-EMG activity was 9.7% greater when wearing Fit Flops™ compared to barefoot (P = 0.012, Cohen's d = 0.47), 18.0% greater when wearing thong style flip flops compared to barefoot (P = 0.000, Cohen's d = 0.87) and 7.6% greater when wearing thong style flip flops compared to Fit Flops™ (P = 0.022, Cohen's d = 0.38).

Discussion: Compared to barefoot walking wearing Fit Flops™ did not increase the activity of the gastrocnemius, biceps femoris and gluteus maximus muscles. However, activity of the tibialis anterior was increased. This increased activity may well be due to the style of shoe (thong style flip flop) as this increase was also apparent when wearing a normal thong style flip flop. This finding is in line with reports of altered kinematics and kinetics of walking in flip flops compared to trainers, including increased ankle range of motion in the swing phase (Shroyer & Weimar, 2010: Journal of the American Podiatric Medical Association, 100(4), 251-257).

Conclusion: The results suggest that wearing Fit Flops™ does not increase muscle activity in the lower extremity above that of normal flip flops whilst walking. Wearing Fit Flops™ therefore does not give an additional 'exercise' benefit in terms of muscle activation whilst walking in a straight line.