

## Physiological Consequences of Boot Material and Sole Type in Men and Women Firefighters

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Most firefighters wear rubber boots or lighter leather boots with either Goodyear welt or cement soles. A 5 to 12% increase in oxygen consumption per kg of weight added to the foot has been observed; however, this increase may depend on gender, boot material, sole type, and whether subjects are wearing additional protective clothing/equipment. To determine the effects of two welt- (GW) and two cement-soled (CM) boot models on firefighters' metabolic and respiratory variables during simulated firefighting tasks, 13 women and 14 men, while wearing full turnout clothing, a 10.5-kg backpack, gloves, a helmet, and a randomly assigned boot model walked for six minutes at three mph on a treadmill while carrying a 9.5-kg hose and climbed a stair ergometer for six minutes at 45 steps per minute. Minute ventilation (VE), oxygen consumption ( $\text{VO}_2$ ),  $\text{CO}_2$  production ( $\text{VCO}_2$ ), and heart rate (HR) were measured, and the data from minute six was used for analysis. Means for the GW (2.57 kg for men, 2.42 kg for women) and CM (2.75 kg for men, 2.44 kg for women) models most closely matched for weight were compared for men and women for each task. For men, HR was 9.0% greater for GW during stair climbing.  $\text{VO}_2$  was 2.1% greater and HR was 6.9% greater for GW during treadmill walking. For women,  $\text{VO}_2$ ,  $\text{VCO}_2$ , and VE, and were 5.0, 5.8, and 10.5% greater, respectively, for GW during stair climbing.  $\text{VO}_2$ ,  $\text{VCO}_2$ , and VE, and were 7.4, 4.8, and 9.5% greater, respectively, for GW during treadmill walking. These data demonstrate that, in addition to boot weight, sole type may be important in determining the physiological consequences of wearing firefighter boots.