Impact of Excess Body Weight on Arterial Structure, Function, and Blood Pressure in Firefighters

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Cardiovascular disease is the leading cause of death among firefighters. The purpose of the present study was to examine the effect of excess body weight on arterial structure and function and blood pressure (BP) in relatively young, apparently healthy, firefighters. The body mass index, brachial BP, carotid BP, aortic BP, radial augmentation index, central pulse wave velocity, forearm blood flow, forearm vasodilatory capacity, carotid arterial compliance, carotid intima-media thickness, and brachial flow-mediated dilatation were assessed in 110 firefighters (aged 29.7 ± 8.0 years). The group was divided into equal tertiles according to the body mass index (<25.9, 25.9 to 29.4, and ≥29.5 kg/m\textsuperscript{2}). Group differences in hemodynamics, anthropometrics, microvascular function, and macrovascular structure and function were tested using multivariate analysis of variance. The obese group was older, heavier, and had a larger waist circumference compared to the lean and overweight groups (p < 0.05). The overweight group was also older, heavier, and had a larger waist circumference than the lean group (p < 0.05). Compared to the lean group, the overweight and obese groups had a greater systolic BP (p < 0.05). The obese group also had a significantly greater mean arterial BP and carotid systolic BP than the lean group (p < 0.05). The obese group had greater β stiffness and elastic modulus compared to the lean and overweight groups (p < 0.05), but no group differences were found in endothelial function. In conclusion, in a population of relatively young firefighters, an increased body mass index was associated with elevated peripheral BP and arterial stiffness, with no apparent decrements in endothelial function. © 2009 Elsevier Inc. All rights reserved. (Am J Cardiol 2009;104:1441–1445)

Several novel risk factors, such as endothelial function, central arterial stiffness, central blood pressure (BP), and the augmentation index, are predictive of all-cause and cardiovascular mortality.\textsuperscript{1,2} Alterations in arterial structure and function and central BP often present as early features of atherosclerosis and vascular disease\textsuperscript{3–5}; however, these novel risk factors have not been systematically studied among firefighters. Furthermore, excess body weight and obesity is associated with reductions in arterial function and an increased central BP even in younger persons.\textsuperscript{6} Arterial function and central BP can also distinguish populations with similar traditional cardiovascular risk factors\textsuperscript{7} and thus provide additional information on cardiovascular function and risk. Obesity is a serious problem in firefighters, because many new recruits are obese, and heavier recruits gain more weight during their years of active duty,\textsuperscript{8,9} potentially increasing their cardiovascular risk. The purpose of the present study, therefore, was to examine the effect of excess body weight on macrovascular structure and function, microvascular function, and hemodynamics in a group of relatively young, apparently healthy, firefighters.

Methods

A total of 110 firefighters participated in the present study (mean age 29.7 ± 8.0 years). All participants provided written informed consent, and the University of Illinois institutional review board approved the study. All participants completed a health history questionnaire and were asked if they had been diagnosed with any cardiovascular disease, if they had ever been diagnosed with hypertension or hyperlipidemia, and to list all medications used. The participants were excluded if they had any history of cardiovascular disease, hypertension, or hyperlipidemia or if they were taking any prescription medication influencing the heart rate, BP, or blood flow. Additionally, participants were not included in the study if they had taken any over-the-counter medication in the past 7 days. We screened 250 firefighters and included the 110 who met the eligibility criteria.

All participants were ≥3 hours postprandial and had not consumed caffeine or alcohol or exercised for 24 hours before testing. At the beginning of the testing session, the participants rested quietly in a temperature-controlled room for a minimum of 5 minutes. The anthropometric variables included the height, weight, and waist circumference. The hemodynamic variables included the brachial BP, carotid