

Thandeka Ngwenyama

Major: Animal Science

University: University of Missouri-Columbia

Faculty Mentor: Dr. James Turk

Mentor Department: Veterinary Biomedical Sciences and Veterinary Pathobiology

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Effects of diet and exercise on carotid lesions in male pigs

The objective of this study was to examine the influence of aerobic exercise-training on atherosclerotic lesion appearance and composition in the carotid artery of male, miniature Yucatan pigs fed a high-fat, high-cholesterol (HFC) diet. Sexually mature, male pigs were assigned to either treadmill exercise (Ex) or sedentary (Sed) groups. After 20 weeks, the pigs were euthanized and their common carotid arteries harvested. Carotid artery intima-media thickness (IMT) is regarded as a valid surrogate of atherosclerosis and was measured in cross sections stained for elastin. The accumulations of foam cells in the HFC carotids were examined immunohistochemically with special stains for endothelial nitric oxide synthase (eNOS), nitrotyrosine, and superoxide dismutase-1 (SOD1). Expression of eNOS causes the release of nitric oxide (NO), which mediates vasorelaxation and has been shown to be impaired by HFC diet. Nitrotyrosine is a marker of oxidative stress and is formed when NO combines with a superoxide radical to form peroxynitrite which can nitrosylate tyrosine residues in proteins, all potentially leading to molecular and cellular dysfunction. SOD-1 is one of three isoforms of the antioxidant enzyme superoxide dismutase (SOD), is Cu/Zn-dependent, and is present in the cytosol and nucleus. SOD-1 is thought to be an important antioxidant defense mechanism. The IMT was significantly less in Ex versus Sed male pigs and nitrotyrosine staining tended to be less intense in Ex pigs. There were no significant differences in staining intensity for SOD1 and eNOS between Ex and Sed groups. The protective effect of exercise in this porcine model of carotid atherosclerosis is similar to that observed in human males, and may be associated with the altered balance between NO and superoxide generation.