Hydroxy-oleic acid, but not oleic acid, inhibits vascular responsiveness in isolated aortic tissue

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Oleic acid (OA) and other fatty acids can become abundant in circulation after air pollution exposure as endogenously released lipolysis byproducts or by entering the body as a component of air pollution. Vascular damage has been observed with OA infusion, but it is not yet established whether increased circulating OA is able to produce the type of adverse cardiovascular effects associated with exposure to air pollution, or the mechanisms involved with such damage. Based on responses observed upon exposure of cultured endothelial cells, we hypothesized that OA and its hydroxylated metabolite (12-OH OA) would increase vascular tissue injury and impair vascular reactivity. Thoracic descending aorta tissue was collected from male Wistar Kyoto rats, aged 13-16 weeks. Prior to reactivity testing, independent LDH assays were performed with aortic rings to establish a subcytotoxic OA dose. To determine changes in vascular reactivity, aortic ring segments were exposed for 1 hr to 100 μM OA, 12-OH OA, or an equivalent EtOH vehicle, followed by testing using myography and pharmacologic agents. Only 12-OH OA exposure significantly inhibited acetylcholine-induced endothelium-dependent vasorelaxation in aortic ring segments, based on maximum relaxation and dose-response, relative to the control. No change was seen in smooth muscle sensitivity to nitric oxide. Maximum contractility using potassium chloride remained unchanged by OA and 12-OH OA exposure, although contractility of the 12-OH OA treated group was slightly reduced in response to phenylephrine. Collectively, these data indicate 12-OH OA impairs endothelium-dependent relaxation, while its parent compound does not, suggesting that metabolism or conversion of OA

may be required to produce vascular effects. Hydroxylated fatty acid products may play a role in the vascular responses observed upon air pollution exposure. (Does not reflect official US EPA policy).