Differential effects of sodium tungstate and vanadyl sulfate on vascular responsiveness to vasoactive agents and insulin sensitivity in fructose-fed rats.

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Abstract

High fructose feeding induces insulin resistance, impaired glucose tolerance, and hypertension in rats and mimics most of the features of the metabolic syndrome X. The effects of a 6-week treatment with the transition metals administered in drinking water, vanadium (VOSO₄·5H₂O, 0.75 mg/mL) or tungsten (Na₂O₄W, 2 g/mL), were investigated on the reactivity to norepinephrine (NEPI) or acetylcholine (ACh) of thoracic aorta rings isolated from fructose (60%) or standard chow fed rats. Maximal effect (Emax) and pD2 (-log EC₅₀) values were determined in each case in the presence or absence of endothelium, while the degree of insulin resistance was determined using the euglycemic hyperinsulenic glucose clamp technique. Aortic segments isolated from 6-week fructose-fed animals were characterized by NEPI hyperresponsiveness (increase in Emax) and endothelium-dependent NEPI supersensitivity (increase in pD2) without any change in the reactivity to ACh. Vanadium or tungsten administered in fructose-fed animals prevented both hypertension and NEPI hyperresponsiveness, while vanadium, but not tungsten, reduced NEPI supersensitivity. Vanadium, but not tungsten, increased the relaxing activity of ACh, both in control and fructose-fed animals. Insulin resistance associated with high fructose feeding was reversed by vanadium but not by tungsten treatment. The differential effects of the two transition metals on vascular responsiveness to NEPI or ACh may be explained by their differential effects on insulin sensitivity.

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