Manganese superoxide dismutase and oxidative stress modulation

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Oxidative stress is characterized by imbalanced reactive oxygen species (ROS) production and antioxidant defenses. Two main antioxidant systems exist. The nonenzymatic system relies on molecules to directly quench ROS and the enzymatic system is composed of specific enzymes that detoxify ROS. Among the latter, the superoxide dismutase (SOD) family is important in oxidative stress modulation. Of these, manganese-dependent SOD (MnSOD) plays a major role due to its mitochondrial location, i.e., the main site of superoxide (O2?-) production. As such, extensive research has focused on its capacity to modulate oxidative stress. Early data demonstrated the relevance of MnSOD as an O2?- scavenger. More recent research has, however, identified a prominent role for MnSOD in carcinogenesis. In addition, SOD downregulation appears associated with health risk in heart and brain. A single nucleotide polymorphism which alters the mitochondria signaling sequence for the cytosolic MnSOD form has been identified. Transport into the mitochondria was differentially affected by allelic presence and a new chapter in MnSOD research thus begun. As a result, an ever-increasing number of diseases appear associated with this allelic variation including metabolic and cardiovascular disease. Although diet and exercise upregulate MnSOD, the relationship between environmental and genetic factors remains unclear.

Diseases

Environmental factors

MnSOD

Oxidative stress

SNP

Translational and posttranslational modulation

reactive oxygen metabolite

superoxide dismutase

exercise

genetics

human

metabolism

oxidative stress

physiology

single nucleotide polymorphism

Exercise

genetics

Humans

metabolism

Oxidative Stress

physiology

Polymorphism, Single Nucleotide

Reactive Oxygen Species

Superoxide Dismutase