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# Ginger: A complementary approach for management of cardiovascular diseases

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## Abstract

Cardiovascular disease (CVD) is a leading cause of morbidity and mortality worldwide. Inflammation and oxidative stress play critical roles in progression of various types of CVD. Broad pharmacological properties of ginger (the rhizome of *Zingiber officinale*) and its bioactive components have been reported, suggesting that they can be a therapeutic choice for clinical use. Consistent with its rich phenolic content, the anti-inflammatory and antioxidant properties of ginger have been confirmed in many studies. Ginger modifies many cellular processes and in particular was shown to have potent inhibitory effects against nuclear factor kappa B (NF- $\kappa$ B); signal transducer and activator of transcription; NOD-, LRR-, and pyrin domain-containing proteins; toll-like receptors; mitogen-activated protein kinase; and mammalian target of rapamycin signaling pathways. Ginger also blocks pro-inflammatory cytokines and the activation of the immune system. Ginger suppresses the activity of oxidative molecules such as reactive oxygen species, inducible nitric oxide synthase, superoxide dismutase, glutathione, heme oxygenase, and GSH-Px. In this report, we summarize the biochemical pathologies underpinning a variety of CVDs and the effects of ginger and its bioactive components, including 6-shogaol, 6-gingerol, and 10-dehydrogingerdione. The properties of ginger and its phenolic components, mechanism of action, biological functions, side effects, and methods for enhanced cell delivery are also discussed. Together with preclinical and clinical studies, the positive biological effects of ginger and its bioactive components in CVD support the undertaking of further in vivo and especially clinical studies.

**Keywords:** *Zingiber officinale*; cardiovascular diseases; drug delivery system; ginger; inflammation; oxidative stress.

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