# Ginger (*Zingiber officinale* Roscoe): A hot remedy for cardiovascular disease?

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**Abstract**

Ginger is now exciting considerable interest for its potential to treat many aspects of cardiovascular disease. This letter reviews the more recent trials, which suggest that ginger shows considerable anti-inflammatory, antioxidant, anti-platelet, hypotensive and hypolipidemic effect in *in vitro* and animal studies. Human trials have been few and generally used a low dose with inconclusive results, however dosages of 5 g or more demonstrated significant anti-platelet activity. More human trials are needed using an appropriate dosage of a standardised extract. Should these prove positive, ginger has the potential to offer not only a cheaper natural alternative to conventional agents but one with significantly lower side effects.


*Keywords:* Ginger; Cardiovascular disease; Arterial disease

## 1. Introduction

Ginger (*Zingiber officinale* Roscoe) has been cultivated for medicinal and culinary purposes for at least two millennia. It contains several hundred valuable compounds and new constituents are still being found [1]. The proportion of each in a sample of ginger depends upon country of origin, commercial processor and whether the ginger is fresh, dried or processed [1–4]. In recent years, clinical trials have shown that ginger can be used successfully in the treatment of a number of conditions; this letter will review those relating specifically to cardiovascular disease.

## 2. Anti-inflammatory effects

Arterial inflammation represents a risk factor for heart disease, largely through oxidised arachidonic acid (AA) metabolites, predominantly the cyclo-oxygenase (COX) and lipoxygenase (LOX) products. *In vitro* studies have shown that a large range of ginger constituents inhibit production of nitric oxide, inflammatory cytokines and the enzymes prostaglandin synthase and arachidonate-5-lipoxygenase in a dose-dependent manner. The latter in turn inhibits the synthesis of prostaglandins and leukotrienes from COX (both 1 and 2) and LOX respectively [5–6]. Ginger has also demonstrated a significant reduction of inflammation in animals compared to conventional drugs [7–8]. A retrospective human survey [5,9] suggested a minimum effective dose of 1 g per day, with higher doses proving more effective. Nevertheless, subsequent human trials used much lower doses and obtained unspectacular results, however they resulted in many fewer side effects than conventional drugs, including NSAIDs [10].

## 3. Antioxidant effects

Ginger's high antioxidant value has proved highly effective with its ability to scavenge a number of free radicals and protect cell membrane lipids from oxidation in a dose-dependent manner [5]. Rat studies showed that ginger significantly lowered induced lipid peroxidation and raised the levels of antioxidant enzymes, together with serum glutathione, and demonstrated that ginger has an equal antioxidant effect to that of ascorbic acid [11].

## 4. Glucose, cholesterol and other lipid-lowering effects

In animals which are diabetic, deficient in the apolipoprotein E gene or have been fed a high lipid diet, ginger significantly lowered serum total cholesterol, LDL, VLDL, triglycerides and phospholipids, reduced atherosclerotic lesions and associated foam cell formation and raised HDL as effectively as conventional hypolipidemic drugs [8,12–13]. It was also found that ginger acted on the liver to reduce cholesterol biosynthesis and may stimulate cholesterol's conversion to bile acids and increase its faecal excretion [13]. The only human trial demonstrated that 4 g of ginger given daily for 4 months to coronary artery disease patients failed to affect significantly either blood lipids or glucose [3].

## 5. Anti-platelet effect

Ginger brought about significant dose-dependent inhibition of AA-induced platelet aggregation, COX-derived

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thromboxanes and prostaglandins and prostacyclin synthesis, with an increase in fibrinolytic activity, in *in vitro* and animal studies [3,8,13–15]. A significant reduction in platelet aggregation in healthy humans who ate high fat meals was achieved by 5 g of ginger a day, although in coronary artery disease patients a daily dose of 4 g for 3 months was ineffective, while a single dose of 10 g was highly effective within 4 hours [3]. Finally, ginger did not affect warfarin's pharmacokinetics or pharmacodynamics when co-administered [2].

## 6. Hypotensive effect

In hypertensive animals, ginger has a generally dose-dependent hypotensive effect, although temporary atrio-ventricular dissociation was documented shortly afterwards [16–17]. In addition ginger caused vasodilation in rats and rabbits, following induced vasoconstriction, and exhibited calcium channel-blocking activity similar to verapamil [16]. The only human trial to address hypertension found a synergistic effect between ginger and nifedipine [18].

## 7. Positive inotropic effect

Japanese animal studies have shown that ginger accelerates the Ca++-pumping rate without affecting its efflux, through activating Ca++-ATPase sarcoplasmic reticulum. This effect was specifically demonstrated in guinea pig atrial muscle. It can also promote the positive inotropic effect of adrenaline by stimulating its release from the adrenals [19–20].

## 8. Conclusion

Evidence exists for ginger's beneficial effect on inflammation, free radicals, hyperlipidemia, platelet aggregation and hypertension and demonstrating a positive inotropic effect. Although these encouraging results are largely based on animal and *in vitro* studies, it paves the way for further human trials using an appropriate dosage and incorporating safety studies. In principle, ginger may exhibit safer therapeutic effects than conventional cardiovascular drugs since its side effects to date are negligible in the dosages tested. Furthermore, its price relative to many conventional agents suggests that ginger could present a much more cost effective remedy for the treatment of cardiovascular disease, the most prevalent disease affecting the human race.

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