

Medicinal Properties of Ginger and Garlic: A Review



Chinedu Imo* and Jivini Salvation Za'aku

Department of Biochemistry, Federal University, Nigeria

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*Corresponding author: Chinedu Imo, Department of Biochemistry, Faculty of Pure and Applied Sciences, Federal University Wukari, P.M.B. 1020, Wukari, Taraba State, Nigeria.

Abstract

This study reviewed the medicinal properties of ginger and garlic. Ginger and garlic are commonly used spices which are important in medicine due to the presence of many important phytochemical constituents and nutrients which are biologically active substances. Some chemical constituents of these medicinal plants have been reported in various literatures to contribute to the prevention and treatment of various diseases and ailments. In literatures, some of the documented properties of garlic and/or ginger include antioxidant, anti-inflammatory, rheumatologic, blood circulation and anti-cramp, anti-ulcer, anticholinergic, analgesic, antimicrobial, anti-stress, anti-cancer, immunity booster, anti-diabetic, regulation of blood pressure and treatment of cardiovascular diseases. The use of these medicinal plant materials will aid the promotion of human health system.

Keywords: Antioxidant; Diseases; Folk medicine; Garlic; Ginger; Phytochemical; Spices

Introduction

Plants have been reported to have very great potential for the treatment and management of some disease conditions. Many plants have been used by tribal and folklore: in different countries for the treatment of various diseases [1]. The medicinal value of plants lies in their bioactive phytochemical constituents. Aside from the primary use of spices as organoleptic enhancers in food preparation, they are increasingly finding other useful roles in animal health care. Currently, many spices and herbs are being investigated for their potential effects in health care. In literatures, there exist many reported findings on medicinal properties of certain spices. The rise in interest on medicinal properties of herbs and spices is consequent on the failing efficacy and toxicity associated with conventional drugs and their inaccessibility to poor rural dwellers or low-income earners. For a long time, there has been a resurgence of interest in the investigation of natural materials as a source of potential drug substance [2]. This study reviewed two important spices: ginger (*Zingiber officinale*) and garlic (*Allium sativum*) common in the culinary of Nigeria and many countries, highlighting some of their reported medicinal properties. Several peer-reviewed articles were consulted for this purpose.

Ginger

Ginger (*Zingiber officinale*) belongs to Zingiberaceae family. It is a flowering plant whose rhizome or root is commonly used in folk medicine and as a spice. Ginger is reported to originate from the tropical rainforests of the Indian subcontinent to Southern Asia where ginger plants show some genetic variation [3]. Ginger is widely cultivated all over many countries such as

Nigeria, Taiwan, India, Jamaica and Bangladesh. It is reported to grow in warm climates [4]. Ginger has been reported as one of the wildly used herbs in traditional medicine in many countries [5]. The Chinese have used ginger for many years as a digestive aid and remedy for nausea, and to treat disorders such as rheumatism and bleeding. It was reported to have been used to treat baldness, snakebite, toothache and respiratory conditions [6]. Ginger is considered an aphrodisiac in Arabian medicine [7], while some Africans believe that eating ginger regularly will aid repel mosquitos [6].



Figure 1: Rhizomes of ginger.

The oil from ginger is believed to be very medicinal. The major active ingredients in ginger oil are reported to be the sesquiterpenes, which include bisapylene, zingiberol and zingiberene [8]. The concentrations of the active ingredients

vary with growing conditions of the ginger. Ginger is used worldwide as a cooking spice, condiment and herbal remedy. The rhizome of ginger plant (Figure 1) has been used as a spice since several years across the globe.

Medicinal properties of ginger

Many studies reported several medicinal properties of ginger, which include the following:

Anti-ulcer and anticholinergic: Ginger acts and protect gastric mucosa against several ulcerogenic agents and is very useful in cases of ulcerogenesis because of its antioxidant properties [9,10]. This has both many benefits and drawbacks, because prostaglandin has been shown to have a housekeeping and gastro-protective function by maintaining gastric mucosal integrity [7,11,12]. Ginger shows strong antiemetic property by enhancing intestinal motility and inhibiting serotonin receptors. Ginger was reported to stimulate the peripheral anti-cholinergic and anti-histaminic receptors and antagonize 5-hydroxytryptamine receptors in the GIT [9,10].

Antioxidant, anti-inflammatory and rheumatologic properties: Ginger was reported to show anti-inflammatory effect through the suppression of PG synthesis and also to have interference in cytokine signaling [6,13]. Several studies have reported that the oil extracted from ginger had scavenging effects due to volatile oils [6,14]. Ginger is a powerful antineoplastic agent. In some studies, extracts of ginger suppressed cell proliferations and also acted against resistance of cancerous cells [15,14]. Ginger is known to exhibit a powerful antioxidant activity due to its oil which has protective effect on DNA. This effect has been demonstrated in some cell culture [16]. Ginger has preventive effect on lipid peroxidation and also inhibits or breaks its chain [5,6,17]. Ginger modulates genetic pathway, acts on tumor suppression of genes and modulates some biological activities [6,12,18]. Gingerols and Paradol have been reported to have good anti-platelet and COX-I inhibitory properties [19]. It was also reported that ginger exerts its anti-inflammatory effects by the mechanisms which explain the role of inhibition of pre-inflammatory factor like prostaglandin and leukotriene biosynthesis which may reduce pain associated with rheumatoid and osteoarthritis. In history, it has been proven to be used for the treatment of rheumatic conditions [6,5,18].

Analgesic effect: Gingerols, which are the key ingredients responsible for the activity of ginger have shown important pharmacological effect. It is used to treat nausea after surgery and same has been proved in several randomized clinical trials. This effect is reported to be seen due to its action on the 5-HT₃ receptor [11,20,21]. Ginger is used for the treatment of headache and also have good effect on reducing symptoms of pain. This effect is believed to be due to reduction in prostaglandin synthesis. It has also been reported that ginger help to suppress leukotriene biosynthesis by inhibiting 5-lipoxygenase [15].

Blood circulation and anti-cramp effects: Ginger has been discovered to enhance blood circulation throughout the body by stimulating the heart muscles and by diluting circulating blood. This enhances cellular metabolism and aids to relieve certain conditions such as cramp and tension [22,16]. The powerful anti-inflammatory action on prostaglandin synthesis also help in relieving menstrual cramps [23].

Cholesterol regulation and hypotensive properties: Ginger extracts interferes with the biosynthesis of cholesterol, thereby leading to decreasing cholesterol levels in animals. Ginger extracts have antilipidemic effects, by reducing thermogenesis and high lipids levels. They also help to increase serum HDL-cholesterol [24]. Ginger is very effective in lowering blood glucose level when taken in dried form. It also decreases triglyceride level. Long term usage has been reported to aid the increase of high-density lipoprotein cholesterol concentrations [5,25]. There is a study which proved the hypotensive effect of ginger when it was given at 0.3-3 mg/kg. It aids the reduction of atrial blood pressure by blocking calcium channel or by acting on muscarinic receptor [24]. Studies have suggested that ginger may improve insulin sensitivity in body. The mineral elements contained in ginger makes it effective for this same purpose [26].

Antimicrobial effects: Due to the presence of some phenolic compounds in it, ginger has shown great antimicrobial activities and effectiveness in controlling certain viral, bacterial and fungal diseases. Ginger is used in many countries for the preservation of foods [27]. Ginger acts as anti-parasitic. Some studies reported the *in vivo* potential of methanolic extract of *Zingiber officinale* in the treatment of trypanosomiasis [12,14,23,26]. Gingerols and Gingerdiol are the main anti-fungal principles, and extract of ginger powder is effective against several antifungal diseases [15]. Ginger has shown antiviral effect; however, more published literature is needed to prove this efficacy [18,28]. Ginger is reported to be effective in management of hepatitis C virus infection where viral clearance is affected [16,23,29]. Ginger has also been reported to have shown good antimicrobial effect against both Gram positive and negative bacteria; however, severally, this effect is reduced due to heating [18,23].

Garlic

Garlic (*Allium sativum*) is among the oldest of all cultivated medicinal plants. It has been used as a spice, food and folklore medicine for many years, and has been widely researched as a medicinal plant. Garlic is a species in the onion genus, *Allium*. Its close relatives include the onion, shallot and leek. Garlic is native to Central Asia and north-eastern Iran, and has long been a common seasoning worldwide, with a history of many years of human consumption and use [30]. The early Egyptians were reported to have used garlic to treat diarrhea and its medical power was described on the walls of ancient temples [31]. In Africa, particularly in Nigeria, it is used to treat certain conditions such as abdominal discomfort, diarrhea and

respiratory tract infections [32]. In India and Europe, it was used to treat asthma, common colds and hay fever. It was well known to ancient people and has been used both as a food flavouring and as a traditional medicine. The process of cooking garlic has been reported to remove allicin, thus mellowing its spiciness [33]. Allicin, along with its decomposition products: diallyl disulfide and diallyl trisulfide, are reported to be the major contributors to the characteristic odour of garlic, with other allicin-derived compounds, such as vinyl dithiols and ajoene [30]. Out of the many medicinal plants, garlic (Figure 2) has an antimicrobial property which protects the host from other pathogens, highlighting the importance of search for natural antimicrobial drugs [34].



Figure 2: Dried bulbs of garlic.

Medicinal properties of garlic

Antioxidant, anti-inflammatory and anti-stress properties: Whole garlic and aged garlic extract have been reported to exhibit direct antioxidant effects and to enhance the serum levels of two antioxidant enzymes: catalase and glutathione peroxidase [35]. According to Torok et al. [36], garlic (both the homogenate of 10% in physiological saline solution and its supernatant) was able to reduce the radicals present in cigarette smoke. It was also hypothesized that garlic organo-sulfur compounds may be able to prevent depletion of glutathione. Garlic ingestion may protect patients who experience increase in reactive oxygen induced stress on liver function [37]. In a research, Morihara et al. [38] reported that rats that were trained with endurance exercises to physical fatigue enjoyed improved parameters of aerobic glucose metabolism, attenuated oxidative stress, and vasodilation, when given garlic at a dosage of 2.86g/kg for 30 min before exercise. Given the extreme chronic stress many people now face in their daily life, garlic may prove usefulness in countering the negative impact of this stress on human physiology [39].

Anti-cancer properties: Many epidemiological, clinical and laboratory research studies have demonstrated that garlic has a great role in prevention of cancer, especially in relation to digestive tract cancers. A Dutch research in the Netherlands

cohort study found a significant decrease in the development of stomach cancer in those consuming garlic [40]. Regular intake of garlic reduced the risk of esophageal, stomach and colon cancer in a human population study. This was believed to be due to the antioxidant effect of allicin in reducing the formation of carcinogenic compounds in the gastrointestinal tract [41]. Garlic was reported to reduce the risk of patients with prostate cancer, especially those with localized disease. The reduced risk of prostate cancer was independent of body size, intake of other foods and total calorie intake and was more pronounced for men with localized prostate cancer than with advanced prostate cancer [42]. Prostate specific antigen serum markers were reported to significantly decreased during short term ingestion but returned to baseline after 4 weeks. Steinmetz et al. [43] reported that, for cancers anywhere in the colon, the modest consumption of one or more servings of garlic (fresh or powdered) per week resulted in a 35% lower risk, while a 50% lower risk was found for cancer of the distal colon.

Treatment of cardiovascular disease: The relevant role of garlic in coronary heart disease was carried out on rabbits and found that even pre-existing athero-sclerotic deposits and lesions could actually be reversed if garlic is consistently consumed [44]. From a study conducted in India, 432 coronary artery disease patients were randomly grouped into two groups, and half of them were supplied with garlic juice in milk, whereas the other group of patients were not supplied with garlic juice. The result of the study showed that within the three years of the study time, nearly twice as many patients had died in the group not supplied with garlic juice [45]. This, therefore, shows garlic could be effective in management of certain cardiovascular diseases.

Reduction of Atherosclerosis and hyperlipidaemia: In vitro studies have clearly shown that garlic has an ability to suppress low density lipoprotein (LDL) and an increased resistance of LDL to oxidation [46]. After 60 days of supplementation in a study, the concentrations of low-density lipoprotein, serum triglyceride and very low-density lipoprotein were reduced by 21, 37, and 36.7%, respectively [47].

Anti-diabetic property: Reports from some animal studies support the effectiveness of garlic in reducing blood glucose in streptozotocin-induced, as well as alloxan-induced diabetes mellitus in mice. Ohaeri [48] reported that garlic can reduce blood glucose level in diabetic mice and rabbits. From a comparative study made between the action of garlic extract and glibenclamide, it was reported that the antidiabetic effect of the garlic was more effective than the glibenclamide [49].

Immunity booster: Garlic is reported to possess abundant sulfur containing amino acids and other compounds that seem to initiate increased activity in the immune system [50]. It is one of the impressive conductors of the body's immune system; which stimulates immune function by making macrophages or killer cells more active. Supplemental nutrients like garlic is reported

by Salman et al. [51] to be clearly needed to aid the reduction or the relieve of some enormous pressures, which our immune systems sustain, often caused by inadequate nutrition, cigarette smoke, physical injury, mental tension and chemical pollution. Its remarkable content of germanium alone offers excellent immune stimulation. In addition to germanium, garlic has been reported to contain thiamine, selenium, sulfur, niacin and phosphorous [52]. These help in boosting the immune system.

Regulation of blood pressure: Capraz et al. [53] documented that garlic has probably been the most popularized spice as a complementary therapy for blood pressure control. An in vitro study has confirmed the vasoactive ability of garlic sulfur compounds whereby red blood cells converts garlicorganic polysulfides into hydrogen sulfide, which is a known endogenous cardio-protective vascular cell signaling molecule [54].

Analgesic effect: A double-blind placebo-controlled research survey using a 100% allicin yielding supplement has reported that allicin has the ability to reduce the occurrence of common cold and enhanced recovery from the symptoms [55].

Antimicrobial effects: The antimicrobial properties of garlic are reported to be first described by Pasteur in 1958, and since then, many research studies have demonstrated its effectiveness and broad-spectrum antimicrobial activity against many species of *bacteria*, *parasites*, *viruses*, *protozoan* and *fungi* [32]. Garlic is more effective with least side effects as compared to commercial antibiotics; as a result, it is reported to be used as an alternative remedy for treatment of various infections. Previously conducted researches confirmed that garlic is not only effective against Gram-positive and Gram-negative bacteria but also possess antiviral and antifungal activities [56]. Ajoene is an active compound found in garlic and has been reported to play a great role as topical antifungal agent [57]. In another study, garlic was reported to inhibit the growth of certain fungal diseases as equally as the drug ketoconazole, when tested on the fungi *Malassezia furfur*, *Candida albicans*, *Aspergillus*, *Cryptococcus* and other *Candida* species [58].

Garlic oil may be used for the treatment of ringworm, skin parasites and warts if it is applied externally. In a study, lesions that were caused by skin fungi in rabbits and guinea pigs were treated with external applications of garlic extract and began to heal after seven days [59]. Allicin exhibits antiparasitic activity against some major human intestinal parasites such as *Entamoeba histolytica*, *Ascaris lumbricoides* and *Giardia lamblia* [60]. *Entamoeba histolytica*, which is the human intestinal protozoan parasite, is reported to be very sensitive to allicin, as only 30µg/ml of allicin totally inhibits the growth of amoeba cultures [61]. Some researchers have discovered that at lower concentrations (5µg/ml), allicin inhibited 90% of the virulence of trophozoites of *E. histolytica* as determined by their inability to destroy mono-layers of tissue-cultured mammalian cells in vitro [62]. Garlic is also reported to be very

active against microorganisms that are resistant to antibiotics and the combination of garlic extracts with antibiotics have been documented to lead to partial and total synergism. Garlic is also an alternative agent used for treating methicillin resistant *Staphylococcus aureus* [63-65].

Conclusion

There are several evidences from literatures on the medicinal properties of ginger and garlic. Apart from their appreciable roles in nutrition, they have been reported to possess several medicinal properties such as antioxidant, anti-inflammatory, rheumatologic, blood circulation booster, anti-cramp, anti-ulcer, anticholinergic, analgesic, antimicrobial, anti-stress, anti-cancer, immunity booster and anti-diabetic. They also play vital roles in regulation of blood pressure and treatment of cardiovascular diseases. The use of these medicinal plant materials will aid the promotion of human health system.

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