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Review

Unlocking the Potential of Garlic: A Review of its Health Benefits and Therapeutic Uses

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Garlic products are used as sources of medicine in many ways in human beings in their day today life. As a result, researchers from various disciplines are now directing their efforts towards discovering the medicinal values of garlic on human health. The main interest of researchers in the medicinal values of garlic is its broad-spectrum therapeutic effect with minimal toxicity. Garlic extract has antimicrobial activity against many genera of bacteria, fungi and viruses. Garlic contains a higher concentration of sulfur compounds which are responsible for its medicinal effects. The chemical constituents of garlic have also been investigated for treatment of cardiovascular disease, cancer, diabetes, blood pressure, atherosclerosis and hyperlipidaemia and highly praised by several authors. Therefore, this paper is reviewed to inspire and impress the young researchers about the medicinal values of garlic.

Key words: *Allium sativum*, immunity booster, antibacterial, antifungal, antiviral, anticancer

INTRODUCTION

Natural products of animals, plants and microbial sources have been used by man for thousands of years either in the pure forms or crude extracts to treat many diseases (Parekh and Chanda, 2007). Garlic (*Allium sativum* L.) is one of those plants that were seriously investigated over several years and used for centuries to fight infectious diseases (Onyeagba et al., 2004). The taxonomic posi-tion of garlic and related genera had been a matter of controversy for long period of time. The most recent classification scheme of garlic was class Liliopsida, subclass Liliidae, superorder Liliianae, order Amary-llidales, family Alliaceae, subfamily Allioideae, tribe Allieae and genus *Allium* which is mainly based on the sequences of nuclear ribosomal DNA (Friesen et al., 2006).

The early Egyptians used garlic to treat diarrhea and its medical power was described on the walls of ancient temples and on papyrus dating to 1500 BC (Bradley, 1992). It was used by Greek physicians Hippocrates and Galen to treat intestinal and extra-intestinal diseases; ancient Japanese and Chinese used it to treat headache, flu, sore throat and fever. In Africa, particularly in Nigeria, it is used to treat abdominal discomfort, diarrhea, otitis media and respiratory tract infections (Jaber and Al-Mossawi, 2007). In Europe and India, it was used to treat common colds, hay fever and asthma. Garlic is nicknamed as Russian penicillin for its widespread use as a topical and systemic antimicrobial agent; it is commonly used in many cultures as an excitement and reputation of healing power (Timbo et al., 2006).

POTENTIALLY ACTIVE CHEMICAL CONSTITUENTS OF GARLIC

Garlic contains at least 33 sulfur compounds, several enzymes and the minerals germanium, calcium, copper, iron, potassium, magnesium, selenium and zinc; vitamins A, B1 and C, fiber and water. It also contains 17 amino acids to be found in garlic: lysine, histidine, arginine, aspartic acid threonine, swine, glutamine, proline, glycine, alanine, cysteine, valine, methionine, isoleucine, leucine, tryptophan and phenylalanine (Josling, 2005). It has a higher concentration of sulfur compounds than any other *Allium* species which are responsible both for garlic's pungent odor and many of its medicinal

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effects. One of the most biologically active compounds in garlic is allicin (diallyl thiosulfinate or diallyldisulfide). The most abundant sulfur compound in garlic is alliin (S-allylcysteine sulfoxide), which is present at 10 and 30 mg/g in fresh and dry garlic, respectively (Lawson, 1998). Typical garlic food preparation such as chopping, mincing and crushing disturbs S-allyl cysteine sulfoxide and exposed it to the allinase enzymes, then quickly converted it to diallyl thiosulfinate, which give off garlic's characteristic aroma. The allinase enzyme responsible for diallyl thiosulfanate conversion becomes inactivated below a pH of 3.5 or with heating (Pedrazza-Chaverri et al., 2006). Although allicin is considered the major antioxidant and scavenging compound, recent studies showing that other compounds may play stronger roles; such as polar compounds of phenolic and steroidal origin, which offer various pharmacological properties without odor and are also heat stable (Lanzotti, 2006).

ROLE OF GARLIC IN HEALTH

Garlic can rightfully be called one of nature's wonderful plants with healing power. It can inhibit and kill bacteria, fungi, lower (blood pressure, blood cholesterol and blood sugar), prevent blood clotting, and contains anti-tumor properties. It can also boost the immune system to fight off potential disease and maintain health (Abdullah et al., 1988). It has the ability to stimulate the lymphatic system which expedites the removal of waste products from the body. It is also considered an effective antioxidant to protect cells against free radical damage. It can help to prevent some forms of cancer, heart disease, strokes and viral infections. Garlic alone can provide us with over two hundred unusual chemicals that have the capability of protecting the human body from a wide variety of diseases. The sulfur containing compounds found in garlic afford the human body with protection by stimulating the production of certain beneficial enzymes (Mansell and Reckless, 1991).

Treat cardiovascular disease

Disorders of the heart and the circulatory system claim more lives than any other diseases. It is the obstruction or clogging of the coronary arteries which causes more deaths than any other factors. The arteries, which supply the heart with blood and oxygen, become increasingly narrower as plaque builds up over time. When blood supply becomes restricted, a certain portion of the heart is deprived of oxygen and leads to heart attack. The two greatest means of heart disease are high blood pressure and high blood serum cholesterol levels; which are directly impacted by the therapeutic action of garlic. The relevant role of garlic in coronary heart disease was done on rabbits and found that even pre-existing athero-sclerotic deposits and lesions could actually be reversed if garlic was consistently consumed (Bordia, 1981).

From a study conducted in India, 432 coronary artery patients were randomly grouped into two groups and half of them were supplied with garlic juice in milk, whereas the other group patients were not supplied with garlic juice. The result 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 (Yeh et al., 2006). It is well reported to scavenge oxidants, increase superoxide dismutase, catalase, glutathione peroxidase, glutathione levels, inhibit lipid peroxidation as well as it reduces cholesterol synthesis by inhibiting 3-hydroxy-3-methylglutaryl-CoA. It has been shown to reduce platelet aggregation, arterial plaque formation, decrease homocysteine, lower blood pressure, and increase microcirculation. It may also help prevent cognitive decline by protecting neurons from neurotoxicity and apoptosis, thereby preventing ischaemia or reperfusion-related neuronal death and by improving learning and memory retention (Borek, 2006).

Reduces high blood pressure/hypertension

Garlic has probably been most popularized as a complementary therapy for blood pressure control (Capraz et al., 2006). A recent *in vitro* study has confirmed that, the vasoactive ability of garlic sulfur compounds whereby red blood cells convert garlic organic polysulfides into hydrogen sulfide, a known endogenous cardio-protective vascular cell signaling molecule (Benavides et al., 2007). Using 2400 mg garlic tablet containing 31.2 mg allicin has high dose reduced diastolic pressure by 16 mmHg after 5 h of administration (McMahon and Vargas, 1993). A meta-analysis made on pooled data from 415 patients showed also reduction of 7.7 mmHg diastolic pressure (Silagy and Neil, 1994).

As natural blood thinner

Platelets and fibrin play great role in blood clotting and higher amount of fibrin in blood can cause heart attack. Garlic constituents can reduce fibrin formation and also help reduce the fibrin existing in the blood even better than aspirin (Fukao et al., 2007). Ajoene, a sulfur compound found in garlic seems to be responsible for its anti-clotting effect; but ajoene is only viable at room temperature or above, it is not present in raw or freeze-dried garlic. It is believed that the addition of garlic to a diet can help to increase the breakdown of fibrin from 24 to 30% in people (Ernst, 1994).

As natural immunity booster

With the arrival of frightening viral diseases like HIV/AIDS, boosting immunity system is receiving a new attention. Because these types of diseases have no

effective cures or treatments, strengthening the body's ability to fight off infection has become even more important. Garlic has abundant sulfur containing amino acids and other compounds that seem to initiate increased activity in the immune system (Lau et al., 1991). 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. We are constantly beaten by inadequate nutrition, cigarette smoke, physical injury, mental tension and chemical pollution. In light of the enormous pressures, which our immune systems sustain, supplemental nutrients like garlic are clearly needed (Salman et al., 1999). Its remarkable content of germanium alone offers excellent immune stimulation. In addition to germanium, garlic contains thiamine, sulfur, niacin, phosphorous, and selenium (Morioka et al., 1993).

Preliminary studies in humans, using an alliin standardized garlic powder preparation, have demonstrated positive effects on immunoreactions and phagocytosis. In aged subjects, the administration of 600 mg garlic powder per day for 3 months induced significant ($p<0.01$) increases in the percentage of phagocytosing peripheral granulocytes and monocytes when tested *ex vivo* for their ability to engulf *Escherichia coli* bacteria. Another human study was conducted with an unrefined garlic extract (5 to 10 g/day) which was given to HIV/AIDS patients. For the seven patients who completed the 12 weeks study, there was a major increase in the natural killer cells activity from a seriously low mean value (Abdullah et al., 1988).

In USA, trials in HIV/AIDS patients have demonstrated the enhancement of natural killer cells activity using garlic extracts; and Chinese studies with viral infections in bone marrow transplant patients have demonstrated a "potent antiviral activity". A double blind placebo controlled survey using a 100% allicin yielding supplement has reported that allicin can reduce the occurrence of the common cold and recovered from symptoms (Josling, 2001).

Atherosclerosis and hyperlipidaemia

Health claims advertizing garlic's universal ability to lower cholesterol level and decrease lipid peroxidation in order to inhibit plaque formation. *In vitro* studies clearly have shown that, it has an ability to suppress low density lipoprotein (LDL) and an increased resistance of LDL to oxidation (Lau, 2006). Results from controlled human studies are mixed with studies performed in the early 1990's and was showing effective results. As more researches were conducted newer processes to extract garlic, recent study of 15 hypercholesterolemia patients evaluated a material produced from garlic fermented with the mold *Monascus pilosus*. This preparation significantly reduced serum total cholesterol and low density lipoprotein cholesterol levels when checked at 2 and 4 weeks after treatment beginning. The level of triglycerides had a tendency towards reduction in hyper-triglycerdemic patients as well, whereas high density lipoprotein cholesterol was unchanged (Sumioka et al., 2006). After 60 days of supplementation, low-density lipoprotein, serum triglyceride and very low density lipoprotein, were reduced by 21, 37, and 36.7%, respectively (Jeyaraj et al., 2006).

Prevents diabetes

A number of animal studies support the effectiveness of garlic in reducing blood glucose in streptozotocin-induced as well as alloxan-induced diabetes mellitus in mice. Most of the studies showed that garlic can reduce blood glucose level in diabetic mice and rabbits (Ohaeri, 2001). A study was conducted to evaluate oral administration of garlic extract for 14 days on the level of serum glucose, total cholesterol, triglycerides, urea and uric acid, in normal and streptozotocin-induced diabetic mice. The result of the study showed significant decrease ($p<0.05$) in serum glucose, total cholesterol, triglycerides, urea, uric acid, aspartate amino transferase and alanine amino transferase levels, while increased serum insulin in diabetic mice, but not in normal mice. From a comparison study made between the action of garlic extract and glibenclamide, it was shown that the antidiabetic effect of the garlic was more effective than the glibenclamide (Eidi et al., 2006).

Anticancer

Of the many favorable actions of garlic, inhibition of the growth of cancer is perhaps the most prominent. It has several synergistic effects that either prevent or possibly may fight cancer. The action of garlic has been attributed to stimulate immune effector cells including T-cell and natural killer cells. Numerous epidemiological, clinical and laboratory studies have demonstrated that, garlic has a great role in cancer prevention especially in relation to digestive tract cancers. Human population studies have shown that, regular intake of garlic reduces the risk of esophageal, stomach and colon cancer. This was thought to be due to the antioxidant effect of allicin in reducing the formation of carcinogenic compounds in the gastro-intestinal tract (Galeone et al., 2006).

Dutch research in the Netherlands cohort study found a significant decrease in the development of stomach cancer in those consuming garlic close relatives of onions (Dorant et al., 1996). Garlic reduces the risk of patients with prostate cancer, especially those with localized disease. Men in the higher of two intake categories of total *Allium* vegetables (>10.0 g/day) had a statistically significant lower risk of prostate cancer than those in the lowest category (<2.2 g/day). Similar comparisons

between categories showed reductions in risk for men in the highest intake categories for garlic specifically. 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 (Hsing et al., 2002). Prostate specific antigen serum markers had significant decreases during short term ingestion, but returned to baseline after 4 weeks (Mehraban et al., 2006).

A very important epidemiological study for Americans has been published in which the intake of 127 foods (including 44 vegetables and fruits) was determined in 41,387 women (ages 55 to 69) followed by a five year monitoring of colon cancer incidence. The most striking result of this "Iowa Women's Health Study" was the finding that garlic was the only food which showed a statistically significant association with decreased colon cancer risk. 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 (Steinmetz et al., 1994).

Dermatologic applications

A study examined 43 persons for their topical use of two different garlic extracts for wart and corn treatment. Of these persons, 15 volunteers utilized a water extract of garlic, while 23 volunteers applied lipid extract to appropriate areas twice a day. Five controls applied only a neutral solvent. All lipid extract volunteers experienced complete resolution of wart and 80% of corn within one to two weeks. The water extract seemed to be less potent, with complete dissolution of smaller warts and corns, and only partial dissolution of larger ones. Controls showed no improvement from baseline. The lipid extract did cause some burning, redness, blistering and skin darken-ing, which was resolved after conclusion of use (Dehghani et al., 2005).

Antimicrobial

The antimicrobial properties of garlic were first described by Pasteur (1958), and since then, many researches had demonstrated its effectiveness and broad spectrum antimicrobial activity against many species of bacteria, viruses, parasites, protozoan and fungi (Jaber and Al-Mossawi, 2007). Garlic is more effective with least side effects as compared to commercial antibiotics; as a result, they are used as an alternative remedy for treatment of various infections (Tepe et al., 2004). Out of the many medicinal plants, garlic has an antimicrobial property which protects the host from other pathogens highlighting the importance of search for natural antimicrobial drugs (Bajpai et al., 2005; Wojdylo et al., 2007). Previously conducted researches confirmed that garlic is not only effective against Gram positive and Gram negative bacteria but also possess antiviral and antifungal activities (Tsao and Yin, 2001).

Antiviral

Garlic and its sulfur constituents verified antiviral activity against coxsackievirus species, herpes simplex virus types 1 and 2, influenza B, para-influenza virus type 3, vaccinia virus, vesicular stomatitis virus, human immunodeficiency virus type 1 and human rhinovirus type

2. The order of compounds found in garlic for virucidal activity was, ajoene > allicin > allyl methyl thiosulfanate > methyl allyl thiosulfanate; no activity was found for the polar fractions, alliin, deoxyalliin, diallyl disulfide, or diallyl trisulfide. Several laboratory tests have shown that garlic is an effectual treatment for both the influenza B virus and herpes simplex virus. Two independent researchers in Japan and Romania have found that garlic is able to protect living organisms from the influenza virus (Tsai et al., 1985). Most recently, a double blind placebo controlled study has shown significant protection from the common cold virus. As conducted by The Garlic Centre, published in Advances in Therapy, this is the first serious work to show prevention, treatment and reduction of re-infection benefits from taking Allimax Powder capsules once daily (Josling, 2001).

Antibacterial

Garlic extract inhibits the growth of Gram positive and Gram negative bacteria, such as *Staphylococcus, Streptococcus, Micrococcus*, *Enterobacter*, *Escherichia*, *Klebsiella*, *Lactobacillus*, *Pseudomonas*, *Shigella, Salmonella, Proteus*, and *Helicobacter pylori* (Tsao and Yin, 2001). Its antibacterial activity is mainly due to the presence of allicin produced by the enzymatic activity of allinase on alliin. Allicin is considered to be the most potent antibacterial agent in crushed garlic extracts, but it can be unstable, breaking down within 16 h at 23°C (Hahn, 1996). However, the use of a water-based extract of allicin stabilizes the allicin molecule due to the hydrogen bonding of water to the reactive oxygen atom in allicin or there may be water soluble components in crushed garlic that destabilize the molecule (Lawson, 1996). The disadvantage of this approach is that allicin can react with water to form diallyl disulphide, which does not exhibit the same level of antibacterial activity of allicin (Lawson and Wang, 1996).

Antifungal

Ajoene is an active compound found in garlic which plays a great role as topical antifungal agent (Ledezma and

Apitz-Castro, 2006). Garlic has been shown to inhibit growth of fungal diseases as equally as the drug ketoconazole, when tested on the fungi *Malassezia furfur*, *Candida albicans*, *Aspergillus, Cryptococcus* and other *Candida* species (Shams-Ghahfarokhi et al., 2006). A report from a Chinese medical journal delineates the use of intravenous garlic to treat a potentially fatal and rare fungal infection of the brain called *Cryptococcus meningitis*. In the report, the Chinese compared the effectiveness of the garlic with standard medical treatment which involved a very toxic antibiotic called Amphotericin-B. The study revealed that, intravenous garlic was more effective than the drug and was not toxic regardless of its dosage (Lemar et al., 2007).

A study found that *Candida* colonies were substantially reduced in mice that had been treated using liquid garlic extract. The study also revealed that garlic stimulated phagocytic activity. This implies that infections such as *Candida* may be controlled because garlic stimulates the body's own defenses. Garlic oil can be used to treat ringworm, skin parasites and warts if it is applied externally. 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 (Sabitha et al., 2005).

Antiparasitic

Many herbalists worldwide recommend garlic as a treatment for intestinal parasites. In some cultures, children infested with helminthes are treated with enemas containing crushed garlic. One of the traditional Chinese medical treatments for intestinal diseases is an alcoholic extract of crushed garlic cloves. Allicin exhibits antiparasitic activity against major human intestinal parasites such as *Entamoeba histolytica, Ascaris lumbricoides* and *Giardia lamblia* (Kalyesa et al., 1975). *Entamoeba histolytica,* the human intestinal protozoan parasite, is very sensitive to allicin, as only 30 µg/ml of allicin totally inhibits the growth of amoeba cultures (Mirelman et al., 1987). Moreover, researchers have found that at lower concentrations (5 µg/ml), allicin inhibited 90% the virulence of trophozoites of *E. histolytica* as determined by their inability to destroy mono-layers of tissue-cultured mammalian cells *in vitro* (Ankri et al., 1997).

Role of garlic against multi-drug resistant bacteria

Garlic is active against microorganisms that are resistant to antibiotics and the combination of garlic extracts with antibiotics leads to partial and total synergism (Didry et al., 1992). The emergence of multi-drug resistant strains of Gram negative (*Pseudomonas*, *Klebsiella*, *Entero-bacter*, *Acinetobacter*, *Salmonella* species, etc) and Gram positive (*Staphylococcus*, *Enterococcus*, *Strepto-coccus* species, etc) bacteria is troubling for human and animals. The emergence of epidemic methicillin resistant *Staphylococcus aureus* (MRSA) resistant to mupirocin has led many authors to suggest that the use of mupirocin should be controlled more strictly, especially as there is a lack of alternative agents. Consequently, garlic is an alternative agent for the treatment of MRSA and in a great demand (Sharma et al., 2005).

Role of garlic against multi-drug resistant tuberculosis (MDR-TB)

Scientific evidence from randomized clinical trials supports the use of garlic and enhances access for MDR-TB infected people, through the public health system. Its use can allow an effective MDR-TB management, due to its affordability and the absence of toxic effects (Catia et al., 2011). In view of the increased incidence of MDR-TB, the research of new anti-tubercular drugs based on affordable and more effective treatments has already begun. Studies on innovative alternative plant extracts of medicinal values need to be emphasized, as plants are an important source of new antimicrobial agents, with little toxicity, able to replace drugs to which *Myco-bacterium* resistance has occurred (Amin et al., 2009).

As garlic is concerned, the *in vitro* tests undertaken about the inhibitory effect on MDR-TB are at an advanced stage whereas few researches *in vivo* have been conducted. The concentration of garlic extract re-quired was in the range of 1.34 to 3.35 mg/ml suggesting that there is only a slight variation in the susceptibility of the strains to allicin (Delaha and Garagusi, 1985). The anti-tuberculosis activity *in vivo* of garlic oil preparation was demonstrated in a study of guinea pigs which were given an intra-peritoneal dose of 0.5 mg/kg. However, when garlic oil was used, a reduced causative process was noted in the organs involved, indicating that garlic oil administration causes less marked lesions in the viscera of the animals inoculated with tubercle bacilli (Jain, 1998). The high potential of garlic extract was revealed to inhibit the growth of *Mycobacterium tuberculosis* $H_{37}R_v$ and *M. tuberculosis* TRC-C1193, susceptible and resis-tant to isoniazid (first-line anti-tuberculosis medication), respectively. The minimum inhibitory concentration (MIC) of garlic was between 80 and 160 µg/ml for the susceptible strain and 100 and 200 µg/ml for the resistant strain. In addition, water extract of garlic was proven to inhibit the incorporation of ^{14}C glycine into the whole cells, indicating that the primary mechanism of action is by inhibition of protein synthesis (Ratnakar and Murthy, 1996).

An interesting *in vitro* test about the anti-tubercular activity of garlic was performed in Nigeria using disc diffusion method and compared with standard antibiotics. The anti-tubercular activity of garlic on multiple-drug resistant *Mycobacterium* was investigated among Nigerian HIV-infected-persons and it exhibited maximal activity against all isolates even at reduced concentrations. Only

two of the standard anti-tubercular antibiotics used, streptomycin and rifampicin, showed significant activity against isolates tested (Dibua, 2010).

Antioxidant

Whole garlic and aged garlic extract exhibit direct antioxidant effects and enhance the serum levels of two antioxidant enzymes, catalase and glutathione peroxidase (Prasad et al., 1995). Garlic extract, allicin is efficiently scavenged exogenously generated hydroxyl radicals in a dose dependent fashion, but their effective-ness was reduced about 10% by heating to 100°C for 20 min. Other garlic constituents, such as S-allyl cysteine, also confirmed significant antioxidant effects. The sulfur compounds found in fresh garlic appear to be nearly 1000 times more potent as antioxidants than crude, aged garlic extract. Garlic (both the homogenate of 10% in physiological saline solution and its supernatant) was able to reduce the radicals present in cigarette smoke (Torok et al., 1994).

Drug toxicities and pharmacokinetics

Glutathione is a compound necessary for liver to facilitate detoxification of substances. It has been hypothesized that garlic organo-sulfur compounds may be able to prevent glutathione depletion. Patients who experience increasing in reactive oxygen induced stress on liver function may be protected by garlic ingestion (Sabayan et al., 2006). It was found in *E. coli* cultures that aged garlic extract, S-allyl cysteine, diallyl sulfide and diallyl disulfide do not interfere with the antibiotic activity of gentamycin but may improve gentamycin-induced nephrotoxicity (Maldonado et al., 2005). Aged garlic has also been shown to reverse oxidant effects of nicotine toxicity in rat studies. More researches are required in the future garlic may be a unique choice to help minimize the toxic effects of therapeutic drugs (Sener et al., 2005).

Reduces stress

Among the many uses of garlic, it appears to have the fortunate capacity for protecting against the negative effects of stress that affects the autonomic nervous and neuroendocrine system. Rats that were trained with endurance exercises to physical fatigue enjoyed improved parameters of aerobic glucose metabolism, attenuated oxidative stress, and vasodilations, when given garlic at a dosage of 2.86 g/kg for 30 min before exercise (Morihara et al., 2006). In rats exposed to psychologically stressful situations, aged garlic extracts significantly prevented the decreases in spleen weight seen in control animals. Additionally, the garlic significantly prevented the reduction of hemolytic plaque forming cells in spleen cells. Moreover, garlic was able to block the lipopolysaccharide induced immune cytokine and plasma corticosterone and catecholamine changes following cold water immersion stress (Nance et al., 2006). Aged garlic extract is also effective to prevent adrenal hypertrophy, hyperglycemia and elevation of corticosterone in hyperglycemic mice induced by immobilization stress. Given the extreme chronic stress many people now face in their daily life, garlic may prove useful to counter the negative impact of this stress on human physiology (Kasuga et al., 1999).

Adverse effects of garlic

The main adverse effect commonly associated with garlic intake is breath odor, especially when raw forms of the herb are used. Nausea and vomiting are other major adverse effects and care should be taken in consuming high quantities. Although an entire bulb produces little juice, it is potent and can act as a strong emetic, even in small quantities. Although garlic generally poses little in terms of safety issues, there are isolated cases of topical garlic burns (Friedman et al., 2006) and anaphylaxis (Yin and Li, 2007). Rare garlic allergy has been attributed to the protein allinase, which has induced immunoglobulin E (IgE) mediated hypersensitivity responses from skin prick testing (Kao et al., 2004). As a result, the literature has generally cautioned against using garlic while using anticoagulant therapy. There is a reported case of spontaneous spinal or epidural hematoma in an 87 years old man, with associated platelet dysfunction related to excessive garlic ingestion (Saw et al., 2006).

CONCLUSION

Garlic, from crushed to capsules, is consumed through-out the world. This review paper demonstrated some of the benefits of garlic for its potential uses in preventing and curing different diseases, and acting as antioxidant for many radicals. Fresh and powdered garlic are popular for food flavor and should continue to be used. Today, with the ever-growing resistant organisms, taking of garlic extract remains a powerful antimicrobial agent. Clearly more studies are needed to refine the use and improvement of the efficacy of this important medicinal plant.

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