



## **Biological potential and effect of *Allium sativum* oil against Hepato and Nephro toxicities**

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### **Abstract**

*Allium sativum* or Garlic has been used as a culinary spice and medicinal herb and has been an important part of Indian Ayurveda and Traditional Chinese Medicine. Garlic and its has been used for numerous health benefits and use useful in treatments of various diseases, like common cold, cancer, antimicrobial and cardiovascular agent. Garlic is a good phytoantioxidant with powerful chemo-preventive properties against chemically-induced oxidative stress. The garlic oil showed defensive role of against Sodium nitrite (NaNO<sub>2</sub>)-induced toxicities in metabolic and biochemical parameters in male albino rats. The NaNO<sub>2</sub> induced a significant increase in serum levels of glucose, aspartate aminotransferase (AST), alanine aminotransferase (ALT), alkaline phosphatase (ALP), bilirubin, urea, creatinine as well as hepatic AST and ALT level. However, garlic oil significantly decreased ALP activity, glycogen content, and renal urea and creatinine levels. Garlic oil also caused significant increase in lipid peroxidation, decrease in glutathione content and catalase activity in the liver and the kidney. However, uses of garlic oil showed a remarkable reduction in these abnormalities.

**Keywords:** *Allium sativum*, Herbal medicine, Garlic oil; Alanine & Aspartate aminotransferase; Alkaline phosphatase

### **Introduction**

Herbal medicine has been used for centuries, but only now has it really become so popular and such a big hype. Herbal medicine is the use of herbs for their therapeutic or medicinal values. Herbal medicines can be used for a variety of health problems, but today is most commonly used for the treatment of cardiovascular diseases, pain, asthma, allergy and other related problems. Although herbal medicine is natural and usually very safe, it is important to know that it should not be mixed with any type of prescription medication, because the result could be incredibly dangerous, even potentially life threatening. There are certain herbs which are very commonly used in herb medicines and garlic is one. Over the centuries, garlic has been used to area off vampires, devils, witches, and evil beings and was thought to have magical properties (Tyler et al., 1993; Borek. 2001; Rottblatt et al., 2002; Amagase et al., 2001; Blumenthal et al., 1998). Medicinal uses date back to 1550 BCE, when it was used as a remedy for heart disease, head-aches, tumors and also been used as an aphrodisiac to improve sexual act and desire, and as a cure for hemorrhoids to snake bites. In 1997, garlic was widely used as natural supplement in US house-holds and used more than twice as much as any other natural supplement (Brown. 1996; Akhondzadeh. 2007). Garlic has been promoted to lower cholesterol and blood pressure, delay the development of atherosclerosis, improve circulation, prevent heart diseases, prevent cancer, and used in tinea infections (Mennella & Beauchamp.1991; Stevinson et al., 2000; Superko & Krauss. 2000). The garlic contained mainly sulfur compound allicin and other sulfur compounds ajoene, allyl sulfides, and vinylthiols. Aged garlic products lack allicin, but may have activity due to the presence of S-allylcysteine.

Sodium nitrite (NaNO<sub>2</sub>) is present in vegetables and is used as a color fixative and preservative for meats and fish (Kilgore & Li. 1980). The hazardous effect of NaNO<sub>2</sub> obtained by the reaction of nitrites with amines to formed nitrosamines, and with amides to formed nitrosamides. The toxic effects of nitrates and nitrites are well recognized in mammals, including impairment of reproductive functions (Sleight et al., 1972), hepatotoxicity and methaemoglobinemia (Swann. 1975), deregulation of inflammatory responses and tissue injury (Blanquat et al., 1983), growth retardation (Prasad.1983), and endocrine disturbance (Jahries et al., 1986). The wide use of nitrates as preservatives in food technology raises the importance.

Although NaNO<sub>2</sub> is generally a weak carcinogen (Maekawa et al., 1982), Wistar rats exposed to 0.3% NaNO<sub>2</sub> in their drinking water for at least one year to developed squamous papillomas of the forestomach (Mirvish et al., 1980) and in a multiorgan carcinogenesis model, 0.3% NaNO<sub>2</sub> given in the drinking water for 28 weeks increased the incidence of forestomach neoplasm in the post-initiation period in F344 rat (Hirose et al., 1993). Thus, it cannot be excluded that NaNO<sub>2</sub> has very weak carcinogen potential, particularly in the squamous epithelium of the forestomach. In combination with other chemicals, NaNO<sub>2</sub> was showed carcinogenic effect or to enhance carcinogenesis. The highly carcinogenic N-nitroso-compounds have been produced when nitrite reacts with secondary amines and N-alkyl amides under acidic conditions (Aoyagi et al., 1980; Hecht. 1997). Other studies showed that uses of NaNO<sub>2</sub> in combination with phenolic compounds (Kawabe et al., 1994) or ascorbic acid (Yoshida et al., 1994) strongly enhanced forestomach carcinogenesis in rats. In human diet which contains large number of natural compounds for protecting the body against the development of diseases. The

*Allium sativum* or garlic is a commonly worldwide used food, and its medical properties have been well recognized since the ancient times. The garlic is one of the well known plant with remarkable anti-carcinogenic properties (Agarwal et al., 2007), antibacterial (Johnson et al., 1969), anticarcinogenic (Hussain et al., 1990), hypolipidemic (Bordia et al., 1975), hypoglycemic (Jain & Vjas. 1975), antifungal (Amer et al., 1980), and anti-atherosclerotic, and antioxidant activity (Moriyama et al., 2006; Banerjee et al., 2003). Many people enjoy eating garlic. However, some people who are sensitive to it may experience heartburn and flatulence. Because of garlic's anti-clotting properties, people taking anticoagulant drugs should check with their doctor before taking garlic (Yeh & Liu. 2001; Steiner & Li. 2001) and those planned for surgery should inform their surgeon if they are taking garlic supplements. Garlic appears to be safe during pregnancy and breast-feeding (Bathaei & Akhondzadeh 2008).

The hepato and nephrotoxic effect of garlic oil estimated by a number of biochemical parameters like serum glucose level, liver glycogen, serum alanine aminotransferase (ALT), aspartate aminotransferase (AST), alkaline phosphatase (ALP), total protein, bilirubin, urea and creatinine, product of lipid peroxidation, thiobarbituric acid reactive substances (TBARS), glutathione (GSH) content level determinations and the activity of catalase in rats.

The garlic oil did not show any significant changes in the majority of the parameters, a significant increase in serum levels of glucose, bilirubin, urea and creatinine as well as the activity of the AST, ALT and ALP enzymes were observed in rats treated with NaNO<sub>2</sub> for a period of three months. The total protein content significantly decreased in serum. However, supplementation of NaNO<sub>2</sub>-intoxicated rats with garlic oil reduced nitrite adverse effects by a significant increase of serum total protein content, and a decrease of serum glucose, bilirubin, urea and creatinine levels, as well as the activity of AST, ALT and ALP enzymes. In the NaNO<sub>2</sub>-treated rats, a significant inhibition of hepatic glycogen and total protein contents, activity of the enzymes ALT and AST as well as levels of renal urea, creatinine and total protein content. The activity of hepatic ALP was significantly increased in the NaNO<sub>2</sub>-treated rats. However, administration of garlic oil to the NaNO<sub>2</sub>-intoxicated rats significantly restored these parameters in the liver and kidney. The oxidative stress parameters and antioxidant activity in the liver and the kidney indicated that TBARS concentration increased significantly, while GSH content, as well as catalase activity were decreased in both organs of NaNO<sub>2</sub>-intoxicated rats. However, combination of garlic oil with NaNO<sub>2</sub> reduced TBARS concentration and restored the levels of GSH as well as the activity of catalase (Hassan et al., 2009).

### Discussion

The NaNO<sub>2</sub> and other additives may react with amines of the foods in the stomach and produce nitrosamines and free radicals and may increased lipid peroxidation, which can be harmful to various body organs including liver and kidney (Choi et al., 2002). These free radicals cause oxidative stress, can be prevented or reduced by dietary antioxidants to scavenge these radicals (Aruoma. 1998). The garlic oil prevented and/or reduced NaNO<sub>2</sub>-induced oxidative stress by examining different biochemical parameters of oxidative damage in the serum, liver and kidney of male rats. The results clearly showed that there was

a significant increase in serum glucose concentration and a decrease in liver glycogen content of NaNO<sub>2</sub>-treated rats. The findings suggest nitrite stimulation of gluconeogenesis (Wiechetek et al., 1992), and glucose shift from tissue to blood or an impairment of glucose mobilization. Furthermore, nitroso-compounds can alter the antioxidant system and causing disturbance in the metabolic processes leading to hyperglycemia (Anil et al., 2005). However, serum glucose and liver glycogen levels were reduced by garlic oil supplementation. The hypoglycemic effect of garlic oil and its organo-sulfur compounds might be due to their ability to enhance insulin secretion (Liu et al., 2005; Eidi et al., 2006). It also indicated that an inhibitory effect NaNO<sub>2</sub> on the biosynthesis of protein, which was restored by garlic oil supplementation. The stimulation of the thyroid and the adrenal glands by NaNO<sub>2</sub> which can lead to a blockade in protein synthesis, fast breakdown, increased rate of free amino acids, and decreased protein turnover (Eremin & Yocharina. 1981). In addition, nitrite interactions results into nitric oxide release, which can inhibit total protein synthesis (Kolpakov et al., 1995). However, the increase in bilirubin concentration as well as the activity of AST, ALT and ALP enzymes in the serum of NaNO<sub>2</sub>-treated rats could be attributed to the toxic effect of nitroso-compounds, formed in the acidic environment of the stomach, in causing severe hepatic necrosis (Kalantari & Salehi. 2001). These abnormalities were prevented by supplementation of garlic oil, perhaps due to its role in stabilizing the cell membrane and protect the liver from free radical-mediated liver cell toxicity (Hikino et al., 1986). In response to NaNO<sub>2</sub> treatment, urea and creatinine were increased in the serum but decreased in the kidney, suggesting an impairment of kidney functions. These effects could also be attributed to the changes in the threshold of tubular re-absorption, renal blood flow and glomerular filtration rate (GFR) (Zurovsky & Haber. 1995). Garlic oil showed a clear improvement in kidney functions, perhaps due to the antioxidant properties of garlic in scavenging free radicals leading to reduced levels of nitric oxide and lipid peroxidation. Moreover, NaNO<sub>2</sub>-inhibited glutathione content and catalase enzyme activity in the liver and the kidney may be recognized to the observed induction of lipid peroxidation (Shahjahan et al., 2005). However, garlic improved the antioxidant mechanism due to the ability of Diallyldisulfide and Diallyl trisulfide present in garlic oil in modulating the oxidative stress and detoxifying enzyme system (Saravanan & Prakash. 2004).

### Conclusion

It can be concluded that the administration of garlic has an extremely beneficial role in reducing the adverse effects of chronic ingestion of sodium nitrite, which is probably through its excellent antioxidant properties and highly nutritional values.

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