ANTHELMINTIC ACTIVITY OF *ALLIUM SATIVUM*


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ABSTRACT

Allium sativum L. (Garlic) belonging to family “Liliaceae” is a well known medicinal plant. The present study was undertaken to evaluate anthelmintic activity of aqueous extract of Allium sativum, against Indian earthworm. The result revealed all tested extract of Allium sativum show anthelmintic activity in a dose dependent manner. The potency of test sample was found to be inversely proportional to time taken for paralysis & death of worms. The activity was assessed by the determination of time of paralysis & death of worms. Piperazine citrate (10 mg/ml) was included as standard. All the concentration of extract exhibited good anthelmintic activity. The present study therefore justifies it’s use in folklore remedies as anthelmintic drug of natural origin.

KEYWORDS: anthelmintic, earthworm, Allium sativum.

INTRODUCTION

Helmintiasis or worm infection is one of the most prevalent disease. Many worms are parasitic in humans and causes serious complication. It is estimated that one fourth of the world population may be infected by worms.

In Helmintiasis this organism multiply outside of the definitive host & have the unique ability to evade host immune defence, for reason that are not fully understood. Helminthic tends to be chronic, possibly lasting an entire lifetime of the host.

Synthetic drugs used in helmintiasis:-

- Benzimidazole –
  E.g.-mebendazole, thiabendazole, albendazole, oxybendazole, parabendazole.
- Diethyl carbamazine.
- Iverctin.
- Praziquantel.
Disease caused by helminth parasites in continuous to be a major productivity constraint, especially in small ruminants in the subtropics. In the developing world, the parasitic disease is indirect & potential productivity losses. Infection by gastrointestinal helminth parasite of livestock are among the most common & economical important disease of grazing livestock. The frequency of life threatening infection caused by pathogenic micro-organism have increased worldwide & becoming an important cause of morbidity &mortality in immune compromised patients in developing countries infectious micro-organism are resistant to synthetic drugs; hence an alternative therapy is much needed. Most of the drugs used in primitive medicines were obtain from plants & are earliest & principle nature source of medicines.

Garlic, Allium sativum L. is a member of the Liliaceae family, has been widely recognized as a valuable spice and a popular remedy for various ailments and physiological disorders. The name garlic may have originated from the Celtic word 'all' meaning pungent. Cultivated practically throughout the world, garlic appears to have originated in central Asia and then spread to China, the Near East, and the Mediterranean region before moving west to Central and Southern Europe, Northern Africa (Egypt) and Mexico (1). Garlic has been used for thousands of years for medicinal purposes. Sanskrit records show its medicinal use about 5,000 years ago, and it has been used for at least 3,000 years in Chinese medicine. The Egyptians, Babylonians, Greeks, and Romans used garlic for healing purposes. In 1858, Pasteur noted garlic’s antibacterial activity, and it was used as an antiseptic to prevent gangrene during World War I and World War II. Garlic’s current principal medicinal uses are to prevent and treat cardiovascular disease by lowering blood pressure and cholesterol, as an antimicrobial, and as a preventive agent for cancer. The active constituents are several complex sulfur-containing compounds that are rapidly absorbed, transformed and metabolized. Pooled data from numerous randomized trials suggest that garlic lowers total cholesterol concentrations by approximately 10% and favourably alters HDL/LDL ratios. Randomized trials also support garlic’s effectiveness as a mild antihypertensive which lowers blood pressure by 5-7%. Garlic also inhibits platelet aggregation and enhances fibrinolytic activity, reducing clots on damaged endothelium. In vitro data suggest antibacterial effects, but these have not been evaluated in controlled trials in humans.
Allium sativum (garlic)

Synonyms:- Garlic, Allium, Lasun
This consist of bulbs of the plant Allium sativum Linn.
Belonging to family – Liliaceae.
Bulbs are white to pink in colour. Its has characteristic, aromatic & pungent odour and taste.
Bulbs are 1.5 to 2.5cm in length.
Flowers are whitish-pink in colour.
Leaves are green & looks like stricks same as that of leaves of onion.

CHEMISTRY OF GARLIC
Garlic contains at least 33 sulfur compounds, several enzymes, 17 amino acids, and minerals such as selenium. It contains a higher concentration of sulfur compounds than any other Allium species. The sulfur compounds are responsible both for garlic’s pungent odor and many of its medicinal effects. Dried, powdered garlic contains approximately 1% allii (S-allyl cysteine sulfoxide). One of the most biologically active compounds, allicin (diallylthiosulfinate or diallyldisulfide) does not exist in garlic until it is crushed or cut; injury to the garlic bulb activates the enzyme allinase, which metabolizes allii to allicin. Allicin is further metabolized to vinyldithiines. This breakdown occurs within hours at room temperature and within minutes during cooking. Allicin, which was first chemically isolated in the 1940’s, has antimicrobial effects against many viruses, bacteria, fungi and parasites. Garlic oil, aged garlic and steam-distilled garlic do not contain significant amounts of aliin or allicin, but instead contain various products of allicin transformation; none appears to have as much physiologic activity as fresh garlic or garilces.

Role of garlic in various diseases:-
- Antihypertensive
- Anticancer
- Anticoagulant & fibrinolytic
ROLE OF GARLIC IN VARIOUS DISEASES

Antihypertensive Potential

Hypertension (systolic blood pressure (SBP) ≥ 140 mm Hg; diastolic blood pressure (DBP) ≥ 90 mm Hg) is a known risk factor for cardiovascular morbidity and mortality, affecting an estimated 1 billion individuals worldwide. Garlic (Allium sativum) has played an important dietary as well as medicinal role in human history. Blood pressure reducing properties of garlic have been linked to its hydrogen sulphide production and allicin content – liberated from alliin and the enzyme allinase which has angiotensin II inhibiting and vasodilating effects, as shown in animal and human cell studies. Studies concerning the effect of garlic consumption on blood pressure are not as numerous as the effect of garlic on serum lipids. Again, inconsistent results of the effect of garlic on blood pressure are abounding. For example, intake of about 900 mg, day–1 garlic powder in hypercholesterolemic, mild hypertension patients, and normotensive subjects resulted in lower diastolic blood pressures as compared to the non-garlic consuming groups. In another study, there was a 5.5% decrease in systolic blood pressure and a modest reduction of diastolic blood pressure in response to 900 mg, day–1 aged garlic consumption. In contrast to the above mentioned studies, consumption of 900 mg, day–1 garlic powder in 42 healthy adults was of no effect on blood pressure. Studies on animal models to determine the effects of garlic on blood pressure are few but all of these reports indicate a blood pressure lowering ability of garlic. For example, consumption of 2% wild garlic leaves powder for 8 weeks was effective in lowering the blood pressure in normotensive rats’. The antihypertensive effects of garlic extract in the rat, two-kidney one-clip Goldblatt model has been reported by the researcher. Garlic gavage (100 mg, kg–1 body wt) in rats has also been shown to block hypoxic pulmonary hypertension. Allicin is known to be a systemic vasodilator; moreover it acts as a pulmonary...
vasodilator in anesthetized intact-chest cat and isolated lung of the rat under constant flow conditions (4-11).

**Wound Healing Potential**

Successful wound healing depends upon angiogenesis, and impaired angiogenesis is a hallmark of the chronic wounds encountered with diabetes and venous or arterial insufficiency. To intervene and improve wound closure, it is essential to investigate the effects of different natural remedies in wound healing. Study was done on the chicken dorsum skin excision wound assay to investigate the influence of different concentrations of aged garlic solution (AGS) on wound healing. Gross, histopathology, scanning electron microscopy (SEM) and computer-based three-dimensional (3D) image-probing techniques were utilized to determine the effects of AGS on wound closure, re-epithelialization, dermal matrix regeneration, and angiogenesis (12,13).

**Antidiabetic Potential**

Diabetes is a metabolic disturbance that gradually affects the function of various systems in the body. Poorly controlled blood glucose is believed to be the most important factor in the development of diabetic complications in both type 1 and type 2 diabetes. Based on report of WHO, garlic can be used for helping treatment of hyperglycemia. According to a report by Ryan et al. (2001), one-third of diabetic patients take alternative medications that they consider efficacious, of which garlic is the most commonly used. Garlic and garlic constituents prepared by various means have been shown to have antidiabetic actions.

In diabetic patients, it was reported that garlic oil can correct hyperglycemia. In addition, a precursor of various allyl sulfide constituents of garlic oil, S-allyl-cysteine sulfoxide (allin), was shown to have a hypoglycemic effect similar to that of glibenclamide. Garlic has been found to be effective in lowering serum glucose levels in STZ-induced as well as alloxan-induced diabetic rats and mice. Most of the studies showed that garlic can reduce blood glucose levels in diabetic mice, rats and rabbits. It is not clear how garlic actually works in alleviating hyperglycaemia. The hypoglycaemic action of garlic could possibly be due to an increase in pancreatic secretion of insulin from β-cells, release of bound insulin or enhancement of insulin sensitivity. It has been previously suggested that garlic (allicin) can enhance serum insulin by effectively combining with compounds like cysteine, which would spare insulin from SH group reactions which are a common cause of insulin inactivation. Another mechanism proposed by researcher states that the antioxidant effect of S-allyl cysteine sulfoxide, an isolated product from garlic, may contribute to its beneficial effect in diabetes. Research postulate garlic may act as an antidiabetic agent by
increasing either the pancreatic secretion of insulin from the β-cells or release of bound insulin (14-18).

**Anticancer Potential**

A number of studies have demonstrated the chemopreventive activity of garlic by using different garlic preparations including fresh garlic extract, aged garlic, garlic oil and a number of organosulfur compounds derived from garlic. The chemopreventive activity has been attributed to the presence of organosulfur compounds in garlic. The exact mode of action was not fully understood, but several modes of action have been proposed. These include its effect on drug metabolizing enzymes, antioxidant properties and tumor growth inhibition. Most of these studies were carried out in the animal models. Also, recent research has focused on the antimutagenic activity of garlic. Recently, it has been observed that aged garlic extract, but not the fresh garlic extract, exhibited radical scavenging activity. The two major compounds in aged garlic, S-allyleysteine and S-allylmercapto-L-cysteine, had the highest radical scavenging activity. In addition, some organosulfur compounds derived from garlic, including S-allyleysteine, have been found to retard the growth of chemically induced and transplantable tumors in several animal models. Therefore, the consumption of garlic may provide some kind of protection from cancer development (19-21).

**Antiatherosclerosis and Hypolipidemic Potential**

Atherosclerosis, the complex interaction of serum cholesterol with the cellular components of the arterial wall, the pathogenic substratum of many cardiovascular diseases, continues to be the leading cause of death in developed countries. However, the mechanism of the onset and development of atherosclerotic lesions is not completely understood. Nevertheless, in recent years, remarkable progress has been made in the prevention and treatment of atherosclerosis. Atherosclerotic diseases such as ischaemic heart disease, stroke, and peripheral arterial disease are associated with high serum cholesterol, male gender, age, hypertension, cigarette smoking, diabetes. The direct influence of garlic in preventing onset and development of atherosclerotic lesions and inducing regression of the lesions on the artery wall can be divided into antiatherogenic or preventive and antiatherosclerotic or therapeutic, respectively. Thus, garlic produces both antiatherosclerotic (therapeutic) and antiatherogenic (preventive) effects on experimental atherosclerosis. Garlic’s antiatherosclerotic activity is probably due to its direct effect on the processes occurring in the vascular wall as it does not depend on blood cholesterol lowering. The direct antiatherosclerotic effect of garlic can be explained by its action at the level of arterial cells. The earliest manifestation of atherosclerosis is an accumulation of intra and
extracellular lipids. Accumulation of intracellular lipids, primarily cholesterol, in the subendothelial intimal cells is accompanied by stimulation of cell proliferation and the extracellular matrix productions. Lipid accumulation (lipidosis), enhanced proliferation and accumulation of extracellular connective tissue matrix (fibrosis) are the major manifestations of atherosclerosis at different stages of plaque formation. It has been recently demonstrated that garlic lowers the contents of free cholesterol and cholesteryl esters in lipid-overloaded arterial cells. After 24 h of incubation in a primary culture of smooth muscle cells derived from atherosclerotic plaque of human aorta, aqueous extract from garlic powder decreased free cholesterol by 30%, cholesteryl esters by 30-40%, and triglycerides by 20%. The mechanisms of garlic’s direct effect on intracellular lipids can be explained by its ability to suppress lipid synthesis as garlic powder extract inhibits biosynthesis of cholesteryl esters and triglycerides in atherosclerotic cells. In addition, garlic extract inhibits the activity of acyl-CoA:cholesterol acyltransferase (ACAT), the enzyme involved in the formation of cholesteryl esters, the main component of the excessive fat accumulated by cells. In atherosclerotic cells overloaded with cholesteryl esters, ACAT activity is 3-fold higher than in normal cells; aqueous extract of garlic powder decreases this enzyme activity to normal levels. On the other hand, garlic extract stimulates cholesteryl ester hydrolase that degrades cholesteryl esters in atherosclerotic cells. The influence of garlic on both enzyme activities may explain cholesteryl ester reduction. Garlic inhibits proliferation of atherosclerotic cells and other cell types, as well as collagen synthesis and accumulation in the aorta; thus, all the major manifestations of atherosclerosis (lipidosis, proliferation, and fibrosis) show a tendency toward a decrease and normalization under the action of garlic, which may account for the direct antiatherosclerotic effect.

**Antimicrobial Potential**

The antibacterial properties of crushed garlic have been known for a long time. Various garlic preparations have been shown to exhibit a wide spectrum of antibacterial activity against Gram-negative and Gram-positive bacteria including species of *Escherichia*, *Salmonella*, *Staphylococcus*, *Streptococcus*, *Klebsiella*, *Proteus*, *Bacillus*, and *Clostridium*. Even acid-fast bacteria such as *Mycobacterium tuberculosis* are sensitive to garlic. Analysis of steam distillations of crushed garlic cloves performed over a century ago showed a variety of allyl sulfides isolated and identified the component responsible for the remarkable antibacterial activity of crushed garlic cloves. The compound turned out to be an oxygenated sulfur compound which they termed allicin from the Latin name of the garlic plant, *Allium sativum*. 

Prajakta et al. / Pharma Science Monitor 6(2), Apr-Jun 2015, 25-37
Traditional Use
Garlic has been used in western herbal medicine as a diaphoretic, expectorant, antiseptic (particularly for the respiratory system), anthelmintic and diuretic. Its major indications include chronic bronchitis, respiratory catarrh, recurrent colds, influenza, whooping cough and asthma. It is also described as a ‘stimulant’, probably meaning circulatory stimulant, as according to traditional European naturopathy, Garlic is an agent that increases perfusion, and Garlic is used traditionally in France in the treatment of circulatory disorders. Writing in the 1st century AD, Dioscorides noted that Garlic “clears the arteries and open the mouths of the veins”.

The anti-infective property of Garlic was well known throughout history. Paracelsus (1493-1541) prescribed it as an antidote for plague. It is said to have protected people from the infection during the Great Plague of London in 1665, the 1721 epidemic in Marseilles and the outbreak in 18th century London. Garlic was used as a remedy in 1848 when a cholera epidemic broke out in Bulgaria. Soldiers whose diet included Garlic suffered less frequently from dysentery than their World War I comrades who did not eat Garlic. Garlic was also used for this purpose during World War II by the countries of Eastern Europe.

Constituents & Products

The main compounds in Garlic cloves are the organic sulfur compounds. Of these, the most important is alliin. When Garlic clove is crushed, or when dried Garlic powder gets wet, the odourless alliin is broken down by the enzyme alliinase. Alliin is converted to allicin (an odorous compound). Allicin is relatively unstable and other constituents are produced, such as ajoenes, vinylthiins and polysulfides. The sulfur-containing constituents are responsible for the characteristic smell of Garlic.

A number of Garlic products are available commercially: dried Garlic powder, aged Garlic extract, steam-distilled Garlic oil, other solvent-extracted Garlic oils, Garlic oil macerate. The
composition of these products, and therefore their therapeutic activity, varies. Aged Garlic extracts do not contain allicin.

The issue of manufacture is important when considering dried Garlic powder products.

- Garlic needs to be dried carefully to preserve the alliin and allinase.
- Because stomach acid can degrade alliinase (thus reducing the production of allicin from alliin), Garlic powder products should be enterically coated. Enteric coating is acid resistant. When enterically coated, the tablet survives intact and enters the intestine.
- If the tablet is correctly coated and able to break down in the non-acidic environment of the small intestine within a specified time limit, the enzymatic reaction can occur: allicin is produced and can be absorbed in the large intestine.
- The tablet, if incorrectly coated and/or affected by other factors leading to slow disintegration, may not produce allicin.
- Other factors may affect the amount of allicin released e.g. whether tablets are consumed with or without food, the protein content of the meal.

Clinical Studies

The clinical research findings are restricted to that of fresh Garlic and Garlic powder. Many of the trials used products standardised for allicin content although the allicin release was not measured or is unknown.

In 2001 allicin release of the most frequently trialled brand of standardised Garlic tablet was tested for batches dating from 1989 to 1997. Older batches (before 1993) released significantly more allicin than product made later (after 1993). The negative results found in later trials may have been influenced by the inadequate release of allicin.

Indications

- Treatment and prevention of age-related vascular changes, coronary artery disease, atherosclerosis.
- Adjunctive treatment for hyperlipidaemia and mild hypertension.
- Treatment and prevention of infections (particularly gastrointestinal and bronchial infections) and intestinal infestation.
- Support detoxification, particularly by enhancing phase II enzymes.
- May support circulation and tissue perfusion, and conditions of reduced arterial oxygenation, such as hepatopulmonary syndrome.
- Part of a protocol to improve bowel flora.
• May provide chemopreventive activity and promote the excretion of heavy metals from the body.

**Cautions and Contraindications**

Intake of Garlic should be discontinued 10 days prior to surgery. Garlic at doses of more than 3 g/day (fresh weight) may interact with antiplatelet medication. These cautions apply to dietary, as well as supplemental Garlic. Allergy to Garlic has been reported.

**Applications**

• Circulatory stimulant and antiseptic; historically documented use for plague, cholera, dysentery.

• Clinically demonstrated to:
  - modestly reduce total cholesterol, mainly by reducing triglycerides
  - reduce blood pressure
  - decrease aortic stiffness in those over 50 years
  - reduce plaque, intima-media thickness and the atherogenicity of serum in patients with atherosclerosis
  - increase peripheral blood flow
  - inhibit platelet aggregation and blood fibrinogen – increase activity of antioxidant enzymes
  - protect against genetic damage, reduce formation of N-nitroso compounds
  - reduce the incidence of acute viral respiratory infections – reduce incidence of infection in burn wounds
  - possibly improve bowel flora (conflicting results)
  - show some antifungal activity
  - provide benefit in giardiasis and worm infestation (small studies)
  - improve immune function in healthy volunteers
  - reduce the severity of hepatopulmonary syndrome
  - reduce lead toxicity
  - provide benefit in osteoarthritis (preliminary, adjunctive treatment) and rheumatoid arthritis
Anthelmintic activity of *allium sativum* (blub extract)

The method describe in Ayurveda was employed for evaluating anthelmintic activity of Indian earthworm of approximately equal size (15-18cm) was divided into five groups. Each group consist of one earthworm of same size. The use of Indian earthworm is due to its anatomical & physiological resemblance with the intestinal round worm parasite of human being. Because of easy availability, earthworms have been used widely for initial evaluation of anthelmintic compound in vitro. Five earthworm of Indian species of nearly equal size were placed in each Petridish containing 10ml distilled water & freshly prepared bulb juice. The standard piperazine citrate (10mg/ml) with distilled water. Time for paralysis was noted when no movement of any sort could be observed except when the worms were shaken vigorously in minute. Time for death of worms were recorded after ascertaining that worms were neither moved when shaken vigorously nor when become hard or to be broken.
RESULT & DISCUSSION

Table 1: Anthelmintic activity of Allium sativum (bulbs extract)

<table>
<thead>
<tr>
<th>Sr. no.</th>
<th>Test sample</th>
<th>Concentration (%)</th>
<th>Time taken for paralysis &amp; death of worms in minutes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Paralysis time (min)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>Aqueous</td>
<td>200</td>
<td>01:43</td>
</tr>
<tr>
<td>2.</td>
<td>Aqueous</td>
<td>150</td>
<td>01:50</td>
</tr>
<tr>
<td>3.</td>
<td>Aqueous</td>
<td>100</td>
<td>02:30</td>
</tr>
<tr>
<td>4.</td>
<td>Aqueous</td>
<td>50</td>
<td>03:10</td>
</tr>
<tr>
<td>5.</td>
<td>Aqueous</td>
<td>20</td>
<td>04:5</td>
</tr>
<tr>
<td>6.</td>
<td>Piperazine citrate</td>
<td>10</td>
<td>01:6</td>
</tr>
</tbody>
</table>

By above observation at highest concentration 200% the time of paralysis of earthworm is 01:43 min & death time is 04:38 min & at lowest concentration 20% the time of paralysis is 04:50 min & death time is 06:00 min. Hence time of paralysis & death is inversely proportional to the concentration of the drug extract which crosses the limit of standard drug.

CONCLUSION

A single clove of garlic has the potential of curing a man from a large number of diseases by inhibiting the population of different strains of bacteria and fungi. Garlic (Allium sativum) use in cardiovascular therapeutics has an even longer history back over 3000 years to ancient time. Numerous animal studies have shown garlic to have a cholesterol lowering effect. The active chemical in garlic is allicin, which is produced when raw garlic is crushed, allowing the enzyme allinase to act on the stable precursor allin. Hence its shows the antihelmintic activity which is compare to standard drug piperazinecitrate.

REFERENCES

9. Rahman K et al. Historical Perspective on Garlic and Cardiovascular Disease. The journal of nutrition 2001; 131: 977S-979S.

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