Garlic – its unexploited antimicrobial potential

**Introduction**

The antimicrobial properties of garlic (Allium sativum) are well known. However, until relatively recently, there have been few rigorous scientific studies of these properties.

The healing attributes of garlic extracts have been part of folklore, and they range from the anti-plague properties of vinaigre des quatre voleurs, an alcoholic garlic extract used in France in the 18th century, to an anti-amoebic concoction used by Albert Schweitzer to treat dysentery in Africa. Allicin, the chemical in garlic originally thought to be antimicrobial, was patented as an antifungal in the USA in the 1940s. Clinical use of this substance was discontinued because of its odour.

There has been an upsurge in studies of the medical properties of garlic and its extracts in recent years, and there are several reasons for this interest. First, garlic is cheap and suitable for countries that cannot afford expensive Western drugs and, second, it works. For example, a broad-scale trial compared the efficacy of ajoene, a condensate product derived from garlic, to Western proprietary tinea treatments. The success rate for ajoene was equivalent to that obtained by using terbinafine cream. In China, a proprietary garlic extract called allitridium has been successfully used as an intravenous treatment for cryptococcosis.

**Problems with current therapies**

In today’s world there are increasing numbers of people who are immunocompromised, either due to immunosuppressive therapy or disease such as AIDS, with a concomitant increase in the incidence of opportunistic fungal infections. Both fungal cells and human cells are eukaryotic, so the target opportunities for suitable antifungal antibiotics is limited compared with those available for prokaryotic bacterial cells. There is a greater likelihood of side effects using chemicals against cells that are similar to human cells and, indeed, nephrotoxicity and other side effects have limited the usefulness of amphotericin B, the drug that has been the standard treatment for systemic fungal infections. The toxicity of this drug limits the amount of drug that can be given, as well as the duration of therapy.

In addition, because of the possibility of irreversible side effects, the decision to treat a suspected fungal infection is not one to be taken lightly, and thus the option for prompt treatment may not be taken up.

**Is there a role for garlic-derived compounds in systemic fungal infections in Western medicine?**

It has been reported that intravenous treatment using A. sativum (garlic) extracts exhibited no serious adverse side-effects, even when treatment was continuous for a month. Of course, the possibility of prophylactic treatment of patients at high risk of systemic fungal infection is an appealing one to caregivers. At the very least, the possibility of having an antifungal where serious toxicity is not an issue may allow treatment to commence earlier for suspected, non-proven fungal infections.
Increasing the survival rate of the recipients of the extract.

Allitridium shows synergy with amphotericin B in vitro and, should this translate to in vivo synergy, lower doses of amphotericin B could be employed in treatment, decreasing toxicity and allowing drug infusion over longer periods.

Current research and the hope for future treatment using garlic extracts

The breakdown products of allicin, the parent antifungal compound in garlic, demonstrate wide-spectrum in vitro antifungal activity against multi-drug resistant organisms such as Scedosporium prolificans, as well as many other fungi. In addition, garlic extracts have immune-enhancing properties as well as anti-cancer properties.

An exciting development at the Women's and Children's Hospital is that garlic extracts have been shown to be successful in destroying chemotherapy-resistant leukaemia cells in vitro. A grant has been awarded to Dr Gregg Hodge, a haematologist at this hospital, to study this effect. His unpublished data have demonstrated that it is the antifungal allicin breakdown products that also appear to be anti-cancerous, with allitridium, ajoene and raw garlic extract having similar anti-cancer properties. Of course, the scope for research is enormous, and to try to understand the mechanism of action whereby allicin breakdown products are efficacious against fungal cells as well as cancer cells, without harming healthy human cells, would be a fascinating project.

Discussion

Published reports have indicated that proprietary garlic extracts used intravenously in China are safe and efficacious against cryptococcal infections, and it is possible that such extracts could be used as broad-spectrum antifungal agents.

One of the impediments to the adoption of this treatment in Australia is a lack of funding for the research and clinical trials that are necessary before such forms of treatment are acceptable to the regulatory authorities. This may be because it is perceived that there is not much money to be made from natural products.

However, the results showing anti-cancer activity of garlic extracts are promising. Time will tell whether the safety and efficacy of garlic extracts will be demonstrated in clinical trials, thus paving the way for the antimicrobial properties of these extracts to be exploited to a greater extent than they are at present.

References


NCCLS broth microdilution method of evaluating the activity of garlic against S. prolificans.