Antiviral Properties of Garlic: In vitro Effects on Influenza B, Herpes Simplex and Coxsackie Viruses

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The spice, garlic or Allium sativum, has been employed for centuries as an herbal or traditional medicine to treat infectious diseases (1,2). In the Peoples Republic of China, cloves of garlic are eaten and concentrated extracts of garlic are given intravenously to treat cryptococcal meningitis (3) and a variety of viral infections. Although the anecdotal evidence suggests that garlic extract has antiviral properties, little scientific data is available to support these clinical impressions. We found that garlic extract produced by the Shanghai Tenth Pharmaceutical Factory possessed in vitro antiviral activity against influenza B and herpes simplex viruses but not against coxsackie B1 virus.

Methods

Influenza B/Lee/40 virus was grown in the allantoic cavity of embryonated chicken eggs and plaque counts were determined using a modification of the method of Tobita (4,5). Herpes simplex virus (HSV) type 1 was grown in rabbit skin cells and plaque counts were determined using the method of Lancz (6). Stocks of coxsackie B1 virus were grown in HeLa cells and plaque counts were determined using the method of Holland and McLaren (7).

Garlic extract (30 mg in 2 ml sterile ampules) was obtained from the Shanghai Tenth Pharmaceutical Factory, Shanghai, Peoples Republic of China (Allitridium, Lot #781227 and 791219). Although the extraction procedure is a commercial secret, factory scientists determined using the method of Tobita (4,5). Herpes simplex virus (HSV) type 1 was grown in rabbit skin cells and plaque counts were determined using the method of Lancz (6). Stocks of coxsackie B1 virus were grown in HeLa cells and plaque counts were determined using the method of Holland and McLaren (7).

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In vitro experiments were performed to determine the antiviral activity of the garlic extract against all three viruses. Experiments were done in duplicate unless noted, and each virus was studied on two to three separate occasions using different ampules of garlic extract. The garlic extract was diluted serially in phosphate buffered saline (PBS), pH 7.5. As a control, PBS was mixed with virus stock. All tubes were incubated at 37 C for 6 or 24 hours. After incubation, tenfold dilutions of each test mixture were made in PBS containing 0.25% bovine serum albumin. For each dilution of virus-garlic mixture or virus-PBS control mixture, 0.1 ml was inoculated onto appropriate cell monolayers for plaque assay.

To determine the toxicity of the garlic extract on the different tissue culture cell lines, serial dilutions of the garlic extract were made in PBS and 0.1 ml was inoculated onto the various cell monolayers. The cells were observed for signs of cytopathic effect.

Results

It was found that concentrations of garlic extract above 1.5 mg/ml produced microscopic cell toxicity with cells rounding, shrinking and dying. Therefore, concentrations at or below this value were always used in the antiviral studies. Incubation of garlic extract at concentrations of 0.15 mg/ml or greater with influenza B/Lee/40 significantly reduced the infectivity titer of the influenza B/Lee virus. (P < .0001, two way analysis of variance) (Figure 1). Garlic extract at concentrations of 0.015 mg/ml or higher significantly reduced the infectivity titer of the herpes simplex virus (P = <.001 one way analysis of variance) (Figure 1). Significant antiviral activity was found with either a 6 or 24 hour incubation. Garlic extract at concentrations as high as 1.5 mg/ml did not reduce the infectivity titers of coxsackie B1 virus. (Figure 1). In two separate experiments no concentration of garlic significantly reduced the infectivity titer of coxsackie B1 virus. There were no differences found between the two lots of garlic extract.

Literatur

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man or animals without significant host toxicity. Since our studies were done only *in vitro*, further studies are needed to determine whether garlic or garlic extracts possess significant antiviral activity in experimental animals or man. Nevertheless, these studies lend credence to the historical usefulness of garlic as an antiviral agent.

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**References**


**Discussion**

The garlic extract possessed *in vitro* antiviral activity against influenza B virus, *herpes simplex* virus type 1, but not against coxsackie B1 virus. The antiviral activity was found to occur at concentrations below those that caused toxicity to tissue culture cells. Hence, these antiviral concentrations might be achieved in