Anti-Viral

Chem Pharm Bull (Tokyo). 2001 Jan;49(1):108-10

Effects of structural modification of calcium spirulan, a sulfated polysaccharide from Spirulina platensis, on antiviral activity.

Lee JB, **Srisomporn P**, **Hayashi K**, **Tanaka T**, **Sankawa U**, **Hayashi T**.

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Calcium ion binding with the anionic part of a molecule was replaced with various metal cations and their inhibitory effects on the replication of herpes simplex virus type 1 were evaluated. Replacement of calcium ion with sodium and potassium ions maintained the antiviral activity while divalent and trivalent metal cations reduced the activity. Depolymerization of sodium spirulan with hydrogen peroxide decreased in antiviral activity as its molecular weight decreased.

PMID: 11201213 [PubMed - indexed for MEDLINE]

J Acquir Immune Defic Syndr Hum Retrovirol. 1998 May 1;18(1):7-12.

Inhibition of HIV-1 replication by an aqueous extract of Spirulina platensis (Arthrospira platensis).

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An aqueous extract of the blue-green filamentous algae Arthrospira platensis (previously called Spirulina platensis) inhibited HIV-1 replication in human T-cell lines, peripheral blood mononuclear cells (PBMC), and Langerhans cells (LC). Extract concentrations ranging between 0.3 and 1.2 microg/ml reduced viral production by approximately 50% (50% effective concentration [EC50]) in PBMCs. The 50% inhibitory concentration (IC50) of extract for PBMC growth ranged between 0.8 and 3.1 mg/ml. Depending on the cell type used, therapeutic indices ranged between 200 and 6000. The extract inactivated HIV-1 infectivity directly when preincubated with virus before addition to human T-cell lines. Fractionation of the extract revealed antiviral activity in the polysaccharide fraction and also in a fraction depleted of polysaccharides and tannins. We conclude that aqueous A platensis extracts contain antiretroviral activity that may be of potential clinical interest.

Publication Types:

- Research Support, Non-U.S. Gov't

PMID: 9593452 [PubMed - indexed for MEDLINE]

AIDS Res Hum Retroviruses. 1996 Oct 10;12(15):1463-71.

A natural sulfated polysaccharide, calcium spirulan, isolated from Spirulina platensis: in vitro and ex vivo evaluation of anti-herpes simplex virus and anti-human immunodeficiency virus activities.

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A sulfated polysaccharide named calcium spirulan (Ca-SP) has been isolated from a sea alga, Spirulina platensis, as an antiviral component. The anti-human immunodeficiency virus type 1 (HIV-1) and anti-herpes simplex virus type 1 (HSV-1) activities of Ca-SP were compared with those of dextran sulfate (DS) as a representative sulfated polysaccharide. Anti-HIV-1 activities of these agents were measured by three different assays: viability of acutely infected CD4-positive cells, or a cytopathology assay; determination of HIV-1 p24 antigen released into culture supernatants; and inhibition of HIV-induced syncytium formation. Anti-HSV-1 activity was assessed by plaque yield reduction. In addition, their effects on the blood coagulation processes and stability in the blood were evaluated. These data indicate that Ca-SP is a potent antiviral agent against both HIV-1 and HSV-1. Furthermore, Ca-SP is quite promising as an anti-HIV agent because even at low concentrations of Ca-SP an enhancement of virus-induced syncytium formation was not observed, as was observed in DS-treated cultures, Ca-SP had very low anticoagulant activity, and showed a much longer half-life in the blood of mice when compared with that of DS. Thus, Ca-SP can be a candidate agent for an anti-HIV therapeutic drug that might overcome the disadvantages observed in many sulfated polysaccharides. When the role of chelation of calcium ion with sulfate groups was examined by removing calcium or its replacement by sodium, the presence of calcium ion in the molecule was shown to be essential for the dose-dependent inhibition of cytopathic effect and syncytium formation induced by HIV-1.

PMID: 8893054 [PubMed - indexed for MEDLINE]

Anti-Viral

J Nat Prod. 1996 Jan;59(1):83-7.

Calcium spirulan, an inhibitor of enveloped virus replication, from a blue-green alga Spirulina platensis.

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Bioactivity-directed fractionation of a hot H2O extract from a blue-green alga Spirulina platensis led to the isolation of a novel sulfated polysaccharide named calcium spirulan (Ca-SP) as an antiviral principle. This polysaccharide was composed of rhamnose, ribose, mannose, fructose, galactose, xylose, glucose, glucuronic acid, galacturonic acid, sulfate, and calcium. Ca-SP was found to inhibit the replication of several enveloped viruses, including Herpes simplex virus type 1, human cytomegalovirus, measles virus, mumps virus, influenza A virus, and HIV-1. It was revealed that Ca-SP selectively inhibited the penetration of virus into host cells. Retention of molecular conformation by chelation of calcium ion with sulfate groups was suggested to be indispensable to its antiviral effect.

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Med Hypotheses. 2004;62(4):507-10.

Algae -- a poor man's HAART?

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Drawing inferences from epidemiologic studies of HIV/AIDS and in vivo and in vitro HIV inhibition by algae, we propose algal consumption as one unifying characteristic of countries with anomalously low rates. HIV/AIDS incidence and prevalence in Eastern Asia (approximately 1/10000 adults in Japan and Korea), compared to Africa (approximately 1/10 adults), strongly suggest that differences in IV drug use and sexual behavior are insufficient to explain the 1000-fold variation. Even in Africa, AIDS/HIV rates vary. Chad has consistently reported low rates of HIV/AIDS (2-4/100). Possibly not coincidentally, most people in Japan and Korea eat seaweed daily and the Kanemba, one of the major tribal groups in Chad, eat a blue green alga (Spirulina) daily. Average daily algae consumption in Asia and Africa ranges between 1 and 2 tablespoons (3-13 g). Regular consumption of dietary algae might help prevent HIV infection and suppress viral load among those infected.

Publication Types:

- Comparative Study

PMID: 15050097 [PubMed - indexed for MEDLINE]

Antiviral Res. 2002 Dec;56(3):279-85.

Antiviral activity of Spirulina maxima against herpes simplex virus type 2.

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Spirulina has been used in a variety of practical applications in biotechnology and medical sciences. This paper presents the antiviral activity found in a hot water extract (HWE) of a commercial preparation of Spirulina maxima, studied by a microplate inhibition assay, using several viruses. The HWE inhibited the infection for: herpes simplex virus type 2 (HSV-2), pseudorabies virus (PRV), human cytomegalovirus (HCMV), and HSV-1, and the 50% effective inhibition doses (ED(50)) were 0.069, 0.103, 0.142, and 0.333 mg/ml for each virus, respectively. For adenovirus the inhibition was less than 20%, and no inhibition was found for measles virus, subacute sclerosing panencephalitis virus (SSPE), vesicular stomatitis virus (VSV), poliovirus 1 and rotavirus SA-11, at concentrations of 2 mg/ml of the HWE. The highest antiviral activity was for HSV-2, with a selectivity index of 128. The antiviral activity was not due to a virucidal effect. Herpesvirus infection was inhibited at the initial events (adsorption and penetration) of the viral cycle. To initiate the isolation and identification of the compound that exhibits the antiviral activity of S. maxima, some extracts made by using several solvents with different polarity were evaluated by microplate inhibition assay using HSV-2. The highest antiviral activity was detected in the methanol-water 3:1, which suggests that the antiviral activity is probably due to highly polar compounds.

Publication Types:

- Research Support, Non-U.S. Gov't

PMID: 12406511 [PubMed - indexed for MEDLINE]

Anti-Viral

Zh Mikrobiol Epidemiol Immunobiol. 2002 Nov-Dec;(6):18-21.

[Action of Spirulina platensis on bacterial viruses]

[Article in Russian]

Gorobets OB, **Blinkova LP**, **Baturo AP**.

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The impact of the biomass of the blue-green microalga (cyanobacterium) S. platensis on bacteriophage T4 (bacterial virus) has been evaluated. The study revealed that the addition of S. platensis biomass into the agar nutrient medium, followed by sterilization with 2% chloroform and thermal treatment, produced an inhibiting or stimulating effect on the reproduction of the bacteriophage in Escherichia coli B cells, depending on the concentration of S. platensis and the multiplicity of phage infection, as well as on the fact whether the microalgae were added during the first cycle of the development of the virus. The reproduction of the bacteriophage in E. coli B was influenced by the method and duration of the sterilization of the nutrient medium with S. platensis.

Publication Types:

- Comparative Study
- English Abstract

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[Studies on evaluation of natural products for antiviral effects and their applications]

[Article in Japanese]

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In the search for novel antiviral molecules from natural products, we have discovered various antiviral molecules with characteristic mechanisms of action. Scopadulciol (SDC), isolated from the tropical medicinal plant Scoparia dulcis L., showed stimulatory effects on the antiviral potency of acyclovir (ACV) or ganciclovir (GCV). This effect of SDC was exerted via the activation of viral thymidine kinase (HSV-1 TK) and, as a result, an increase in the cellular concentration of the active form of ACV/GCV, i.e., the triphosphate of ACV or GCV. On the basis of these experimental results, cancer gene therapy using the HSV-1 tk gene and ACV/GCV together with SDC was found to be effective in suppressing the growth of cancer cells in animals. Acidic polysaccharides such as calcium spirulan (Ca-SP) from Spirulina platensis, nostoflan from Nostoc flagelliforme, and a fucoidan from the sporophyll of Undaria pinnatifida (mekabu fucoidan) were also found to be potent inhibitors against several enveloped viruses. Their antiviral potency was dependent on molecular weight and content of the sulfate or carboxyl group as well as counterion species chelating with sulfate groups, indicating the importance of the three-dimensional structure of the molecules. In addition, unlike dextran sulfate, Ca-SP was shown to target not only viral absorption/penetration stages but also some replication stages of progeny viruses after penetration into cells. When mekabu fucoidan or nostoflan was administered with oseltamivir phosphate, their synergistic antiviral effects on influenza A virus were confirmed in vitro as well as in vivo.

Publication Types:

- English Abstract
- Review

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