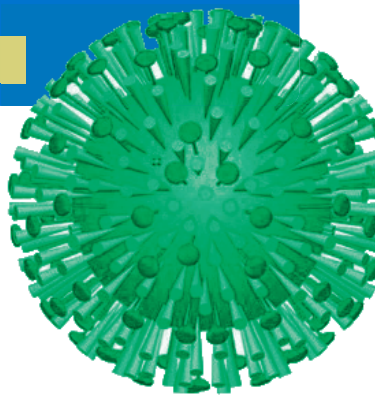
ANTIVIRAL RESEARCH

Study Summary August 2009



Echinacea has an antiviral effect and modulates the secretion of pro-inflammatory cytokines in the *in vitro* infection model[1]

Study objective

The typical symptoms of colds and flu-like infections are primarily caused by an increased secretion of signaling proteins which promote inflammation (pro-inflammatory cytokines). The prevailing opinion is that the symptoms and spread of infection can be controlled with drugs, if these are designed to have antiviral effects and are able to control the cytokine secretion (SL Johnston, 1997[2]). The objective of the present study is to clarify in an *in vitro* setting whether a standardised Echinacea extract has an antiviral effect on typical triggers of acute respiratory tract infection and also whether it is possible to regulate the infective secretion of pro-inflammatory signaling proteins.

Participating research facilities

Prof. James B. Hudson and Dr. Manju Sharma, Department of Pathology and Laboratory Medicine, University of British Columbia, Vancouver, Canada; Dr. Shawn A. Anderson, Prostate Centre, Vancouver General Hospital, Canada.

Plant extract used

A standardized ethanol extract of the fresh herb and roots of the herbal medicine Echinacea purpurea (L.) Moench (Echinaforce®) was used.

Test material/Test system

Inhibition of viral growth and of the mediators was tested in various epithelial cell lines, including mucosal cells from the human bronchial system and pulmonary alveoli. The tested viruses included human influenza viruses (A/H3N2) and herpes simplex viruses type 1 as well as rhinovirus types RV1A and RV14, adenovirus types 3 and 11, or respiratory syncytial viruses (RSV).

Antiviral activity was determined from the MIC100 (minimum inhibitory concentration 100). This measures the weakest concentration of extract that still produces complete inactivation of the viruses. In addition to important inflammatory mediators such as interleukin-6, interleukin-8 or TNF-α, a further 20 relevant signaling proteins were studied. Mediator secretion was determined using ELISA and a cytokine antibody array respectively.

The Echinacea extracts were added to the cell culture in various dilutions before and during viral infection. Depending on virus type, the antiviral effects were measured after 2 – 5 days, while the signaling substances were measured 24 and 48 hours post-infection.

[1] Sharma M, Anderson SA, Schoop R, Hudson JB: Induction of multiple pro-inflammatory cytokines by respiratory viruses and reversal by standardized Echinacea, a potent antiviral herbal extract. Antiviral Res. 2009 Aug;83(2):165-70 (http://dx.doi.org/10.1016/j.antiviral.2009.04.009).
[2] Johnston SL: Problems and prospects of developing effective therapy for common cold viruses. Trends Microbiol. 1997 Feb;5(2):58-63.

Note: The Echinacea herbal extract tested is equivalent, in terms of raw-material use, manufacture and composition, to the product Echinaforce® (A. Vogel Bioforce AG, Roggwil, Switzerland).

Study results

a) Antiviral efficacy

In even the tiniest quantities, the Echinacea extract used completely inactivates influenza and herpes simplex viruses in particular, but also RSV. This activity is explained as a direct antiviral effect of the Echinacea extract.

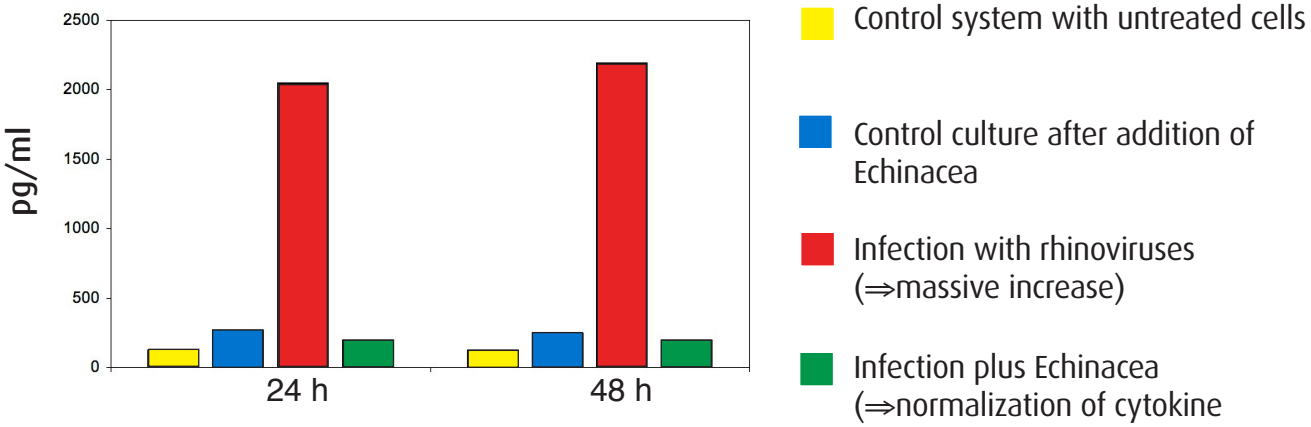
Antiviral activity		MIC100 (µg/ml)
Enveloped viruses	Influenza (A/H3N2, human), flu	0,58±0,22
	Herpes simplex (HSV, type 1), herpes labialis, and any others	0,39
	Respiratory syncytial virus (RSV), upper-respiratory tract infections especially in infants and children	2,50
Non-enveloped viruses	Rhinovirus (types RV1A and RV14), colds, bronchitis	~800
	Adenovirus (types 3 and 11), respiratory tract infections	>800
	Feline calicivirus (FCV), cat flu	

MHK_{100} – lowest concentration of a substance that completely inhibits viral multiplication.
In this case, therefore, the lowest concentration of Echinacea extract, in µg/ml, necessary for complete viral inactivation.

b) Immunomodulatory effect

The tested Echinacea extract blocks the post-infection release of numerous mediators of inflammatory reactions, such as IL-6, IL-8 and TNF-α *in vitro*.

These anti-inflammatory activities of Echinacea were apparent in all the viral triggers of acute respiratory tract infections tested.



Secretion of interleukin-8 by human bronchial cells 24 and 48 hours after the start of the test.

Conclusion

These studies show, *in vitro*, a dual effect of the Echinacea extract used (Echinaforce®). Firstly, it has a antiviral effect on the tested enveloped viruses (e.g. influenza) at even very low concentrations. Secondly, after infection with all the viral triggers of acute respiratory disease, the extract modulates the release of numerous inflammatory mediators significant to the clinical symptoms. The results support the assumption that this dual mode of action is the basis for the known efficacy of Echinacea in the prevention of flu-like infections, and also in their acute treatment.