

Antiviral activity of monoterpenes thymol, carvacrol and *p*-cymene against herpes simplex virus *in vitro*

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Abstract

Introduction: In recent years, with increased prevalence of viral infections and having no specific treatment and also the continuous appearance of resistant viral strains, finding of novel antiviral agents is necessary.

Methods and Results: In this study, monoterpenes of thymol, carvacrol and *p*-cymene were screened for their inhibitory effect against herpes simplex virus type 1 (HSV-1) *in vitro* on Vero cell line CCL-81-ATCC using a plaque reduction assay. The antiviral activity of three monoterpenes (thymol, carvacrol and *p*-cymene) were evaluated by cytotoxicity assay, direct plaque test. In addition, the modes of antiviral action of these compounds were investigated during the viral infection cycle. Results showed that the inhibitory concentrations (IC₅₀) were determined at 0.002%, 0.037% and >0.1%, for thymol, carvacrol, *p*-cymene, respectively. A manifestly dose-dependent virucidal activity against HSV-1 could be exhibited for compounds tested. In order to determine the mode of the inhibitory effect, compounds were added at different stages during the viral infection cycle. At maximum non-cytotoxic concentrations of the compounds, plaque formation was significantly reduced by more than 80% when HSV-1 was pre incubated with *p*-cymene. However, no inhibitory effect could be observed when the compounds were added to the cells prior to infection with HSV-1 or after the adsorption period.

Conclusions:

These results indicate that compounds affected HSV-1 mostly before adsorption and might interact with the viral envelope. Thymol exhibited a high selectivity index and seems to be a promising candidate for topical therapeutic application as antiviral agent for treatment of herpetic infections.

Key words: Antiviral activity, HSV-1, Antiviral agents, Viral infection cycle

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