

An Extract from *Taxodium Distichum* Targets Hemagglutinin- and Neuraminidase-related Activities of Influenza Virus in Vitro

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Background/Objective

Taxodium distichum Rich is a popular garden tree, originally indigenous from eastern United States through Mexico to Guatemala where it has been used as a folk medicine to treat inflammation and infection. However, *T. distichum* has not been described as a traditional medicine to treat influenza viruses. Influenza virus remains an emerging virus and causes pandemics with high levels of fatality. We aimed to identify new plant sources of anti-influenza virus agents.

Method

The EC₅₀ of water extract of *T. distichum* stems (TDSWex) was shown antiviral efficacy against various strains of human influenza A and B viruses. We observed that the synthesis of viral RNA and protein by western blot and reverse transcription – quantitative PCR (RT-qPCR). The time-of-addition assay suggested that TDSWex inhibited some steps of viral replication. In the hemagglutination inhibition assay and the NA assay showed the antiviral mechanism of TDSWex.

Result

The EC₅₀ of TDSWex was 0.051 ± 0.024 mg/mL against influenza virus A/WSN/33. TDSWex had excellent antiviral efficacy against various strains of human influenza A and B viruses, particularly oseltamivir-resistant clinical isolates and an H1N1pdm strain. We observed that the synthesis of viral RNA and protein were inhibited in the presence of TDSWex. The results of the time-of-addition assay suggested that TDSWex inhibited viral entry and budding. In the hemagglutination inhibition assay, TDSWex inhibited the hemagglutination of red blood cells, implying that the extract targeted HA-related functions such as viral entry. In the attachment and penetration assay, TDSWex showed antiviral activity with EC₅₀s of 0.045 ± 0.026 and 0.012 ± 0.003 mg/mL, respectively. We further confirmed that viral budding was blocked by TDSWex.

Conclusion

We conclude that TDSWex has bimodal activities against both viral entry and budding.