

# Inhibition of herpes simplex virus type 2 by green tea and oolong tea extracts



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## Abstract

This research studied the effect of green tea and oolong tea extracts on the inhibition of herpes simplex virus type 2. The aqueous and ethanolic extracts of green tea and oolong tea were determined for cytotoxicity on Vero cell cultures. The results showed that the aqueous extract of oolong tea had the lowest cytotoxicity, with a 50% cytotoxic dose of  $681.13 \pm 9.21 \mu\text{g/ml}$ . From the study of antioxidant activity, it was found that the ethanolic extracts of green tea had the greatest antioxidant activity of  $1002.65 \pm 9.83 \text{ mg trolox/g extract}$ . Then, efficacy of the extracts in inhibiting HSV-2 after and during viral attachment was determined. It was found that the ethanolic and aqueous green tea extracts at concentrations of 20 and 40  $\mu\text{g/ml}$  had the highest inhibitory activity on HSV-2 after viral attachment by 76.82% and 76.26%, respectively. During viral attachment, ethanolic and aqueous extracts of green tea at concentrations of 20 and 40  $\mu\text{g/ml}$  showed the highest inhibition of the virus by 92.10% and 92.95%, respectively. The ethanolic and aqueous extracts of oolong tea at concentrations of 40  $\mu\text{g/ml}$  showed the inhibition of the virus by 85.96% and 89.84%, respectively. Therefore, the green tea and oolong tea extracts could inhibit HSV-2 and the green tea extracts demonstrated higher anti-HSV activity than the oolong tea extract.

## Introduction

Herpes simplex virus type 2 (HSV-2) is the primary cause of genital herpes. It is usually transmitted through contact with the secretions of an infected person during sexual intercourse. HSV-2 can be treated with antiviral drugs, but prolonged use in some patients may lead to viral drug resistance and side effects from medication.

## Objectives

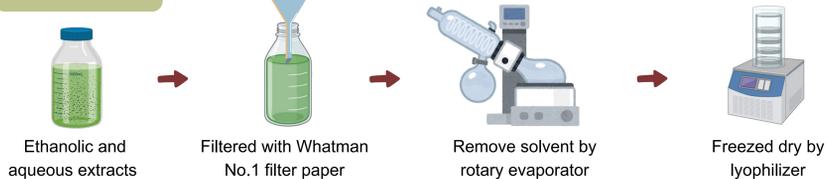
1. To study the toxicity of green tea and oolong tea extracts on cell culture
2. To determine the efficacy of green tea and oolong tea extracts on inhibiting herpes simplex virus type 2

## Material and Method

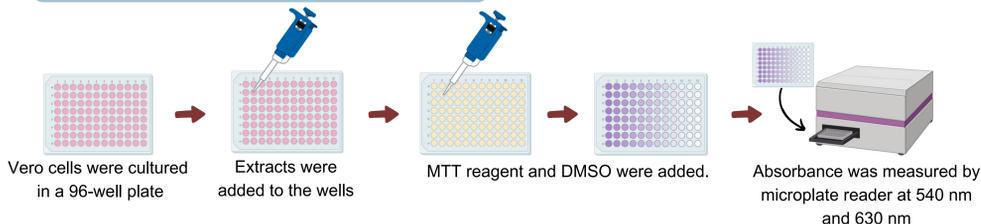
### Materials



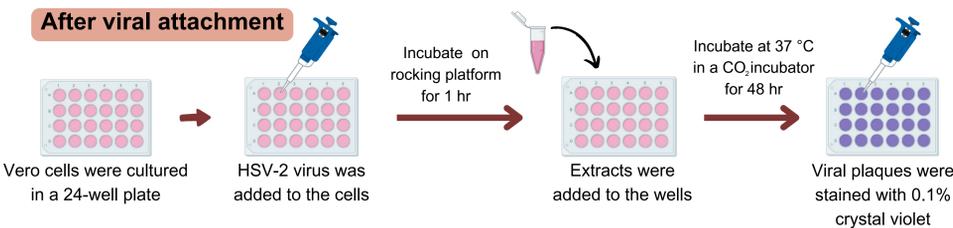
### Extraction



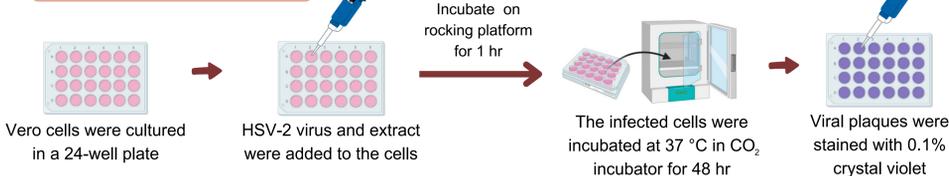
### Cytotoxicity test by MTT assay



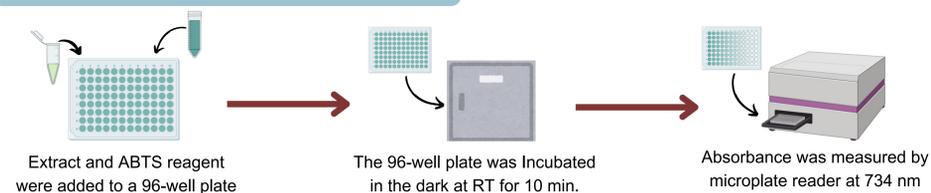
### Anti-HSV-2 activities



### During viral attachment



### Antioxidant test by ABTS assay

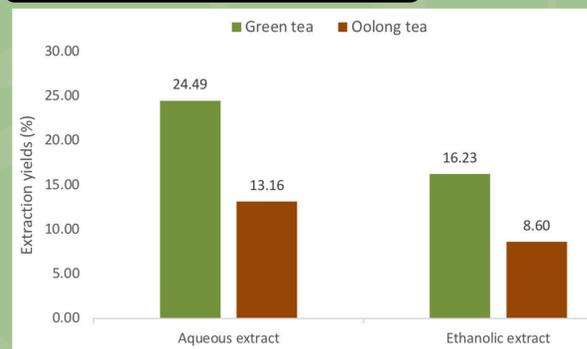


## Acknowledgements

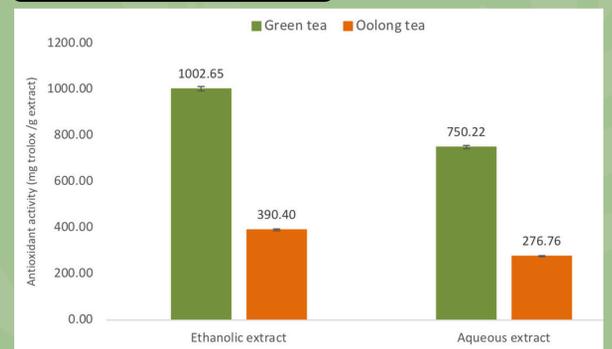
- Department of Biology, Faculty of Science, Chiang Mai University
- Assoc. Prof. Dr. Yingmanee Tragoolpua. Advisor's project
- Virology laboratory (SCB2711)

## Results

### Percentage yield of extracts



### Antioxidant activities



### Cytotoxicity test

<i>C. sinensis</i>	50% Cytotoxicity dose ( $\mu\text{g/ml}$ )	
	Ethanolic extract	Aqueous extract
Green tea	$58.25 \pm 5.11$	$51.32 \pm 4.11$
Oolong tea	$56.74 \pm 4.11$	$681.13 \pm 9.21$

### Anti-HSV-2 activity after viral attachment to the cell

Extraction Type	Concentration ( $\mu\text{g/ml}$ )	Inhibition (%)	Extraction Type	Concentration ( $\mu\text{g/ml}$ )	Inhibition (%)
Green tea	20.00	$79.82 \pm 2.10$	Green tea	40.00	$76.26 \pm 1.29$
	10.00	$63.23 \pm 5.16$		20.00	$68.32 \pm 2.63$
Oolong tea	40.00	$59.56 \pm 1.84$	Oolong tea	10.00	$51.85 \pm 1.84$
	20.00	$52.87 \pm 2.63$		40.00	$76.26 \pm 1.29$
	10.00	$49.12 \pm 1.84$		20.00	$68.32 \pm 2.63$
				10.00	$51.85 \pm 1.84$

### Anti-HSV-2 activity during viral attachment to the cell

Extraction Type	Concentration ( $\mu\text{g/ml}$ )	Inhibition (%)	Extraction Type	Concentration ( $\mu\text{g/ml}$ )	Inhibition (%)
Green tea	20.00	$92.10 \pm 3.56$	Green tea	40.00	$92.95 \pm 0.90$
	10.00	$73.13 \pm 1.17$		20.00	$77.60 \pm 3.24$
Oolong tea	40.00	$85.96 \pm 2.48$	Oolong tea	10.00	$72.32 \pm 2.88$
	20.00	$57.02 \pm 3.72$		40.00	$89.84 \pm 1.20$
	10.00	$41.22 \pm 1.24$		20.00	$73.62 \pm 1.07$
				10.00	$46.22 \pm 3.14$

## Discussion and Conclusion

- Aqueous extract of green tea showed the highest yield at 24.49%.
- Ethanolic extracts of green tea had the greatest antioxidant activity of  $1002.65 \pm 9.83 \text{ mg trolox/g extract}$ .
- Aqueous extract of oolong tea had the lowest cytotoxicity on Vero cells, with a 50% cytotoxic dose of  $681.13 \pm 9.21 \mu\text{g/ml}$ .
- Green tea and oolong tea extracts were effective by inhibition of HSV-2 during viral attachment than after viral attachment to Vero cells. Green tea and oolong tea extracts contain catechins or EGCG that can inhibit binding of viral glycoproteins gB, gD or other envelope glycoproteins. (Isaacs *et al.*, 2008)
- Green tea extract can inhibit HSV-2 virus more effectively than oolong tea extract because green tea contains higher amount of EGCG than oolong tea, which is the active compound that has inhibitory effect on HSV. (Stamos *et al.*, 2022)
- Oolong tea is a semi-fermented tea, which may cause some polyphenol compounds, such as catechins and EGCG, to be oxidized and converted to other compounds. (Vastrad *et al.*, 2021)

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