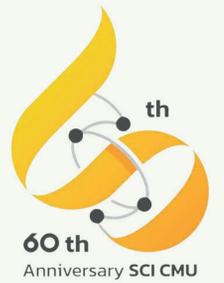




# Determination of antioxidant and antibacterial activities of kombucha



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## Abstract

fermented tea or Kombucha is a beverage made from fermentation of tea with microorganisms such as bacteria and yeast. It contains antioxidants and probiotics in high amount, which promotes the systems in body and control the amount of pathogenic microorganisms. The efficacy of antioxidant activities of kombucha made from four types of tea leaves: green tea, white tea, oolong tea and black tea was compared. Moreover, the anti-bacterial activity against pathogenic enteric bacteria including *E. coli*, *E. coli* O157:H7, *S. Typhi*, *S. dysenteriae*, and *V. cholerae* was investigated. The highest antioxidant activity of kombucha from green tea was demonstrated by  $8.27 \pm 0.85$  mg gallic acid/g extract and  $42.37 \pm 0.13$  mg trolox/g extract using DPPH and ABTS assays. Furthermore, kombucha from green tea demonstrated the highest levels of phenolic compounds of  $6.62 \pm 0.71$  mg gallic acid/g extract. However, the highest flavonoid compound of  $1.45 \pm 0.02$  mg gallic acid/g extract was found in kombucha from black tea. The inhibitory effect of kombucha on enteric pathogenic bacteria was investigated using agar well diffusion and broth dilution assays. The results indicated that concentrated kombucha from all four tea types effectively inhibited the growth of pathogenic enteric bacteria.

## Introduction

Kombucha is a fermented tea beverage that produced from boiling tea leaves and sugar. The fermentation process enhances the production of bioactive compounds that is beneficial to human health and results in a high concentration of probiotic microorganisms. These probiotics support various physiological functions, regulate pathogenic microorganisms, and contribute to the neutralisation of free radicals, further highlighting potential health benefits of kombucha.

## Objective

To study antibacterial and antioxidant activities of concentrated kombucha.  
To investigate total phenolic and flavonoid content in concentrated kombucha.

## Methods



## Antioxidant activity

- DPPH assay
- ABTS assay
- Total phenolic content
- Total flavonoid content

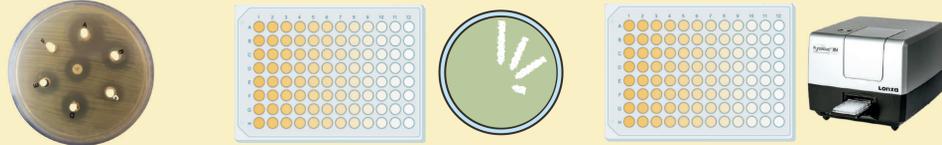


Anti-free radical activities of the kombucha were determined by DPPH and ABTS assays

Total phenolic and flavonoid content of kombucha were determined by Follin-ciocalteu and Aluminium chloride colorimetric methods

## Antibacterial activity

- Agar well diffusion
- MIC and MBC
- The effects of kombucha on bacterial inhibition



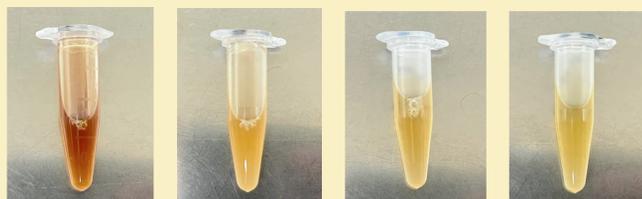
Kombucha was tested by agar well diffusion assay, incubated at 37 °C for 24 hr and measured an inhibition zone

Kombucha was added in 96 well pates, incubated 24 hr 37 °C and observed the MIC by re-streak on agar plate. The plate was incubated again and MBC was observed

Kombucha was tested in 96 well pates, incubated at 37 °C for 0, 3, 6, 24 and 48 hr. Measure absorbance at 600 nm

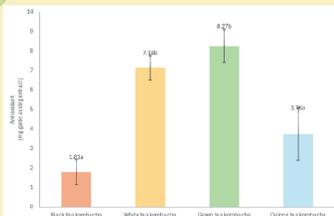
## Result

### Characteristics of kombucha made from different types of tea



Black tea (kombucha), White tea (kombucha), Oolong tea (kombucha), Green tea (kombucha)

### DPPH assay



### ABTS assay

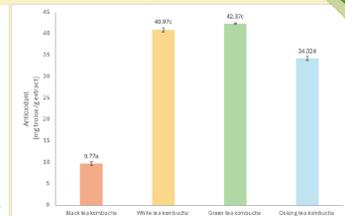
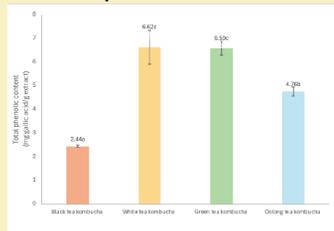


Fig 1 Antioxidant activity of kombucha from black tea, white tea, green tea and oolong tea

### Total phenolic content



### Total flavonoid content

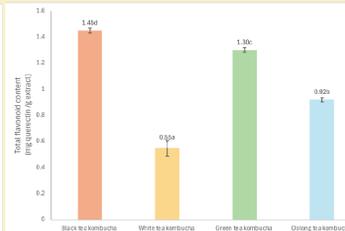


Fig 2 The phenolic and flavonoid compounds of Kombucha from black tea, white tea, green tea and oolong tea

Table 1 Antioxidant activity, Total phenolic and flavonoid content of kombucha from different types of tea.

Kombucha	Antioxidant activity		Total phenolic and flavonoid content	
	DPPH (mg gallic acid/g extract)	ABTS (mg trolox/g extract)	Total phenolic content (mg gallic acid/g extract)	Total flavonoid content (mg quercetin/g extract)
Green tea	8.27±0.85	42.37±0.13	6.62±0.71	1.30±0.02
white tea	7.16±0.63	40.97±0.51	6.59±0.30	0.55±0.06
Oolong tea	3.76±1.35	34.32±0.50	4.76±0.20	0.92±0.02
black tea	1.81±0.65	9.77±0.41	2.44±0.10	1.45±0.02

### Agar well diffusion and broth dilution assay

It was found that concentrated kombucha could not inhibit the tested pathogenic enteric bacteria; *E. coli*, *E. coli* O157:H7, *S. Typhi*, *S. dysenteriae* and *V. cholerae* at a concentration of 200 mg/ml

### The effects of kombucha on enteric pathogenic bacterial inhibition

Kombucha from green tea exhibited the highest antibacterial activity. It effectively inhibited the growth of *E. coli*, *E. coli* O157:H7, and *V. cholerae*, with inhibition of 72.14%, 72.14%, and 56.43%, respectively. Additionally, kombucha from white tea demonstrated the strongest antibacterial activity against *S. Typhi*, with inhibition of 86.26%. Meanwhile, kombucha made from black tea exhibited the highest antibacterial activity against *S. dysenteriae* with inhibition of 83.35%.

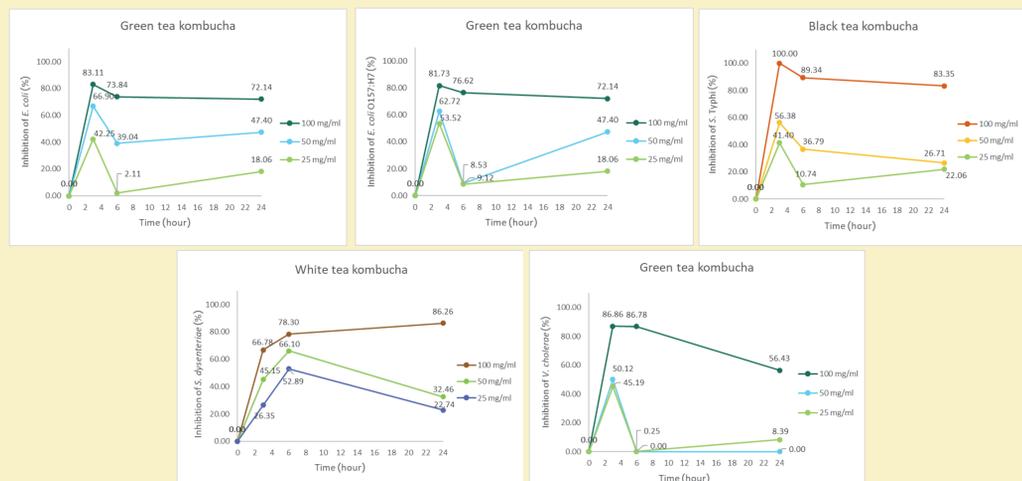


Fig 3 Effect of Kombucha on pathogenic enteric bacteria; *E. coli*, *E. coli* O157:H7, *Samonella Typhi*, *Shigella dysenteriae* and *Vibrio cholerae*

## Conclusion

The antioxidant efficacy of concentrated kombucha was evaluated using the DPPH and ABTS assays. The results showed that kombucha made from green and white tea demonstrated the highest antioxidant activity. In addition, white and green tea kombucha demonstrated the highest phenolic compounds and, the highest flavonoid compounds was found from black tea kombucha. The antibacterial activity of kombucha against pathogenic enteric bacteria was investigated by the agar well diffusion, broth dilution and The effects of kombucha on pathogenic bacterial inhibition. While kombucha could reduce pathogenic enteric bacterial growth.

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