



(RESEARCH ARTICLE)



## Antioxidant activity and phenolic content of ginger (*Zingiber officinale Roscoe*) combination with cinnamon (*Cinnamomum burmanii*) and Sappan wood (*Caesalpinia sappan*) as an anti-diabetic

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### Abstract

Based on IDF 6.7 million people deaths due to diabetes mellitus in 2021. Current study showed that dietary of fruits and vegetables containing antioxidant have associated with the reduction of the risk of many chronic diseases such as diabetes and cardiovascular. Plant phenolic compounds can act as antioxidant individually or in combination. *Zingiber officinale Roscoe*, *Caesalpinia sappan*, and *Cinnamomum burmannii* have phenolic compounds. However less information about antioxidant activity of ginger in this combination especially in decoction extraction method. This research was descriptive quantitative and aim at determining the content of phenolic compound and antioxidant activity of three varieties of ginger (*Zingiber officinale Roscoe*) combination with *Cinnamomum burmannii* and *Caesalpinia sappan* in decoction extraction method. Phenolic compound test was conducted by utilizing Folin-Ciocalteu method; while antioxidant activity test was performed by DPPH method. Both tests used Spectrophotometer UV-Vis. Based on ANAVA and independent t test combination of three varieties of ginger have higher total phenolic ( $38.80 \pm 0.217$ ,  $39.34 \pm 1.02$ ,  $39.99 \pm 0.44$ ) than of non-combination ( $21.222 \pm 0.25$ ,  $21.36 \pm 0.60$ ,  $23.58 \pm 1.02$ ). Three varieties of ginger combination have antioxidant activity higher (75.64 %, 68.97 %, 61.45 %) than ginger without combination (68.39 %, 60.29 %, 51.55%). Conclusion of this research is total phenolic content and antioxidant activity of ginger combination higher than in non-combined ginger, therefore ginger combination can be antidiabetic candidate.

**Keywords:** Antioxidant activity; Extraction; Ginger; Phenolic content

### 1 Introduction

573 million adult age 20-79 years are living in diabetes in the world and is predicted to increases to 643 million by 2030 and 783 by 2045 [1] Diabetes is one of non-communicable diseases (NCD-s), where is obesity, in active life style or sedentary, unhealthy food consumption, and genetic are as a risk factor for development [2]. there for study on potential medicinal plant -base products for anti-diabetes is still needed. Ginger contains chemicals compound especially gingerol and shogaol which are thought to have functions as anti-cancer, anti-inflammatory, anti-hypertensive and also diabetes and as antioxidant [3], cardiovascular disease [4]. Further, Bekkouch and colleagues stated that aqueous extract and methanolic fraction of *Zingiber officinale* have a potent of hypolipidemic and antiatherogenic [5]. Based on Liang [6] sub-critical n-butane contains the main compound cinnamaldehyde E and Coumarin with area percentage 74.32% for *Cinnamomum cassia* and 76.43% for *Cinnamomum burmanii*. *Cinnamomum burmanii* contained 25.67% eugenol and

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was not detected in *Cinammomum cassia*. While the sub critical ethanol extract Cinnamaldehyde E was 67.92 % in *Cinammomum cassia* and 48.48 % in *C.inammomum burmanii*, and the coumarin content was almost the same, while Eugenol was not detected in both species. *Cinnamomum burmanii* from several regions in Indonesia also showed cinnamaldehyde between 60-70 % the same with other country [7] however, in *Cinnamomum burmanii* originating from Sumatera no coumarin was found [8]. Based on IC50, the Cinnamaldehyde derivative has strong and very strong antioxidant activity [9]. Cinnamaldehyde from Indonesia has a potential as an antioxidant, which can suppress DPPH radicals, chelate metals and inhibit peroxidase activity. Similar to ginger and cinnamon, *Caesalpinia sappan* also has the activity of bioactive compounds and has antioxidant properties. Base on [10] bioactive compound from ethanolic extract of *Caesalpinia sappan* heartwood, such as episappanol, protosappanin C, brazilin, (iso-) protosappanin B and sappanol and showed significant anti-inflammatory properties in two different cell lines, macrophages and chondrocytes. In contrast, the extraction with dichloromethane, the main compounds were linolic acid, sitosterol and brazilin. Brazilin shows various biological activities including antioxidant, antibacterial, anti-inflammatory, hypoglycemia, hepatoprotective, and vasorelaxation etc. Brazilin has the potential to develop into a drug and also act as a nutraceutical [11]. Brazilin also as anti-cancer [12].

Combination of plant can influence chemical compound composition because of they will have various interactions towards each other that can be synergism, antagonistic or additive. Different action of the combined extracts can be attributed to the chemical properties, nature and reactivity of the components of the extracts [13]. Study by Elsadek and colleagues was showed the combined formulation found to be beneficial than the separated herb for enhancing the antioxidant status of STZ- induced diabetic rats resulted in reducing oxidative stress [14]. *Cinnamomum* and *Zingiber* have synergistic effect as antidiabetic, notwithstanding antioxidant activity in combination *Zingiber officinale Roscoe*, *Cinnamomum burmannii* and *Caesalpinia sappan* both in vitro and in vivo, there is still no information. Based on previous research, this study aims to determine total phenolic content and antioxidant activity in the combination of *Zingiber officinale Roscoe*, *Cinnamomum burmannii*, and *Caesalpinia sappan* in decoction extraction method.

## 2 Material and methods

### 2.1 Plant Materials

Rhizome of three varieties of ginger (*Zingiber officinale Roscoe*), *Cinnamomum burmannii* bark and *Caesalpinia sappan* heart wood from local market. The obtained gingers, cinnamon and sappan wood were then washed, thinly sliced, and then put in the blender for grinder. 25 g of ginger powder then were added by 250 mL water, then put in boiling water for ± 10 minutes (decoction) and added boiling water for 10 minutes (infusion) for ginger without combination and in ginger combination *Zingiber officinale Roscoe* + *Cinnamomum burmannii* + *Caesalpinia sappan* (80:10:10) %.

### 2.2 Reagent and Chemical

Folin-Ciocalteu phenol reagent, Na<sub>2</sub>CO<sub>3</sub>, gallic acid from Sigma Aldrich, DPPH (1.1 diphenyl, 2-picrylhydrazyl) from Sigma Aldrich were all prepared in analytical grades.

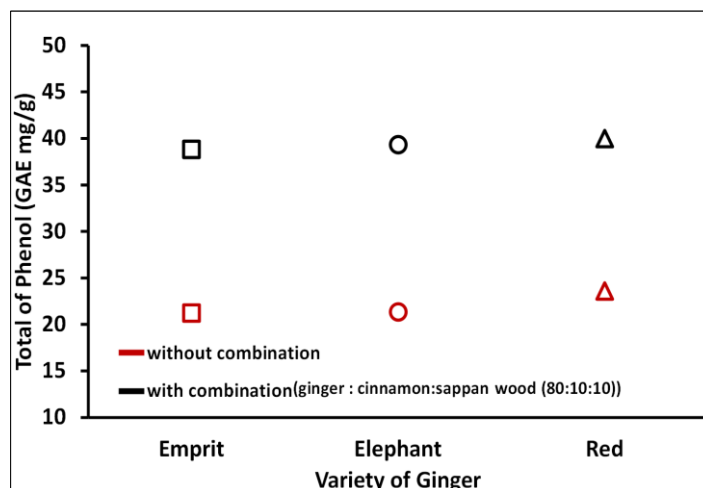
### 2.3 Determination of Total Phenolic Content

Total phenolic content determination base of modified method [15,16] the steps were: 1 ml sample (1mg/mL) was added into 1 ml Folin-Ciocalteu phenol reagent, and then incubated for 5 minutes. It was then added with 10 mL of 7 % Na<sub>2</sub>CO<sub>3</sub> solution, then with 13 mL of distilled water shaken and incubated in dark environment with the temperature of 23 degree Celsius. The samples were measured by Spectrophotometer UV Vis in the absorbance of 750 nm. The total of phenolic content was then determined by comparing with a standard curve of gallic acid where the total of phenolic acid was indicated by the value of mg GAE/g of dry sample.

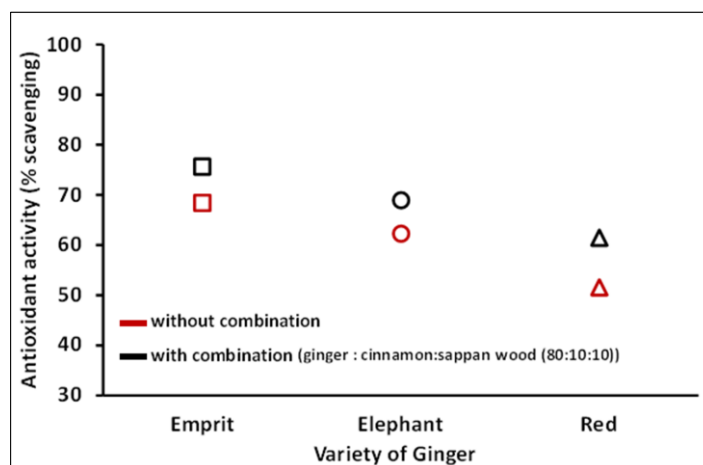
### 2.4 Antioxidant Activity Determination

Antioxidant Activity Determination was also conducted based on a modified method [15,16] as follows: Liquid solution of 24 mg DPPH in 100 mL of methanol and stored at a temperature of 20 °C. DPPH can be used by dissolving DPPH in methanol to obtain 0.98 ± 0.02 DPPH absorbance at 517 nm with spectrophotometer. 3 mL DPPH was then added to 100 µL of sample (concentration might vary from 10-500 µg/mL). Mixed well and incubated in the dark room for more or less 15 minutes in room temperature; it could be read by absorbance in spectrophotometer.

### 3 Results



**Figure 1** Total phenolic compounds in decoction extracts of rhizomes of ginger with combination and without combination (All analysis are the means of triplicate measurement  $\pm$  standard deviation a: expressed as mg Gallic acid (GAE)/ g of dry plant material)



**Figure 2** Number of antioxidant activity in decoction extracts of rhizomes of ginger with combination and without combination (All analysis are the means of triplicate measurement  $\pm$  standard deviation a: expressed as mg percent of free radical inhibitions)

Total phenolic compounds and antioxidant activity in decoction extracts of rhizomes in the varieties of *Zingiber officinale Roscoe* as well as combination of *Zingiber officinale Roscoe* with *Cinnamomum burmannii* and *Caesalpinia sappan* are presented in Figure 1 and Figure 2 respectively.

### 4 Discussion

Based on ANOVA and independent t-test were showed that combination of *Zingiber officinale Roscoe*, *Cinnamomum burmannii* and *Caesalpinia sappan* have antioxidant activity higher than *Zingiber officinale Roscoe* without combination. The combination has synergic effect although the presentation in combination with the composition in 80:10:10. The results of this study are the same as previous studies on different plants. Poh and teams stated that the combination of 53.7 % lemongrass, 43.4 % curry leaves, 2.9 % ginger and 0.0 % turmeric higher antioxidant activity than non-combination and as optimum formulation [17]. Based on Parathodi [18] combining fresh fruit apples, grapes, oranges, pomegranate and sapota, research result that combination of fruits provide synergistic effect in bioactive phytochemical that lead bring in health benefits. Combination of fruits can be more effective in improving the natural defenses of antioxidants. *Pfaffia glomerata* and *Arrabidaea chica* extracts combination showed synergistic effect with effective antioxidant capacity and suggesting that these extracts in combination offer higher potential for the restrain of photoaging and diseases which

are related with oxidative stress [19]. Combination of (*Premnaserratifolia* Linn.), Meniran (*Phyllanthus niruri* L.), Secang (*Caesalpinia asappan*) and Roselle (*Hibiscus sabdarifa*) showed higher antioxidant activity compared to before combination and the best combination composition is 1:1:1/2:1 [20].

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## 5 Conclusion

Combination of *Zingiber officinale* Roscoe, *Cinnamomum burmanii* and *Caesalpinia sappan* have antioxidant activity and phenolic content higher than *Z. officinale* itself. The combination more potential as a candidate for anti-diabetes mellitus.

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## Compliance with ethical standards

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### Disclosure of conflict of interest

The authors declare that there is no conflict of interest.

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