

Antioxidant Activity of Combination of Mangosteen Peel (*Garcinia Mangostana*) and Green Tea Leaves (*Camellia Sinensis*)

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Abstract—Mangosteen peel and green tea leaves are natural antioxidants that have been widely used in the community. Usually, people use it as a tea drink. The aim of this study was to find the composition of green tea-mangosteen peel combination which has the highest antioxidant. The material used is a mixture of mangosteen peel and green tea leaves powder with a composition (92.5: 7.5); (95: 5) and (97.5: 2.5). The combination powder mixture was extracted by maceration method using ethanol solvent. Antioxidant tests were carried out using the DPPH method. The antioxidant activity is expressed as ES50. Gallic acid is used as a positive control. The results showed that gallic acid and extracts of the combination of mangosteen peel-green tea leaves had antioxidant activity with ES 50, respectively 3.025 µg/ml; 20.62 µg/ml; 33.175 µg/ml and 38.210 µg/ml. The combination of mangosteen peel-green tea leaves (92.5: 7.5) is a combination with the highest antioxidant activity.

Keywords—mangosteen, green tea, combination, antioxidant, DPPH

I. INTRODUCTION

Tea leaves are widely consumed by the public and having many benefits in health [1]. As levels of fermentation increased from green to oolong to black tea, the major flavan-3-ol profiles changed. Total catechins were 13.6 g/100 g in green and 4.2 g/100 g dry weight in black tea [2]. Quercetin, myricetin and kaempferol are major flavonols making up 2 - 3% of water soluble extractive in tea. Flavonols in tea are mainly in glycosidic form because non-glycosidic forms are water insoluble. Variable flavonols content are demonstrated possibly due to use of different analytical techniques. For example, 0.83-1.59, 1.79 - 4.05 and 1.56 - 3.31 g/kg are found respectively for myricetin, quercetin and kaempferol in green tea after acid hydrolysis, when these results are compared on dry weight bases [3]. Previous researchers reported that polyphenol compound in tea leaves have antioxidant activity.

Mangosteen peel is a source of natural antioxidants. The content of secondary metabolites in the peel of the mangosteen fruit is tannin and xanthenes. Xanthenes are natural chemical substances classified as polyphenolic compounds. Xanthenes are very beneficial for body health as an antioxidant, antiproliferative, anti-inflammatory and antimicrobial [3]. According to the Nature of Health Resources, xanthenes, mangostin, garcinone, flavonoids and tannins in the mangosteen are phenolic bioactive compounds.

The skin of the mangosteen which contains xanthenes has a high antioxidant function so that it can neutralize and destroy free radicals which trigger the emergence of degenerative diseases, such as cancer, heart disease, arthritis, cataracts, and diabetes mellitus.

Some researchers previously reported that extract combinations could increase biological activity. One of them [4] reported that antioxidant activity from a combination of mangosteen peel extract, soursop leaves, red betel nut and taro tuber with variations of LHHL dosage for each extract in a row on a volume ratio (1: 1: 1: 1: 1) has the highest antioxidant activity with inhibition ability of 93.73%.

Antioxidant activity is owned by most phenolic compounds caused by the presence of phenolic hydroxyl groups in their molecular structure. When reacting with free radicals, these compounds form new radicals that are stabilized by the aromatic resonance effect of the nucleus. Thus the propagation phase which includes radical reactions will be inhibited [5]. To determine the antioxidant activity can be done by several methods including: DPPH method, Ferric Reduction Power method, TBA method.

On the market, single mangosteen peel extract and single green tea preparations are available. In developing products into tea preparations, mangosteen peel needs to be combined with tea leaves. Therefore it is necessary to look for a comparative composition of mangosteen peel and tea leaves to produce optimal antioxidant activity. Based on the background above, it is deemed necessary to have research on the optimization of the composition of mangosteen peel and green tea leaves along with the test of antioxidant activity.

II. MATERIAL AND METHOD

A. Tools and Materials

The equipment used in this study, namely: analytic scales, knives, magnetic stirrers, Buchner funnels, aluminum foilpaper, glass wares of various sizes, a set of Spectrophotometer (UV-1800 Shimadzu).

Mangosteen peel and tea leaves powder obtained from Beringharjo local market (special Region of Yogyakarta, Indonesia), FeCl₃ p.a (E-Merck), gallic acid (sigma), ethanol p.a (E-Merck), DPPH (Sigma).

B. Method

1) Extract Preparation

The powder of mangosteen peel and tea leaves were authenticated by expert at Biological Pharmacy Laboratory Faculty of Pharmacy, University of Gadjah Mada with Certificate number : UGM/FA/4527/M/03/02. The mangosteen peel-tea leaves composition of combination in this study were (92.5:7.5), (95:5), (97.5:2.5)w/w. Each combination were weighed as much as 100 grams, then extracted by maceration method with the help of sonication for 2 hours by using ethanol solvent. The macerate was filtered using vacuum and filter paper to separate the pulp and filtrate, the filtrate was then evaporated with a vacuum rotary evaporator to obtain the thick extract.

2) Determination of the Antioxidant Activity

The antioxidant activity was conducted by DPPH method. Gallic acid was used as a positive control. The DPPH assay was done as procedure below :

Each one ml of gallic acid solution and combination extract in several concentrations added 1.0 ml of DPPH 0.15mM solution. Shaken and stayed for 30 minutes. The absorbance was read at a wavelength of 517 nm against ethanol as the blank solution [6].

C. Data Analysis

The percentage of radical scavenging (% inhibition) activity of gallic acid and the extracts were calculating by using equation below:

$$\% \text{inhibition} = \frac{C_{\text{Abs}} - S_{\text{Abs}}}{C_{\text{Abs}}} \times 100\% \quad (1)$$

while C_{Abs} = The control negative absorbance

S_{Abs} = Positive control or sample absorbance

The Effective scavenging 50 (ES50) parameter was determine by using the linear regression equation $y = bx + a$ while y was % inhibition, x was the extract concentration. The ES50 data was statistically analysis [7].

III. RESULT AND DISCUSSION

Antioxidant test was carried out by DPPH method. This test was based on a decrease in the intensity of DPPH absorption due to the presence of antioxidant compounds measured at a wavelength of 517 nm. As a positive control, gallic acid is used. The ability of compounds as antioxidants is expressed in the amount of ES50 (table 1).

TABLE I. THE ES50 VALUE OF GALLIC ACID AND THE MANGOSTEEN PEEL, TEA LEAVES AND IT'S COMBINATION EXTRACT

Sample	ES50 (µg/mL) ± SD
Gallic acid	3.026 ± 0.121
MP	44.9 ± 0.326
TK	8.77 ± 0.044
MP-TL (97.5:2.5)	38.210 ± 0.658
MP-TL (95:5)	33.175 ± 0.472
MP-TL (92.5:7.5)	20.620 ± 0.230

Note: MP is mangosteen peel, TL is tea leaves, n=3

The table 1 showed that gallic acid has the highest antioxidant activity. It supported by the hydroxyl content of

the chemical structure. It has been known that the hydroxyl-phenolic group have the main role of antioxidant activity of many natural substances [8,9]. The tea leaves extract has lower IC₅₀ than Mangosteen peel extract and The combination of both. The phenolic content of mangosteen peel plays the main role of antioxidant activity. Caffeic acid (1.51 mg/g), t-cinnamic acid (0.73 mg/g), vanillic acid (0.71 mg/g), sinapic acid (0.71 mg/g) and syringic acid (0.63 mg/g) were the predominant phenolic acids in the BHPA fraction. Zarena reported that [10] Correlation existed between the DPPH• value and the total phenolic content of the mangosteen fraction, with the correlation coefficient (r) = 0.89 ($y = 1.28x$), $P < 0.01$; $r = 0.85$ ($y = 1.19x$), $P < 0.01$; and $r = 0.961$ ($y = 4.53x$), $P < 0.001$ for FPA, BHPA and AHPA fractions, respectively.

According to the table 1, it's seen that the addition of tea leave into the mangosteen peel will enhance the antioxidant activity. The more portion of tea leaves in the combination showed the higher antioxidant activity. In the other hand, the more tea leaves portion in the combination, its higher antioxidant activity. It caused by the more hydroxyl phenolic content in this extract. So, it can be suggested that tea leaves can be added into mangosteen peel to get a higher antioxidant activity in daily use rather than a single use of mangosteen peel.

IV. CONCLUSION

- Gallic acid, a combination of green tea mangosteen leaves (92.5: 7.5); (95: 5) and (97.5: 2,5) have antioxidant activity with ES50 value of 3,025; 20.62; 33,175 and 38,210 µg/ml.
- The combination of green tea mangosteen leaves (92.5: 7.5) is a combination with the highest antioxidant activity.

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