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Study on the Profile of Noni (*Morinda* sp.) Leaves as an Ingredient in Herbal Drinks

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Abstract. Two typical noni trees grow in locations close to each other in Keputih Permai, Surabaya City, and have certain characteristics that can be investigated further. From phytochemical testing of the leaves of both types of plants, the results showed that both gave positive values to be declared as plants containing antioxidant compounds. The antioxidant compound content of noni leaves was then compared with dry green tea from the local market. The design was completely randomized design, with 3 levels of treatment factors based on the type of ingredients used, namely green tea, narrow-leaf noni (*Morinda officinalis*), and wide-leaf noni (*Morinda elliptica*). From the experimental results, it is known that the total phenol, total flavonoids, the ability to counteract DPPH, and the ability to reduce iron ions of green tea are higher than Morinda sp. Whereas when compared between each type of Morinda, it is known that M. officinalis is superior to *M. elliptica* with total phenol 73.37± 1.87 mgGAE/Kg extract, total flavonoids 0.92± 0.1 mgEQ/L extract, DPPH free radical scavenging ability 228.58± 2.19 mgGAE/L extract, and iron ion reducing ability 815.17± 16.85 mgGAE/L extract. Noni leaves can be used as a promising herbal drink ingredient.

1 Introduction

The noni plant is known as a plant that has health benefits, especially from its fruit. Apart from that, noni leaves also have several health benefits. In line with the many studies on herbal drinks for health, research on noni leaves as an herbal drink also needs to be studied in more depth. Noni plant has many medicinal benefits so dubbed a magical food in Hawaii, all parts of the noni plant can be utilized for health purposes. Research for noni leaves has also been conducted along with research for noni fruit, including testing the antioxidative properties of noni leaves [1], antioxidants [2], catechins and hypolipidemic activity [3], biological activity [4], and profiling polyphenols and antioxidants of noni leaves [5]. This study aims to determine the potential of natural materials that can be utilized as basic ingredients in the manufacture of herbal drinks. To

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investigate the potential of noni leaves as herbal drink ingredients, comparisons were made with green tea, which has many known benefits. The data from this research is used as a basis for selecting these natural ingredients for the planned herbal drink formulation.

2 Material and method

The material used in this study was noni leaves obtained in the Keputih Permai residential area, Surabaya with coordinates -7.290492, 112.810349 https://maps.app.goo.gl/4xX9uR7jZTwXHhNVA. Material species were identified based on comparison with images presented in the journal [6]. Based on the comparison data, the natural materials obtained can be categorized as similar to *Morinda officinalis* and *Morinda elliptica* (Fig 1.).

a. *Morinda officinalis* b. *Morinda elliptica*

Fig. 1. Comparison between the figure *Morinda officinalis* and *Morinda elliptica*

2.1 Material

The material used was young noni leaves from the tip to the 5th young leaf from the tip. Noni leaves after being picked were allowed to wither at room temperature (28±3°C), with a measured RH of 73±5%, for five days. Next, the dried noni leaves were blended for about 2 minutes, until a 45 mesh size was obtained, with an average moisture content of 6±0.5% (w.b.). Then weighed 2 g each to be put into a tea bag, which was then brewed using 200 mL of boiling water at a temperature of 94±2°C for 5 minutes. The dried green leaves used as a comparison were obtained from a local supermarket with the brand 'KD' produced in Central Java, with a moisture content of 6.2% (w.b.), which was then blended for about 2 minutes, until it passed 45 mesh, and further processed as dried noni leaves. Materials for chemical analysis were obtained from Merck chemicals for analysis.

2.2 Method

The experimental design used was a completely randomized design (CRD), with 3 types of materials as treatments, and 12 replications, with data parameters read 3 times. The parameters measured were total phenol, total flavonoids, the ability to counteract DPPH

free radicals, and the ability to reduce Fe iron ions. The data obtained were then analyzed using single factor ANOVA, using Minitab 17, followed by a post hoc test using Tukey at 5% alpha. The analytical method used for total phenol with the procedure [7] modification using gallic acid with λ max 760 nm, Total flavonoid testing using procedure [8] with modification using quercetin standard solution with λ max 517 nm, DPPH testing using procedure [9,10] using a gallic acid standard solution with λ max 517 nm. Antioxidant Activity Testing FRAP Method [11] with modification using gallic acid with λ max 700 nm.

3 Result and discussion

The results of the experiments that have been carried out, the results are described below.

3.1 Total phenol

Total phenol analysis was measured using a spectrophotometer with Folin-Ciocalteau reagent. The principle of total phenol testing is that the Folin-Ciocalteau reagent oxidizes phenolic-hydroxyl groups reducing heteropolyacid (phosphomolybdate-phosphotungstat) into a blue molybdenum-tungsten complex. Total phenol in green tea was 167.14 ± 7.04 mgGAE/kg extract, while *M. offinalis* and *M. elliptica* were 73.37 ± 1.87 mgGAE/kg extract and 30.52 ± 1.14 mgGAE/kg extract, respectively (Fig 3.1.). This shows that green tea contains more phenolic compounds and phenolic compounds in green tea include catechins [12].

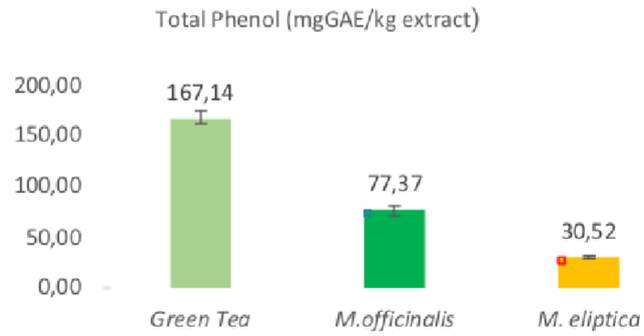

Fig. 2. Comparison of total phenol between green tea, *Morinda officinalis* and *Morinda elliptica*

Phenolic compounds have many hydroxyl groups in free form that can function as hydrogen atom contributors when reacting with radical compounds through an electron transfer mechanism, to produce high total phenol. The fewer free -OH (hydroxyl) groups can result in lower total phenol because the ability to donate hydrogen electrons is less.

3.2 Total flavonoid

Flavonoid compounds contain hydroxyl groups that can act as free radical catchers, thus functioning as hydrogen donors to free radicals. From the total flavonoid test, the results are shown in Fig. 3, which shows the results of total flavonoids using the quercetin standard. It can be seen that green tea has the highest total flavonoid value of 2.19 ± 0.18 mgEQ/L, very much different when compared to the two types of Morinda, respectively *M. officinalis* and *M. elliptica*, 0.92 ± 0.1 mgEQ/L and 0.91 ± 0.2 mgEQ/L. Total flavonoids for both Morinda species were not significantly different.

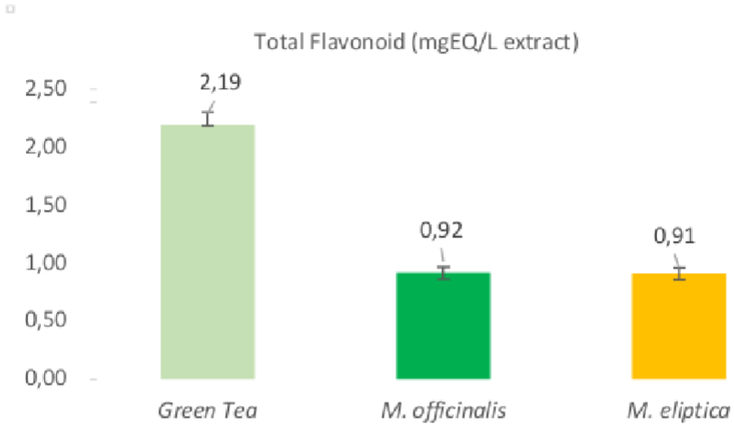

Fig. 3. Comparison of total flavonoid between green tea, *Morinda officinalis* and *Morinda elliptica*

This can be understood because in Morinda the flavonoid compounds present are rutin and quercetin. The structure of quercetin and rutin (quercetin-3-O-rutinoside) shows an important role in determining the antioxidant potential of flavonoids, the hydroxylated B ring plays the most important role in donating hydrogen (electrons) to stabilize radical compounds. The presence of a 2,3-unsaturated group conjugated at 4-oxo on ring C, capable of binding transition metal ions (Fe and Cu). The results of this study indicate that phenolic compounds such as flavonoids (quercetin and rutin) have a major role as antioxidants from leaf extracts. These phytochemical compounds can donate electrons (hydrogen) to free radicals to counteract potential damage. Total flavonoid levels can be an indicator of the effectiveness of flavonoids as free radical catchers/able to act as antioxidants (inhibit oxidation reactions) because they can produce phenoxyl radicals that are stabilized by the resonance effect of the aromatic ring [13]. The antioxidant properties of flavonoids come from the ability to transfer an electrons to free radical compounds and form complexes with metals. Flavonoid compounds that can be found in green tea are flavan-3-ols (epicatechin, epicatechin-3-galate, epigalocatechin, epigalocatechin-3-galate, catechin, galocatechin, teaflavin, teaflavin-3,3'-digalate, teaflavin-3'-galate, teaflavin-3-galate. Flavonoid compounds that can be found in green tea are flavan-3-ols (epicatechin, epicatechin-3-galate, epigalocatechin, epigalocatechin-3-galate, catechin, galocatechin, teaflavin, teaflavin-3,3'-digalat, teaflavin-3'-galat,

teaflavin-3-galat) [14]. Flavonoid compounds have antioxidant activity and metal-chelating ability due to the presence of one carboxyl group and two hydroxyl groups that can capture free radicals by chelating and stabilizing Fe [15].

3.3 The DPPH free radical scavenging ability test

From the DPPH free radical scavenging ability test, it was found that green tea was 1085.33±14.49 mgGAE/L extract, M. officinalis was 228.58±2.19 mgGAE/L extract, and M. elliptica was 159.02±4.42 mgGAE/L extract.

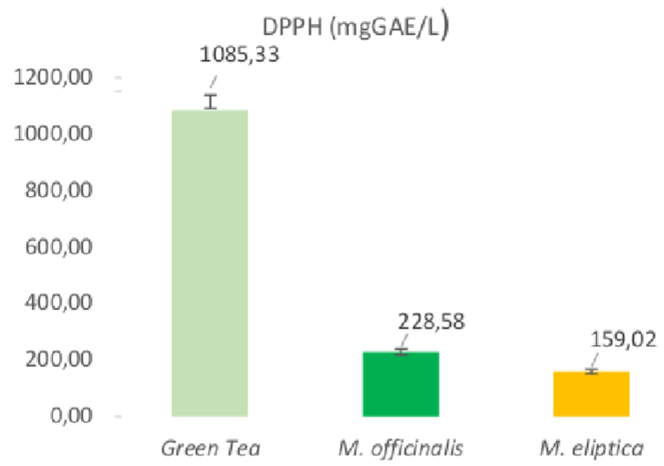

Fig. 4. Comparison of DPPH between green tea, *Morinda officinalis and Morinda elliptica*

This difference occurs because the ability to counteract DPPH free radicals, related to the effectiveness of antioxidants in reducing DPPH, depends on the shape of the chemical structure of phenolic compounds and the reactivity of phenolic compounds in donating electrons or donating hydrogen atoms [16].

3.4 Ferric reducing antioxidant power (FRAP)

The ability to reduce iron ions is related to reductant compounds that can break the radical chain by donating hydrogen atoms [17]. Phenolic compounds in the material contribute to reducing iron because they contain hydroxyl groups with the ability to donate electrons, reducing them to more stable and unreactive compounds [18]. From the ability to reduce iron ions (FRAP), it is known that for green tea 1857.83 ± 10.82 mgGAE/L extract, *M. officinalis* 815.17 ± 16.85 mgGAE/L extract, and M. *elliptica* 459.43 ± 35.67 mgGAE/L extract.

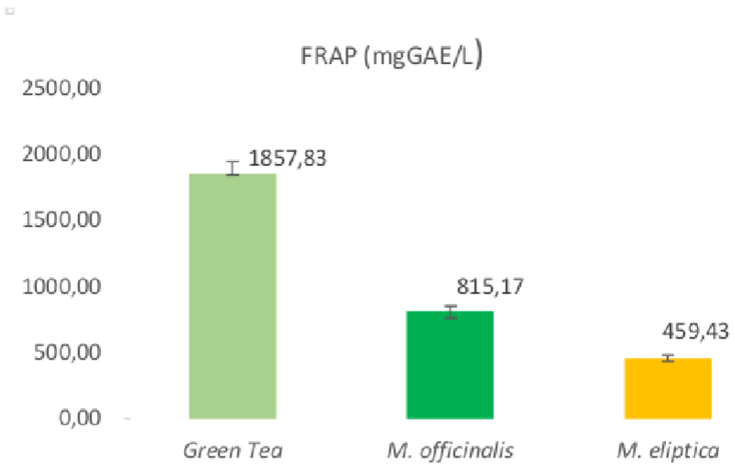

Fig. 5. Comparison of FRAP between green tea, *Morinda elliptica* and *Morinda officinalis*

From the above results, it can be seen that there is a comparable correlation between total phenols and total flavonoids with the ability to reduce iron ions. The higher the total phenol and total flavonoid, the higher the ability to reduce iron ions, because phenolic compounds play a role in chelating iron ions.

From the experiment, it is known that fellow Morinda sp has total phenol, total flavonoids, the ability to counteract DPPH and reduce iron ions almost smaller than green tea. Between Morinda sp, there is also a difference in that *Morinda elliptica* has a lower value when compared to *Morinda officinalis*, however, there are plant parts of Morinda sp other than leaves that have specific properties. In addition to this, there is a scopoletin [19] compound that has a distinctive character for health [20].

4 Conclusion

From the experiment, it can be concluded that Morinda sp has total phenol, total flavonoids, the ability to counteract DPPH, and reduce iron ions which are smaller than green tea. Between Morinda sp there is also a difference that *Morinda elliptica* has a lower value when compared to *Morinda officinalis*. Noni leaves still have the potential to become herbal drinks and can be further developed by using mixed formulations with other ingredients.

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