Antioxidant analysis of instant herbal beverages ingredients

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Abstract. The development of herbal beverages as Indonesian heritage from traditional forms to become instant herbal beverages that are processed into the form of powder or drink is estimated to be able to improve the quality of the herbal beverages. These herbal beverages have several health benefits such as the presence of antioxidant compounds that can capture free radicals to keep up immunity. This herbal powder drink is made to make it easier to consume, more efficient in time and maintain the health benefits of these herbs. The objectives of this research are to produce herbs-based herbal beverages from the commodities of sambiloto, meniran, ginger, curcuma, lemongrass and palm sugar to find out the physical and chemical contents and antioxidant value of ingredients for instant herbal beverages. The research method is conducted by making two kinds of drink formulations consisting of 1) sambiloto, curcuma, lemongrass, ginger, palm sugar, 2) meniran, curcuma, lemongrass, ginger, palm sugar. This research tested with several observational parameters: organoleptic analysis physical test with pH measurement, chemical analysis to see water and ash content, antioxidant and 2,2-diphenyl-1-picryl-hydrazyl-hydrate (DPPH) antioxidant activity analysis. The expected results are instant herbal beverages in the form of powder put into tea bags or instant herbal beverages ready for consumption with the observed parameter values expected to be able to adjust to the Indonesian National Standards (SNI) on the quality of traditional beverage powder and ready to drink consumption.

1. Introduction

The traditional herbal drink is one of the well-known herbal medicines for Indonesian people. Some of the basic ingredients that are often used to make this herbal drink include ginger, curcuma, ginger and several other herbal plants. Apart from being used as a medicine for several diseases, this herbal drink can also be used to boost immunity. The antioxidants found in the ingredients for making herbal drinks have the function of capturing free radicals. The mechanism carried out by this antioxidant substance is by giving one or more electrons to free radicals. Giving these electrons to protect the body from damage to body functions by these free radicals. Electron compounds given to free radicals are used as scavengers and prevention of chain reactions to free radicals [1].

Ginger (Zingiber officinale) is one of the superior ingredients for making herbal drinks. This ginger has two active ingredients, namely essential oils and phenolic compounds. The phenolic compounds in ginger are the cause of ginger with a spicy sensation. Phenolic is a very important part of secondary
metabolites. Phenolic compounds are known to have antioxidant activity that can protect the body from diseases caused by free radicals [2].

Curcuma (*Curcuma xanthorrhiza*) is part of the Zingiberaceae family which is known to contain active compounds such as anti-tumor, hypertriglyceridemic, anti-inflammatory, antibacterial, etc.[3]. Curcuma contains several ingredients such as xanthorrhizol, curcumene and several volatile substances. Xanthorrhizol is a content of ginger that can distinguish curcuma from other Zingiberaceae families. Xanthorrhizol is known to have biological activity such as antibiotics, antibacterial and antiseptic [4].

Lemongrass (*Cymbopogon citratus*) is a plant commonly used as a spice which has many benefits. The chemical content of lemongrass includes citronellal, geraniol, citronellol, and geraniol acetate. This content has a function as an antioxidant [5].

Meniran (*Phyllanthus urinaria*) contains chemical compounds, namely saponins, flavonoids, polyphenols, filatin, hypofilantin, and potassium salts. The content of compounds in meniran is a class of compounds that have antioxidants. Meniran also has many benefits, namely to increase endurance, as a diuretic, expectorant, menstrual laxative, appetite enhancer, fever medicine, diarrhea and jaundice medicine. The results of meniran extract have been shown to be immunomodulatory or able to stimulate a person's immune system so that it is immune to disease attacks [6].

Sambiloto (*Andrographis paniculata*) is a type of medicinal plant that contains the chemical compound andrographolide (along with several analogues), paniculide, farnesol, arabinogalactan protein, flavonoids, saponins, alkaloids, phenols, and tannins. Sambiloto has properties in diseases such as fever, gastric infection, respiratory infection, malaria fever, diabetes complications, protects against liver diseases, antiviral, immunostimulator and suppresses retenosis in angiosplastic patients [7].

Nowadays, instant and practical things were also popular. It is hoped that the production of herbal drinks make it easier for consumers or someone to consume healthy drinks with an efficient aspect. Therefore this paper is made to see the potential of instant herbal beverages to see antioxidant activity.

2. Materials and Methods

2.1. Preparation of ingredients for instant herbal beverages
The ingredients used for the making of instant herbal beverages *sambiloto*, *meniran*, ginger, curcuma, lemongrass and palm sugar. These materials are purchased at the Malang traditional market, East Java, Indonesia. The material was cleaned, peeled and cut.

The research design was carried out by comparing the ingredients of the two formulas made to see the best results through the parameters used. The first formula is the formula of *sambiloto*, ginger, lemongrass, curcuma and palm sugar. The second formula is *meniran*, ginger, lemongrass, curcuma and palm sugar. Making instant herbal beverages using [8] method, each ingredient in each formula has a ratio of 1: 1, as well as the addition of distilled water at the time of blending, which is 1: 1 with the total ingredients.

2.2. Analysis of instant herbal beverages
The analysis is conducted to determine the components of the ingredients for instant herbal beverages using physical and chemical analysis and analysis of antioxidant activity. Physicochemical analysis to obtain instant herbal beverages which is safe for consumption and the ability to dissolve when stirred. Physicochemical analysis using pH measurement test, calculation of ash content and moisture content. The water content is used by the drying method to determine the water content of the material produced. Analysis of antioxidant activity to determine antioxidant activity in instant herbal beverages which have the potential to increase body immunity using the DPPH test. The antioxidant analysis is seen from the IC50 value, if the resulting value is smaller, the value of the antioxidant activity is higher and it is calculated using the% antioxidant formula [9].
The ash content presented by a percent value calculated using the following formula:

\[
\% \text{ Ash} = \frac{\text{Difference in Wt. of Ash} \times 100}{\text{Wt. of sample}} \tag{1}
\]

The difference in wt. of Ash = \( W_3 - W_1 \) [10].

The water content calculated by the following formula [11]:

\[
\% \text{ Water} = \frac{\text{initial sample weight} - \text{final sample weight}}{\text{initial sample weight}} \times 100\% \tag{2}
\]

Analysis of the results used aims to determine the best formula for making powder for traditional herbal drinks. Each formula is compared from the analysis performed. Then, the analysis results adjusted to the existing standards in Indonesia. The best formula was selected with good analysis results according to the standards.

3. Results and Discussion

3.1 Physical test

3.1.1 pH measurement

The results of pH measurements from the ingredients of instant herbal beverages can be seen in Table 1. The highest pH value was found in Curcuma (Curcuma xanthorrhiza) of 7.1, while the lowest pH value was found in Red Ginger (Zingiber officinale var.) of 2.3.2. The pH value recommended for herbal instant beverages is at an optimum value of 5-7. This pH value is adjusted to the SNI 01-3553-1996 standard for drinking water having a value between 6.5 to 8.5. The results obtained indicate that the pH value of the instant herbal beverages ingredients is still within the range of the optimum pH standard for instant herbal beverages.

| Ingredient                      | pH Value |
|--------------------------------|----------|
| Sambiloto (Andrographis paniculata) | 6        |
| Meniran (Phyllanthus urinaria)    | 5.4      |
| Red Ginger (Zingiber officinale var.) | 2.3-2    |
| Curcuma (Curcuma xanthorrhiza)    | 7.1      |
| Lemongrass (Cymbopogon citratus)  | 4.34     |

3.2 Chemical test

3.2.1 Ash content

The ash content produced by meniran extract is 2.8186% [6] and sambiloto is 8.4% [7]. Content value in a sample that exceeds the SNI quality limit is due to the addition of compounds containing many minerals such as sugar cane and sap so that when burned it leaves ash marks. Based on the SNI quality standard (01-4320-1996) the value of ash content for powder drinks is allowed to be a maximum of 1.5%. So that the ash content of instant herbal beverages that have been studied depends on the added sweetener, if the added sweetener contains high enough minerals, the ash content in instant herbal beverages be even higher. Table 2 describes the results of the ash content of each potential ingredient for the production of instant herbal beverages. The lowest value of ash content is found in curcuma, namely 3.10%-9.20%. The highest value of ash content is found in sambiloto, which is 8.4%. Analysis of ash content is important because can be regarded as a common indicator of product quality and determine food adulteration. Total ash content may be used to show the nutritional value of food products. Nutritional information is obtained by implementing elemental analysis on the resulting ash content precisely [15].
Table 2. Ash content of ingredients for instant herbal beverages.

| Ingredient                      | Ash content (%) |
|---------------------------------|-----------------|
| Sambiloto (Andrographis paniculata) | 8.4             |
| Meniran (Phyllanthus urinaria)   | 2.8186          |
| Ginger (Zingiber officinale var.) | 4.79 - 5.67    |
| Curcuma (Curcuma xanthorrhiza)   | 3.10 - 9.20     |
| Lemongrass (Cymbopogon citratus) | 4.11 [12]       |

3.2.2 Water content

Water content is used to determine the effect on the shelf life of instant herbal beverage products because products that have high water content can reduce shelf life. Table 3 describes the results of the moisture content of each potential ingredient for the production of instant herbal beverages. The water content of meniran extract is 13.51% [6], while sambiloto water content is 8.16 [7]. Water content for red ginger extract is 3.70% the lowest and 4.11% the highest [13], curcuma and lemongrass have water content at 1.19-5.08 [14] and 8.52 [12], respectively. The highest value is owned by meniran at 13.51%. Determining moisture content can generate solid content and conversely. And also, the chemical, physical and microbial stability of the ingredients of food products is affected by the properties of water. The factor that affecting the rate of moisture removal is temperature, air velocity, drying time, humidity, pressure, and vacuum [15].

Table 3. Water content of ingredients for instant herbal beverages.

| Ingredient                      | Water content (%) |
|---------------------------------|-------------------|
| Sambiloto (Andrographis paniculata) | 8.16              |
| Meniran (Phyllanthus urinaria)   | 13.51             |
| Red Ginger (Zingiber officinale var.) | 3.70-4.11        |
| Curcuma (Curcuma xanthorrhiza)   | 1.19-5.08         |
| Lemongrass (Cymbopogon citratus) | 8.52              |

3.4 Antioxidant activity test using DPPH

The antioxidant activity of ingredients from instant herbal beverages can be seen in Table 4. From this table, it can be seen that red ginger and curcuma have very strong antioxidant activity, while lemongrass has strong antioxidant activity, but meniran and sambiloto have very weak antioxidant activity. The difference in antioxidant activity in each of these materials can be caused by several factors, including the method of extracting the ingredients and the active compounds present in these ingredients.

The lower the IC50 value, the higher the antioxidant activity of the ingredient. Antioxidants in a material have three ranges, a material is said to have very strong antioxidants when the IC50 value is less than 50 µg / ml, strong when the IC50 is 50-100 µg / ml, moderate when the IC50 value is 100-150 µg / ml and weak when IC50 values 151 -200 µg / ml [16].

Table 4. Antioxidant activity of ingredients for instant herbal beverages.

| Ingredient                      | Antioxidant Activity (µg/mL) |
|---------------------------------|------------------------------|
| Sambiloto (Andrographis paniculata) | 1018.75                     |
| Meniran (Phyllanthus urinaria)   | 246.01                      |
| Red Ginger (Zingiber officinale var.) | 8.29 ± 1.73                |
| Curcuma (Curcuma xanthorrhiza)   | 10.5                         |
| Lemongrass (Cymbopogon citratus) | 72.4 ± 3.4                   |
4. Conclusions
Instant herbal beverages have the potential as antioxidant drinks that can increase the body's immunity for those who consume it. The use of method type in the process of making instant herbal beverages affect the parameters used in this study. The highest pH value was found in Curcuma (Curcuma xanthorrhiza) of 7.1, while the lowest pH value was found in Red Ginger (Zingiber officinale var.) of 2-3.2. Curcuma has the lowest moisture content with a value range of 1.19%-5.08% and the highest value from meniran at 13.51%. The lowest value of ash content is found in ginger, namely 3.10% -9.20% and highest value is found in sambiloto at 8.4%. Red ginger and curcuma have very strong antioxidant activity, while lemongrass has strong antioxidant activity, but meniran and sambiloto have very weak antioxidant activity.

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