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Antioxidant Activity of Arabian Leaves (*Ziziphus spina-christi* L) and Cinnamon (*Cinnamomum burmannii* (*Nees & T. Nees*) Blume) Herbal Tea

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ABSTRACT

Herbal tea is a drink made from the roots, stems, flowers, leaves, seeds and fruit skin of plants which have medicinal plant benefits, easily dissolved in hot water. Herbal tea is beneficial for health because it can act as an antioxidant, namely flavonoid and phenolic compounds which can ward off free radicals. The aim of the research was to determine the antioxidant activity and physical quality of herbal tea from Arabic bidara leaves and cinnamon. Quantitative research method with descriptive design. The tests carried out were physical quality, qualitative flavonoids, quantitative flavonoids and antioxidant activity using a spectrophotometer. The results of the physical quality of chopped herbal tea have a brownish yellow color, a characteristic tea odor, and a characteristic bitter taste of tea. Qualitative flavonoid tests showed that herbal tea contained flavonoid compounds in the flavonol group due to the orange color that was formed, then continued with a test to determine total flavonoid levels with results of 14.382%. The antioxidant activity of herbal tea shows a very strong antioxidant category.

INTRODUCTION

In Indonesia, tea is a drink that is popular with people, drinking tea has become a habit. Tea can be used to refresh or relieve fatigue after carrying out daily routines, which can be served warm or cold. The habit of drinking tea is not only known in Indonesia but also throughout the world. In the midst of the invasion of various brands of soft drinks, soda or isotonics, the habit of drinking tea is still very popular in Japan, China, Vietnam, Egypt, Ireland, England and several European countries (1).

Herbal tea is a drink made from the roots, stems, flowers, leaves, seeds and fruit skins of plants which have benefits as medicinal plants, dissolve easily in hot water and are easy to prepare

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and do not contain caffeine, so they are suitable for use as a body detoxifier (2). Herbal tea made from leaves has health benefits because of the content contained in the leaves. One plant that can be used as herbal tea is bidara leaves. Several types of bidara that are widely known to the public are Upas Bidara, Sea Bidara, Chinese Bidara, Putsa/Indian Apple and Arabic/Sidr Bidara (3).

Arabic bidara leaves (*Ziziphus spina-christi* L) because this plant has various benefits for body health. The chemical contents found in bidara plants include alkaloids, flavonoids, polyphenols, tannins and terpenoids. Phenolic and flavonoid compounds influence antioxidant activity. Antioxidants have an important role in preventing degenerative diseases . Based on research (5), Arabic bidara leaf extract (Ziziphus Spina Christi. L.) contains very strong antioxidants of 90.9584 ppm. Arab bidara leaves (Ziziphus spina-christi L) have antioxidant, anti-inflammatory, antimicrobial, antifungal properties and prevent the emergence of tumors (6).

This herbal tea is made using the basic ingredients of Arabic bidara leaves (*Ziziphus spina-christi* L) and the addition of cinnamon (*Cinnamomum burmannii* (Nees & T. Nees) Blume) as a flavor so that the herbal tea tastes much better. Cinnamon (*Cinnamomum burmannii (Nees & T. Nees) Blume) is a type of bark which is generally used for various kinds* of businesses, including industrial drinks and foods, as well as medicines. The fragrant aroma of cinnamon bark (*Cinnamomum burmannii* (Nees & T. Nees) Blume) is often used as a flavoring, aroma in perfume and can also be used as medicine. Cinnamon (*Cinnamomum burmannii* (Nees & T. Nees) Blume) contains chemical compounds in the form of phenols, terpenoids and saponins which are a source of antioxidants (7). Test the flavonoid content using a spectrophotometer (8,9) . Activity is expressed as effective concentration IC_{50} (*inhibitory concentration*) (10).

To determine the content of herbal tea, quality tests are carried out in accordance with SNI No. 01-3836-2013. Flavonoid levels using spectrophotometry (9).

METHOD

This research method is quantitative in the form of numbers and qualitative in the form of numbers (35). Type of observational research. Observational research is research carried out using planned procedures, including, among other things, seeing, hearing and recording a number and level of certain activities that are related to the problem being studied. This research is intended to observe, see and record the results of organoleptic tests such as smell, color and taste as well as antioxidant activity.

This research design uses a descriptive research design. Descriptive research is research carried out with the main aim For make description or description about something circumstances objectively (37).

The materials used in this research were green tea, Arabic bidara leaves, cinnamon, distilled water, PA ethanol (*Merck*), Mg metal powder, concentrated HCl (*Merck*), quercetin (*Sigma Aldrich*), $AlCl_3$, 5% acetic acid 1, 1-diphenyl-2-picrylhydrazyl (DPPH). The tools are as follows: spatulas, test tubes (*Pyrex*), test tube racks, beakers (*Pyrex*), measuring cups (*Pyrex*), measuring

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flasks (*Pyrex*), micropipette, water bath, vortex (*Thermo scientific*), tongs, glass funnel (*Pyrex*), stir bar, cup, dropper pipette, oven (*Sense*), desiccator, crucible, cuvette, porcelain cup, UV-Vis spectrophotometer (*Raptor*).

Research steps

a. Preparation phase

Arabian bidara leaf plants. (*Ziziphus spina-christi* L).

b. Implementation stage

1) Preparation of raw materials

The first raw material for tea plants used was obtained from the Medini tea garden, Ngesrepbalong village, Limbangan District, Kendal Regency, Central Java. The second raw material is Arabic bidara leaves (*Ziziphus spina-christi* L) obtained from the Kalitan bidara garden, Kertonatan Kartasura.

2) Making simplicia chops

The tea leaves, Arabic bidara leaves and cinnamon that will be used are sorted first. The tea leaves, Arabic bidara leaves and cinnamon that have been sorted are washed and then drained. Then the withering process is carried out by leaving it at room temperature for 14-24 hours.

3) Making simplicia chops

Each slice of simplicia is prepared and then combined into one product with the formulation in Table 1.

Table 1. Herbal tea powder formula

Composition	Amount (%)
Chop green tea leaves	80
Chop the bidara leaves	16
Cinnamon chop	4

The extracts of green tea leaves, Arabic bidara leaves and cinnamon refer to Meilinda's (2015) modification, namely 10 grams of simplicia chopped green tea leaves, Arabic bidara leaves and cinnamon.

c. Testing

1) Organoleptic testing

Organoleptic tests were carried out by researchers' senses including smell, color and tast (38).

2) Water content testing

The sample was weighed to ± 2 grams and then placed in a cup, the cup was dried in the oven again so that a constant weight was obtained (AOAC, 2005).

Water content = $\frac{W_1 - W_2}{W}$ x 100%

Information:

W: sample weight before drying (grams)

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W_1 : empty weight + sample (grams)

W_2 : empty weight + sample after drying (grams)

3) Ash content testing

Calculation of ash content, using the formula:

$$= \frac{W_1 - W_2}{W} \times 100\%$$

Information:

W: sample weight before ashing (grams)

W_1 : empty weight + cup after ashing (grams)

W_2 : weight of empty cup (grams)

4) Flavonoid test tube test method

The test is carsried out three times, the color is orange, yellow or red, this indicates flavonoids (40).

5) Analysis of Flavonoid Levels

a) Preparation of 200 ppm quercetin solution

b) Preparation of a working standard solution of 100 ppm quercetin

c) Creation of a calibration curve

d) Determination of total flavonoid levels

The sample was added with ethanol in a 10 ml measuring flask (42) .

6) Activity Antioxidant

a) Preparation of solution

The solution was prepared by weighing 2.5 mg DPPH into 50 ml ethanol pa to obtain a DPPH solution of 50 ppm (43) .

b) Wavelength

c) Preparation of blank solution

d) Determination of antioxidant activity

e) Calculation IC_{50}

The formula for calculating (44):

Sample Inhibition = $\frac{Abs\ kontrol - Abs\ sampel}{Abs\ kontrol} x\ 100\%$

Information :

% Inhibition: percentage of DPPH free radical capture

Abs control: DPPH absorbance

Abs sample: absorbance of the extract after reaction with DPPH.

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RESULT

1. Making herbal tea chops

Table 2. Composition of Chopped Herbal Tea

Material Composition	Amount	Material weight in 10 grams	Chopping Weight
Chopping Tea Leaves	80%	8 grams	10 grams
Chopped Bidara Leaves	16%	1.6 grams	10 grams
Cinnamon Chop	4%	0.4 grams	10 grams

Parameters tested from herbal tea of arabic bidara leaves (*Ziziphus spina-christi* L) and cinnamon (*Cinnamomum burmannii* (Nees & T. Nees) Blume) including organoleptic tests, water content tests, ash content tests, qualitative and quantitative flavonoid tests, and antioxidant activity tests.

2. Organoleptic test

Organoleptic tests were carried out to determine the physical quality of herbal tea from Arabic bidara leaves (*Ziziphus spina-christi* L) and cinnamon (*Cinnamomum burmannii* (Nees & T. Nees) Blume) includes color, smell and taste.

Table 3. Organoleptic Tests on Herbal Tea Brews

Test Criteria	Results
Color	Brownish yellow
Smell	Typical tea
Flavor	Typical bitterness of tea

Organoleptic test results of herbal tea drinks from Arabic bidara leaves (*Ziziphus spina-christi* L) and cinnamon (*Cinnamomum burmannii* (Nees & T. Nees) Blume) It has a brownish yellow color, has a distinctive tea smell, and a bitter tea taste.

3. Test the water content

Content test aims to determine the level of water content in herbal tea from Arabic bidara leaves (*Ziziphus spina-christi* L) and cinnamon (*Cinnamomum burmannii* (Nees & T. Nees) Blume) . Water content test results in table 4.

Table 4. Water Content Test in Herbal Tea

Testing	Standard	Levels (Mean ± SD)
Water content	Max 8.0%	6.31 ± 0.91

The results of the water content test of herbal tea of arabic bidara leaves (*Ziziphus spina-christi* L) and cinnamon (*Cinnamomum burmannii (Nees & T. Nees) Blume) with three replications showed* an average result of 6.31 ± 0.91.

4. Test the ash content

Content test aims to determine the mineral content of herbal tea from Arabic bidara leaves (*Ziziphus spina-christi* L) and cinnamon (*Cinnamomum burmannii* (Nees & T. Nees) Blume).

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The results of the ash content test for herbal tea of arabic bidara leaves (*Ziziphus spina-christi* L) and cinnamon (*Cinnamomum burmannii* (Nees & T. Nees) Blume) are in Table 5.

Table 5. Ash Content Test in Herbal Tea

Testing	Standard	Mean ± Standard Deviation
Ash content	Max 8.0%	7.63 ± 0.12

5. Flavonoid test

The flavonoid test was carried out to determine the presence of flavonoid content in herbal tea samples of arabic bidara leaves (*Ziziphus spina-christi* L) and cinnamon (*Cinnamomum burmannii* (Nees & T. Nees) Blume) which has potential as an antioxidant. The flavonoid test consists of qualitative and quantitative flavonoid tests.

a) Qualitative test of flavonoids

A qualitative flavonoid test was carried out to determine the presence of flavonoid compounds in the herbal tea of arabic bidara leaves (*Ziziphus spina-christi* L) and cinnamon (*Cinnamomum burmannii* (Nees & T. Nees) Blume) . Qualitative test results in Table 6.

Table 6, Qualitative test of flavonoids in herbal tea

Sample	Results	Interpretation (+/-)	Flavonoid Group
Herbal tea of Arabic bidara leaves and cinnamon	Orange yellow	+	Flavonols

Qualitative test results of flavonoids in herbal tea of Arabic bidara leaves (*Ziziphus spina-christi* L) and cinnamon (*Cinnamomum burmannii (Nees & T. Nees) Blume)*. The flavonol group is characterized by the formation of an orange-yellow color.

b) Quantitative test of total flavonoids

A quantitative test of total flavonoids was carried out to determine the flavonoid levels in herbal tea samples of arabic bidara leaves (*Ziziphus spina-christi* L) and cinnamon (*Cinnamomum burmannii* (Nees & T. Nees) Blume) which was analyzed using a UV-Vis Spectrophotometer.

c) Wavelength

The wavelength is carried out in the range 400-430. The maximum wavelength of the quercetin standard solution obtained was 416 nm and the absorbance value was 0.572.

d) Calibration curve

curve measurements using concentrations of 40, 60, 80, 100 and 120 ppm with a maximum wavelength (λmax) of 416 nm. Quercetin absorbance values are in Table 4.6.

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Table 7. Absorbance Standard curve

Concentration	Absorbance
40	0.254
60	0.356
80	0.454
100	0.555
120	0.647

The standard curve absorbance results show that concentrations of 40, 60, 80, 100, and 120 ppm have quercetin absorbance in the range of 0.2 - 0.8. Next, the calibration curve is determined. Calibration curve in the image below:

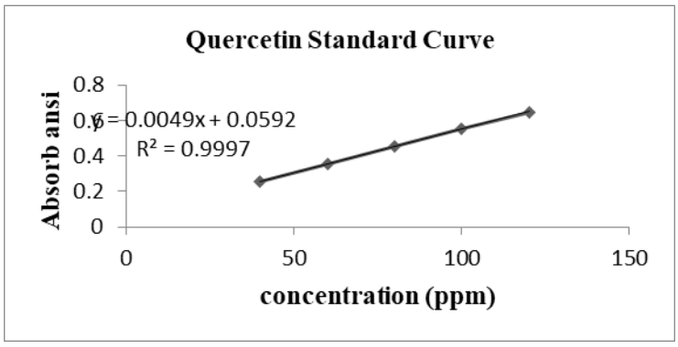

Figure 1. Calibration curve

The quercetin calibration curve was obtained from y =0.0049x + 0.0592, R^2 = 0.9997.

e) Rate determination flavonoids total

Total flavonoid content of herbal tea of arabic bidara leaves (*Ziziphus spina-christi* L) and cinnamon (*Cinnamomum burmannii* (Nees & T. Nees) Blume) in Table 8.

Table 8. Results of determining total flavonoid levels

Concentration (ppm)	Absorbance	Rate Flavonoids(%)
800	0.623	14.382%

Level measurement results The total flavonoids in the herbal tea drink samples of Arabic bidara leaves and cinnamon were 14.382%.

f) Test activity antioxidant

Test activity antioxidant aim for know the power of antioxidants in warding off free radicals. The stages in determining antioxidant activity in this research include determining the maximum wavelength of DPPH, determining abasorbance and percent inhibition, determining the antioxidant activity of herbal tea of Arabic bidara leaves (*Ziziphus spina-christi* L) and cinnamon (*Cinnamomum burmannii (Nees & T. Nees) Blume).*

g) Wavelength

Wavelength in the range 510-530nm. Maximum wavelength 518nm, absorbance 0.765.

h) Determination % inhibition.

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Table 9. Results of % Inhibition

Concentration (ppm)	Control Absorbance	Absorbance	% Inhibition
10		0.664	13,567
20		0.568	26,094
30	0.769	0.468	39,055
40		0.375	51,192
50		0.260	66,103

Sample of Arabic bidara leaf herbal tea and cinnamon, the linear regression equation y = 1.3017x + 0.1517 with R^2 = 0.9988 was obtained. Inhibitory curve of herbal tea of arabic bidara leaves (Ziziphus spina-christi L) and cinnamon (Cinnamomum burmannii (Nees & T. Nees) Blume) in Figure 2.

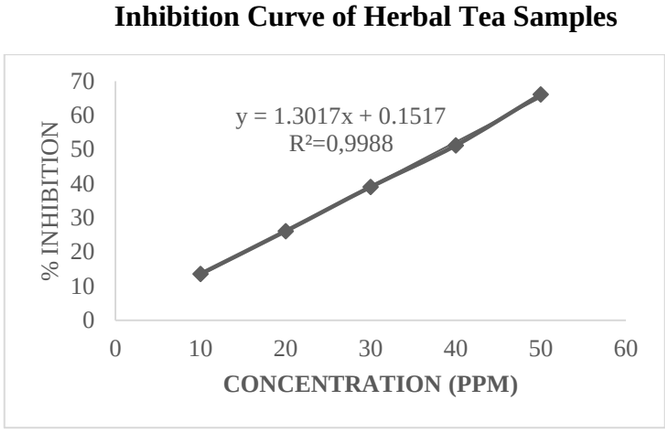

Figure 2 Herbal tea inhibition curve

i) Antioxidant activity

Antioxidant activity of herbal tea samples of Arabic bidara leaves and cinnamon is in Table 10.

Table 10. Antioxidant activity test results

Formulation	IC50 (mg/L)	Antioxidant Properties
F1	38,294	Very strong

The antioxidant activity test results showed an IC_{50} value for the sample herbal tea of arabic bidara leaves (*Ziziphus spina-christi* L) and cinnamon (*Cinnamomum burmannii* (Nees & T. Nees) Blume) amounted to 38.294 mg/L which shows that herbal teas have characteristic antioxidant Which very strong.

DISCUSSION

On study This herbal tea drink from Arabic bidara leaves (*Ziziphus spina-christi* L) and cinnamon (*Cinnamomum burmannii* (Nees & T. Nees) Blume) which has made done testing with organoleptic parameters , water content test, ash content test, flavonoid qualitative test, quantitative test flavonoids, And test activity antioxidant. Objective did it testing This is to determine the

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physical quality and antioxidant activity of herbal tea from arabic bidara leaves (*Ziziphus spina-christi* L) and cinnamon (*Cinnamomum burmannii* (Nees & T. Nees) Blume). Stage making chopped herbal tea started with weigh the weight of simplicia tea leaves, arabic bidara leaves and cinnamon as in table 4.

The results obtained are in accordance with SNI 01-3836-2013 concerning dry tea quality standards which states that dry tea must have a yellowish green to brownish red color, a distinctive tea smell and taste.

The water content test results were found to be 6.31 % . The results obtained are in accordance with SNI 01-3836-2013 concerning herbal tea quality standards which states that the water content of herbal tea is a maximum of 8%. Determining the water content of herbal tea products needs to be done because it is closely related to determining the quality (24) .

The results obtained are in accordance with SNI 01-3836-2013 concerning herbal tea quality standards which states that the ash content of herbal tea is a maximum of 8%. Ash content is all the inorganic or mineral components contained in a food ingredient.

Total flavonoids are the total content of secondary metabolite compounds from a plant. The total flavonoid content was measured based on the presence of quercetin in plant extracts because quercetin is the most active substance in flavonoids so that quercetin represents other flavonoid compounds. Quantitative analysis of total flavonoids in herbal tea from Arabic bidara leaves and cinnamon using the UV-Vis spectrophotometric method. The test begins with determining the maximum wavelength determined with a quercetin solution. The maximum wavelength is the wavelength with the highest or maximum absorbance. Determining the maximum wavelength is carried out to find out what the maximum absorption value is in the sample, so that the measurement results are accurate and minimize. The antioxidant activity of functional drinks is expressed as *Inhibitor Concentration* 50 (IC_{50}).

CONCLUSION

The antioxidant activity of herbal tea from Arabic bidara leaves (*Ziziphus spina-christi L*) and cinnamon (*Cinnamomum burmannii (Nees & T. Nees)* Blume) falls into the category of very strong antioxidants. Herbal tea from Arabic bidara leaves (*Ziziphus spina-christi L*) and cinnamon (*Cinnamomum burmannii (Nees & T. Nees)* Blume) contains flavonoid compounds in the flavonol group.

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