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Original Article

Comparison of Antioxidants in Red Ginger Powder Preparations with the Addition of Sucrose and Red Ginger Powder Preparations Without the Addition of Sucrose

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ABSTRACT

Antioxidants are compounds that can inhibit oxidation reactions in the human body. Antioxidants can be obtained from food intake. Intake containing antioxidant compounds can also be found in red ginger. Red ginger is available in the form of instant powder obtained through a crystallization process using sucrose as the main agent. Granulated sugar has a sucrose content of 99.95% and functions as a sweetener as well as a crystallization agent that affects the speed of crystallization. This study aims to determine the comparison of antioxidant levels contained in red ginger powder with the addition of sucrose and without the addition of sucrose. The research design used was experimental research design by testing the comparison of antioxidant compound activity between red ginger powder added sucrose and red ginger powder without added sucrose using DPPH reagent measured by spectrophotometer. The measurement of antioxidant content showed that red ginger powder without added sucrose has a very strong IC50 value of antioxidant activity with a value of 46.12 ppm while red ginger powder without added sucrose has a weak IC50 value of antioxidant activity with a value of 205.47 ppm. The results of antioxidant activity testing on both red ginger powders were then statistically tested using the unpaired T-Test test with a p-value <0.05 which means significant. It can be concluded that there is a significant difference in antioxidant activity values between red ginger powder without added sucrose and red ginger powder with added sucrose.

Keywords: *Powder, Red Ginger, Antioxidants, Sucrose, DPPH.*

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INTRODUCTION

The current modern era and the rapid development of technology and science as well as changes in people's lifestyles to a more practical life can be the cause of the formation of free radicals. Free radicals can enter and form in the body through breathing, unhealthy environmental conditions, and foods containing fat[1–3].

Free radicals react with proteins, fatty acids, and even DNA so that they can cause cell and tissue damage which is the root of various diseases. The above conditions cause the body to need an intake containing antioxidant compounds which are able to capture and neutralize free radicals. Antioxidants can be defined as compounds that are able to delay, slow down, or inhibit oxidation reactions. One intake that contains antioxidant compounds is ginger[1,3,4].

Ginger is a spice plant that originates from South Asia and has spread throughout the world. Apart from being used as a cooking spice, people in Asia, one of which is Indonesia, also use the ginger plant as a traditional medicinal plant. In research conducted by Rahmin Munandi (2018), the results showed that one type of ginger, namely red ginger, contains tannins, flavonoids, saponins, alkaloids and terpenoids which have very strong antioxidant activity.[5–7].

Red ginger in fresh form has a fairly short shelf life, therefore it is necessary to process ginger in various preparations so that it can be used for a long period of time. One of the processed red ginger preparations available to the public is processed red ginger in instant powder form. Preparations in instant powder form have several advantages, including being more practical in serving and having a long shelf life. Preparations in powder/instant powder form are usually made through a crystallization process using the main crystallization agent, namely sucrose. Granulated sugar has a sucrose content of 99.95% and functions as a sweetener and as a crystallization agent which influences the speed of crystallization[8–11].

Based on the description above, researchers are interested in comparing the antioxidant activity between red ginger powder with the addition of sucrose and red ginger powder without the addition of sucrose.

METHOD

This research uses an experimental type of research using the DPPH method. The research was carried out in the Pharmacognosy-Phytochemistry laboratory, Faculty of Pharmacy, Indonesian Muslim University, which was carried out in November-December 2023. The variables in this study were red ginger powder with added sucrose and red ginger powder without added sucrose as the independent variable and antioxidant content as the dependent variable. The samples in this study were red ginger that met the inclusion criteria, namely red ginger that was large and felt hard, ginger with smooth and dry skin, and was still fresh.

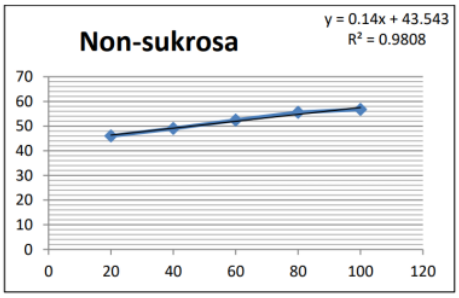
The tools used in this research are analytical scales, filter paper, blender, chemical glass/beaker, aluminum foil, dropper pipette, UV-Vis spectrophotometer, sieve, rotary evaporator, measuring flask, soaking container, drying cabinet. Meanwhile, the materials used were red ginger samples that had been made into powder, 96% ethanol, DPPH reagent and sucrose solution. Quercitin. Data analysis was carried out by calculating and analyzing the IC50 value obtained from the linear regression equation using the Microsoft Excel program via the T-test method. The smaller the IC50, the stronger the antioxidant activity.

RESULTS

Table 1. Antioxidant Activity Test Results on Red Ginger Powder Without Added Sucrose

Concentration	Absorbance	% inhibition	IC 50	Antioxidant activity
20	0.567	46.00	46.12	Very strong (IC50 < 50)
40	0.535	49.05		
60	0.500	52.38		
80	0.467	55.52		
100	0.454	56.76		

Based on the table above, it can be seen that as the concentration increases, the % inhibition increases and the absorbance value decreases. The linear regeneration curve equation for calculating antioxidants in red ginger powder without the addition of sucrose can be seen below.



Picture1. Graph of concentration and % inhibition of red ginger powder extract without the addition of sucrose

Table 2. Antioxidant activity test results red ginger powder with the addition of sucrose

Concentration	Absorbance	% inhibition	IC50	Antioxidant activity
20	0.585	44.29	205.47	Weak (IC50 150-200)
40	0.579	44.86		
60	0.570	45.71		
80	0.563	46.38		
100	0.561	46.57		

From the table above it can be seen that as the concentration increases, the % inhibition increases and the absorbance value decreases. The linear regeneration curve equation for calculating antioxidants in red ginger powder with the addition of sucrose can be seen below.

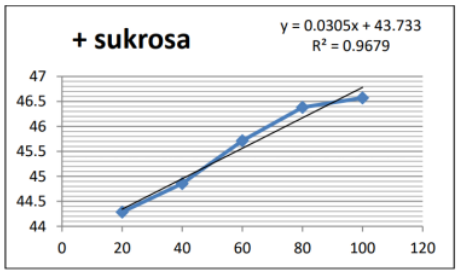


Figure 2. Graph of concentration and % inhibition of red ginger powder extract with the addition of sucrose

Based on the data that has been presented, the results obtained from calculating antioxidant activity using the linear regression equation y = ax + b show that the antioxidant activity value of red ginger without added sucrose (table 1 and graph 1) is stronger than the antioxidant activity of red ginger powder with added sucrose. (table 2 graph 2).

Red Ginger Powder Phytochemical Screening Test Results

Table 3. Phytochemical Screening Test Results for Red Ginger Powder Without Sucrose

No	Compound Classes	Reactor	information
1	Tannin	FeCl3	(+) Tannin
2.	flavonoids	AlCl3	(+) flavonoids
3.	steroids	Liberman Bauchardat	(-) steroids
4.	Soponin	Hot water + Hcl 2N	(-) soponin
5.	alkaloids	mayer	(+) alkaloids
		Dragendrof	(+) alkaloids
		bauchardat	(+) alkaloids

From the table above, it can be seen that red ginger powder without added sucrose contains secondary metabolite compounds in the form of tannins, flavonoids and alkaloids.

Table 4. Phytochemical Screening Test Results for Red Ginger Powder with Sucrose

No	Compound Classes	Reactor	Information
1	Tannin	FeCl3	(+) Tannin
2.	flavonoids	AlCl3	(+) flavonoids
3.	steroids	Liberman Bauchardat	(-) steroids
4.	Soponin	Hot water + Hcl 2N	(-) soponin
5.	alkaloids	mayer	(-) alkaloids
		Dragendrof	(-) alkaloids
		bauchardat	(+) alkaloids

From the table above, it can be seen that red ginger powder to which sucrose is added contains secondary metabolite compounds in the form of tannins, flavonoids and alkaloids.

Based on the results of phytochemical screening on the two red ginger powders, it was found that both red ginger powders both contain secondary metabolite compounds in the form of tannins, flavonoids and alkaloids.

Table 5. Comparison Test Results for Antioxidant Activity Using Independent Sample T-Test

	Sig. (2-tailed) P-Value < 0.05
Red ginger without sucrose and plus sucrose	.014
	.031

In the table above you can see the significance value (2-tailed) for both powder

samples, namely <0.05. From this data it can be determined that H1 is accepted and H0 is rejected. This indicates that there is a significant difference in levels of antioxidant activity in the two powders.

DISCUSSION

Measurement of Antioxidant Activity of Red Ginger Powder Samples Without Addition of Sucrose

Based on table 1 and graph 1 presented, it can be seen that testing samples of red ginger powder extract without added sucrose were made with 5 concentrations, namely 20, 40, 60, 80 and 100 ppm. After that, we continued calculating the antioxidant activity values using a linear regression equation. The R2 value obtained for red ginger powder extract which did not add sucrose was 0.9808 with a value = 0.14 and b value = 43.543. where the R2 value illustrates that as the concentration of the extract increases, the antioxidant activity will also increase[12–14].

Based on the IC50 value calculation carried out on samples of red ginger powder extract without added sucrose, the IC50 value was 46.12 ppm.where this value is classified as very strong antioxidant activity (<50 µg/mL). This can be caused because the compounds contained in the red ginger powder preparation without the addition of sucrose are still pure. As mentioned in research conducted by Irma Erika Herawati and Nyi Mekar Saptarini in 2019, it is known that red ginger contains compounds in the form of flavonoids, tannins and alkaloids. All of these structures have hydroxyl groups that can donate hydrogen to interact with DPPH radicals to produce DPPH-H. Apart from that, red ginger also contains the compound zingerone, which is one of the active non-volatile phenolic compounds which has been proven to have the ability to act as an antioxidant.[6,15,16].

Another thing that can influence the high levels of antioxidant activity in sediThe reason why red ginger powder does not have added sucrose is the total phenol content contained in red ginger powder. The greater the ratio of red ginger powder to ethanol, the higher the instantaneous total phenol content of red ginger, the higher the antioxidant activity. In the data displayed, it can be seen that the greater the concentration of the red ginger powder solution without sucrose, the more antioxidant compounds will become hydrogen or electron donors for DPPH radicals, resulting in a change in the color of DPPH which causes the resulting absorbance to be smaller. The presence of antioxidants in the test sample plays a role in neutralizing DPPH free radicals. Color loss will be proportional to the number of electrons taken by DPPH so it can be measured spectrophotometrically[17,18].

Measurement of Antioxidant Activity of Red Ginger Powder Samples with Sucrose Addition

Based on table 2 and graph 2, it can be observed that testing samples of red ginger powder extract with the addition of sucrose was carried out by making 5 concentration series, namely 20, 40, 60, 80 and 100 ppm, then antioxidant testing was carried out using a linear regression equation to obtain a value of R = 0.9679. The R value illustrates that the greater the concentration of the extract, the greater the antioxidant activity. Based on antioxidant activity test data, the IC50 value of red ginger powder extract with the addition of sucrose was obtained from the results of linear regeneration calculations. The y variable in this linear regression equation is IC50, the variables a and b are constants while the x variable acts as the concentration needed to reduce 50% of DPPH radicals.[12–14].

In the sample of red ginger powder extract which added sucrose, a linear regression equation was obtained, namely y = 0.305x + 43.733 and R2 = 0.9679. Then proceed with calculating the antioxidant value and the result was 205.47 ppm, which is classified as a weak antioxidant (> 150 µg/mL). This is possibly caused by the sucrose content in the red ginger powder preparation which can inhibit the active compounds contained in the red ginger powder. As a result, the antioxidant activity contained in red ginger powder decreases and results in secondary metabolite compounds which act as antioxidants being damaged even though the antioxidants are naturally found in food. This research is also in line with research conducted by Anis Usfah Prastujati et al in 2023 with the results that the addition of sucrose can affect the reduction of antioxidant activity[6,19–21].

Differences in Antioxidant Activity in Red Ginger Powder with Sucrose Added and Red Ginger Powder without Sucrose Added

In this study, the comparison of antioxidant activity of red ginger powder with added sucrose and that without added sucrose was tested using the T-test method. T-test or T-test is one of the testing methods of parametric statistical tests. T-Test This test aims to compare or compare whether the average of a population or 2 populations has significant differences. The T-test is divided into two, namely the dependent t-test and the independent t-test. In this study, the independent t-test was used. The term independent sample t test is a test of unrelated or unpaired samples (independent samples). Comparative test data on antioxidant activity between red ginger powder with added sucrose and red ginger powder without added sucrose can be seen in the table[5,22–24].

From the results presented in table 5, it can be concluded that there is a significant difference in antioxidant activity between red ginger powder without addition and red ginger powder with added sucrose. There are several factors that can cause a decrease in antioxidant activity, some of which are drying time, temperature, heating time, processing process and mixture of other ingredients. In this study, the decrease in antioxidant activity in red ginger powder was caused by the addition of sucrose to one of the powders. Added sucrose can affect antioxidant activity because it can reduce methylation groups and H atoms, resulting in a reduction in H atoms, where H atoms are free radical hydrogen donors and can also degrade antioxidant compounds. This is different from red ginger powder which does not add sucrose. The compounds contained in red ginger powder without the addition of sucrose are natural compounds that act as antioxidants[16,25–28].

CONCLUSIONS

Based on the results and discussion of the research, it can be concluded that there is a significant difference in antioxidant levels in red ginger powder added with sucrose and red ginger powder added with sucrose. Red ginger powder without the addition of sucrose contains secondary metabolite compounds in the form of tannins, flavonoids and alkaloids. Meanwhile, red ginger powder with the addition of sucrose contains secondary metabolite compounds in the form of tannins, flavonoids and alkaloids. This research provides an illustration that red ginger powder will be very beneficial for health because it contains very strong antioxidants when consumed without the addition of sucrose (sugar). Future researchers are advised to carry out further research on the effects of antioxidants and test them clinically, examine further what compounds are contained in red ginger powder with added sucrose and red ginger powder without added sucrose and can carry out comparative tests of antioxidant levels in red ginger powder with different methods.

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