White Tea Leaf Extract Fraction (*Camellia sinensis* L.) has Promising Antioxidant Activity

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Abstract. Tea is known to have antioxidant activity because it contains polyphenol compounds. One type of tea leaf based on its processing is white tea. White tea also contains polyphenol compounds. This study aims to determine class of compounds with antioxidant properties in white tea leaves and the antioxidant activity of white tea leaf extract fractions. Identification of groups of compounds with antioxidant properties in white tea leaves was carried out by phytochemical screening. White tea leaf extract was obtained by maceration method using 96% ethanol solvent. Furthermore, the extract fraction was obtained by liquid-liquid extraction. The antioxidant activity test was carried out using the DPPH method and obtained IC_{50} values . The results showed that polyphenol compounds were detected in white tea leaves and The IC_{50} for the ethyl acetate fraction of 2.12 ppm, and the water fraction of 3.85 ppm. The n-hexane fraction could not be obtained in sufficient quantities so that measurements could not be carried out. In white tea leaves, polyphenol compounds have been detected which have antioxidant properties and the ethyl acetate fraction and the water fraction of white tea leaves showed very strong antioxidant potential.

Keywords: White tea leaves, DPPH, IC_{50}, antioxidant activity.

A. Introduction

Free radicals are molecules whose presence in the body must be monitored. In normal amounts, free radicals can be beneficial for health because they help fight the entry of foreign substances into the body, such as fighting inflammation and killing bacteria. However, in excessive amounts, free radicals can cause oxidative stress, a condition where there is an imbalance between free radicals and the antioxidants produced by the body. Free radicals have one or more unpaired electrons and are reactive. They will try to stabilize themselves by seeking electron pairs from stable molecules. This can then cause cell damage and can trigger degenerative diseases such as hypertension, diabetes, cancer, stroke, and so on. Therefore, the stability of free radicals in the body needs to be maintained by using antioxidants (Nurkhasanah et al., 2023).

Tea leaves have high antioxidant activity that can provide several health benefits to the body including cardioprotective (good for the heart), neuroprotective (good for nerves), as an antidiabetic, anticancer, and antimicrobial. White tea is one type of tea that is quite rare compared to other types of tea because white tea is picked from the peko shoots or unopened Camellia sinensis leaves and covered by fine silvery white hairs that are processed only by withering and drying processes that are generally done manually without the help of machines and no fermentation process is carried out (T. Anggraini, 2017). This unique picking process and minimal drying are thought to make the polyphenol content in white tea higher than other types of tea (Linnarto et al., 2019). Therefore, it is suspected that white tea leaves have strong antioxidant activity. This study aims to detect the presence of a group of compounds with antioxidant properties from white tea leaves and to prove its antioxidant potential before being developed into an antioxidant-rich preparation.

B. Methods

White tea leaf crude extract was collected. Extracts were then prepared using maceration using 90% ethanol. Phytochemical screening of the crude extract and the resulting ethanol extract was performed to identify the chemical compounds in the white tea leaf extract, which include: alkaloids, polyphenols, flavonoids, tannins, saponins, monoterpenoid-sesquiterpenoids, and triterpenoid-

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steroids. (Widyasanti, Rohdiana, *et al*., 2016).

The preparation of the extract fraction was carried out using the liquid-liquid extraction method using ethyl acetate, water and n-hexane solvents (Muhamad *et al*., 2017). Then, the ethyl acetate fraction, water fraction and n-hexane fraction from the white tea leaves obtained were tested for antioxidant activity using the DPPH (2,2-diphenyl-1-picrylhydrazyl) method to obtain the IC50 value (Widyasanti, Rohdiana, *et al*., 2016). Testing with the DPPH method was carried out by measuring the absorbance of DPPH at a wavelength of 510 nm using a UV-Vis spectrophotometer because the DPPH compound contains a chromophore group and an auxochrome group and is a compound that will produce a dark purple color with maximum absorption at a wavelength of 510 nm so that it can be identified using the UV-Vis spectrophotometry method. The parameter observed in the antioxidant activity test using the DPPH method is the IC50 (Inhibition Concentration 50%) value, which describes the concentration of the extract or test fraction capable of capturing 50% of free radicals. The antioxidant strength is listed in Table 1 (Utami, 2020).

Table 1. Antioxidant strength based on IC_{50} value (Utami, 2020)

Antioxidant Strength	IC_{50} value (ppm)
Very strong	< 50
Srong	50 - 100
Currently	100 - 150
Weak	151 - 200

Description: IC50 = Inhibition concentration or concentration required to inhibit 50% of free radicals

C. Result and Discussion

The white tea leaves used in this study were obtained from the producer in the form of dried herbal extracts. Furthermore, phytochemical screening was performed on the herbal extracts to detect the presence of chemical compounds. The yield of ethanol extract of white tea leaves was 35.32%. The ethanol extract of white tea leaves was also subjected to phytochemical screening to detect the presence of chemical compounds. The results of phytochemical screening on the herbal extracts and ethanol extracts are shown in Table 2. The herbal extracts and ethanol extracts of white tea leaves detected the presence of alkaloids, polyphenols, flavonoids, tannins, saponins, monoterpenoid-sesquiterpenoids, and triterpenoid-steroids. This is in line with the results of research conducted by other researchers (Lesli and Gunawan, 2019).

Table 2. Results of phytochemical screening of simplex and white tea leaf extract

Golongan Senyawa	Result	
	Simplisia	Extract
Alkaloid (*mayer*)	(+)	(+)
Alkaloid (*dragendorff*)	(+)	(+)
Polyphenols	(+)	(+)
Flavonoids	(+)	(+)
Tannin	(+)	(+)
Saponin	(+)	(+)
Monoterpenoid-Sesquiterpenoid	(+)	(+)
Triterpenoid-Steroid	(+)	(+)

Description:
(+) = Detected
(-) = Not detected

Based on the fractionation, the following results were obtained: ethyl acetate fraction of 0.9613 g (yield 9.613% %), water fraction of 3.1105 g (yield 31.105% %), while the n-hexane fraction obtained was too little so that measurements could not be carried out.

Antioxidant activity measurements were carried out on the ethyl acetate fraction, the water fraction of the ethanol extract of white tea. Vitamin C was used as a comparison. From the tests that have been carried out, the IC50 values of vitamin C, the ethyl acetate fraction and the water fraction were obtained and listed in Table 3. Based on the data in Figure 1, the linear regression equation for vitamin C was y = 2.2312x + 46.237 with an R^2 value of 0.9937. Based on this linear regression equation, the IC50 value was 1.69 ppm (table 1). Based on the strength of antioxidant activity as listed in table 1, vitamin C is proven to be an antioxidant with very strong activity, as has been known so far (Gegotek A and Skrzydlewska, 2023). This shows that the method is valid and the work procedure has been carried out correctly.

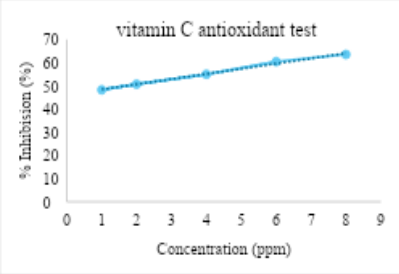

Figure 1. Vitamin C antioxidant test curve

From the data in Figure 2, a linear regression equation was obtained for the ethyl acetate fraction, namely y = 3.4812x + 42.635 with an R2 value of 0.9868 and an IC50 value of 2.12 ppm (table 3). A linear regression equation was obtained for the ethyl acetate fraction, namely y = 3.4812x + 42.635 with an R2 value of 0.9868 and an IC50 value of 2.12 ppm (table 3).

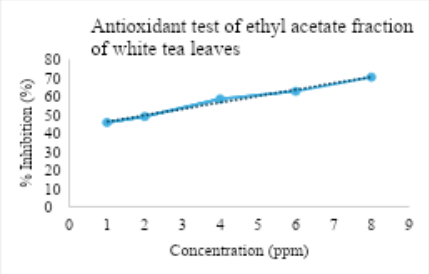

Figure 2. Antioxidant test curve of ethyl acetate fraction of white tea leaves

Then, from Figure 3, a linear regression equation for the water fraction was obtained, namely y = 2.3121x + 41.093 with an R2 value of 0.9484 and an IC50 value of 3.85 ppm (Table 3).

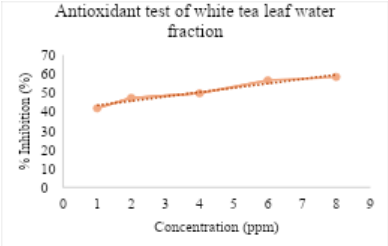

Figure 3. Antioxidant test curve of water fraction of white tea leaves

The IC50 value obtained indicates that the ethyl acetate fraction and the water fraction of the ethanol extract of white tea have very strong antioxidant activity because they have an IC50 value of less than 50 ppm referring to Table 1 regarding antioxidant strength. included in the category of very strong antioxidant strength. So it can be concluded that the ethyl acetate fraction and the water fraction

of the ethanol extract of white tea leaves have very strong antioxidant strength, but this result is still lower when compared to the ethanol extract, which is 1.14 ± 0.26 ppm (Rosidin et al., 2024).

Table 3. IC_{50} values of white tea extract fractions

Sample	IC_{50} (ppm)
Ethyl acetate fraction	2,12
Water fraction	3,85
Vitamin C	1,69

D. Conclusion

In the simplex and ethanol extract of white tea leaves, the presence of polyphenol compounds known to have antioxidant activity was detected. The concentration required for the ethyl acetate fraction of white tea leaves (Camellia sinensis L.) to inhibit 50% of free radicals (IC50) was 2.12 ppm and for the water fraction 3.85 ppm. The IC50 value obtained is included in the category of very strong antioxidant strength. Thus, the white tea leaf extract fraction has great potential to be developed as a preparation with antioxidant properties.

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