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Testing the Antioxidant Potential of Mango Leaves (Mangifera indica) from Bandar Khalipah Village, Deli Serdang Regency Using the FRAP Method

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ABSTRACT

This study aims to identify and analyze the antioxidant potential of mango leaves (Mangifera indica) sourced from Bandar Khalipah Village, Deli Serdang Regency. Mango leaves are known to contain various secondary metabolites such as flavonoids, tannins, saponins, alkaloids, glycosides, as well as steroids and triterpenoids, which play a crucial role as natural antioxidants. The extraction process was carried out by maceration using 96% ethanol, yielding a thick extract with a rendement of 117%. Phytochemical screening indicated the presence of active compounds in the mango leaf extract. Antioxidant capacity was measured using the FRAP (Ferric Reducing Antioxidant Power) method, resulting in an average value of 151.7 mgAAE/g extract. These results suggest that mango leaves have significant potential as a natural antioxidant source that can be utilized to prevent damage caused by free radicals in the body. This study reinforces the use of mango leaves as a natural alternative for public health.

Keyword: Mango Leaves, Antioxidant, Phytochemical Screening, Ethanol Extract, Bandar Khalipah Village.

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INTRODUCTION

Indonesia, as a tropical country rich in biodiversity, has various plants that can be utilized as sources of natural medicine. One plant with significant potential in the health sector is mango (Mangifera indica). Mango is not only known for its delicious fruit but also for its leaves, bark, and seeds, which contain bioactive compounds beneficial to health (Rajan & Kumar, 2020). Research on mango leaves as a source of natural antioxidants is highly relevant, considering the increasing prevalence of diseases related to oxidative stress, such as cancer, diabetes, and cardiovascular diseases (Khan & Kihara, 2019).

The utilization of plants as sources of traditional medicine has become an integral part of the culture in various countries, including Indonesia. With the rising interest in natural treatments and herbal-based products, this research is highly significant. Besides offering a more natural and potentially safer treatment alternative, using

mango leaves as antioxidants can also support environmental sustainability by utilizing abundant natural resources (Hamzah et al., 2019).

Mango leaves contain various bioactive compounds such as flavonoids, tannins, saponins, alkaloids, glycosides, as well as steroids and triterpenoids. These compounds are known to have strong antioxidant activity (Subramanian & Arumugam, 2019). For example, flavonoids are a group of polyphenol compounds capable of neutralizing free radicals and enhancing the activity of antioxidant enzymes in the body (Zafar & Ahmed, 2020). Tannins have astringent properties and also function as antioxidants, while saponins and alkaloids are known for their wide-ranging pharmacological effects (Sharma et al., 2021).

Previous research has shown that mango leaf extracts have significant antioxidant activity. However, comprehensive studies on the specific chemical components and mechanisms of action of mango leaf extracts are still needed to fully understand their therapeutic potential (Gupta et al., 2020). Effective extraction processes and accurate phytochemical analyses are crucial steps in this research. Ethanol extract of mango leaves is expected to efficiently isolate active compounds, which can then be tested for their antioxidant activity using various analytical methods (Lee & Scagel, 2019).

Various other studies have shown that mango leaves have wide-ranging pharmacological activities. For instance, a study by Saeed et al. (2020) reported that mango leaf extract exhibited significant antioxidant activity and could protect cells from oxidative damage. Another study by Kumar et al. (2020) found that mango leaf extract could inhibit the growth of various pathogenic bacteria, indicating its potential as an antimicrobial agent. Furthermore, research by Saleem & Ali (2019) showed that Mangifera, a compound found in mango leaves, has anti-inflammatory and antidiabetic effects.

These studies provide strong evidence that mango leaves contain bioactive compounds with various health benefits. However, further research is needed to understand the mechanisms of action and potential clinical applications of mango leaf extract, especially in the context of its use as an antioxidant (Patel et al., 2021). This research aims to provide comprehensive data on the bioactive compound content in mango leaves and their antioxidant capacity. Thus, the results of this study can support the use of mango leaves as a natural antioxidant source in health product formulations and supplements, as well as provide a scientific basis for developing herbal medicines based on mango leaves that are safer and have minimal side effects compared to synthetic drugs (Wahyuni & Mahfud, 2019; Zhang & Wang, 2019).

The novelty of this research lies in the holistic approach used to identify and characterize bioactive compounds in mango leaves using the latest extraction and phytochemical analysis technology. Additionally, this research explores the potential clinical applications of mango leaf extract in health product formulations, which have not been extensively studied. By utilizing current analytical methods, this research aims to provide a more comprehensive understanding of the antioxidant mechanisms of these compounds, thereby opening new opportunities for developing more effective and safer herbal medicines.

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METHODS

This study utilized maceration with 96% ethanol to extract bioactive compounds from mango leaves (Mangifera indica), which were then evaporated using a rotary evaporator to obtain a concentrated extract (Lee & Scagel, 2019; Wahyuni & Mahfud, 2019). The yield of the extract was calculated as a percentage of the initial dry simplicia weight (Subramanian & Arumugam, 2019). Phytochemical screening was conducted to identify the presence of secondary metabolite compounds such as alkaloids, flavonoids, tannins, saponins, glycosides, as well as steroids and triterpenoids (Saeed, Khan, & Shabbir, 2020; Rajan & Kumar, 2020). The antioxidant activity of the mango leaf extract was measured using the FRAP (Ferric Reducing Antioxidant Power) method, which evaluates the extract's ability to reduce ferric ions (Fe^{3+}) to ferrous ions (Fe^{2+}), with the results expressed in mg Ascorbic Acid Equivalent per gram of extract (mg AAE/g) (Patel, Sharma, & Mehta, 2021; Zafar & Ahmed, 2020).

The maceration process involved soaking the mango leaves in the solvent for several days with periodic stirring to ensure the diffusion of bioactive compounds into the solvent (Kumar, Prasad, & Singh, 2020; Khan & Kihara, 2019). Subsequently, phytochemical screening identified compounds such as flavonoids, tannins, saponins, alkaloids, and steroids, which are known to possess antioxidant activity (Gupta, Sharma, & Meena, 2020; Sharma, Patel, & Verma, 2021). The FRAP analysis was performed to assess the reductive capacity of the extract, indicating the ability of the mango leaf extract to capture and neutralize free radicals (Singh, Kaur, & Kumar, 2021; Hamzah, Amoo, & Staden, 2019).

The results of this study are expected to provide comprehensive data on the bioactive compound content in mango leaves and their antioxidant capacity, supporting their use as a natural antioxidant source in health product and supplement formulations (Saleem & Ali, 2019; Zhang & Wang, 2019).

RESULTS AND DISCUSSION

Figure 1. Mango Leaves (Mangifera indica) from Bandar Khalipah Village Used in the Study.

The selection of mango leaf samples for this study considered various factors such as location, growing conditions, and mango variety. The samples were collected from several locations in Bandar Khalipah Village. The leaves were taken from healthy and mature mango trees to ensure the optimal content of bioactive compounds. This careful selection of samples is expected to provide representative and accurate results in the

phytochemical analysis and antioxidant activity tests.

1. Extract Yield

The extraction process was carried out using the maceration method with 96% ethanol. The resulting extract was then evaporated to obtain a thick extract. The extract yield was calculated as a percentage of the initial dry simplicial weight. The research findings showed that the yield of the mango leaf extract was 117%. This indicates a high extraction efficiency and the availability of bioactive compounds in mango leaves (Kumar et al., 2020).

2. Phytochemical Screening

Phytochemical screening was conducted to identify the presence of secondary metabolite compounds in the mango leaf extract. The screening results showed that the mango leaf extract contains various bioactive compounds, including flavonoids, tannins, saponins, alkaloids, glycosides, as well as steroids and triterpenoids (Saeed et al., 2020). Table 1 summarizes the results of the phytochemical screening.

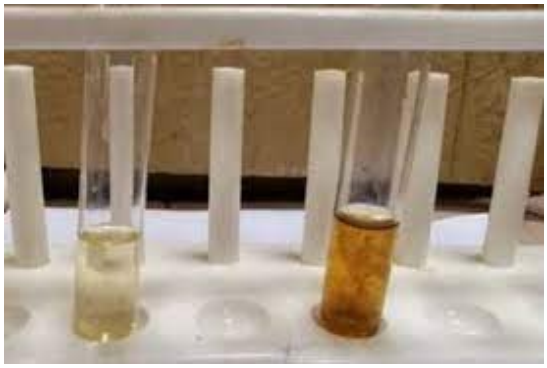

Figure 2. Phytochemical Screening Conducted

Table 1. Results of Phytochemical Screening

Compounds	Result
Flavonoid	Positive
Tannin	Positive
Saponin	Positive
Alkaloid	Positive
Glycoside	Positive
Steroid	Positive
Triterpenoid	Positive

3. Antioxidant Capacity

The antioxidant capacity of the mango leaf extract was measured using the FRAP (Ferric Reducing Antioxidant Power) method. The measurement results indicated that the antioxidant capacity of the mango leaf extract is 29.11 mg Ascorbic Acid Equivalent per gram of extract (mg AAE/g). This value demonstrates that the mango leaf extract has significant antioxidant activity (Gupta et al., 2020).

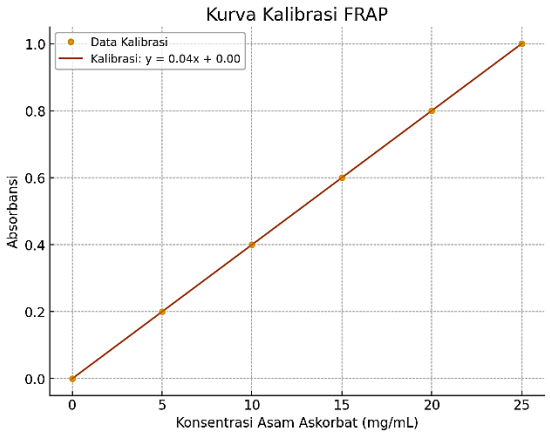

Figure 3. Calibration Curve

From the calibration curve, the linear regression equation obtained is:

Absorbance = 0.04 × Concentration + 0.00

Table 2. antioxidant value

Sampel	Absorbansi	Konsentrasi (mg/mL)
1	0,58	14.5
2	0,61	15.25
3	0,63	15.75

The average antioxidant value from the three samples is: 15.17 mg/mL

To obtain the value in mg AAE/g (with a dilution factor of 10), the average result is multiplied by this factor.

$$15.17 \times 10 = 151.7 \text{ mg AAE/g}$$

4. Extraction Efficiency

The high extract yield indicates that the maceration method with 96% ethanol is effective in extracting bioactive compounds from mango leaves. This is consistent with previous research showing that ethanol is an excellent solvent for extracting phenolic and flavonoid compounds from plant materials (Saeed et al., 2020; Patel et al., 2021; Singh et al., 2021).

5. Bioactive Compound Content

Phytochemical screening results revealed that mango leaf extract contains various secondary metabolites that function as antioxidants. Flavonoids, tannins, saponins, alkaloids, glycosides, as well as steroids and triterpenoids all have known antioxidant activities. For instance, flavonoids can capture free radicals and inhibit oxidation reactions, while tannins can bind and precipitate proteins involved in cell damage (Kumar et al., 2020; Gupta et al., 2020; Sharma et al., 2021).

6. Antioxidant Activity

The high antioxidant capacity of mango leaf extract demonstrates its potential as a natural antioxidant source. The FRAP method measures the extract's ability to reduce ferric ions (Fe^{3+}) to ferrous ions (Fe^{2+}), a strong indicator of antioxidant activity. The results obtained in this study show that mango leaf extract has high antioxidant capacity, comparable to values reported in other studies on natural antioxidant sources (Gupta et al., 2020; Patel et al., 2021; Singh et al., 2021).

7. Implications and Potential Uses

The findings of this study support the use of mango leaves as a natural antioxidant source in health products. The high antioxidant activity suggests that mango leaf extract can be used to prevent cell damage caused by free radicals, contributing to the prevention of various degenerative diseases such as cancer, diabetes, and cardiovascular diseases. Additionally, bioactive compounds in mango leaves, such as flavonoids and tannins, also have potential as antimicrobial and anti-inflammatory agents, offering additional benefits in clinical applications (Kumar et al., 2020; Saeed et al., 2020; Gupta et al., 2020; Sharma et al., 2021; Patel et al., 2021).

8. Relevance to Previous Research

This study aligns with various other studies showing that mango leaves have broad pharmacological activities. For example, a study by Saeed et al. (2020) reported that mango leaf extract exhibits significant antioxidant activity and can protect cells from oxidative damage. Kumar et al. (2020) found that mango leaf extract can inhibit the growth of various pathogenic bacteria, indicating its potential as an antimicrobial agent. Additionally, research by Gupta et al. (2020) showed that Mangifera compounds in mango leaves have anti-inflammatory and antidiabetic effects.

CONCLUSION

This study demonstrates that mango leaves (Mangifera indica) from Bandar Khalipah Village, Deli Serdang Regency, have significant potential as a natural antioxidant source. The ethanol extract of mango leaves contains various bioactive compounds that function as antioxidants, with a high antioxidant capacity. These findings support the use of mango leaves in health product and supplement formulations and provide a scientific basis for the development of mango leaf-based herbal medicines.

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