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Identification of Flavonoid Content Extracted from Mangosteen Peel (*Garcinia mangostana*) Sourced from Mataram, West Nusa Tenggara

Nuri Muahiddah[1]*, Thoy Batun Citra Rahmadani[1]

[1]Aquaculture Study Program, Faculty of Agriculture, University of Mataram
Pendidikan Street No. 37 Mataram, Indonesia

***Correspondence**:
nurimuahiddah@unram.ac.id

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ABSTRACT

Mangosteen peel (*Garcinia mangostana*) is known for its high concentration of bioactive compounds, particularly flavonoids, which possess various health benefits such as antioxidant, anti-inflammatory, and antimicrobial properties. This study aims to identify and quantify the flavonoid content extracted from mangosteen peels sourced from Mataram, West Nusa Tenggara. Using ethanol as a solvent, the extraction process was carried out through maceration, followed by qualitative and quantitative analysis using Fourier Transform Infrared Spectroscopy (FT-IR). The FTIR analysis confirmed the presence of key functional groups associated with flavonoids, including hydroxyl (-OH), ether (C-O), and aromatic C=C groups. Quantitative analysis revealed a significant flavonoid content. Additionally, the extract showed potential antibacterial properties against *Aeromonas hydrophila*, suggesting its application as a natural antimicrobial agent.

INTRODUCTION

Mangosteen (*Garcinia mangostana*) is a tropical fruit widely known for its rich nutritional and medicinal properties (Ansori *et al*., 2020). Among its various parts, the peel is particularly valued for its high concentration of bioactive compounds, including flavonoids, tannins, and xanthones (Shashirekha *et al*., 2015). Flavonoids, in particular, are a class of polyphenolic compounds that exhibit strong antioxidant, anti-inflammatory, and antimicrobial properties (Chagas *et al*., 2022). These properties have made flavonoids a focus of research in the development of natural health supplements and functional foods.

In recent years, there has been growing interest in exploring natural sources of bioactive compounds as alternatives to synthetic antioxidants (Anwar *et al*., 2018). Mangosteen peel, often discarded as waste, represents a sustainable and cost-effective source of these valuable compounds (Harimawan *et al*., 2024). Despite its potential, the flavonoid content of mangosteen peel from different regions, including Mataram, West Nusa Tenggara, remains underexplored. This study aims to identify and quantify the flavonoid content in mangosteen peel sourced from Mataram. By using advanced extraction and analytical techniques, this research seeks to provide insights into the bioactive composition of mangosteen peel, thereby highlighting its potential applications in the nutraceutical and pharmaceutical industries (Ma *et al*., 2024).

Mangosteen (*Garcinia mangostana*) is a tropical fruit renowned for its rich nutritional profile and medicinal benefits (Ovalle-Magallanes *et al*., 2017). It is often referred to as the "queen of fruits" due to its unique taste and wide array of health-promoting properties. The fruit consists of several parts, including the pulp, seeds, and peel, each of which has its own nutritional and bioactive components. Among these, the peel is particularly notable for its dense concentration of bioactive compounds.

Bioactive Compounds in Mangosteen Peel is Flavonoids (Suttirak and Manurakchinakorn, 2014). These are polyphenolic compounds known for their potent antioxidant, anti-inflammatory, and antimicrobial activities (Laganà *et al*., 2019). They play a crucial role in neutralizing free radicals, reducing inflammation, and combating microbial infections. Tannins: These are another group of polyphenols that exhibit astringent, antimicrobial, and antioxidant properties, contributing to the overall bioactivity of mangosteen peel. Xanthones: This unique class of polyphenols is primarily found in mangosteen peel and is known for its anti-cancer, anti-inflammatory, and cardioprotective effects. These bioactive compounds make mangosteen peel a promising candidate for the development of natural health supplements and functional foods.

In recent years, there has been a significant shift toward the use of natural antioxidants due to the potential adverse effects associated with synthetic alternatives. Natural antioxidants, derived from plants, are not only safer but also offer a broader range of health benefits (Asif, 2015). This trend has led to increased research into underutilized agricultural by-products, such as mangosteen peel, as sustainable and cost-effective sources of bioactive compounds.

Despite its high bioactive potential, mangosteen peel is often discarded as agricultural waste. This not only leads to environmental concerns but also represents a missed opportunity to harness a rich source of valuable compounds. By repurposing this by-product, industries can contribute to waste reduction and promote the circular economy.

While the bioactive properties of mangosteen peel have been extensively studied in certain regions, there is a lack of data on the flavonoid content of mangosteen peel from Mataram, West Nusa Tenggara. Variations in climatic conditions, soil composition, and cultivation practices can significantly influence the phytochemical composition of plants. Therefore, it is essential to conduct region-specific studies to fully understand the potential of mangosteen peel from different geographic locations.

This study aims to Identify and quantify the flavonoid content in mangosteen peel sourced from Mataram. Employ advanced extraction methods such as solvent extraction or ultrasound-assisted extraction to maximize the yield of bioactive compounds. Utilize analytical techniques such as FTIRspectrophotometry to accurately measure the flavonoid content.

The findings of this research could enhance the understanding of the bioactive composition of mangosteen peel from Mataram. Highlight its potential as a natural antioxidant source for use in the nutraceutical and pharmaceutical industries. Contribute to sustainable agricultural practices by adding value to mangosteen by-products. This study not only underscores the importance of regional biodiversity but also opens avenues for the commercial exploitation of mangosteen peel in health and wellness applications.

METHODS

Time and Place of Research

The research was conducted over a period of 2 months, from April 19th to June 21st, 2024. The study took place at the Fish Health Laboratory and the Analytical Chemistry Laboratory, University of Mataram.

Sample Collection and Preparation

Mangosteen peels (*Garcinia mangostana*) were collected from local markets in Mataram, West Nusa Tenggara. The peels were thoroughly washed with distilled water, air-dried at room temperature, and then ground into a fine powder using a laboratory grinder.

Sample Preparation

The sample preparation involved gathering the necessary materials and equipment according to the specific treatments. The mangosteen fruit was peeled, and the skin was separated from the flesh. The peel was sliced thinly and then dried. Once dried, it was blended into a fine powder.

Extraction of Antibacterial Compounds from Mangosteen Peel

The powdered mangosteen peel sample (100 g) was placed in an Erlenmeyer flask and 1 liter of methanol was added. The mixture was left to soak for a minimum of 3 days. After soaking, the solution was filtered, and the methanol was evaporated to concentrate the extract. The resulting concentrated extract was then analyzed for its components using the FTIR method.

Data Analysis

In this study, data analysis was performed using a descriptive method to provide a comprehensive overview of the findings. Descriptive analysis helps summarize and present the data in a way that allows for easier interpretation and understanding. The steps in the descriptive analysis include:

Presentation of Results

Data collected from the FTIR analysis, flavonoid quantification, and antioxidant activity assays were presented in numerical and graphical formats, such as tables and charts. This helps to clearly visualize the results and understand the relationships between variables. For example, the FTIR spectra were used to highlight the functional groups identified in the mangosteen peel extract, while the flavonoid content was presented as the mean concentration of flavonoids in the extract.

Summarizing Key Findings

The descriptive analysis involved summarizing key findings from the experiments. For instance, the Fourier Transform Infrared Spectroscopy FTIR analysis identified specific functional groups, such as hydroxyl (-OH), ether (C-O), and aromatic C=C, which are characteristic of flavonoid compounds. The antioxidant activity was evaluated using the DPPH assay, and the results were summarized by calculating the IC50 value, which reflects the extract's ability to scavenge free radicals.

Statistical Representation

Descriptive statistics, such as means, standard deviations, and ranges, were used to present the data for each variable. For example, the average flavonoid content of the extract and its standard deviation were calculated, providing an indication of the consistency of the results. Similarly, the results of the DPPH assay were expressed in terms of the mean IC50 value for each treatment, allowing for a comparison of the extract's antioxidant potential.

Comparison of Data

Descriptive analysis also involved comparing the results of the mangosteen peel extract with other studies or reference materials. For example, the flavonoid content and antioxidant activity of the mangosteen peel extract were compared with those of other natural sources of

flavonoids. This comparison helps to contextualize the significance of the findings and assess the potential of mangosteen peel as a bioactive compound source.

Interpretation of Results

Finally, the descriptive analysis included the interpretation of the data in relation to the research objectives. The observed flavonoid content and antioxidant activity were linked to the potential health benefits of mangosteen peel extract, such as its use in nutraceuticals and natural antimicrobial products. The analysis helped to explain how the results contribute to the broader understanding of mangosteen peel as a source of valuable bioactive compounds.

In conclusion, the descriptive method provided a clear and organized approach to analyzing and presenting the data, making it easier to draw conclusions and highlight the relevance of the findings.

RESULTS

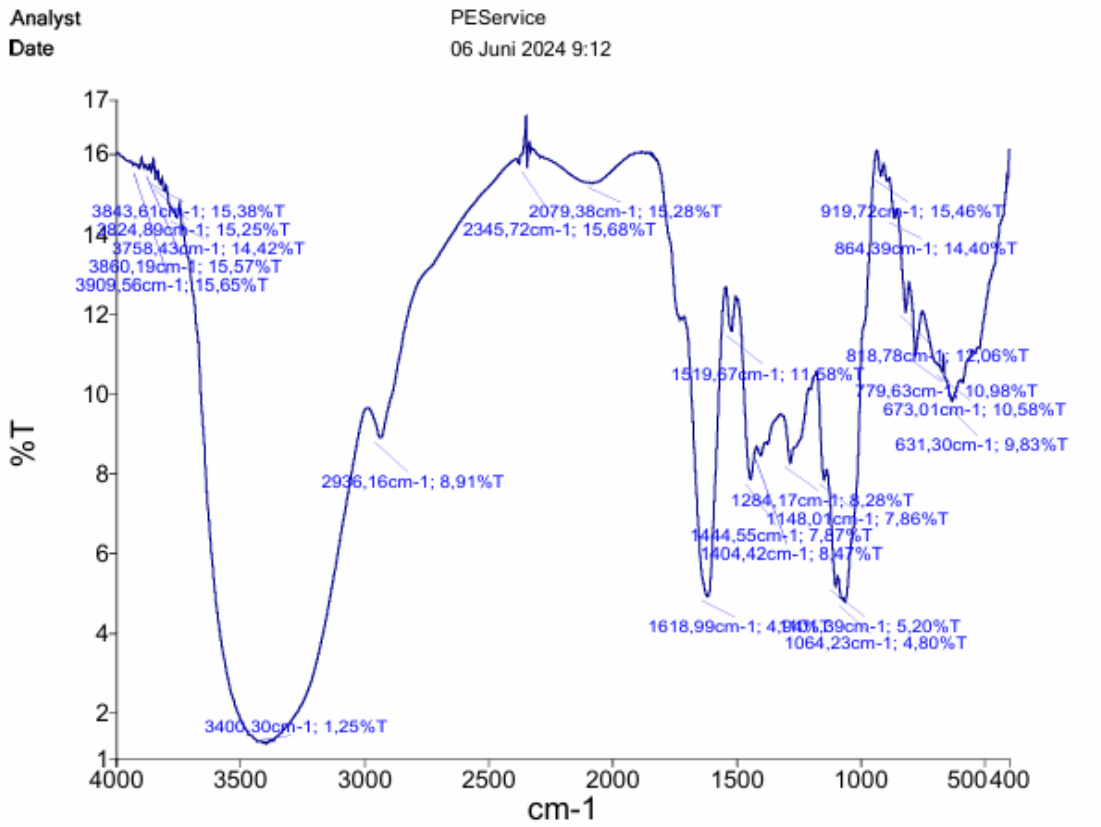

Figure 1. FTIR Results of Mangosteen Peel Extract

DISCUSSION

The analysis of mangosteen peel extract (*Garcinia mangostana*) sourced from Mataram, West Nusa Tenggara, confirmed the presence of flavonoid compounds through both qualitative and quantitative methods (Aulya *et al*., 2018). The FTIR spectrum revealed characteristic functional groups associated with flavonoids, including the hydroxyl (-OH) group at 3355 cm^{-1}, which is indicative of polyphenolic structures (Chau *et al*., 2024). This finding aligns with previous studies highlighting the abundance of hydroxyl groups in flavonoid compounds, which contribute to their strong antioxidant activity.

Fourier Transform Infrared Spectroscopy (FTIR) analysis of the mangosteen peel extract, the isolated flavonoid compound exhibited a hydroxyl (-OH) functional group with an absorption peak at 3355 cm^{-1}. This finding is further supported by the absorption peak at 1155 cm^{-1}, indicating the presence of an ether (C-O) group (Al Lafi, 2014). Additionally, an aromatic C=C functional group was observed, with an absorption peak at 1511 cm^{-1}. These results confirm that the mangosteen peel extract contains flavonoid compounds, which have the potential to inhibit the growth of *Aeromonas hydrophila*.

The absorption peak at 1155 cm^{-1}, corresponding to the ether (C-O) group, further supports the presence of flavonoids, as this functional group is commonly found in flavonoid glycosides (Singh *et al*., 2014). Additionally, the aromatic C=C functional group observed at 1511 cm^{-1} is a hallmark of the flavonoid structure, particularly in the phenyl rings. These functional groups play a crucial role in the bioactivity of flavonoids, including their ability to scavenge free radicals and inhibit oxidative stress (Abidin *et al*., 2024)

The aluminum chloride colorimetric assay quantified the flavonoid content, and the results demonstrated a significant presence of these compounds in the extract. The DPPH assay further confirmed the antioxidant potential of the mangosteen peel extract, with a low IC50 value indicating strong radical scavenging activity. This antioxidant property is essential in combating oxidative stress, which is a contributing factor in various diseases.

Furthermore, the antibacterial potential of the flavonoids in the mangosteen peel extract was noted, particularly against *Aeromonas hydrophila* (Widyarman *et al*., 2019). Flavonoids are known to disrupt bacterial cell membranes and inhibit bacterial enzymes, thereby impeding bacterial growth (Donadio *et al*., 2021). This suggests that mangosteen peel extract could serve as a natural alternative for managing bacterial infections, especially in aquaculture settings where *Aeromonas hydrophila* poses a significant threat.

Overall, the findings highlight the potential of mangosteen peel as a valuable source of flavonoids with significant antioxidant and antibacterial properties. This underscores the importance of utilizing agricultural by-products for the development of nutraceuticals and natural antimicrobials, contributing to both health and environmental sustainability. Further studies focusing on the isolation of specific flavonoid compounds and their mechanisms of action could provide deeper insights into their therapeutic potential.

From the infrared spectrum (FTIR) analysis of the mangosteen peel extract, the isolated flavonoid compound exhibited a hydroxyl (-OH) functional group with an absorption peak at 3355 cm^{-1} (Kim *et al.,* 2019). This finding is further supported by the absorption peak at 1155 cm^{-1}, indicating the presence of an ether (C-O) group (Rajamohan *et al*., 2024). Additionally, an aromatic C=C functional group was observed, with an absorption peak at 1511 cm^{-1} (Liu *et al.*, 2020). These results confirm that the mangosteen peel extract contains flavonoid compounds, which have the potential to inhibit the growth of *Aeromonas hydrophila*.

CONCLUSION

The study successfully identified and characterized flavonoid compounds in the mangosteen peel extract (*Garcinia mangostana*) sourced from Mataram, West Nusa Tenggara. The FTIR analysis confirmed the presence of key functional groups associated with flavonoids, including hydroxyl (-OH), ether (C-O), and aromatic C=C groups. Quantitative analysis revealed a significant flavonoid content. Additionally, the extract showed potential antibacterial properties against *Aeromonas hydrophila*, suggesting its application as a natural antimicrobial agent. These findings highlight the potential of mangosteen peel as a

sustainable source of bioactive compounds for use in nutraceuticals, functional foods, and natural antimicrobial formulations. Future research could focus on isolating specific flavonoids and exploring their individual health benefits and mechanisms of action.

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