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Qualitative and Quantitative Analysis of Vitamins, Micro-Macro Nutrient Content and Physicochemical Characteristics of Surat Dibata Leaves *(Macodes Petola)*

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Abstract: This research was conducted with the aim of determining the vitamin content, micro-macro nutrients, and physicochemical properties contained in the leaves of the Surat Dibata plant *(Macodes petola)*. The analysis procedure included qualitative and quantitative vitamin tests using the DCPIP method and UV-Vis spectrophotometry, analysis of micro-macro nutrients using AAS, and measurement of water content, ash, pH, and water-soluble organic compounds based on the AOAC standard method. The test results showed that qualitatively these leaves contain vitamins C, B1, and E, with concentrations (mg/100 g) of 47.8; 1.02; and 0.99, respectively. Meanwhile, for micro-macro nutrients such as Fe, Zn, Mg, and Ca, quantitative results showed levels (mg/kg) of 47.2; 30.7; 212.3; and 433.7, respectively. Furthermore, the detected water content was 79.22%, the ash content was 10.15%, the pH was 5.8, and the water-soluble organic compound content reached 66.6%. Overall, this data shows that Surat Dibata leaves have great potential as a natural source of nutrients and phytochemicals that support the development of herbal products and environmentally friendly agriculture.

Keywords: Micro-Macro Nutrients; Physicochemical Analysis; Qualitative and Quantitative Tests; Surat Dibata Leaves *(Macodes petola)*; Vitamins

Introduction

The Surat Dibata plant *(Macodes petola)* is a type of jewel orchid popular not only for its beauty but also for its potential uses in traditional medicine (Sianturi, 2024; Silalahi & Nisyawati, 2015). Several ethnic groups in North Sumatra have long used the leaves of this plant to treat minor wounds, reduce fever, and as a body-strengthening herbal remedy (Pane, 2024). However, scientific information detailing the macro- and micronutrient and vitamin content of Surat Dibata leaves is still very limited, especially in Indonesia.

Previous research conducted by Sianturi et al. (2024) entitled "Identification of Secondary Metabolite Compounds in the Stems and Leaves of Surat Dibata *(Macodes petola)* Using Gas Chromatography Mass Spectrometry (GCMS)" aimed to identify the types and levels of secondary metabolite compounds found in the stems and leaves of the Surat Dibata plant *(Macodes petola)*. This study used a maceration extraction method to obtain secondary metabolite compounds, followed by analysis of compound content using GCMS (Cacique et al., 2020). The results showed that the stem extract contained steroid compounds, while the leaf extract contained flavonoids, steroids, and tannins. Based on GCMS analysis, the stem contained 0.63% steroid compounds, while the leaves contained 0.002% flavonoids, 0.002% tannins, and 2.215% steroids.

Vitamins such as C and B-complex are known to play important roles as coenzymes in metabolic

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processes and function as natural antioxidants. Similarly, nutrients such as iron (Fe), zinc (Zn), magnesium (Mg), and potassium (K) contribute not only to plant metabolism but also enhance its functional value in the context of consumption and traditional medicine (Islam et al., 2023; Messaoudi et al., 2025; Radha et al., 2021).

In addition to nutritional aspects, testing physicochemical properties such as moisture and ash content is necessary to assess the quality and shelf life of herbal ingredients (Alamgir, 2017). Moisture content is related to resistance to microorganisms and product stability, while ash content reflects the total mineral content of the sample (Mauer, 2024; Zheng et al., 2011). The pH value and water-soluble organic compound content are also important indicators in determining the stability of active chemical compounds and their potential for development in liquid dosage forms, both as herbal medicines and for agrotechnological applications (Krivácsy et al., 2001).

Therefore, this study aims to qualitatively and quantitatively evaluate the vitamin content, micro-macronutrients, and physicochemical properties of Surat Dibata leaves to strengthen their potential use in the development of agrotechnology and natural product-based products.

Method

Fresh Surat Dibata leaves *(Macodes petola)* used as samples were collected from the highlands of Karo Regency. Laboratory equipment used in this study included a UV-Vis spectrophotometer, analytical balance, AAS (Atomic Absorption Spectrophotometer), pH meter, oven, and distillation apparatus.

Research Procedures

Qualitative Testing of Vitamins and Secondary Metabolites

Vitamin C

The test was conducted using DCPIP (2,6-dichlorophenol-indophenol) reagent. A positive indication is indicated by a color change from blue to clear.

Vitamin B1 (Thiamine)

This test uses a combination of potassium ferrocyanide and NaOH reagents (Hennessy, 1941). The formation of a blue-green color indicates the presence of vitamin B1.

Vitamin E (Tocopherol)

The DPPH (2,2-diphenyl-1-picrylhydrazyl) reagent was used to detect antioxidant activity (Clarke et al., 2013; Xie & Schaich, 2014). The presence of vitamin E is indicated by a color change in the DPPH solution from purple to pale yellow or transparent, depending on the concentration (Celebioglu & Uyar, 2017).

Quantitative Vitamin Testing

Vitamin C: Measured using UV-Vis spectrophotometry at a wavelength of 520 nm (Mussa & Sharaa, 2014). Vitamin B1: Measurements were made at a wavelength of 366 nm using UV-Vis (Dadkhah et al., 2022). Vitamin E: Quantification was performed using UV-Vis spectrophotometry at 517 nm.

Micro and Macro Nutrient Analysis

Mineral content such as Fe, Zn, Mg, K, and Ca was analyzed using a dry digestion method and then read using an AAS instrument (Manhas Verbi Pereira et al., 2006).

Physicochemical Characteristics Testing

Moisture Content: Determined gravimetrically by drying at 105°C. Ash Content: Obtained by burning the sample at 400°C. pH: Measured using a pH meter from a solution resulting from mixing the sample and distilled water with a ratio of 1:10. Water-Soluble Organic Compounds: Tested through an extraction method followed by an evaporation process to determine their content.

Result and Discussion

Result

Qualitative Test Results of Vitamin

The test results showed a positive reaction, indicated by a color change in the DCPIP solution from blue to clear. Vitamin B1 (Thiamine) positively identified by a color change to blue-green after the addition of potassium ferrocyanide and NaOH reagents (Rahmawati & Pitaloka, 2023). Vitamin E (Tocopherol) a positive result was obtained by a color change in the DPPH solution from purple to pale yellow, indicating antioxidant activity (Housam et al., 2014).

Vitamin Content Test Results (Quantitative)

Analysis results show that Macodes petola leaves contain significant amounts of vitamins, particularly vitamin C, which acts as a natural antioxidant essential for maintaining cell stability and boosting the immune system. Although not as high as vitamin C, the content of vitamins B1 and E still contributes to supporting enzymatic function and protecting cells from oxidative damage.

Table 1. Vitamin Concentrations in Surat Dibata Leaves

Types of Vitamins	Consentration (mg/100 g)
Vitamin C	47.8
Vitamin B1	1.02
Vitamin E	0.99

Micro and Macro Nutrient Content

Mineral content such as magnesium (Mg), potassium (K), and calcium (Ca) indicates that this plant has potential as a good source of micronutrients (Kathpalia & Bhatla, 2018). Magnesium supports chlorophyll function and energy metabolism, potassium plays a role in maintaining cell osmotic balance, while calcium is essential for cell wall structure and intercellular signal transmission (Ahmed et al., 2023; Tränkner et al., 2018).

Table 2. Micro and Macro Nutrient Content

Nutritional Elements	Consentration (mg/kg)
Fe	47.2
Zn	30.7
Mg	212.3
Ca	433.7

Physicochemical Characteristics

The high water content (79.22%) indicates that Macodes petola leaves have high humidity, which can shorten their shelf life if not properly dried or stored. This also indicates that fresh leaves are more suitable for direct use or in liquid forms such as juice or herbal infusions.

Table 3. Results of Physicochemical Tests of Surat Dibata Leaves

Parameters	Result
Moisture Content (%)	79.22
Ash Content (%)	10.15
pH	5.8
Water-Soluble Organic Compounds (%)	66.6

The pH value of 5.8 is in the weakly acidic range, which is suitable for maintaining the stability of bioactive compounds such as flavonoids and phenolics. This pH also supports antioxidant activity because phenolic compounds tend to be stable in slightly acidic conditions.

Furthermore, the 66.6% water-soluble organic compound content indicates that most of the active components in the leaves can be extracted using polar solvents, making them suitable for use in herbal solutions, tonics, or other liquid preparations in the development of phytopharmaceuticals and sustainable agrotechnology.

Overall, Macodes petola has great potential as a source of natural phytonutrients (Prapitasari et al., 2024) and can be further developed in the fields of agrotechnology, herbal pharmacy, and natural product innovation.

Conclusion

The results of this study indicate that Macodes petola leaves have a relatively high vitamin content, particularly vitamin C. Mineral content such as Mg, K, and Ca demonstrates the potential of this plant as a highly nutritious food ingredient. The high water content indicates that the leaves retain a high moisture content, which affects storage. A pH close to moderate acidity (5.8) is suitable for the stability of flavonoid and phenolic compounds. The content of water-soluble organic compounds supports its potential application in liquid preparations or herbal tonics.

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Conflicts of Interest

The authors declare no conflict of interest.

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