ISSN 3031-0911

Syzygium Polyanthum as a Potential Hemoglobin Booster for Iron Deficiency Anemia Due to its High Vitamin C Content

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Abstract

Anaemia management can be done pharmacologically through Boosting Tablets (TTD) and non-pharmacologically by consuming natural food ingredients such as bay leaves. Bay leaves are one of the sources of iron and vitamin C readily available in the community. This study aims to analyze the nutritional content and vitamin C in bay leaves at Karanganyar. The research design is an experimental study that examines the nutritional content and vitamin C levels in bay leaf powder to facilitate Fe absorption in anaemia management. Vitamin C plays a crucial role in absorbing non-heme iron, which is essential for haemoglobin production in the human body. The vitamin C content in bay leaf powder at Karanganyar, 1294.78 mg per 100 grams, was tested in the Food Chemistry and Biochemistry Laboratory, Food Science and Technology Study Program, Faculty of Agriculture, Universitas Sebelas Maret. A high vitamin C concentration in bay leaf powder is expected to enhance iron absorption and reduce the risk of anaemia-related iron deficiency. This analysis provides insights into the potential contribution of bay leaf powder in addressing anaemia through nutritional approaches.

Keywords: Iron Deficiency Anemia, Iron, Vitamin C, *Syzygium polyanthum* (bay leaves)

Introduction

Iron deficiency anaemia is a common global health problem characterized by a lack of iron in the body, leading to reduced red blood cells and insufficient haemoglobin levels. It affects individuals of all ages and can significantly impact physical and cognitive functions. Adequate iron intake and absorption are crucial for preventing and treating this condition (AlDallal, 2016; Alli *et al*., 2017; Benz, 2018). The prevalence of anaemia worldwide is significant and has a global impact on public health. According to data from the Global Health Observatory (GHO) published by the World Health Organization (WHO) in 2022, approximately 32.8% of the world's population experiences anaemia. The highest prevalence occurs among children under five (42.6%), followed by women of reproductive age (29.1%). In Indonesia, anaemia is also a severe health issue. According to the Basic Health Research (Riskesdas) data from 2018 conducted by the Ministry of Health Indonesia, the prevalence of anaemia among pregnant women is 29.5%, while among children under five years old, it is 35.1%. These figures indicate that anaemia remains a significant concern in Indonesia (Kemenkes RI, 2018; WHO, 2022)

Iron is essential in producing haemoglobin, the protein responsible for transporting oxygen throughout the body. Iron deficiency can result in decreased haemoglobin levels, leading to anaemia. Individuals with iron deficiency anaemia can restore their haemoglobin levels and improve overall health by incorporating iron-rich foods or supplements into their diet. Vitamin C plays a crucial role in enhancing iron absorption. It helps convert non-heme iron from plant-based sources into a more readily absorbable form. By combining iron-rich foods with a good source of vitamin C, individuals can maximize their iron absorption and optimize haemoglobin production (Pdxscholar & Alarcon Basurto 2020; Shubham *et al*., 2020; Zhu *et al*., 2016)

Syzygium Polyanthum, commonly known as "Daun Salam" or Indonesian bay leaf, is native to Southeast Asia. It has been traditionally used for culinary purposes due to its aromatic properties. Beyond its culinary uses, *Syzygium Polyanthum* possesses several potential health benefits, including its high content of iron and vitamin C. *Syzygium Polyanthum* stands out as a possible natural remedy for iron-deficiency anaemia due to its dual advantage of being rich in both iron and vitamin C. By consuming this plant; individuals can increase their iron intake and enhance iron absorption simultaneously, effectively combating anaemia. Moreover, incorporating *Syzygium Polyanthum* into the diet offers a natural and sustainable alternative to synthetic iron supplements, which can sometimes cause digestive discomfort or undesirable side effects. The plant's bioavailability and the synergy between iron and vitamin C may further enhance its potential as a haemoglobin booster (Ismail *et al*., 2019; Silalahi, 2017; Suharni *et al*., 2021).

ISSN 3031-0911

This study aims to comprehensively examine the nutritional content and vitamin C levels in bay leaf powder, particularly in anaemia management. Using an experimental research design, analysis was conducted to understand better the nutritional composition and vitamin C content in bay leaf powder, thus providing a healthy approach to address anaemia.

Methods

This research was conducted in the Laboratory of Chemistry and Biochemistry of Food, Food Science and Technology Study Program, Faculty of Agriculture, Universitas Sebelas Maret. The utilization of laboratory equipment includes tools such as analytical balances, Erlenmeyer flasks, volumetric flasks, beakers, filter paper, glass funnels, burets, filling pipettes, measuring pipettes, dropping pipettes, glassware, aluminium, and stirring rods. The materials used include bay leaf powder, distilled water, Sodium Thiosulfate, 0.001 N iodine solution (I2), and 1% starch indicator. Sample preparation involves mixing bay leaf powder with distilled water to achieve homogeneity, followed by filtration into volumetric flasks (Basir, 2017; Khadijah, 2019).

For the vitamin C analysis, 25 ml of the sample solution is taken and poured into an Erlenmeyer flask, adding two drops of starch indicator. The answer is titrated with 0.01 N Iodine until a dark blue colour change occurs. The vitamin C content is calculated based on this titration. The Proximate Analysis determination of Moisture Content is done by drying a clean porcelain crucible in an oven at 105°C for 1 hour. The crucible is then cooled in a desiccator for 10-20 minutes and weighed to obtain the initial weight. A sample weighing 0.5-1 gram is placed into the porcelain crucible and dried in the oven at 105°C for 12-16 hours. The weight of the crucible and sample is then weighed again after removal from the container and cooling in the desiccator. Determination of Ash Content is carried out with a similar process: a cleaned and dried porcelain crucible is weighed, followed by placing a sample of 3 grams of plant material or 5 grams of concentrate into the container. The model is then burnt in a furnace at 600°C until it turns white. After cooling, the crucible is reweighed (Basir, 2017; Khadijah, 2019).

Determination of Crude Protein is done by weighing 0.3 grams of the sample and placing it into a combustion tube. Approximately 0.2 grams of mixed catalyst and 5 ml of concentrated H2SO4 are added. The mixture is heated in a fume hood, ensuring controlled destruction to avoid overflow. The process is stopped when the solution turns bright green or clear. The resulting solution is transferred to a distillation flask and diluted with distilled water. Distillation occurs until the evolved nitrogen is captured by 0.3 N H2SO4 solution in an Erlenmeyer flask. This methodology aims to determine bay leaf powder's nutritional composition and vitamin C content, particularly in addressing anaemia (Basir, 2017; Khadijah, 2019).

Results and Discussions

The results obtained from the research on *Syzygium Polyanthum* samples have unveiled this plant's chemical composition within the context of various parameters. Specific analytical methods have yielded data depicting certain substances within the model. Based on thermogravimetric analysis of the *Syzygium Polyanthum* sample, the percentage of water content in this plant was recorded at 9.38%. This analysis provides information regarding the proportion of water in the model, which can significantly indicate the physical properties and stability of chemical components within the plant (Basir, 2017; Khadijah, 2019).

Table 1. Analysis of Vitamin C and Proximate *Syzygium Polyanthum*

Analysis	Method	Results
Water	Thermogravimetry	9,38%
Mineral	Dry Method	4,81%
Fat	Soxhlet	4,27%
Proteins	Kjeldahl	9,34%
Carbohydrates	By Different	72,20%
Vitamin C	Spectophotometry	1294,78 mg/ 100 g

The analysis conducted through a dry method indicated a mineral content of 4.81% in the *Syzygium Polyanthum* sample. This analysis is crucial for understanding the mineral content that could contribute to this plant's nutritional value and properties. The fat content in the *Syzygium Polyanthum* sample was analyzed using the Soxhlet

ISSN 3031-0911

method, revealing a range of 4.27%. Information about fat content is essential in exploring the potential energy content and other bioactive components present in the plant. The Kjeldahl method analysis on the sample showed a protein content of 9.34%. Protein content is a crucial indicator for evaluating the nutritional potential of this plant, especially in terms of its contribution to protein intake in the human diet (Basir, 2017; Ismail *et al*., 2019).

A different analysis was employed to assess the carbohydrate content in the *Syzygium Polyanthum* sample, revealing a carbohydrate content of 72.20%. This information holds significant relevance in evaluating the contribution of carbohydrates to the overall nutritional composition of this plant. The results of the spectrophotometric analysis indicated that the vitamin C content in the *Syzygium Polyanthum* sample was 1294.78 mg per 100 grams. Vitamin C plays a crucial role in human health and fitness and enhances the absorption of non-heme iron in the body (Harismah & Chusniatun, 2016; Suharni *et al.*, 2021). Overall, these analysis results provide a detailed overview of the chemical composition of the *Syzygium Polyanthum* sample, including the proportions of water, minerals, fats, proteins, carbohydrates, and vitamin C. This information can offer deeper insights into this plant's potential nutritional and health benefits in its utilization in diets and medical treatments.

The test results prove that the elements vitamin C and Fe in Karanganyar have a high concentration level compared to other ingredients, namely spinach, green beans, Moringa leaves, and bay leaves, in the 2017 Indonesian food composition table. Apart from that, according to Suharni (2021) research, it was stated that the Fe content in 100 grams of bay powder is 1.48 mg. The obtained results from the analyses conducted on the *Syzygium polyanthum* samples offer valuable insights into this plant's botanical composition and nutritional potential. Diverse aspects of the plant's chemical constitution have been scrutinized by meticulously applying distinct analytical methodologies, yielding quantitative data about critical constituents. The thermogravimetric analysis of the *Syzygium polyanthum* sample has furnished a discerning perspective on its water content, indicating a recorded value of 9.38%. This outcome is of paramount significance as it provides essential knowledge regarding the moisture content inherent in the plant material. The information derived from this analysis is pivotal in comprehending the physicochemical attributes and stability of the plant's constituents under varying conditions. In a parallel vein, applying a dry method for mineral analysis has elucidated a mineral content of 4.81% within the *Syzygium Polyanthum* sample. This mineral composition directly relates to the plant's nutritional profile and potential contributions to human health. The insight from this particular analysis enriches our understanding of the plant's mineralogical constitution and its significance in dietary contexts (Wang *et al*., 2021).

An investigation into the lipid content of the *Syzygium polyanthum* sample was undertaken employing the Soxhlet analysis, uncovering a lipid content measuring 4.27%. This lipid analysis offers an intricate portrayal of the plant's fat content, a pivotal aspect in nutritional evaluation. The fat content not only imparts energy density but also serves as a carrier of essential lipid-soluble bioactive compounds, thereby influencing the potential health benefits of the plant. Furthermore, the examination of protein content was achieved through the Kjeldahl method, revealing a protein content of 9.34% within the *Syzygium polyanthum* sample. The protein content is a hallmark parameter for assessing the nutritional value of the plant, especially its capacity to contribute to the dietary protein intake of individuals. This quantitative insight aids in evaluating the plant's suitability as a potential protein source in various nutritional regimens (Hertzler *et al*., 2020).

Table 2. Differences In Ingredient Content

Material	Fe (mg)	Vit C
Bay leaf	44.1	0
Mung beans	7.5	10
Moringa Leaves	6	22
Red spinach	7	62

An alternative approach, "Different Analysis," assessed the carbohydrate content, yielding a carbohydrate composition of 72.20%. The carbohydrate analysis, conducted using a distinct methodology, offers a comprehensive outlook on the plant's carbohydrate constituency, pivotal in deciphering its caloric value and potential dietary applications. Finally, employing the spectrophotometric technique, the analysis of vitamin C content showcased a prominent value of 1294.78 mg per 100 grams within *the Syzygium Polyanthum* sample. Vitamin C, a pivotal water-soluble micronutrient, plays multifaceted roles in human health, particularly in bolstering immune functions and augmenting the absorption of non-heme iron, a vital constituent in haemoglobin synthesis (Pecora *et al*., 2020).

ISSN 3031-0911

In totality, the multi-pronged analyses have collectively furnished an intricate panorama of the chemical makeup of the *Syzygium Polyanthum* sample. These analyses have discerningly revealed the plant's water content, mineral constitution, fat content, protein composition, carbohydrate makeup, and abundant vitamin C. This comprehensive dataset is poised to illuminate potential applications in nutrition, dietary interventions, and healthcare paradigms, substantiating its significance as a promising botanical entity for diverse uses (Kehati, n.d.).

Conclusions

The analyses reveal the *Syzygium polyanthum* intricate chemical composition, including water content (9.38%), mineral content through dry method analysis (4.81%), lipid content through Soxhlet analysis (4.27%), protein content via Kjeldahl analysis (9.34%), distinct carbohydrate content (72.20%), and a notable vitamin C presence (1294.78 mg/100 g) determined by spectrophotometric analysis. These findings provide valuable insights into its potential applications across nutritional and health contexts.

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