Analysis Of Iron (Fe) And Zinc Content (Zn) From Bay Leaves (*Syzygium Polyanthum*)

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Abstract.

Background: Anemia is a nutritional problem in children, pregnant women, teenagers, and women of childbearing age. The prevalence of anemia in Indonesia in 2018 among young women was 48.9%. Bay leaves are widely known in various culinary and traditional medicine in Indonesia. Objective: This study analyzes the iron (Fe) and zinc (Zn) content in bay leaves (Syzygium polyanthum) growing in Karanganyar, Indonesia. Method: This research is an observational descriptive experiment with a laboratory approach carried out through a series of experiments. An Atomic Absorption Spectrophotometer (AAS) is used to analyze iron levels. Results: This research shows that the average concentration of Fe in bay leaves growing in Karanganyar is 294.28 mg/L per 100 grams of bay leaves. Meanwhile, the average concentration of Zn in bay leaves is 15.19 mg/L per 100 grams of bay leaves. According to TKPI 2017, bay leaves contain around 44.1 mg of iron per 100 g. Apart from that, the results of research conducted by Suharni 2021 show that 100 g of bay leaf extract contains around 30.09 mg of iron. Comparison with other plants shows that bay leaves contain much more iron and zinc. Higher than plants such as Moringa leaves. As an example of another plant that is often consumed, Moringa leaves have a lower iron and zinc content, namely 6 mg Fe/100 grams of Moringa leaves and 0.6mg/100 grams of zinc. In addition, this research opens up opportunities for application to experimental animals such as mice, which can be given bay leaf powder to understand its impact on iron and zinc levels in their bodies. Conclusion: The average test concentration of Fe in bay leaves is 294.28 mg/L. Meanwhile, the average concentration of Zn in bay leaves is 15.19 mg/L.

Keywords: *Bay Leaf, Iron and Zinc.*

I. INTRODUCTION

Anemia is a nutritional problem in children, pregnant women, teenagers, and women of childbearing age. In Indonesia, the prevalence of anemia in adolescent girls reached 48.9% in 2018 (Ministry of Health, 2018). Bay leaves are plants widely recognized in various culinary and traditional medicine aspects in Indonesia, especially in the Karanganyar region (Silalahi, 2017). Apart from providing a distinctive taste to dishes, bay leaves also have the potential for high nutritional value and may have medicinal properties that benefit human health (Adyani et al., 2018). An in-depth understanding of the Fe and Zn content in bay leaves can provide valuable insight into making more optimal use of this plant in daily food and traditional medicine.Anemia can cause decreased work productivity, poor pregnancy outcomes, increased maternal and newborn mortality and morbidity, cognitive decline, dementia, and poor educational attainment (Lopez et al., 2016). Iron supplementation in blood supplement tablets (TTD) containing 60 mg Fe and 400 µg folic acid are two ways to treat anemia. TTD is given one tablet weekly and one tablet daily during menstruation in adolescents, while pregnant women consume a minimum of 90 TTD during pregnancy (Ministry of Health, 2015). Apart from that, treating anemia can also be done by fulfilling the nutritional intake and supplements of anemia sufferers, such as bay leaves, which are rich in iron (Ministry of Health of the Republic of Indonesia, 2017).

Iron (Fe) is one of the essential microelements the human body needs to carry out various important biological functions (Ibanez et al., 2017). This element produces hemoglobin in the blood, which helps

transport oxygen throughout the body. Iron also affects cellular metabolic processes and growth (Mahmudah, 2023). Apart from iron, bay leaves also contain zinc (Zn), which is very important in the human body (Wati, 2021).Zinc (Zn) is essential in many enzymes participating in metabolic processes, digestion, and immune system function. Zinc deficiency can result in various health problems, including decreased immune function and impaired growth (Skrajnowska & Bobrowska-Korczak, 2019). These two elements can be found in various foods and plants. However, plants' iron and zinc content can vary significantly depending on various factors, including the soil type in which the plant is grown, climatic conditions, and the plant variety itself. In addition, knowing the level of Fe and Zn content in bay leaves can help identify bay leaves as a valuable source of nutrition for people with specific nutritional needs, such as in cases of anemia.

Bay leaves from the Karanganyar area, which has advantages in mineral content due to unique soil and environmental factors, can produce products with higher nutritional value. This research can provide valuable insight into the potential for using local bay leaves to meet the nutritional needs of local communities (Azri, 2019). Bay leaves are an exciting plant to analyze because of their popularity as a spice in Indonesian cooking and their potential as a good source of nutrition in treating anemia. As in the TKPI (Indonesian et al. The table shows that the Fe content in bay leaves is 44.1 mg/ 100 g (Indonesian Ministry of Health, 2017). In addition, Suharni's research in 2021 shows that 100 g of bay leaf extract contains 30.09 mg of iron and 9.39 of vitamin C (Suharni et al., 2021). This research is expected to further understand variations in Fe and Zn content in bay leaves growing in the Karanganyar area based on these data.This research aims to analyze the content of two microelements, namely iron (Fe) and zinc (Zn), in bay leaves (*Syzygium polyanthum*) that grow in the Karanganyar region, Indonesia. These microelements are essential in maintaining human health and the functionality of various biological systems. Therefore, this research is relevant to nutrition and developing plant-based food products and medicines.

II. METHODS

The method used in this research is experimental research or descriptive observational experiments with a laboratory approach carried out through a series of experiments. Analysis of iron (Fe) content was carried out by making a standard curve solution of Fe with a concentration of 0 ppm, 0.5 ppm, 1 ppm; 1.5ppm, two ppm; and 2.5 ppm using an atomic absorption spectrophotometer with a wavelength of 248.3 nm. Bay leaf powder samples were destroyed before analysis using an atomic absorption spectrophotometer at 248.3 nm. Zinc (Zn) content analysis was carried out by making a standard curve solution of ascorbic acid with a concentration of 0 ppm; 0.5 ppm; 1 ppm; 1.5ppm, 2 ppm; 2.5 ppm using an atomic absorption spectrophotometer with a wavelength of 213.3 nm.

III. RESULT AND DISCUSSION

Iron (Fe) Analysis Results

Analysis of a standard solution of iron (Fe) with a concentration of 0 ppm; 0.5 ppm; 1 ppm; 1.5ppm, 2 ppm; and 2.5 ppm using an atomic absorption spectrophotometer with a wavelength of 248.3 nm, the absorbance was obtained as follows:

Table 1. The absorbance of Iron (Fe) Standard Solution

Concentration (ppm)	Absorbance
0	-0.00212
0.5	0.00067
1	0.00212
1.5	0.00272
2	0.00413
2.5	0.00549

Based on these absorbance values, a diagram of the relationship between the concentration and absorbance of the standard Iron (Fe) solution is obtained as follows:

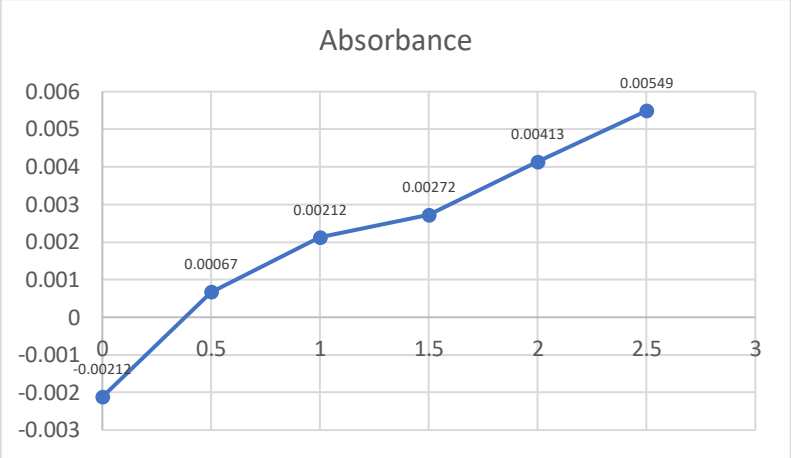

Fig 1. The curve of the Relationship between Concentration and
The absorbance of Iron (Fe) Standard Solution

The iron concentration in the sample is determined based on the regression equation from the calibration curve with the formula y = a + bx, namely y = 0.00280x - 0.0013 with an r coefficient value for iron of 0.9587.

The results of determining the iron (Fe) content in bay leaf powder obtained the following data:

Table 2. Iron (Fe) content in bay leaves in Karanganyar

N	Absorbance	Konsentrasi Kadar Fe (ppm)
1	0.81591	291.86
2	0.82542	295.26
3	0.82674	295.73

Zinc (Zn) Analysis Results

Analysis of a standard zinc (Zn) solution with a concentration of 0 ppm, 0.5 ppm; 1 ppm, 1.5ppm, 2 ppm, 2.5 ppm using an atomic absorption spectrophotometer with a wavelength of 213.3 nm, the absorbance was obtained as follows:

Table 1. Absorbance of Zinc (Zn) Standard Solution

Concentration (ppm)	Absorban**ce**
0	-0.00174
0.5	0.00613
1	0.02091
1.5	0.03874
2	0.08363
2.5	0.08407

Based on these absorbance values, a diagram of the relationship between the concentration and absorbance of the zinc (Zn) standard solution is obtained as follows:

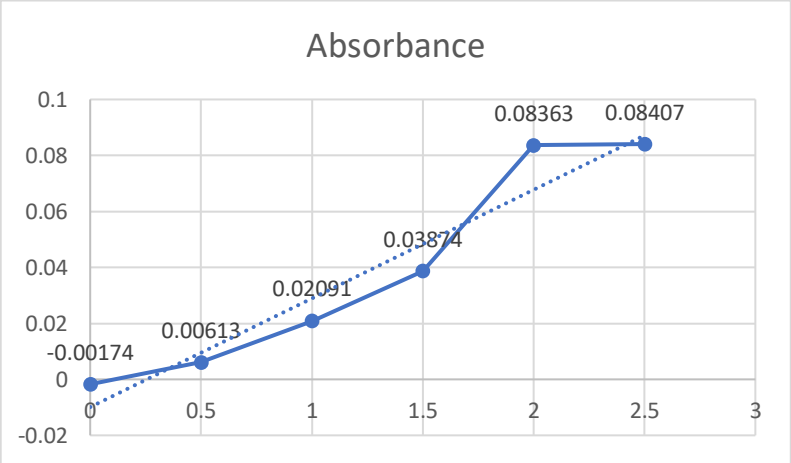

Fig 2. Correlation Curve of Concentration and Absorbance of Zinc (Zn) Standard Solution

The zinc concentration in the sample is determined based on the regression equation from the calibration curve with the formula y = a + bx, namely y = 0.04612x - 0.0006 with a coefficient r value for iron of 0.9523.

The results of determining zinc (Zn) content in bay leaf powder obtained the following data:

Table 2. Zinc (Zn) levels in bay leaves in Karanganyar

N	Absorbance	Level Concentration Fe (ppm)
1	0.69817	15.15
2	0.70349	15.27
3	0.69826	15.15

The results of the analysis of iron (Fe) and zinc (Zn) concentrations in bay leaf (Syzygium polyanthum) samples, represented through three repetitions identified as P1, P2, and P3, have produced data that provides in-depth insight into the presence of these elements in plant. The Fe concentration in sample P1 was recorded at 17.7 mg/L, while sample P2 showed a value of 17.91 mg/L, and sample P3 had a concentration of 17.94 mg/L. These results reflect slight variations in Fe content between the three replicates, which overall shows a high level of consistency in the Fe content in bay leaves (Syzygium polyanthum).Furthermore, regarding the Zn concentration in the samples, the analysis showed that the Zn concentration in sample P1 was 15.15 mg/L. In comparison, sample P2 was 15.27 mg/L, and sample P3 again showed a 15.15 mg/L concentration. The Zn concentration results also showed a high level of uniformity between the three repetitions, indicating strong consistency in the Zn content of bay leaves (Syzygium polyanthum).These results scientifically illustrate that bay leaves (Syzygium polyanthum) have Fe and Zn contents that are pretty stable between repetitions, which means this plant has the potential to become a trusted source of these two elements.

This information may have essential implications in nutrition, diet, or the potential use of this plant in medicine or other applications requiring the elements Fe and Zn.The results of the analysis of iron (Fe) and zinc (Zn) concentrations in bay leaf (Syzygium polyanthum) samples, which were carried out through three repetitions called P1, P2, and P3, need to be carried out in-depth and detailed analysis to interpret these findings scientifically. Iron (Fe) concentration. The analysis results show that the Fe concentration in sample P1 is 17.7 mg/L, sample P2 has a concentration value of 17.91 mg/L, and sample P3 has a concentration of 17.94 mg/L.These data show a minimal difference between the Fe concentrations in the three repetitions. This shows that bay leaves (Syzygium polyanthum) have a consistently high level of Fe content. The low variability in Fe concentration in the three replications shows that this plant has stable Fe content characteristics, so it can be considered a reliable source of iron. Then, in the context of zinc (Zn) concentration, the analysis results show that the Zn concentration in sample P1 is 15.15 mg/L, sample P2 is 15.27 mg/L, and sample P3 again shows the same value. concentration 15.15 mg/L. In this case, we also see a slight variation between these three repetitions in the Zn content. This high consistency shows that bay leaves (Syzygium polyanthum) have a substantial degree of uniformity in Zn content, thus indicating the stability of this element.

Table 2. Differences In Ingredient Content

Material Name	**Fe (mg)**	**Zn (mg)**	**Reference**
Bay Leaf	**294.28**	**15.19**	**Primary Data**
Bay leaf	44.1	0.7	TKPI, 2017
Green beans	7.5	2.9	TKPI, 2017
Moringa leaf	6	0.6	TKPI, 2017
Red spinach	7	0.8	TKPI, 2017
Bay Leaf	1.48	-	Suharni, 2021
Human Needs	18	8	Kemenkes,2019
Rat Needs	0.01	0.1	Primary Data

The test results prove that the elements iron (Fe) and zinc (Zn) studied 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 (TKPI). Apart from that, according to Suharni's 2021 research, it was stated that the Fe content in 100 grams of bay powder is 1.48 mg.The content of bay leaves

per 100 grams is 44.1 mg (Kemenkes, 2017). An adult's daily iron requirement is 18 mg. For the dose to mice, it is multiplied by 0.018. A conversion factor of human (70 kg) to mouse (200 gr). Adult iron and zinc requirements are 18 mg and 8 mg. A rat's daily Fe and Zn needs are 0.01 mg and 0.1 mg.Overall, the results of this analysis scientifically demonstrate that bay leaves (Syzygium polyanthum) have relatively stable Fe and Zn concentrations between repetitions, thus highlighting their potential as a reliable source of these two elements. This information has important implications in the context of nutrition and the potential use of this plant in medicine or other applications that require the elements Fe and Zn in consistent and measurable proportions. Many studies have explored bay leaves to treat certain human diseases, but their use as an alternative treatment for anemia is still limited.

IV. CONCLUSION

The average Iron (Fe) test concentration in bay leaves was 294.28 mg/L. Meanwhile, the average concentration of Iron (Zn) in bay leaves is 15.19 mg/L.

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REFERENCES

[1] Adyani K, Anwar A, Bandung ER-MK and 2018 U (2018). Peningkatan Kadar Hemoglobin Dengan Pemberian Ekstrak Daun Salam (Syzygium Polyanthum (Wight) Walp) Pada Tikus Model Anemia Defisiensi Besi. *Core.ac.uk*. Available at: https://core.ac.uk/download/pdf/295349540.pdf (Accessed: 31 July 2023).

[2] Azri (2019). Pengaruh Pupuk Hayati Dan Pupuk Organik Terhadap Produktivitas Tanaman Jagung Pada Lahan Bekas Tambang Bouksit Kegiatan Pertambangan Memiliki Dua Sisi Yang Berlawanan Yaitu Sebagai Sumber Ekonomi Dan Perusak Lingkungan . Bagi Kalimantan Barat , Alam Poten, pp.: 225–234.

[3] A. Harahap, P. Hrp, N.K.A.R. Dewi, Macrozoobenthos diversity as anbioindicator of the water quality in the River Kualuh Labuhanbatu Utara, ***International Journal of Scientific & Technology Research***, 9(4), 2020, pp. 179-183.

[4] Ibanez G, Penafiel COR- and Sanchez AS (2017). Iron Deficiency Anaemia. *Paediatrics and Child Health (United Kingdom)*, 27(11), pp.: 527–529. doi 10.1016/j.paed.2017.08.004.

[5] Harahap, Arman ,2018, Macrozoobenthos diversity as bioindicator of water quality in the Bilah river, Rantauprapat, Medan. J. Phys.: Conf. Ser. 1116 052026.

[6] Harahap, et, all, Macrozoobenthos diversity as anbioindicator of the water quality in the Sungai Kualuh Labuhanbatu Utara, AACL Bioflux, 2022, Vol 15, Issue 6.

[7] Harahap, Arman. 2020. Species Composition & Ecology Index Of The Family Gobiidae At The Mangrove Belawan Of Sicanang Island ***International Journal of Scientific & Technology Research*** Volume 9, Issue 04, April 2020.

[8] Harahap, A., et all (2021), ***Monitoring Of Macroinvertebrates Along Streams Of Bilah River International Journal of Conservation Sciencethis*** link is disabled, 12(1), pp. 247–258.

[9] Mamangkey,J.,Suryanto,D.,etall (2021).Isolation and enzyme bioprospection of bacteria associated to Bruguiera cylindrica, a mangrove plant of North Sumatra, Indonesia, Biotechnology Reports, 2021, 30, e00617.

[10] Kemenkes RI (2018a).Laporan Nasional Riskesdas. *Badan Penelitian dan Pengembangan Kesehatan*, pp.: 674.

[11] Mahmudah H (2023). Efektivitas Jus Buah Jambu Biji Merah Pada Penderita Anemia Remaja Putri. ***Journal of Innovation Research and Knowledge,*** 2(9), pp.: 3745–3752.

[12] Skrajnowska D and Bobrowska-Korczak B (2019). Role of Zinc in Immune System and Anti-Cancer. *Nutrients*, 11(10), pp.: 1–28.

[13] Wati RW (2021). Hubungan Riwayat Bblr, Asupan Protein, Kalsium, Dan Seng Dengan Kejadian Stunting Pada Balita. ***Nutrizione: Nutrition Research And Development Journal,*** 1(2), pp.: 1–12. doi: 10.15294/nutrizione.v1i2.50071.