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Analysis Of Iron Content 70% Ethanol Extract Of Potato Peel

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ABSTRACT

Introduction: *Potato peel is a food ingredient that is cheap and easy to obtain. This ingredient can help people fulfill their iron needs so that the production of hemoglobin levels in the blood is not lacking. Potato peel can also be considered as a remedy to prevent and overcome cases of anemia, especially in adolescent girls and pregnant women, who are considered vulnerable groups.*
Objective: *The purpose of this study is to determine the iron content value in potato peel extract.*
Methods: *The research method used a laboratory approach, tested through qualitative and quantitative analysis. The place and time of the research were the Undergraduate Pharmacy Laboratory, Faculty of Health Sciences, Ibrahimy University, from March to July 2024, using a UV-Vis spectrophotometer and potato peel extract samples.*
Result: *The results obtained showed the presence of iron in the research sample, with an iron content value of 11.526 mg in 100 grams.*
Conclusions: *The conclusion of this study is that potato peel extract can be used by processing it into food products that can be consumed daily as needed, in order to avoid anemia.*

Introduction

Potato is one type of vegetable that grows in Indonesia. The largest producer of potatoes is the province of East Java. This is what makes the community consume potatoes almost every day. In addition, potatoes are not only used as vegetables but can also be processed into other food products that help fulfill the body's nutritional needs, one of which is the need for iron (Martinez, B.R., et al., 2021).

Iron in the body must be adequately fulfilled in order to avoid anemia. This disease is particularly vulnerable to occur in adolescent girls and pregnant women. Several factors that can trigger anemia in adolescent girls include monthly menstruation, as well as the rapid process of growth and development in the body, which causes an increased need for iron (Sari, P., et al., 2019). This also applies to pregnant women, who require twice as much iron compared to non-pregnant women. The increased iron requirements of adolescent girls require them to consume iron daily. However, data from the 2023 Indonesian Health Survey shows that the reason adolescents aged 10-19 years do not take iron supplements is because of the unpleasant taste and smell (Kemenkes RI, 2023). Data from the 2018 Basic Health Research (Riskesdas) shows that 32% of adolescent girls experience anemia. This means that out of 10 adolescent girls, 4 suffer from anemia (Riskesdas, 2018). Adolescent girls are a national asset whose health status needs attention, as it will affect future pregnancies. The same source also shows that 48.9% of pregnant women suffer from anemia. Anemia during pregnancy can impact both the mother and the fetus. The common effects on the mother include bleeding during childbirth and miscarriage of the fetus (Bruno F, et al., 2021). Therefore, it is necessary to consume foods that contain iron.

One of the foods that can be consumed is potato. However, the skin of the potato also contains a high amount of iron. Many people are unaware of the benefits of potato peel. Several experts have stated that one of the benefits of potato peel is its ability to increase hemoglobin (Hb) levels, thereby preventing and treating anemia (Sri Lasmawanti, et all, 2024).

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Anemia occurs in individuals who have hemoglobin levels below normal. A deficiency in hemoglobin levels can cause fatigue, headaches, shortness of breath, and other symptoms, which may interfere with daily activities. Iron is not only obtained from iron supplement tablets, but can also come from food sources, such as potato peel (Putri, N.M., et al., 2021).

Potato peel is a part of the potato that is often treated as waste. However, when studied, potato peel contains a high level of iron. A study conducted by Ifa Nurhasanah in 2022 on the analysis of Fe (Iron) content in potato peel flour showed that 100 grams contained 111.8 mg of iron (Ifa Nurhasanah, 2023).

Potato peel is known to contain not only iron, but also 115 kcal of calories, 5 grams of fiber, 7.8 grams of vitamin C, 5.5 mg of folic acid, 19.8 mg of calcium, 322 mg of potassium, and 3.1 mg of sodium. Considering the wide range of nutrients found in potato peel, it can be utilized effectively by the public for consumption. In addition to addressing anemia, potato peel may also be beneficial for other health conditions.

Potato peel has not been widely studied, which results in limited information being received by the public. This has led researchers to conduct further studies on potato peel, specifically on its extract, to determine the iron content value it contains. In the future, this will serve as the basis for continued research aimed at developing it into food products or medicine in the form of capsules.

Methods

The method used in this study involved both qualitative and quantitative approaches through laboratory experimentation. The qualitative aspect of the study aimed to identify the presence of iron content in the potato peel extract, while the quantitative aspect aimed to determine the iron content value in the extract. This research was conducted from March to July 2024 at the Undergraduate Pharmacy Laboratory, Faculty of Health Sciences, Ibrahimy University.

The instruments used in this study included a UV-Vis spectrophotometer, oven, crucible, moisture analyzer, powder grinder, knife, and rotary evaporator. The materials used were fresh potato peels, 70% ethanol, iron (Fe), and distilled water (aquadest). Several steps were required in the analysis to determine the iron content value in the potato peel extract, including preparation of the potato peel extract, followed by qualitative and quantitative analysis.

Potato Peel Extract

The sample used in this study was potato peel extract. The process of preparing the sample was carried out as follows is the first step is prepare fresh and non-rotten potatoes. Wash the potatoes thoroughly until all dirt and soil residues are removed. Prior to washing, soak the potatoes to make cleaning easier. Thinly peel the potatoes and separate the peel from the flesh. During the peeling process, take extra care to avoid removing the potato flesh along with the peel. Then, dry the potato peels using an oven for 3 days at a temperature of 40˚C. Once dried, grind the potato peels using a powder grinder. Sieve the powdered potato peel using a 100-mesh sieve. Measure the moisture content using a moisture analyzer, which yielded a result of 9.85%. Proceed with maceration using 70% ethanol at a ratio of 1:10. The maceration method with 70% ethanol can be used to extract iron ions because iron (Fe^{2+} and Fe^{3+}) is soluble in aqueous ethanol, especially when it forms complexes with phenolic compounds or tannins such as ferro-tannate and ferric-tannate. These complexes make iron more stable and soluble. Extraction efficiency increases if the contact time between the solvent and the sample is sufficiently long, allowing for the dissolution and breakdown of iron complexes. Studies also show that 70% ethanol can dissolve and distribute iron ions, making this method valid for extracting iron in its complex form (Susilo et al. 2023; Taşkın et al. 2021; Wang et al. 2020). Maceration was conducted for 3 days, with stirring performed daily. After maceration, filtration was carried out, to separate the filtrate

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from the maceration. during which foam was observed, indicating the presence of saponins. The filtrate was then subjected to solvent evaporation using a rotary evaporator at 40˚C and 100 rpm until no solvent droplets remained. The resulting extract was transferred into a crucible and thickened using a water bath at 40˚C for 8 hours. The final product was a thick potato peel extract.

The next step was to conduct a qualitative test to identify the presence of iron in the thick extract. The procedures carried out included the followingis the thick extract was dissolved in a suitable solvent. The presence of Fe ions in the extract was then tested using NH_4OH reagent (a positive result for Fe^{3+} ions is indicated by the formation of a brownish, jelly-like precipitate) and a mixture of KSCN + HNO_3 (a positive result for Fe^{3+} ions is indicated by the appearance of a slightly reddish-yellow solution).

Next, the potato peel extract was subjected to quantitative analysis using a UV-Vis spectrophotometer. The following steps were carried out are preparation of 0.5 N KSCN reagent was done by dissolving 4.85 grams of KSCN in 100 mL of water using distilled water (aquadest) as the solvent. Preparation of 2 N HNO_3 was carried out by diluting 12.85 mL of concentrated HNO_3 in 100 mL of aquadest. Preparation of a 10,000 ppm stock solution was done using $FeCl_3$ standard as the Fe^{3+} ion source, by dissolving 1 gram of $FeCl_3$ in 100 mL of aquadest. Preparation of an intermediate standard solution of 100 ppm was done by diluting 1 mL of the stock solution in 100 mL of aquadest. The calibration curve was created using intermediate standards with concentrations varying between 5 and 10 ppm in 10 mL flasks, to which 1 mL of KSCN and 1 mL of HNO3 were added as reagents before the solution was added up to the mark. The absorbance of each solution was measured at a wavelength of 480 nm. The resulting calibration curve equation was y = 0.0473 + 0.1291, with an R^2 value of 0.9915. Maximum wavelength measurements were performed in the visible wavelength range of 380 to 750 nm. The maximum wavelength obtained was then used to measure the absorption of the calibration curve and samples. The calibration curve of the standard solution was measured using solutions with a concentration range of 5–10 ppm. This calibration curve equation was then used as the basis for determining the Fe^{3+} concentration in the sample. The test solution was prepared by dissolving 1 gram of the thick extract in 100 mL of aquadest. From the resulting solution, 1 mL was taken and placed into a 10 mL volumetric flask, to which 1 mL of KSCN and 1 mL of HNO_3 were added. If a reddish-yellow solution was formed, the flask was filled to the mark with aquadest, and the procedure was replicated three times. The absorbance of each test solution was measured and calculated using the calibration curve equation. This study is a quantitative research with a descriptive-analytic design, which is used to describe existing problems (Ratna, Nyoman Khuta, 2012). The sampling technique used was purposive sampling. The sample consisted of 75 adolescent girls aged 12–14 years. The study was conducted from September 2024 to February 2025 at the Salafiyah Syafi'iyah Islamic Boarding School in Sukorejo, Situbondo. The research instrument used was a questionnaire. The data were analyzed using univariate analysis.

Results

The results of the qualitative and quantitative analysis to determine the iron content value in the potato peel extract are presented in the table below.

Qualitative analysis results indicate the presence of Fe ions. With NH4OH, a brown precipitate forms, indicating the presence of Fe3+ ions because Fe3+ ions in basic conditions form a brownish-red Fe(OH)3 precipitate. With KSCN + HNO_3, a color change to reddish-yellow occurs, indicating the formation of the $Fe(SCN)_3$ complex, characteristic of Fe^{3+} ions in acidic solutions. In summary, both reagents provide strong evidence of the presence of Fe^{3+} ions in the ethanol extract of potato peel tested. This reaction is a common approach in qualitative analysis of iron ions in plant extract samples. Studies related to potato skin ethanol extract mention the content

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of active compounds that can interact with Fe ions, and show the potential for chemical testing in accordance with the color and precipitate results. The intensity of the red color that appears in the $Fe(SCN)_3$ complex solution (the result of the reaction of Fe^{3+} ions with KSCN) correlates with the amount or concentration of Fe^{3+} ions in the sample. The $Fe(SCN)_3$ complex is blood red/orange red in color, and the more Fe^{3+} ions that react with thiocyanate ions (SCN^-), the more intense the red color that forms. The measurement of color intensity is usually performed with a spectrophotometer at the maximum wavelength of the complex (usually around 450–500 nm depending on the solution conditions). The higher the concentration of Fe^{3+} ions, the greater the absorbance measured, and the darker/more intense the color of the solution will appear. Therefore, this color intensity can be used as a quantitative analysis method for Fe^{3+} ions by creating a calibration curve from standard Fe^{3+} solutions (Fahmi, Kurniawan, and Indriawati 2022).

Table 1. Qualitative Test Results

Sample	Reagent	Result	Description
Potato peel ethanol extract	NH4OH	There is brown deposit	Positive Fe^{3+}
	KSCN+HNO3	There is a change in color to reddish yellow	Positive Fe^{3+}

The standard curve obtained is the equation y = 0.0473 + 0.1291 with an R2 value of 0.9915, which is then used to calculate the Fe ion content in the sample. The standard curve obtained can be seen in the following figure.

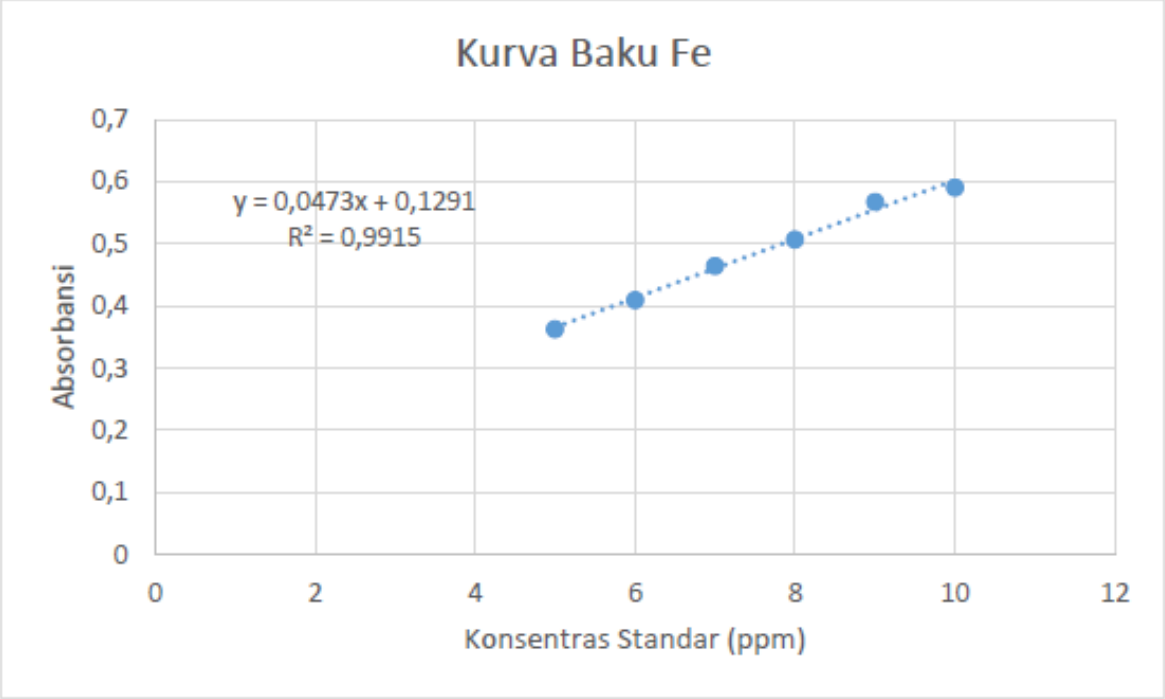

Table 2. Iron Content Value in Potato Peel Extract

Sample	Result	SD
Potato Peel Extract	11,526 mg	0,072639819

Table 2 shows that the iron content value in the potato peel extract is 11.526 mg per 100 grams. This value is relatively high and differs from that found in the potato flesh.

Discussion

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Qualitative Analysis

Fe^{3+} ions react with SCN^- from KSCN to form a red-colored Fe $(SCN)_3$ complex, which is characteristic of the presence of iron (III) ions. HNO_3 serves to maintain an acidic environment so that Fe remains in the form of Fe^{3+} and aids in dissolution. Fe^{2+} does not produce the same red color, so this reaction is specifically used for Fe^{3+} analysis (Fahmi et al. 2022).

This study was conducted to determine the results of qualitative and quantitative analyses. The qualitative test of the potato peel extract indicated the presence of iron, as shown by the appearance of a slightly reddish-yellow color. Potato peel, which is often considered waste by the public, in fact contains nutrients that are essential for the body, one of which is iron (Susarla N, 2019). Iron is a mineral that plays a crucial role in the body with several important functions. One of its key roles is in the formation of hemoglobin. Hemoglobin is a protein found in red blood cells that binds and distributes oxygen throughout the body. A deficiency in hemoglobin levels in the body is often caused by insufficient daily iron intake. The impacts of this deficiency include fatigue, difficulty concentrating, shortness of breath, frequent dizziness, and headaches (Putri, N.M., et al., 2021). These symptoms can be addressed simply by meeting the body's iron needs, one of which can be achieved by consuming potato peel.

Quantitave Analysis

The low Fe content in potato skin ethanol extract is likely due to the naturally low Fe content in potato skin (±4.1 mg/100 g) and suboptimal extraction techniques, such as time, temperature, solvent ratio, and stirring. In addition, Fe is generally bound as a complex with tannins or phenolic compounds, which may not be completely broken down in 70% ethanol. Oxidation or degradation processes during extraction may also reduce the soluble Fe content (Karunia and Fauziyyah, 2023).

The purpose of the quantitative analysis was to determine the iron content value in the sample. The sample used in this study was potato peel extract. The iron content value is presented in Table 1, which shows that the extract contains 11.526 mg of iron per 100 grams. This indicates that potato peel extract can meet a person's daily iron needs if consumed regularly. There is a difference in iron content values between potato peel flour and extract, as observed in studies conducted by the same researcher. However, the iron content present in potato peel can serve as a reference for the public as a preventive and responsive measure against the occurrence of anemia.

The age groups most vulnerable to anemia are adolescent girls and pregnant women. Several factors that contribute to the occurrence of anemia in these at-risk groups can be prevented by consuming foods rich in iron. Potato peel can be considered a viable food option that can be utilized for this purpose. It is an ingredient that is both easily accessible and affordable, making it a practical choice for addressing anemia through dietary means.

Potato peel extract may also be used as a remedy without further processing, which can benefit individuals who prefer simpler methods without the need for cooking. However, based on the results of this analysis, it was found that the potato peel extract contains saponins. When consumed in excess, saponins may lead to other health issues. Therefore, the consumption of potato peel should be adjusted according to individual needs. The presence of saponins was indicated by the appearance of foam during the extraction process. In addition, potato peel intended for consumption should be handled carefully, including the selection of fresh potatoes and proper cooking methods to prevent damage to the iron content.

Conclusion

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This study shows the presence of Fe^{3+} ions from qualitative tests using NH4OH and KSCN+HNO3 reagents. The iron content in potato skin ethanol extract is 11.526 mg per 100 g. This study concludes that the iron content value in potato peel extract is 11.526 mg per 100 grams. Potato peel extract can be used as a remedy to prevent and address anemia in vulnerable groups, particularly adolescent girls and pregnant women, by helping them achieve adequate hemoglobin levels through sufficient iron intake.

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