

## Comparison of Iron (Fe), Calcium (Ca) and Magnesium (Mg) Qualitative Test on Yellow and Black Raisins Nutrition-Rich Snacks as Alternative Blood Enhancement

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### ABSTRACT

*Lack of blood or iron deficiency or better known as anemia, which is in the blood there is a condition where the hemoglobin level in the blood is lower than normal. The aims of this study was to compare Fe levels, Calcium levels and the presence of magnesium in raisins. Qualitative examination of the presence of magnesium content in yellow currants and black currants by means of drying through a furnace until ash is formed and followed by the addition of 2 N nitric acid. Furthermore, several reagents such as dilute HCl, NaOH and Na<sub>2</sub>S are added. The formation of a white precipitate indicated that the raisin sample contained magnesium and was examined quantitatively by the AAS (Atomic Absorption Spectrometry) method. In the qualitative test of yellow currants and black currants, positive results were obtained containing Magnesium (Mg). Quantitative research uses the AAS (atomic absorption spectrophotometry) method, which is a quantitative elemental analysis method whose measurement is based on the absorption of light with a certain wavelength by metal atoms in a free state. Determination of Fe content in yellow currants obtained values of 17.620 µg/g, Ca as much as 106.200 µg/g and in black currants obtained Fe values of 17.590 µg/g and Ca as much as 288.750 µg/g. Based on the value obtained, the average Fe requirement in humans is around 1-2 grams per day by making daily snacks, both yellow currants and black currants, which can meet the needs of iron and calcium in the body. Besides being recommended to consume yellow or black raisins, it is also highly recommended to take sources of iron and calcium from milk and dairy products as well as foods from other calcium sources, for maximum results.*

**Keywords:** AAS, Fe, calcium, raisins, anemia

### INTRODUCTION

Lack of blood or iron deficiency or better known as anemia is in the blood there is a condition where the hemoglobin level in the blood is lower than normal. In developing countries such as Indonesia, it is predicted that most iron deficiency or anemia is caused by a lack of iron consumed in daily food. Menus that are inadequate and contain iron sources are due to a lack of public understanding of sources of iron from animal and plant foods. (Damayanti, 2017)

Anemia is one of the problems, namely nutritional problems that are often found in all countries, both in developed and developing countries, it becomes a health problem for the community. (Indriana, 2017)

According to the World Health Organization (WHO) in the World Wide Prevalence of Anemia in 2015 shows that the incidence of anemia in the world is estimated to be around 40.88%. According to the Ministry of Health (2018) "In Asean countries it is estimated that 25-40% of adolescent girls experience mild and severe levels of anemia,

this is due to the lack of understanding of the population in a society about sources of iron that are easy and cheap to obtain. The total population of adolescents (10-19 years) in Indonesia is estimated to be around 26.2% consisting of 50.9% male and 49.1%. (Putri, 2018)

According to the Indonesian Demographic and Health Survey in 2017, anemia sufferers in Indonesia in children aged 5-12 years is 26%, in women aged 13-18 it is 23%. The prevalence of anemia in men is lower than women, namely 17% in men aged 13-18 years. (Faiqah et al., 2018)

The level of knowledge of nutritional problems which is the highest prevalence is anemia. In children there is a lack of blood so that it interferes with the process of growth and development, is susceptible to disease and development in thinking can also be disrupted. (Listiana 2016).

### Reviews About Raisin

According to Nanik (2020) which states that "The universal era has an impact on

various aspects of life, one of which is changes in people's lifestyles. Ease of access from technological and industrial developments makes people tend to have unhealthy lifestyles such as lack of activity, often consuming fast food and increasing stress burden “.

Utilization of raisins into food products is expected to optimize the utilization of wine centers in Indonesia. In addition, the use of raisins as snacks can also reduce the number of anemia sufferers in children under five in Indonesia so as to improve the quality of life of the nation's successors. (Nadira, 2018 )

Raisins are one of the dried fruit that comes from grapes, whether they come from red, green or purple grapes. Raisins have an attractive appearance with a sour taste and aroma mixed with sweet, dry fruits that contain lots of vitamins, minerals and bioactive compounds that can be used as an alternative for people who are on a diet or weight loss. (Fajariani, 2017)

Recent studies have also demonstrated the efficacy of these foods on IDA. Raisins are a source of vitamin C, B-12, and iron, which play an important role in treating anemia by increasing the number of red blood cells. Another study showed that the combination of jaggery with raisins as a natural dietary supplement was better for treating IDA without the prominent side effects observed with oral and parenteral iron preparations. Regarding grape molasses, a study found that in non-anemic individuals, the absorption of iron from grape molasses was comparable to that of ferrous sulfate. Therefore, grape molasses is an effective source of iron in preventing iron deficiency anemia. Investigating the effects of chickpeas on anemia, animal studies in female rats demonstrated that chickpea seeds are an effective source of iron supplementation for IDA in rats and could be developed as a functional product to address iron deficiency due to malnutrition. ( Rosyada, 2013 )

### **Overview of Anemia**

According to WHO (2015) the classification of normal hemoglobin levels in the age range 10-11 years <11.5 g/dl, age range 12-14 years <12 g/dl, women aged >15 years

<12 g/dl, and men aged >15 years <13 g/dl. One of the main contributions to anemia is iron deficiency although folic acid deficiency, vitamin B12 deficiency and protein deficiency, as well as other vitamins and trace elements are very influential on the occurrence of anemia. (Muliani, 2018)

According to Citra (2012), anemia is divided into 2 types; nutritional anemia, is subdivided into several types based on the main source of anemia, such as anemia caused by iron deficiency, anemia caused by vitamin C deficiency, anemia caused by vitamin E deficiency, anemia caused by folic acid deficiency and anemia caused by anemia. caused by vitamin B12 deficiency. Non-nutritional anemia caused by damage to the spinal cord as a place for the formation of blood cells, such as red blood cells (erythrocytes), white blood cells (leukocytes) and platelets (blood platelets).

### **Overview of Atomic Absorption Spectrometry (AAS)**

Spectrometry is a quantitative analytical method whose measurement is based on the amount of radiation produced or absorbed by an atomic or molecular species of analyte. One part of spectrometry is Atomic Absorption Spectrometry (AAS), which is a quantitative elemental analysis method whose measurements are based on the absorption of light with a certain wavelength by metal atoms in a free state. (Pardede 2012)

In the AAS method, as in other atomic spectrometry methods, the sample must be converted into the atomic vapor form. This conversion process is known as atomization, in this process the sample is evaporated and decomposed to form atoms in the form of vapor. In general, the formation of free atoms in the gaseous state goes through the following steps; separation of the solvent, at this stage the solvent will evaporate and leave a solid residue, evaporation of the solid, this solid dissociates into its constituent atoms which will initially be in the ground state, some atoms will experience excitation to a higher energy level and will reach a condition where the atoms are able to emit energy. (Jamaluddin, 2018)

## MATERIALS AND METHODS

This research is an in vitro laboratory experiment. This research was conducted at the Pharmacy Chemistry Laboratory of the Health Ministry of Health Makassar and Makassar Health Laboratory from June 2021 to August 2021. Materials and tools used; yellow currants and black currants, HCl solution, Na<sub>2</sub>S, NaOH, Furnace, cup, analytical balance, dropper, test tube, AAS.

### Qualitative Analysis

First, the cleaned samples of yellow currants and black currants were weighed 20 g, then put into a cup, followed by heating in a furnace for 2 days until they became ash at a temperature of 600 °C. The next step is diluted with 2 N nitric acid, then filtered to get a clear solution. After that, 2 mL was added with NaOH, 2 mL was added, Na<sub>2</sub>S was taken, 2 mL was added HCl. A positive result containing magnesium is indicated by the formation of a white precipitate.

### Quantitative Analysis

In the preparation stage for calibration, first a standard solution was made for each element, namely Fe and Ca, then the absorbance of the standard solution was measured with optimum parameters using AAS.

### Tools and Materials

The tools used in this study were Atomic Absorption Spectrophotometer (PG Instrument AA500), analytical balance (ADAM PW-254), sample container, knife, oven, blender, measuring flask, beaker, Erlenmeyer, measuring pipette, stirring rod, electric bath. While the materials used in this study were samples of yellow currant and black currant, HNO<sub>3</sub> (Merck), aquades, and pure standard solutions for iron and calcium.

The working procedure carried out in this study was initiated by weighing 2 grams of samples of yellow currant and black currant that had been roasted and mashed in an erlenmeyer whose weight was known. Then 10 mL of HNO<sub>3</sub> p.a. added to each erlenmeyer and

left for ± 24 hours, after which the sample was heated at 100 °C until the yellow vapor was not visible and the solution became clear. Next, measure the extract from heating as much as 1 mL diluted with water to an exact volume of 50 mL and shake it until it is homogeneous and the results of the dilution are analyzed using AAS.

## RESULTS AND DISCUSSION

From some literature it says that raisins contain iron which is very good to be used as a daily snack as a blood enhancer as well as containing high levels of antioxidants. The need for iron is adjusted to a person's age and usually increases with age.

**Table 1.** Results of qualitative examination of magnesium

No	Name	NaOH	Na <sub>2</sub> S	HCl
1	Yellow raisins	↓White	↓White	↓White
2	Black raisins	↓White	↓White	↓White

**Table 2.** The results of the yellow raisins examination

No	Parameter	Unit	Inspection Results
1	Iron (Fe)	µg/g	17.62
2	Calcium (Ca)	µg/g	106.20

**Table 3.** Results of black raisins examination

No	Parameter	Unit	Inspection Results
1	Iron (Fe)	µg/g	17.58
2	Calcium (Ca)	µg/g	288.75

Data from the qualitative examination of the presence of magnesium in yellow currants and black currants all produced white deposits on the addition of NaOH, Na<sub>2</sub>S and HCl, this indicates that yellow currants and black currants contain magnesium (Mg). Magnesium (Mg) is needed by the body because it plays an important role in helping the activation of vitamin D in regulating the need for calcium (Ca) and phosphate to support bone growth and formation. Adequate intake of magnesium is able to protect bones from loss, fractures and osteoporosis. The benefits of magnesium for the body are many, including relieving symptoms of heartburn, treating constipation, reducing the risk of colon cancer, lowering high blood pressure, reducing the risk

of diabetes, playing a role in bone formation, reducing symptoms of premenstrual syndrome, maintaining heart health. Seeing the many benefits of magnesium for the body, it is highly recommended to consume yellow currants and black currants every day, besides that other sources of magnesium from other types of food are spinach, almonds, chocolate, tofu, edamame (a type of nuts). If there is a lack of magnesium in the body, it can cause nerve dysfunction and cause mental problems.

The results of the examination by atomic absorption spectrometry in table 1 and table 2 show that the Fe content in yellow raisins is 17.62 µg/g (also known as sultanas) while in black currants the value is 17.58 µg/g. The results of the examination values are not too much different, only about 0.4µg/g. Both yellow currants and black currants are made from dried grapes. Seeing the differences that are not too different, this is because yellow raisins and black raisins are only distinguished by the color of the raisins. Yellow raisins are obtained from a type of Thomson grape with a greenish yellow color which during the drying process is added sulfur dioxide gas to maintain the color. While black currants come from purple/black grapes that are dried.

**Table 4.** Fe or iron requirements in humans

No	Age	Iron Needs
1	Infant up to 6 months of age	0.27 mg
2	Infants 7 – 12 months	11 mg
3	Children aged 1-3 years	7 mg
4	Children aged 4 – 8 years	10 mg

In table 1 and table 2, the comparison of calcium (Ca) examination results is higher in black currants than yellow currants. While the two have much in common, they are also different in several ways. What sets them apart is the type of wine that is made and the processing method used. Raisins are dry white grapes that only turn dark in color after they go through the drying process. They can be made from a variety of different grape species, such as Moscatel, Lexia, Waltham Cross and Thompson grapes. Sultanas are also dry white grapes, but they come from seedless varieties. They tend to absorb liquids easily, are smaller

than raisins, and are usually slightly sweeter. Raisins are usually dried for three weeks, while sultanas are first coated in a solution of vegetable oil and then dried more rapidly. They are also preserved with sulfur dioxide more often than raisins, which helps maintain their lighter golden color. Calcium in the body is needed to build strong bones. However, the body cannot produce calcium on its own and requires external intake. Calcium intake can be obtained from food and supplements.

Calcium intake that enters the body will be absorbed and then sent to the bones with the help of vitamin D. The period of calcium absorption increases between the ages of 10-20 years, and reaches a peak at the age of 30 years. After that, calcium absorption will decrease. Calcium reserves in the body will continue to decrease along with the decreased absorption of calcium. To be able to meet the needs of the body, it needs to be balanced with adequate calcium intake.

## CONCLUSION

Based on the results obtained in the working phase of this research, several conclusions can be drawn, namely; Both types of raisins, both yellow and black raisins contain magnesium (Mg) which plays a very important role in assisting the activation of vitamin D in regulating calcium requirements to support bone growth and formation. The content of Fe (iron) in yellow raisins and black raisins is not too much different, so it is highly recommended to consume both types of raisins to help the government in the government's food diversification program. The content of calcium (Ca) in black raisins is higher than that of yellow raisins, this is because apart from the type of processing, which takes longer to dry than yellow raisins and the different types of grapes, also because yellow raisins are given sulfur dioxide to maintain their color.

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## REFERENCES

- Citrakesumasari. (2012). Nutritional Anemia Problems and Its Prevention. Kaliaka :
- Damayanti ET, Kurniawati P, 2017, Comparison of Vitamin C Determination Methods in Packaged Drinks Using UV-Vis Spectrophotometer and Iodimetry Methods, [https://diploma.chemistry.uui.ac.id/wp-content/uploads/2018/03/ Proceedings - SNKP-UM-2017-Puji-Kurniawati-2.pdf](https://diploma.chemistry.uui.ac.id/wp-content/uploads/2018/03/Proceedings-SNKP-UM-2017-Puji-Kurniawati-2.pdf)
- Fajariani D, Gunadi A., Wahyukundari M. A., 2017, Antibacterial Power of raisins Infusion (*Vitis vinifera* L.) Concentration of 100%, 50% and 25% Against *Streptococcus mutans*. <https://jurnal.unej.ac.id/index.php/JPK/article/download/5778/4288> <https://m.brilio.net/brilicious/kuliner-kesehatan/10-food-high-calorie-to-gain-weight-child-190314t.html>, accessed January 15, 2020).
- Indriana, R. (2017). The Relationship of Adequacy Levels of Fe, Vitamin B9, AND Vitamin B12 with Hemoglobin Levels in 11-Year-Old Children at Public Elementary School 02 Pedurungan Kidul Semarang. *Journal of Chemical Information and Modeling*, 53(9), 1689–1699. <https://doi.org/10.1017/CBO9781107415324.004> accessed March 25, 2020
- Jamaludin Al Anshori, S.Si.,2018, Teaching materials, atomic absorption spectrometry, Staff of the Chemistry Laboratory of Natural and Environmental Materials, Department of Chemistry, Faculty of Mathematics and Natural Sciences, Padjadjaran University
- Listiana A., 2016, Analysis of Factors Associated with the Incidence of Iron Nutrient Anemia in Young Women at SMKN 1 Terbanggi Besar, Central Lampung. *Journal of Health*, VII, 455–469. accessed 27 March 2020
- Muliani S., 2018, Knowledge of Young Women About the Benefits of Fe Tablets at SMK Tunas Husada Kendari, <http://repository.poltekkes-kdi.ac.id/628/1/pdf>.
- Nadira Deanda Putri, Yosef Purwoko, 2018, The effect of giving raisins (*Vitis vitifera* L.) to VO2 max in young students from the medical faculty of the University of Diponegoro. *JKD*, vol. 7, No. May 2, 2018 : 875 –
- Nanik Suhartatik , Diah Ayu Eka Patmasari, Yustina Wuri Wulandari, Akhmad Mustofa, Sri Handayani , 2020 .The Effect of Nutrition Education on Students' Consumption Behavior at Universitas Slamet Riyadi Surakarta. *Indonesian Journal of Agricultural Research* Vol. 03, No. 01, 2020 | 1 – 9.
- Pardede, T. R., Muftri D. S., 2012, Determination of Sodium and Magnesium Levels in Watermelon (*Citrullus vulgaris*, Schard) Yellow and Red Flesh by Atomic Absorption Spectrophotometry. Thesis, Fak. USU Pharmacy, Medan.
- Putri, AV., Sri Tj., and Ame S. 2018. "Differences in Saliva pH After Consumption of Thompson Seedless Raisin Raisins" in the *Journal of Dentistry Unpad*, Faculty of Dentistry, University of Padjadjaran, 30 (2) : 133 – 137
- Rachmiaty R., 2009, Overview of Calcium Sources of Food Intake and Associated Factors in Adolescent Athletes in Swimming at the South Jakarta Area Swimming Club in 2009,

<http://lib.ui.ac.id/file?file=digital/124544-S-5745-Overview%20intake-HA.pdf>

Rosyada F. A., Nurmilasari H, Kalamilah M, Bokis (Processed Raisins): Solutions to Reduce Malnutrition in Toddlers in Central Java, Faculty of Mathematics and Natural Sciences, Sebelas Maret University, <https://doi.org/10.24127/124544-S-5745-Overview%20intake-HA.pdf> December 2013 Yogyakarta..

Wulandari, S. 2017. "Effectiveness of Fe Tablet Consumption During Menstruation on Hemoglobin Increase in D-III Midwifery Students at Pasir Pengaraian University" in the Journal of Martenity and Neonatal, 18.