Effect of Leaf and Fruit Extract of Fig (Ficus carica) on Hemoglobin Levels in Mice (Mus musculus)

Eva Agustina[1], Nova Lusiana[2], Reynaldi Candro Permana[1], Yanuar Bakhrul Alam[1], Yolanda Safira Virginia[1], Risa Purnamasari[1]

[1]*Faculty of Science and Technology, Universitas Islam Negeri Sunan Ampel, Surabaya, Indonesia*
[2]*Faculty of Psychology and Health, Universitas Islam Negeri Sunan Ampel, Surabaya, Indonesia*
risap1989@gmail.com

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Abstract: According to WHO, the number of people with anemia in the world reaches two billion or 30% of the world's population. About 25% of adolescents and school-age children in Indonesia suffer from anemia. One of the anemia drugs that is often used is neo plus blood tablets, but the side effects of these drugs cause nausea and constipation. The leaves and fruit of tin can be used as an alternative to natural anemia treatment. This research is experimental in nature using a completely randomized design. This study aims to determine the effect of fig leaf and fruit extracts on hemoglobin (Hb) levels tested on mice. The test animals were divided into 3 groups, the control group was given distilled water and the other two groups were given extracts of fig leaves and fruit. The volume of the extract was given orally at a dose of 300 mg/Kg BW for 14 consecutive days. The results showed the average hemoglobin level of mice in group 1 (8.73 g/dl), group 2 (10.90 g/dl), and group 3 (11.28 g/dl). It can be concluded that group 3 with fig extract gave the best results in increasing the hemoglobin levels of the test animals.

1 INTRODUCTION

Anemia is a condition when erythrocytes and hemoglobin cannot carry out their functions as oxygen suppliers to body tissues (Fajriyah & Fitriyanto, 2016). This causes a decrease in hemoglobin levels below normal (Handayani & Wibowo, 2008; Fajriyah & Fitriyanto, 2016). One of the symptoms of anemia is lethargy, weakness, dizziness, dizzy eyes, and a pale face (Indartanti & Kartini, 2014). Acute anemia causes hemolysis of blood cells (Dhaliwal *et al*, 2004). Anemia is one of the biggest public health problems in the world for women of reproductive age (Astriana, 2017).

The largest cases of anemia in Indonesia occurred in the group of adolescent girls (Suryani et al, 2017) with a prevalence of 57.1%, followed by pregnant women at 40.1%, and women of reproductive age at 27.9% (Fajriyah & Fitrianto, 2016). One of the causes of anemia is iron deficiency (Ani, 2016; Dewi, 2020). One of the anemia drugs that is often used is neo tablets plus blood. Based on research (Deswati *et al*, 2019), of 125 pregnant patients, 90 (72%) experienced nausea and 35 patients (28%) experienced constipation. There needs to be an alternative herbal treatment as an effort to prevent and treat anemia. Efforts to increase blood hemoglobin levels are an effort to cure anemia. According to (Almatsier, 2011 & Amalia, 2016) one way to increase blood hemoglobin is by eating foods that contain iron, folic acid, vitamin B12, and vitamin C.

Medicinal plants are a biodiversity that can potentially be a natural alternative medicine. The fig plant (*Ficus carica*) belongs to the Moraceae family which is native to the Middle East and West Asia (Lestari et al, 2020). This plant can adapt and thrive in Indonesian soil (Dewi *et al*, 2017). Fig plants have properties to overcome various diseases. In 100 g of figs contains 0.75 grams of protein, 2 mg of vitamin C, 6 micro grams of folic acid (Aiman *et al*, 2019). According to (Badgujar *et al*, 2014) figs contain umbelliferone and scopoletin so that it can be used as a traditional medicine for anemia.

In addition to the fruit, fig leaves also contain complete secondary metabolites such as saponins,

tannins, steroids, flavonoids, alkaloids, and terpenoids which are traditionally used to prevent anemia (Hasanah & Wijayanti, 2020). Long-term administration of fig leaf extract has been shown to increase hemoglobin (Odo *et al*, 2016). The dose of fig leaf and fruit extract given to mice was 300 mg/kg BW/day. This study aims to determine the effect of fig leaves and fruit on hemoglobin levels in the blood.

2 METHODS

Tools And Materials

The tools used in this practicum are cages and drinking containers, glass beakers, analytical scales, 2.5 ml syringes, digital scales, 50 ml ependorf, surgical instruments, masks, gloves, syringes, sonde needles, HBCU Accu Check, HB strips 48, Microscope, Object glass, and Cover glass.

The materials used in this practicum are mice, fig leaf and fruit extract, EDTA, and Aquades.

Method

This research was carried out from 1 to 30 June 2022 at the Integrated Laboratory of UIN Sunan Ampel Surabaya, the complete stages are as follows.

Test Animal Preparation

Prepare a cage that has been filled with husks, eat and drink. The test animals used in this study were DDY strain mice with 3 treatments, namely distilled water as a control, fig leaf extract, and fig fruit extract. The initial weight of the mice was measured and labeled as identification, then 2 mice were placed in each cage. Feeding and drinking was done every day and the husk was replaced every 3 days.

Giving Treatment

The treatment was given orally at a dose of 300 mg/kg BW/day as a control variable. Making fig leaf extract by dissolving 300 mg of fig extract with 10 ml of aquadest. Giving treatment volume extract in mice by calculating the weight of mice/1000g x 10 ml. The extract was administered for 14 consecutive days.

HB level measurement with Easy Touch

After administration of the extract for 14 days, the mice were sacrificed under anesthesia using chloroform. Blood sampling was carried out by direct injection in the heart of the mice (cardiac puncture) according to research conducted by (Sitaswi & Sri, 2017). The next process, blood is dripped on the HB 48 strip which has been placed on the Easy Touch device to determine the HB level. The rest of the blood is put into an ependorf which has been filled with EDTA solution so that it doesn't clot.

3 RESULTS

Observations of the test animals were carried out after 14 days of treatment. The results of observations on the average hemoglobin (Hb) levels of mice treated with distilled water/control (group 1), fig leaf extract (group 2), and fig fruit extract (group 3), are presented in the following graph.

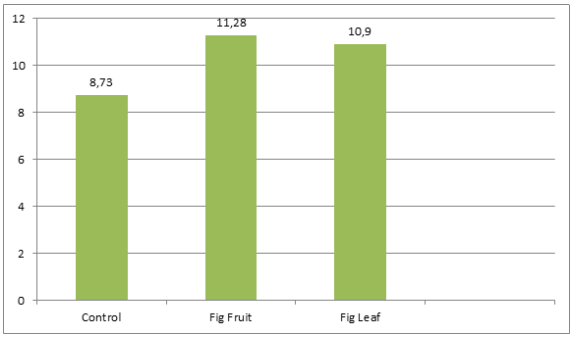

Figure 1. Average results of hemoglobin levels after treatment (mg/dl)

The results of measuring hemoglobin (Hb) levels based on table 1 show that there is an increase in hemoglobin levels after treatment of fig leaf extract and fig fruit when compared to the treatment of distilled water as a control. The best results from the measurements in graph 1 show that the highest hemoglobin levels of mice after 14 were found in group 3 with fig fruit extract, which was 11.28 g/dl. Fig fruits are proven to be more optimal in increasing hemoglobin because they contain essential compounds in the body's absorption such as vitamin C, protein, and folic acid.

4 DISCUSSIONS

According to research (Sitaswi & Sri, 2017) normal hemoglobin levels in mice are approximately 12.79 g/dl. The results of this study indicate that the

hemoglobin level of the control group is below the normal limit. Based on these data, it was proven that the increase in the hemoglobin level of mice which was originally below normal (8.73 g/dl) increased to close to normal levels (11.28 g/dl). *Ficus carica* is a plant source of iron, calcium, phosphorus, and fiber (Makmun, 2020). The vitamin contained in *Ficus carica* is vitamin B12 (Zaenuri *et al*, 2018). Thus, it can be seen that *Ficus carica* can increase hemoglobin. So that oxygen from the lungs can be circulated throughout the body and carbon dioxide can be immediately removed from the body (Lyza, 2010).

Nutrition is the most important component in body health (Pane *et al*, 2020). The body gets nutrients from food and drink intake. The small intestine (duodenum) is a place for absorption and decomposition of food structures (Nisa, 2020), one of which is minerals. One of the minerals found in food and drink is iron. One of the nutrients in food that can increase iron absorption is vitamin C (Palifiana *et al*, 2022).

According to (Hidayati, 2021) iron in food is divided into two, namely heme iron and non-heme iron. Heme iron will be absorbed into intact porphyrin complexes by the mucosa and then broken down by the hemooxygenase enzyme, so that iron can be released. Non-heme iron can only be absorbed by the body when it is dissolved.

According to (Hidayati, 2021) when in the stomach, most of the non-heme iron in the form of ferric ions will be reduced to ferrous. The process of ionizing ferric ions into ferrous ions in the stomach will be more optimal when the stomach is in an acidic atmosphere. Acidic atmosphere in the stomach is influenced by HCl and Vitamin C. Then, iron in the form of ferrous ions is dissolved into ascorbic acid, sugar and amino acids containing sulfur. Thus, non-heme iron can be absorbed by the duodenum. Absorption of non-heme iron will increase fourfold when vitamin C is present (Adriani & Wirjatmadi, 2012; Septyasih et al, 2016).

Heme and non-heme iron absorption processes use the same mechanism (Hidayati, 2021), namely by using transferrin and ferritin proteins (Almatsier, 2009; Patria *et al*, 2013). According to Hidayati (2013), mucosal transferrin takes iron from the digestive tract to the surface of the duodenum to be bound to transferrin receptors. Most of the transferrin carries iron to the bone marrow. The red marrow is the part that produces blood cells (Rosita *et al*, 2019). Ferritin becomes a storage protein for substances in the liver (Puspitaningrum *et al*, 2016).

According to (Adenkola et al, 2010; Patria *et al*, 2013) red blood cells (erythrocytes) have membranes composed of unsaturated fatty acids, so they are very susceptible to lipid peroxidation. Lipid peroxidation can cause unstable erythrocyte membranes which can then cause cell lysis. Vitamin C is an antioxidant that plays a role in maintaining erythrocyte membranes (Patria *et al*, 2013).

Erythrocytes contain hemoglobin that serves as a medium for transporting oxygen from the lungs to various peripheral tissues (Kosasi *et al*, 2014). According to (Rosita *et al*, 2019) hemoglobin is a protein consisting of globin protein consisting of four polypeptide chains. Each chain binds to heme which binds to Fe2+ ions which can bind to oxygen.

The process of forming hemoglobin will run normally when there is no disturbance in the formation of erythrocytes. The essential elements in the formation of erythrocytes, besides Fe, are vitamin B12, and folic acid (Sari, 2018). According to (Rosita *et al*, 2019) vitamin B12 and folic acid play an important role as cofactors in the synthesis of erythrocytes in red bone marrow. Vitamin B12 and folic acid combine with Fe2+ with transferrin from the duodenum. In folate deficiency anemia, megaloblasts are formed, which are abnormally large red blood cells in the bone marrow (Septyasih et al, 2016).

5 CONCLUSIONS

The most significant hemoglobin levels occur in figs. The average hemoglobin level in the treatment of figs, the hemoglobin level of mice increased by 29.21%. Meanwhile, the hemoglobin level of mice with fig leaf treatment increased by 24.86%.

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