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# Purple Sweet Potato Biscuits Affects Total Antioxidant Levels in Pregnant Women with Anemia

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**Abstract**

**Background:** One of the causes of the high maternal mortality rate is anemia that occurs during pregnancy. The purpose of this study was to determine the effect of giving eel and purple sweet potato biscuits to total antioxidant levels in anemic pregnant women in the Pampang Public Health Center, Makassar City. **Research methods**: This study used experimental research methods with a Randomized Control Trial pretest-posttest design with a control group. The research was conducted in the working area of Pampang Public Health Center, Makassar City. The number of samples was 20 pregnant women who were divided into 2 groups, namely the control group and the comparison group. The data analysis used included Wilcoxon, Mann Whitney, Paired T-test, and Independent T-test. Research result. **The results**: of the Mann Whitney test showed that there was no significant effect on the total antioxidant levels of pregnant women between groups in the post-intervention condition (p=0.496>0.05). However, the Wilcoxon test results showed a significant effect in both the intervention group (p=0.005) and the control group (0.018 <0.05). **Conclusion:** It was concluded that giving eel biscuits and purple sweet potato could increase total antioxidant levels and albumin levels in anemic pregnant women in the working area of Pampang Public Health Center Makassar City.

**Keywords: Eel, Purple Sweet Potato, Total Antioxidant, Albumin**

## I. INTRODUCTION

Nutrition and food problems are one of the problems that have an influence on the high maternal mortality rate (MMR) in Indonesia. Until now, the cause of the high maternal mortality rate (MMR) in Indonesia, one of which is the main nutritional problem that causes anemia that occurs during pregnancy [1].

The World Health Organization (WHO) defines anemia in pregnancy where the hemoglobin concentration is below 11 g/dl. Overall, WHO estimates that anemia in pregnant women is around 69.0%. In developing countries, the prevalence of anemia in pregnant women is estimated to vary between 53% to 90%, and an estimated 8.3% occurs in developing countries, such as Indonesia [2].

The Maternal Mortality Rate (MMR) in 1991 to 2007 was recorded to have decreased from 390 to 228 per 100,000 live births. However, data from the Indonesian Demographic and Health Survey (SKDI) in 2012 recorded a significant increase in MMR, from 228 to 359 per 100,000 live births. For this reason, the Ministry of Health launched the Expanding Maternal and Neonatal Survival (EMAS) program as an effort to reduce the MMR by 25%. Six of the provinces that have maternal mortality rates in Indonesia are 52.6% of the total maternal deaths and one of them is South Sulawesi [2].

The results of Riskesdas (2013) show that the proportion of anemia in pregnant women is 36.4% in urban areas and 37.8% in rural areas. Based on the 2014 Provincial Health Office report, the coverage of pregnant women receiving 90 Fe tablets in Indonesia from 2005 to 2014 tends to increase, but this increase has not yet reached the target. South Sulawesi Provincial Health Office report in 2014 with a percentage of 88.9%. The coverage of administration of Fe tablets in Puskesmas throughout Makassar City in 2012 was 70.40% for Fe21 tablets (30 tablets) and 63.59% for Fe3 tablets (90 tablets). Compliance with consuming Fe tablets was measured from the accuracy of the number of tablets consumed, the correct way of consuming, and the frequency of consumption per day [4].

Pregnancy is a stressful condition in which many physiological and metabolic functions are altered to some extent. As a result, an extraordinary series of events occurs during this period to sustain the mother while encouraging the growth and maintenance of the fetus [5]. This can cause an increase in oxidative stress in pregnant women and can pose a risk to the health and safety of the fetus and mother who experience anemia during pregnancy [7]. There are studies that show that the biological basis of the effects of pregnancy can increase oxidative stress which also affects the increase in iron requirements in pregnant women, even the body's antioxidant level can be used as a chemical biomarker of anemia [3]. Antioxidants play an important role for every individual under any conditions, especially in conditions of anemia, the administration and intake of antioxidants plays a very important role in preventing oxidative damage to erythrocytes [6].

Judging from the potential of regional resources, Indonesia has the potential for food availability as a source of nutrients in avoiding anemia, especially for pregnant women. One of them is sweet potato (Ipomoea batatas L). The purple color of sweet potatoes is due to the presence of natural dyes called anthocyanins. Anthocyanin compounds function as antioxidants and free radical scavengers, so that they play a role in preventing aging, cancer, and degenerative diseases. Sweet potatoes as food have good quality in terms of their nutritional content, especially carbohydrates, minerals, and vitamins [4]. Purple sweet potato contains anthocyanins in the range of ± 519 mg/100 g wet weight. Purple sweet potato anthocyanins have physiological functions as antioxidants, because they contain the minerals selenium and iodine whose activity is twenty times higher than other types of sweet potatoes. Sweet potatoes have considerable prospects and opportunities as raw materials for the food industry such as sweet potato flour [5]. Sweet potato flour has many advantages, namely it is easier to develop food products and nutritional value, it is more resistant to storage so it is important as a provider of industrial raw materials and prices are more stable [9]. The productivity of Indonesian sweet potato is 13.93 tons per hectare, above the world average productivity. It is hoped that the use of sweet potato flour can minimize the use of wheat flour, so that it can help reduce dependence on imported wheat and utilize domestic production which is abundant and high in nutrition.

Suggested that most sources of iron and protein come from animals such as fish, eggs, meat. Fish as animal food has several advantages over other protein sources. Among them, the high protein content in the fish body is composed of amino acids in the human body [10]. One type of fish that is rich in protein is eel.

Eel (Anguilla bicolor) is one of the fish that has not been widely known by the wider community which has a high nutritional content. Based on the results of the analysis of eels at the Health Laboratory of the Health Office on November 24, 2015, namely iron (Fe) 11.99 ug/g, albumin 147.78 mg/g, calcium (Ca) 469.16 ug/g, zinc/zinc 10.66 g/g, vit. A 0.10 g/g, vit. C 0.99 g/g, vit. E 4.41 g/g, carbohydrates 0.43%. In addition to its advantages, eel also has several disadvantages, namely high water content (80%) and fish body pH which is close to neutral causing the meat to be easily damaged. This can hinder its use as a food ingredient, therefore a processing process is needed to add value, both in terms of nutrition, taste, smell, shape and durability [6].

Pastries are practical food because they can be consumed at any time and with good packaging, besides that they have a relatively long shelf life. By adding certain food ingredients such as eel flour and purple sweet potato into the process of making pastries, cookies with added value can be produced that are good for health. Based on the results of an initial survey conducted at the Pampang Health Center in Makassar City in 2016 as many as 177 pregnant women who visited, there were still 149 women (82%) who experienced symptoms of anemia with signs of weakness, tiredness, lethargy, pale, dizzy eyes from position sitting while standing. The high incidence of anemia can generally be caused by a lack of nutrients in the food consumed. Iron deficiency anemia is the most common form of anemia, accounting for 50% of pregnant women. Iron deficiency causes a decrease in the amount of hemoglobin, low levels of hemoglobin which in turn causes a decrease in the production of

normal red blood cells. Based on the description above, the researcher is interested in conducting research on the effect of giving eel biscuits and purple sweet potato on total antioxidant levels in pregnant women with anemia in the Pampang Public Health Center Makassar City in 2016.

## II. METHOD

This study uses experimental research methods (Experiment Research) with a Randomized Control Trial pretest-posttest design with control group. Randomization was carried out in this study with the aim of allocating subjects into the treatment group and control group, thus making the two groups comparable. The purple sweet potato-eel biscuit intervention for pregnant women was carried out from April to May 2016 in the working area of Pampang Health Center, Panakukang District, Makassar City. This location was chosen because of the high prevalence of anemia in pregnant women [7].

The sample should be as large as possible. This opinion of Gay and Diehl (1992) assumes that the more samples taken, the more representative they will be and the results can be generalized. However, the size of the sample received will depend on the type of research. In a simple experimental study using an experimental group and a comparison group, the number of sample members can be used between 10 to 20 respondents each [6]

The samples in this study were 20 pregnant women, 10 experiments and 10 comparisons. The sampling technique used is purposive random sampling. Sampling of members of the population is carried out based on the considerations of the researcher, namely the inclusion and exclusion criteria.

## III. RESULT

The characteristics of pregnant women in this study are age, recent education, and working status of pregnant women. The description can be seen in the table below.

**Table 1. Distribution of Pregnant Women Anemia Based on Characteristics**

| Characteristics | Group | | | |
|---|---|---|---|---|
| | Intervention | | Control | |
| | n = 10 | % | n=10 | % |
| **Age** | | | | |
| <21 years old | 1 | 10 | 0 | 0 |
| 21-25 years old | 5 | 50 | 6 | 60 |
| >25 years old | 4 | 40 | 4 | 40 |
| **Education Level** | | | | |
| Elementary School | 1 | 10 | 2 | 20 |
| Junior High School | 4 | 40 | 1 | 10 |
| High School | 5 | 50 | 7 | 70 |
| **Working Status** | | | | |
| Work | 4 | 40 | 7 | 70 |
| Not Working | 6 | 60 | 3 | 30 |

*Source : Primary Data, 2016*

Table 1 shows that in the intervention group more pregnant women with anemia with ages 21-25 as many as 5 pregnant women (50%), last educated high school as many as 5 pregnant women (50%), and with working status i.e. not working as many as 6 pregnant women (60%). While in the comparison group, more 21-25 year olds as many as 6 pregnant women (60%), last educated high school as many as 7 pregnant women (70%), and with working status in pregnant women as many as 7 people (70%).

**b. Antioxidant Level**

The antioxidant levels of pregnant women of anemia are divided into two categories, namely low and normal. Here is the results of frequency analysis based on the total antioxidant levels of pregnant women anemia.

**Table 2. Distribution of Pregnant Women Anemia Based on Levels Antioxidant in Primary Health Center of Pampang Makassar**

| Group | Level Antioxidant | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Pre | | | | Post | | | |
| | Low | | Normal | | Low | | Normal | |
| | n | % | n | % | n | % | n | % |
| Intervention | 8 | 80 | 2 | 20 | 5 | 50 | 5 | 50 |
| Control | 4 | 40 | 6 | 60 | 3 | 30 | 7 | 70 |

*Source : Primary Data, 2016*

Table 2. showed that in the intervention group more pregnant women were anaemic with low antioxidant levels (80%) before intervention, but in the condition after treatment low antioxidant levels decrease to 50% only. While in the comparison group, more pregnant women were anaemic with normal antioxidant levels prior to intervention (60%) and also showed an improvement in post conditions to 70%.

**Bivariate Analysis**

**Effect of Fish Eel- Purple Sweet Potato Biscuits on Total Antioxidant Levels**

Data of the results of the examination of total antioxidant levels tested normality using Shapiro wilk. Based on normality tests, data on total pre and post antioxidant levels showed no normal distribution, so Mann Whitney's analysis used to determine the effect of eel fish-purple sweet potato biscuits on total antioxidant levels in two research groups. Meanwhile, to know the effect of giving eel fish-purple sweet potato biscuits to total antioxidant levels after intervention was used wilcoxon test. The results of the analysis can be seen in the following table 3.

**Table 3. Effect of Giving Purple Sweet Potato Fish Biscuits to Total Antioxidant Levels of Pregnant Women Anemia**

| Group | Antioksidan Total | | p* |
|---|---|---|---|
| | Pre | Post | |
| | Mean ± SD | Mean ± SD | |
| Intervention | 0,77 ± 0,48 | 1,21 ± 0,54 | 0,005* |
| Control | 1,05 ± 0,52 | 1,14 ± 0,51 | 0,018* |
| p** | 0,186** | 0,496** | |

Table 3 shows that based on mann whitney test results shows no significant influence between groups on conditions after intervention (0.496 > 0.05). However, wilcoxon test results showed significant influence in both the intervention group (p=0.005) and the control group (0.018<0.05).

## IV. DISCUSSION

In this study, interventions were carried out for pregnant women who had anemia by giving biscuits rich in nutrients, namely fish eel-purple sweet potatoes biscuits. These two main ingredients used have excellent nutritional content for the health of pregnant women, especially those with anemia.

Increased oxidative stress in pregnant women with anemia can interfere with maternal health as well as fetal growth at risk of maternal death and preterm birth. Oxidative stress is involved in various pathological processes in neonates [8]. Hundekar et al. (2012) reports that oxidative stress plays a considerable role in the pathogenesis of anemia [9] . Hemoglobin is highly susceptible to oxidants that cause disruption to oxygen transport. While erythrocytes are highly susceptible to oxidative damage as a result of lipid peroxidation in erythrocytes. Increased oxidative stress in pregnant women with anemia can interfere with maternal health as well as fetal growth at risk of maternal death and preterm birth [10].

The total antioxidant levels of pregnant women in the comparison group averaged 0.77 mmol/L in the pre-treatment, then to 1.21 mmol/L after treatment. The increase occurred about 57.1% in just one month. While the control group showed an average total antioxidant level before treatment of 1.05 mmol/L then increased to 1.14 mmol/L. The increase occurred by approximately 8.5% within a month. In addition, non-parametric test results showed that in both groups experienced significant changes. However, the fact is that the increase in the intervention group was much better and consistent in anaemic pregnant women compared to the comparison group. This suggests that purple sweet potato fish biscuits given to pregnant women in the intervention group were able to provide optimal benefits in increasing antioxidant levels in the body of pregnant women. The total antioxidant levels of pregnant women in the comparison group averaged 0.77 mmol/L in the pre-treatment, then to 1.21 mmol/L after treatment. The increase occurred about 57.1% in just one month. While the control group showed an average total antioxidant level before treatment of 1.05 mmol/L then increased to 1.14 mmol/L. The increase occurred by approximately 8.5% within a month. In addition, non-parametric test results showed that in both groups experienced significant changes. However, the fact is that the increase in the intervention group was much better and consistent in anaemic pregnant women compared to the comparison group. This suggests that purple sweet potato fish biscuits given to pregnant women in the intervention group were able to provide optimal benefits in increasing antioxidant levels in the body of pregnant women.

Biscuits with a mixture of eel fish are able to provide nutrient intake that can help in the improvement of anemia conditions. The iron content in fish eel is quite high, which is 11.99 µg/g. According to Ujang (2012), fish eel is also useful to increase the body's immunity by acting as an anti-oxidant [11]. Eel fish contain omega-3 (complex chain fatty acids), especially linoleic acid, EPA and DHA which are able to maintain optimal health status, lower blood cholesterol, and boost immunity [12]. The omega-3 content in fish eel is 5.64%. Not only omega-3, eel fish are also rich in omega-6 and omega-9 which can act as an anti-oxidant for the body to ward off free radicals [13][14]. Biscuits with a mixture of eel fish are able to provide nutrient intake that can help in the improvement of anemia conditions. The iron content in eel fish is quite high, which is 11.99 µg/g. According to Ujang (2012), eel fish is also useful to increase the body's immunity by acting as an anti-oxidant. Fish eel contain omega-3 (complex chain fatty acids), especially linoleic acid, EPA and DHA which are able to maintain optimal health status, lower blood cholesterol, and boost immunity [12][15].

In addition to the use of eel fish which is an animal food source, the biscuits in this study were also combined using plant food sources that are no less rich in nutrients for the body, namely purple sweet potatoes. The dominant purple sweet potato content to serve as a source of antioxidants is its anthocyanin content and phenol compounds. Ragil et al (2015) shows that purple sweet potatoes have the potential to prevent oxidative stress. The mechanism of purple yam tape extract in preventing oxidative stress is as an exogenous antioxidant that will decrease the number of free radicals formed, with a decrease in the number of free radicals then oxidative stress can also be avoided. Therefore, excessive amounts of antioxidants can bind to the activeness of antioxidants in neutralizing the free radicals that form [16].

## V. CONCLUSION

Giving eel biscuits and purple sweet potato can increase total antioxidant levels in anemic pregnant women in the working area of Pampang Public Health Center Makassar City. Good antioxidants will react with fatty acid radicals as soon as these compounds are formed. Of the various antioxidants that exist, the mechanism of action and its ability as an antioxidant varies greatly. Often, a combination of several types of antioxidants provides better protection (synergism) against oxidation than one type of antioxidant alone. So the higher the consumption of fat, the more depletion of anti-oxidants in the body. Pregnant women who have low levels of total antioxidants can have various negative impacts, such as abortion, premature labor, prolonged labor, postpartum hemorrhage, infection, etc. So it takes the intake of foods rich in antioxidants during this pregnancy. Therefore, the consumption of this purple sweet potato-eel biscuit is very good for pregnant women, especially pregnant women who also have anemia.

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