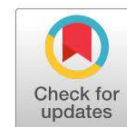


## The effect of *Averrhoa Carambola L.* on hemoglobin, blood pressure, defecation, and IL-6 serum levels



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### ABSTRACT

Prevention of anemia by consuming Fe tablets causes many complaints such as nausea, vomiting, constipation. The majority of WHO countries (132 to 159) have health problems particularly anemia among women and children. To address this issue and minimize its side effect, needed an alternative such as *Averrhoa Carambola L* (ACL) fruit which also contains iron. This fruit contains several compounds like flavonoid, alkaloid, saponin, protein, fat, calcium, phosphorus, iron/Fe, and vitamin A, B1 and C. Antioxidant content within this fruit is oxalic acid. In addition, the high nutrients in this fruit function as a dietary supplement. This investigation examined the effect of ACL on Hemoglobin (Hb), Blood Pressure (BP), defecation and IL-6 serum levels. This study explored literature reviews on ACL and its effect on Hb, BP, defecation, and IL-6. Keywords used in this study were of ACL, hemoglobin concentration, blood pressure, defecation, IL-6 serum concentration, health, anemia, hypertension, obstipation, immunity, mechanism, and evidence. Based on literature analysis, it showed that ACL improved Hb level, decreased BP, prevent obstipation, and lowered IL-6 serum. ACL can be given to women and children in Indonesia, but it needs further investigation to determine the appropriate dosage will be prescribed.

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### INTRODUCTION

Prevention of anemia on pregnant women by consuming Fe tablets during pregnancy raises complaints such as nausea, vomiting, constipation.(1) The star fruit (*Averrhoa Carambola L/ACL*) is offered as juice because it contains flavonoid, alkaloid, saponin, protein, fat, calcium, phosphorus, iron, and vitamin A, B1 and C.(2)(3)(4) Iron contained inside this fruit can increase Hb levels. In every 100 gram of this fruit contains energy 35,00 cal, protein 0,50 g, fat 0,70 g, carbohydrate 7.70 g, calcium 8.00 g., Phosphorus 22,00 mg, Fiber 0,90 g, iron 0.80 mg, vitamin B2 0.02 mg, Vitamin C 33.00 mg niacin 0.40 g.(5)(6) The natural antioxidant content of sweet star fruit is oxalic acid. The high nutrients content of star fruit is potential as a dietary supplement.(7)

It is estimated that pregnant women worldwide as much as 41, 8% get anemia. National coverage of pregnant women who got the Fe tablet in 2014 by 85.1%, the data did not reach the target program in 2014 which is 95%. In 2014, several provinces in Indonesia with the highest Fe coverage were Bali Province (95%), DKI Jakarta (94.8%), and Central



Java (92.5%). While the lowest coverage was West Papua Province (38.3%), Papua (49.1%), and Banten (61.4%).(8)(9)

The Sustainable Development Goal (SDGs) program is a program which is expected to address various issues including health promotion.(10)(11) One of them gives Fe tablet at least 90 tablets during pregnancy is expected to increase Hb levels. Based on previous research there was an effect of decreased systolic and diastolic blood pressure after consuming starfruit juice. In addition, instead of giving Fe tablet, ACL juice) is expected to increase Hb levels and control blood pressure, defecation and improve the immune system.

## METHOD

This study explored the literature on the effects of ACL juice on hemoglobin, blood pressure, defecation and IL-6 serum levels in white mice. Information's were collected through literature review. The databases used to search the literature were Pub Med, Portal Garuda and The Cochrane Library. As a complement, some literature was obtained from certain websites such as WHO, American Society of Hypertension and the International Society of Hypertension and MOH Indonesia. In order to provide more relevant evidence, the selected literature was between 1994 and 2018. Keywords used were *Averrhoa Carambola L*, hemoglobin concentration, blood pressure, defecation, IL-6 serum concentration, health, anemia, hypertension, obstipation, immunity, mechanism, and evidence.

## RESULTS

Most of the literature was obtained from Cochrane systematic reviews, which showed that the effect of ACL juice on hemoglobin levels, blood pressure, defecation, and IL-6 serum levels. Summary of the findings was attached.

### Effect of ACL juice against hemoglobin levels



Figure 1. *Averrhoa Carambola L* Leaves

Leaves are 15-25 cm long. The compound leaves are soft, medium-green, smooth on the upper surface and whitish on the underside.(9)(12)



Figure 2. *Averrhoa Carambola L* flowers

Purple to bright purple colored flowers are produced in the axils of the leaves. The flowers are arranged in small clusters and each cluster is attached to the tree with red. Stalks: The flowers are small, about 6 mm wide, pedicellate with 5 petals (having curve ends).(9)(12)



Figure 3. *Averrhoa Carambola L* fruits

The fruits are green when small and unripe but turn to yellow or orange when matured and ripe. The fruits are crunchy, having a crisp texture and when cut in cross-section are star shaped, hence its name.(12) Consuming starfruit by pregnant women will give many advantages.(12) The pregnant women will have sufficient levels of hemoglobin in relation to the amount of Vitamin C within the pregnant women body. Based on the research, there were 20 respondents which divided into intervention and control groups. It showed that there was an increase of Hb concentration after consuming star fruit of 60% and there was a decrease of Hb concentration of 40% of the respondents among those two groups.(13) Paired T-test showed a p-value of 0.161 and 0.713 on treatment and control groups consecutively. Because of those p-value > 0.05, meaning that there was no significant effect on Hb levels of the respondents. This is occurring in the control group because instead of consuming star fruits, respondents also consumed another fruit which contain vitamin C, such as bananas and oranges. Due to ethical reasons, the researchers did not recommend the restriction of fruit consumption and Fe supplements among respondents (pregnant women control group) so this turned out into bias.

Based on the investigation of 32 pregnant women divided into two groups with the average mean of Hb level was 9.76 gr /dl. The first group was given star fruit and the second group was given guava. The results of the average hemoglobin concentration in the first group were 11.03 gr/dl compared to the second group which was 10,4gr / dl. Meanwhile, based on Paired Samples T-Test, it showed a p-value of 0,013 so it can be concluded that there was a significant difference between giving of guava and star fruit towards hemoglobin level on pregnant mothers.(14)

### Effect of ACL juice against blood pressure

Starfruit has been known widely by Indonesian and found in supermarkets easily at affordable prices. Starfruit is helpful to lower blood pressure due to the content of fiber, potassium, phosphorus, and vitamin C. (15) The estimated daily requirement of sodium for adults is 500 mg. WHO recommends limiting salt intake of up to 6 grams a day (equivalent to 2400 mg of sodium). This limitation is performed because of the potential role of sodium in triggering high blood pressure/hypertension.(15)

Hypertension can be classified based on the value of blood pressure, the higher the blood pressure, the higher the risk of getting complications. The classification of hypertension according to the American Society of Hypertension and the International Society of Hypertension in 2013 can be seen in the following table:

Table 1

Classification of Hypertension According to the American Society of Hypertension and the International Society of Hypertension, 2013.(12)

Category	Systolic (mmHg)		Diastolic (mmHg)
Optimal	< 120	and	< 80
Normal	120 – 129	and / or	80 – 84
Normal high	130 – 139	and / or	84 – 89
Hypertension grade 1	140 – 159	and / or	90 – 99
Hypertension grade 2	160 – 179	and / or	100 – 109
Hypertension grade 3	≥ 180	and / or	> 110
Isolated systolic hypertension	≥ 140	and	< 90

Based on DASH research (Dietary Approaches to Stop Hypertension), it is mentioned that to decrease blood pressure is highly recommended to consume foods with high potassium and fiber, and low in sodium. A star fruit weighted 127 gram contains 207 mg potassium and 5 gram of fiber. This suggests that the potassium and fiber content in star fruit has a significant amount in helping to lower blood pressure, combined with low sodium content.

Starfruit works to lower blood pressure by lowering the secretion of anti-diuretic hormone (ADH) and thirst sensation. ADH is produced in the hypothalamus and work on the kidneys to regulate osmolality and urine volume. With low ADH, there will be a lot of urine excreted, thus the urine becomes dilute with low osmolality. To concentrate, the intracellular fluid volume will be enhanced by extracting fluid from the extracellular. Meanwhile, the decrease in NaCl concentration will be concentrated by decreasing extracellular fluid. Mixed with reduced thirst sensation so that fluid intake is also reduced. All of these mechanisms will result in a decrease in blood pressure. Therefore, star fruit can be used as an alternative to help lower blood pressure because of its high potassium and fiber content and low sodium, in accordance with the recommendations of the DASH diet.

Another study showed an inverse result that on post-test respondents in the intervention group who decreased in systolic blood pressure as many as 3 pregnant women and the other 3 people remained. After tested Paired t-test, it was obtained p-value of 0.840. Because  $p > 0.05$ , it means that starfruit consumption in pregnant women

in the intervention group has no significant effect on systolic blood pressure. This may be due to the physical fatigue experienced by the respondents because most of the respondents still working outside causing their blood pressure to increase and also there was a decrease because there are respondents who suffer from fever when the research was being done.(11) (13)(15) (16)(17)(18)

#### **Effect of ACL juice toward defecation**

Based on the research output, it showed that on the pre-test, there were 30% of the respondents got constipation while on post-test all respondents who took star fruit did not get any constipation (100%). The Mc-nemar test delineated that p-value of 0.250. It means that starfruit consumption in the treatment group did not have an effect on the incidence of constipation. It can be caused by the limitations number of samples that were only 20 pregnant women which also can cause insignificant statistical tests in this.(19)

#### **Effect of ACL juice against IL-6 serum levels**

Based on the previous study, ACL contains flavonoid, tannin, and saponin which has an anti-inflammatory effect through inhibition of protein denaturation.(19) IL-6 is a pro-inflammatory cytokine which is related to auto-immune, chronic inflammation, and malignancy.(20)(21)(22) The finding showed that ACL decreased IL-6 serum.

### **CONCLUSION**

ACL has an effect on increasing hemoglobin concentration so that it has the potential to prevent and overcome the anemia problem. ACL has an effect on lowering blood pressure so it has the potential to prevent and overcome hypertension problem. Starfruit can be used as an alternative to help decrease blood pressure because of its high potassium and fiber content and low sodium, in accordance with DASH diet recommendations. The ACL juice lowers blood pressure through the anti-diuretic mechanism. ACL has an effect on defecation and prevents obstipation and constipation. ACL has an effect on lowering IL-6 serum, a cytokine pro-inflammatory substance that triggers to malignancy. The effects of ACL which have been presented in the literature review can be applied to women and children in Indonesia.

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