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ORIGINAL RESEARCH

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## THE EFFECT OF KELAKAI (*STECHNOLAENA PALUSTRIS*) CONSUMPTIONS ON HEMOGLOBIN LEVELS AMONG MIDWIFERY STUDENTS

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### Abstract

**Background:** It is estimated that 49.2% of Indonesian adolescents (10-19 years) have iron deficiency of anemia. Green vegetables can be used as an alternative consumption to meet the body's need for iron. Kelakai (*Stenochlaena palustris*) containing 291.32 mg-100 g of Fe has been consumed by Dayak ethnic society to prevent anemia.

**Objective:** The aim of this study was to determine the effect of Kelakai (*Stenochlaena palustris*) consumptions to increase hemoglobin levels among late adolescents (17-19 years).

**Methods:** It was a quasi-experiment with pre-test and post-test study on anemic Midwifery students (8-11 g / dl) of Betang Asi Midwifery Academy of Palangka Raya Indonesia in September 2017. In which Kelakai was given as dietary supplements of the subject line and *ferrous fumarate* tablet as a control. There were 66 participants recruited by purposive sampling, divided into 33 subjects for each group. Kelakai (*Stenochlaena palustris*) (250 mg) and *ferrous fumarate* tablet (60 mg) were administrated daily for a week. Hemoglobin levels were measured before and after intervention using the hemoglobin testing system quick-check tool. Data were analyzed using paired and independent t-test.

**Result:** The result showed of significant increases on hemoglobin levels (3.24 g / dl) after consuming Kelakai (*Stenochlaena palustris*) for a week ( $p \leq 0.05$ ). The hemoglobin levels after intervention in the control group were 0.03 g / dl higher than Kelakai group, but based on the analysis, there was no significant difference on both groups ( $p \geq 0.05$ ).

**Conclusion:** Kelakai is proven to increase hemoglobin levels. Thus, Kelakai (*Stenochlaena palustris*) is recommended a food supplementation to prevent iron deficiency of anemia.

**Keywords:** kelakai; *stechnolaena palustris*; iron deficiency of anemia; adolescent; adolescence

## INTRODUCTION

Adolescents (10-19 years) have higher risk for iron-deficiency of anemia due to increased iron requirement, inadequate nutrition intake, worm infections and severe infections that affect the reserves of iron in the body ([WHO, 2011](#)). WHO estimates that 22% of women of reproductive age (15-49 years) and 49.2% of young women (10-19 years) in Indonesia have

iron deficiency of anemia ([Dick & Ferguson, 2015](#); [WHO, 2011](#)). The study of 87 adolescent girls in India on non-hematological effects arisen from iron deficiency was the growth and developmental barriers, decreased immunity, decreased physical activity performance and cognitive function ([More, Shivkumar, Gangane, & Shende, 2013](#)).

The target to realize the goal of "ending all forms of malnutrition" of Nutrition Global Targets for 2025 by the Sustainable Development Goals program is to reduce 50% incidence of anemia among women of reproductive age ([IFPRI, 2016](#)). The Indonesian government's efforts to handle the incidence of deficiency anemia are through the *Program Penanggulangan Anemia Gizi Zat Besi* with supplementation of ferrous tablets for adolescents, women of childbearing age, pregnant women and postpartum women ([MOH, 2015](#)).

Alternatives to meet iron needs include food-based approaches, the fortification and diversification of foods containing iron ([WHO, 2011](#)). Green vegetables can be a source of iron that can be consumed daily ([Hurrell & Egli, 2010](#)). Kelakai (*Stenochlaena palustris*) is a typical ferns of Central Kalimantan commonly found in swamps, roadsides, agricultural areas, open lands and a former area of land burned grown without the use of pesticides and fertilizers ([Wijaya, Widiputri, & Rahmawati, 2017](#)). Dayak tribes hereditary consume Kelakai (*Stenochlaena palustris*) to treat anemia ([Purwandari](#)). The people of the Dayak tribes of Central Kalimantan consume Kelakai (*Stenochlaena palustris*) as vegetable preparations by means of pan-fried, boiled, made into plain vegetables or eaten raw ([Irawan et al., 2006](#)).

Kelakai contains Fe (4153 mg / 100 g), vitamin C (41 mg / 100 g), protein (2.36%), *beta carotene* (6.69 mg/100 g) and folic acid (1.13 mg/100 g) ([Wijaya et al., 2017](#)). Consuming Kelakai (*Stenochlaena palustris*) for 22 days shows to significantly increase maternal hemoglobin concentration (p-value  $\leq 0.05$ ) and proves to be as effective as taking *ferrous fumarate* tablets to increase Hemoglobin levels ([Mahyuni, Riyanto, & Muhhalimah, 2016](#)). A study on the effect of giving Kelakai (*Stenochlaena palustris*) extract for 1 week on a white rat showed that hemoglobin levels was improved two times higher than the control group (p-value  $\leq 0.05$ ) ([Negara, 2017](#)).

## METHODS

### Study design

This study was quasi-experiment with pretest-posttest control group design.

### Setting

The study was conducted at the Midwifery Academy of Betang Asi Raya Palangka Raya in Central Kalimantan province on September 2017.

### Sample

There were 66 participants recruited by purposive sampling, with 33 randomly assigned to the experiment and control group. Inclusion criteria of this study were female students aged 17-19 years, who had regular menstrual cycles (21-35 days) and mild-moderate anemia status (8-11.9 g/dL). The exclusion criteria in this study were female students aged 17-19 years, who had a history of severe disease affecting hemoglobin levels (kidney failure, lung disease, lymphatic disorders, cancer and malaria) and experienced menstrual disorders including *metrorrhagia*, *hypermenorrhea*, *polimenorrhea*, *oligomenorrhea* and *amenorrhea*.

### Instrument

Hemoglobin levels were measured before and after intervention using the hemoglobin testing system quick-check tool. An observation sheets was used to record the possible side effects of Kelakai (*Stenochlaena palustris*) and *ferrous fumarate* tablet consumption.

### Intervention

The experiment group was given 250 gr of sauteed Kelakai (*Stenochlaena palustris*), which was consumed at dinner for seven days. While the control group was consumed *ferrous fumarate* tablet (60 mg) at the same time. Based on the results of biochemistry laboratory tests in the Medical Faculty of Universitas Lambung Mangkurat, Banjarbaru, South Kalimantan province, the sauteed Kelakai (*Stenochlaena palustris*) in this study contains 0.48  $\mu\text{g}$ /250 gr. All female students were given the same food 3 times a day and

snacks in the afternoon, which is prepared by researcher and a nutritionist.

#### Ethical consideration

This study has been approved by the ethical feasibility (*Ethical Clearance*) from the Ethics Commission of the 'Aisyiyah University of Yogyakarta. All of the subject research has already signed study approval sheets.

#### Data analysis

Univariate analysis was conducted to see the distribution of age and hemoglobin level of participants. The *Shapiro-Wilk test* was conducted to see the normality of the data. The increase levels of hemoglobin in the

intervention group were analyzed using *paired t-test*, whereas the control group of hemoglobin levels were analyzed using the *Mann Whitney*. The differences in hemoglobin levels between intervention and control groups were analyzed using *independent t-test* (CI 95%;  $\alpha = 5\%$ ).

## RESULTS

Table 1 shows the majority of all participant aged 18 years old, had normal BMI, had mild anemia before the intervention and after being given intervention for 7 days the majority of subjects were no longer anemic.

**Table 1** Characteristic of participant (n=66)

Variable	Mean	Median	SD	Min	Max
Age (year)	18	18	0.72	17	19
Body Mass Index (BMI)	21.04	20.15	4.45	15.38	35.19
Hemoglobin Level (g/dl)					
Pre-test	11.1	11.1	0.67	9.3	12.9
Post-test	12.1	12	0.993	9.8	14.6

Table 2 shows the mean of hemoglobin levels in the experiment group before given Kelakai (*Stechnolaena palustris*) was 11.06 gr/dl and increases by 1.04 gr/dl after a week. While in the control group the mean of hemoglobin levels before intervention is 11.14 gr/dl and

increases by 0.94 g/dl after a week of consuming *ferrous fumarate* tablets. Comparing both groups, it can be seen that the experiment group increased hemoglobin level of 0.02 g/dl higher than the control group.

**Table 2** Distribution hemoglobin level before and after given intervention

Hemoglobin level (gr/dl)	Mean	Median	SD	Min	Max
All participants					
Pre-test	11.1	11.1	0.67	9.3	12.9
Post-test	12.1	12	0.993	9.8	14.6
Experiment Group					
Pre-test	11.06	11.1	0.66	9.4	11.9
Post-test	12.10	12	0.75	10.4	13.8
Control Group					
Pre-test	11.14	11.1	0.68	9.3	12.9
Post-test	12.08	12	1.09	9.8	14.6

Table 3 shows a significant increase (p-value  $\leq 0.05$ ) in hemoglobin level of 3 g/dl after consuming Kelakai (*Stechnolaena palustris*) for a week. The comparison

between the two groups shows the control group increased hemoglobin level of 0.04 g/dl higher than the experiment group.

**Table 3** Mean different of hemoglobin levels in the experiment and control group

Characteristics	Mean	t-calculate//Z-calculate	P-value
Fe Tablet <sup>δ</sup>			
Before	-		-
After	-	-5.007	0.000
Kelakai <sup>f</sup>			
Before	9.38		-
After	12.62	3.91	0.005
Intervention <sup>‡</sup>			
<i>Ferrous fumarate</i> tablet	11.62	-	-
Kelakai	11.58	-0.44-0.47	0.938

Source: The results of the data analysis changes in Hb levels

Remarks:  $\delta$  = Mann Whitney,  $f$  = Paired t-test,  $\ddagger$  = Independent t-test, CI = Value of confidence interval, P-value (CI = 95%,  $\alpha$  = 5%)

## DISCUSSION

The finding of present study showed there was a significant effect of (*Stechnolaena palustris*) on increased hemoglobin levels. Kelakai (*Stechnolaena palustris*) was given 250 g/day for seven days can improve hemoglobin levels of 3 g/dl, as previous study proved that Kelakai (*Stechnolaena palustris*) extract (624.2 mg) for a week can improve hemoglobin levels for three times (p-value  $\leq 0.05$ ) (Negara *et al.*, 2017). Study Mahyuni *et al.* (2015) also proved that the consumption of Kelakai (*Stechnolaena palustris*) for 22 days can increase maternal hemoglobin level of 1.86 g/dl (p-value  $\leq 0.05$ ).

The increase of hemoglobin levels due to the *non-heme* iron content in the Kelakai (*Stechnolaena palustris*) (Chai, 2015). Each 100 g of Kelakai (*Stechnolaena palustris*) contain 4.153-33.64 mg of Fe (Purwandari). Iron contained in Kelakai (*Stechnolaena palustris*) is a *non-heme* iron which the absorption depends on the enhancer and inhibitor factors (Hurrell & Egli, 2010). Another previous study revealed that the vitamin C increases *non-heme* iron absorption three times higher group control (da Silva Rocha *et al.*, 2011).

The results of this study reinforce the empirical evidence regarding the potential

Kelakai (*Stechnolaena palustris*) to prevent anemia that is believed by Dayak tribes (Negara, 2017). Based on the result of this study, Kelakai (*Stechnolaena palustris*) is an alternative choice in order to increase hemoglobin levels naturally (Zannah, 2015).

The results *independent t-test* of analysis stated that the *ferrous fumarate* tablets is able to increase the hemoglobin levels of 0.04 g/dl higher than the Kelakai (*Stechnolaena palustris*), however was not clinical significance (p-value  $\geq 0.05$ ). The increase of Hb levels due to the consumption of *ferrous fumarate* tablet is 0.1 g/dl per day (Arisman, 2004; Dewoolkar, Patel, & Dodich, 2014). Mahyuni *et al.* also proved that there is no significant difference in increase of hemoglobin level between experiment group and control group (p-value  $\geq 0.05$ ) (Mahyuni *et al.*, 2016). In present study Kelakai (*Stechnolaena palustris*) was consumed as dishes served through heating. Kelakai (*Stechnolaena palustris*) which has been through a heating process (stir-fried, boiled) will decreased by 9-43% Fe (Chai, Panirchellvum, Ong, & Wong, 2012). The consumption of Kelakai (*Stechnolaena palustris*) extract on white rats (*Rattus norvegicus*) proved to increase hemoglobin levels four times higher than

the control group (Negara, 2017). Therefore, the Kelakai (*Stechnolaena palustris*) processing affect to the increase of hemoglobin levels.

Other data collected from this study are the side effects of both types of provided intervention. The reasons supporting data collection regarding the side effects of iron consumption is based on theory and previous study (Friedman et al., 2015; Tolkien, Stecher, Mander, Pereira, & Powell, 2015; Yakoob & Bhutta, 2011), which stated that the chances of the side effect emergence on the digestive system after ingestion of *ferrous sulfate* tablets are 20-40% of nausea, bloating, abdominal pain, diarrhea, constipation, and dark feces.

In the group consuming *ferrous fumarate* tablets, 81.8% of the study complained of feeling dizzy, nauseous and discoloration of feces from the first day of consumption. Complaints of dizziness and nausea are also experienced by 15.2% of the study who consumed Kelakai (*Stechnolaena palustris*). Side effects arising from the consumption of *ferrous fumarate* tablet are five times higher than the side effects of Kelakai (*Stechnolaena palustris*) consumption.

## CONCLUSION

This study provided the evidence that Kelakai (*Stechnolaena palustris*) is effective to increase hemoglobin levels. Kelakai (*Stechnolaena palustris*) can be recommended as food supplements that *cost efficiencies, effectiveness* and minimal side effects to prevent iron deficiency anemia. Future study is expected to perform an analysis of the substances of these compounds in Kelakai (*Stechnolaena palustris*) that have potential *inhibitors* and

*enhancers* of iron. In addition to required more study to formulate Kelakai (*Stechnolaena palustris*) in the dosage form in which iron content is better.

## Declaration of Conflicting Interest

None declared.

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## Author Contribution

All authors contributed equally in this study.

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