Improvement of haemoglobin levels with catfish floss among teenage girls in Semarang City, Central Java, Indonesia

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Submitted: November 2025
Accepted: January 2026
Published: February 2026

Citation: Nugraheni et al. Improvement of haemoglobin levels with catfish floss among students in Semarang City, Central Java, Indonesia. South Sudan Medical Journal, 2026;19(1):45-48
DOI: https://dx.doi.org/10.4314/ssmj.v19i1.8

ABSTRACT

Introduction: Among teenage girls in Indonesia, the incidence of anaemia rose from 37.1% in 2013 to 48.9% in 2018. The main cause is iron deficiency, aggravated by menstruation and by insufficient dietary iron. Catfish is high in protein and iron. This study aimed to compare the effects of catfish floss on haemoglobin (Hb) levels among teenage girls in Semarang, Indonesia.

Method: Using a purposive sampling technique, 102 girls aged 13 to 15 years from two junior high schools were assigned to the intervention and control groups, each with 51 participants. Girls with chronic diseases such as cancer, spleen, or kidney-related problems were excluded. The intervention group received 30 grams of catfish floss twice daily for two months. A pre-test and post-test Hb levels in the groups were analysed.

Results: The Hb level in the intervention group increased from 11.88 g/dL to 12.88 g/dL ($p < 0.001$), and the incidence of anaemia decreased by 37.2%. There was a small non-significant ($p = 0.132$) decline of Hb in the control group to 12.23 g/dL from 12.51 g/dL, and anaemia cases increased by 2%.

Conclusion: This study found a significant increase in Hb levels in the intervention group. The catfish floss had an effect, even when not mixed with other nutrients, on the prevention of anaemia.

Keywords: catfish, anaemia, haemoglobin, teenage girls, Indonesia

Introduction

According to the most recent Riskesdas survey data, anaemia is a major health issue among Indonesian teenage girls, with prevalence rising from 37.1% in 2013 to 48.9% in 2018.[1] Because of blood loss during menstruation, teenage girls are regarded as high-risk for iron deficiency anaemia.[2] The World Health Organization (WHO) defines anaemia as a haemoglobin (Hb) level of less than 12.0 g/dL in a girl aged 12 to 14 years and in a non-pregnant woman aged 15 to 18.[3] Anaemia in teenage girls can result in poor academic achievement, impaired immunity, and diminished physical fitness, leading to an adverse effect on athletic performance and productivity.[3]

Adolescent females are at risk of anaemia due to several factors, including low socioeconomic status, heavy menstrual loss, poor education, and inadequate consumption of iron, folic acid, and protein.[3–6] The importance of eating a balanced diet should be emphasized in any efforts to prevent anaemia in teenage girls.[6,7] Locally produced food with a high iron content can also help address this issue. With a production of 116,114 tons in 2022, catfish is abundant in Indonesia, reasonably priced, and high in iron and protein. Additionally, unsaturated fatty acids found in catfish may improve immunological function.[2]

Catfish (*Clarias* spp.) floss (Abon lele) is a high-protein food product preserved through cooking and drying. The final product is dried fish meat fibre with a low moisture content (generally <10%), making floss relatively stable against microbiological spoilage, easy to store, and has a long shelf life without refrigeration.[8] In Africa, it is often called African catfish (*Clarias gariepinus*), a species biologically very similar to the catfish used in Southeast Asia. Nigeria, for example, is the largest catfish producer and is ranked among the top 10 in the world in several FAO reports. Therefore, the availability of raw materials for floss is very high, making floss an alternative value-added product.

Studies on catfish-derived products have demonstrated encouraging results in treating anaemia. The potential of fish-based products enhanced with iron-rich components to treat anaemia, especially in pregnant and reproductive-age women, has been investigated in recent studies.[9] Reports also suggest that catfish flour and moringa leaves significantly affect Hb levels in anaemic pregnant women.[10]

However, research on catfish floss (Abon lele) without additional nutrient-rich ingredients remains limited. Most studies have focused on catfish floss combined with other ingredients, without specifically assessing its effects alone. This study aimed to bridge this gap by evaluating how teenage girls' Hb levels are affected by catfish floss consumption.

Method

One hundred and two girls aged 13 to 15 years from two junior high schools in Semarang City were included in this study: 51 in the intervention group and 51 in the control group. The sampling technique used was purposive sampling, a nonprobability sampling method, to select participants based on specific criteria. The sample was collected from two different junior high schools, one as the intervention group and the other as the control group. The sample was selected using the inclusion criteria, namely junior high school teenage girls not taking vitamins/ other supplements, and not in their menstrual period. Those with chronic diseases such as cancer, spleen, or kidney-related problems were excluded.

A paired-samples t-test was used to compare Hb levels before and after the intervention within each group. An independent t-test was then used to compare the post-intervention Hb levels in the two groups. Hb levels were measured using a Haemoglobin Analyzer (HemoCue, Hb 201+). A questionnaire was given to the girls to assess their knowledge of anaemia. The intervention group received 30 grams of catfish floss twice daily for two months.

Ethical permission to conduct this work was given by the Health/Medical Research Bioethics Committee, Faculty of Medicine, Sultan Agung Islamic University, Semarang (250/VII/2024/Bioethics Committee).

Results

This research shows that in the intervention group, the number of anaemic girls decreased, whereas in the control group, the number of girls with anaemia increased (Table 1).

Based on the normality test with Kolmogorov-Smirnov, it is known that the pretest and post-test data of Hb levels in both groups show normal data distribution (p-value>0.05). So, we analyse differences in pretest and post-test data in each group using the Paired Simple T-test. The intervention group t-test presented a p-value of 0.000(<0.05) (Table 2), indicating a significant rise in the Hb levels.

The differences in changes in Hb level between the intervention group and the control group were significant (p-value = 0.014) (Table 3) indicating a beneficial effect of catfish floss.

Table 1. Frequency distribution of anaemia in the pre- and post- intervention and control groups (N=51)

Group	Anaemia	
	Pre-intervention n (%)	Post-intervention n (%)
Intervention Group	27 (52.9)	8 (15.7)
Control Group	15 (29.4)	16 (31.4)

Table 2. Analysis of the differences in haemoglobin levels between pre-test and post-test in the intervention and control groups

Haemoglobin levels	Mean/Median	p-value (Paired Simple T-Test)
Intervention Group (Normalities test: 0.200)		
Pre-test	11.88/11.88	0.000
Post-test	12.88/13.00	
Control Group (Normalities test: 0.200)		
Pre-test	12.51/12.50	0.132
Post-test	12.23/12.20	

Table 3. Analysis of haemoglobin level between the intervention and control groups

Haemoglobin levels	Mean/Median	p-value (independent T-test)
Intervention Group Post-test	12.88/13.00	**0.014**
Control Group Post-test	12.23/12.20	

Discussion

Table 1 indicates that anaemia in the intervention group decreased. The number of anaemic students in the control group increased, but only marginally. Similar findings were reported by Hastuti et al., who found that the administration of crispy catfish and red beans improved Hb levels in the intervention group.[2] Haemoglobin consists of iron (Fe) bound to porphyrin and globin, so adequate iron intake is essential.[3] Iron from animal products is more easily absorbed because it is not dependent on duodenal pH and is not affected by inhibitors such as phytates and polyphenols.[11] Therefore, catfish, which is high in protein and iron, is one of the food products capable of addressing anaemia.[2,12]

Data in Table 2 show that in the intervention group, Hb levels increased significantly after catfish floss use. A similar study found that administering catfish geblek (traditional food made from catfish flour) and moringa leaves had an effect on haemoglobin levels in pregnant women with anaemia at the Winong Kemiri Community Health Center in Purworejo, with a p-value of 0.000 (0.05) based on the post-test score, which increased compared to the pre-test score.[9]

Table 3 presents the post-test results for both groups. A p-value of 0.014 indicated a significant difference in Hb levels between the intervention and control groups. A comparable intervention that included tuna fish with chayote leaf purée, moringa leaf purée, and catfish dumplings also showed an increase in Hb levels in teenage girls.[13]

Catfish is one of the most popular types of fish in Indonesia and in many other countries. It is delicious, high in nutritional value, and easily combined with other ingredients. Its relevance to African countries is strong because: Catfish is a major aquaculture commodity in many African countries; floss products are suitable for contexts with minimal cold chain infrastructure; they can play a role in improving food security and nutritional status; they have economic prospects; and they are culturally accepted. The item on p59 describes how fish floss is prepared in South Sudan.

Research has shown that biscuits made with catfish flour and spinach (45g:15g) meet the nutritional requirements set by the Indonesian National Standard (SNI) and improve carbohydrate and iron provision.[14] Another formula, consisting of catfish, corn, and pisang raja (plantain) in a 30%:25%:45% ratio, has been proven to be an alternative solution for anaemia prevention in teenage girls.[15]

Conlusion

This study demonstrates that a single-dose intervention of catfish floss, without formulation with other nutrients, significantly increases the Hb levels in teenage girls. It is advised that catfish floss be marketed as a nutritional supplement to help prevent and lessen anaemia in teenage girls.

Acknowledgments: We thank the Faculty of Public Health, Diponegoro University, for the opportunity to conduct this study. We also express gratitude to everyone who contributed to this research.

Author Contributions: Study design: SAN; Data collection: SAN, ANMU, AY, WA, FAFA; Data analysis: SAN, ANMU, AY; Manuscript writing: SAN, HA; Manuscript revision: SAN, HA; Study supervision: FAFA, SAN, HA.

Declarations: Our database is available from the corresponding author

Conflict of Interests: Nil

Funding: Nil

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