**Jurnal Gizi Indonesia (The Indonesian Journal of Nutrition)**

*Vol. 13, No. 1, December 2024 (16-24)*
*Received: 20 March 2024, Revised: 7 August 2024,*
*Accepted: 19 September 2024, Published: 30 December 2024*
*https://ejournal.undip.ac.id/index.php/jgi , DOI:10.14710/jgi.13.3.16-24*

# *Smart solutions for overcoming anemia emergencies in young girls using Tricky Card Games Education Methods and Smartphone Monitoring Alert Systems*

**Farida Wahyu Ningtyias[1*], Karera Aryatika[2], Selvi Irmayanti[1]**

**ABSTRACT**

**Background:** The government has made efforts in the prevention and management of anemia through the distribution of Iron Supplementation Tablets (IST) in schools. One of the problems facing by the government and schools is lack of periodic measurement of hemoglobin levels. Furthermore, there was no socialization source of iron comes from foods by schools.

**Materials and Methods :** The aimed of this study is to increase adolescent knowledge about foods source of iron and also to monev government IST among adolescent. This research is a quasy experimental with a one group pretest-posttest design. Experimental study conducted at MTSN X Jember with a total of 30 female adolescent respondents who fused into one intervention group. Supplementation of IST (1 tablet per week) was provided for 8 weeks (November-December 2021). Improving knowledge among adolescent was measured using Tricky Card Games and pre-posttest questionnaires. Hemoglobin levels were measured before and after the intervention, and monitoring and education were conducted as reminders for taking the tablets through the Monev IST application and a WhatsApp Group. Monitoring and evaluation of adolescent's adherence for IST consumption using Monev Tablet Tambah Darah application which can download by each adolescent smartphone and also connected with supervisor.

**Results**: The results showed an increase in hemoglobin levels after the treatment, with pre-treatment levels ranging from 9.1 g/dL to 16 g/dL, and an average of 13.53 g/dL, while post-treatment levels ranged from 8.1 g/dL to 17.2 g/dL, with an average of 13.67 g/dL. There was a significant increase in knowledge of foods source iron among adolescent ($p < 0.05$). However, there was no significant difference in hemoglobin levels ($p > 0.05$) or consumption patterns ($p > 0.05$) after the intervention through the tricky card game.

**Conclusion**: Giving IST regularly can increase Hb levels supported by improving knowledge and consumption patterns can be a solution to handling anemia in adolescent girls.

**Keywords** : Anemia; counseling; level of knowledge; consumption patterns; young women

## BACKGROUND

Anemia is a public health problem that is widely prevalent globally in both developed and developing countries[1]. In Indonesia, the number of adolescent girls with anemia has been increasing year by year. In 2014, the prevalence of anemia in Indonesia among the age group of 5-14 years was 26.4%[2] and it further increased to 32% in 2018[3]. East Java province is one of the provinces with a higher prevalence of anemia among adolescent girls compared to the national prevalence. In East Java, 52% of adolescent girls suffer from anemia. According to data from the East Java Provincial Health Office, there are ten districts in East Java with a prevalence of anemia among adolescent girls exceeding 40%, including Jember Regency. Jember Regency has a relatively high prevalence of anemia among adolescent girls, which is 42%[4]. It is because adolescent who lived there have less diverse consumption of foods, most of them have consumption of high energy dense and nutrient poor foods, and it leads to have overconsumption of energy. Beside that, there is not good monitoring system of iron supplementation among adolescent, meanwhile there was iron supplementation program given by government for adolescent.

The impact of anemia on adolescent girls and poor nutritional status contributes negatively during pregnancy in adulthood, leading to low birth weight, maternal and infant morbidity, and even mortality. Furthermore, anemia also has negative effects on the physical and cognitive development of adolescents, which can impair learning achievement and productivity[5]. Several suspected causes of anemia in adolescent girls include experiencing menstruation for five days or more, resulting in the loss of iron during menstrual bleeding.

[1]Nutrition Science Program, Faculty of Public Health, Universitas Jember, Jember, Jawa Timur, Indonesia
[2]Nutrition Science Program, Faculty of Public Health, Universitas Mulawarman, Samarinda, Kalimantan Timur, Indonesia
[*]**Correspondence** : farida.fkm@unej.ac.id

Another reason is an unhealthy eating pattern, as adolescent girls may restrict their food intake to maintain a slim or thin appearance[6].

The Indonesian government has made efforts in prevention and management through the distribution of IST in schools. This initiative has also been implemented in Jember Regency, with a recorded distribution of 8,802 tablets to female adolescents in junior high schools, madrasah tsanawiyah, and vocational schools, and 7,632 tablets to senior high schools, madrasah aliyah, and special needs schools[4]. However, schools have encountered a problem whereby the government has not conducted periodic hemoglobin level measurements in each school and has not carried out monitoring and evaluation to assess the success of the program.

Previous research show that, low consumption of foods source iron causing anemia among adolescent in Jember Regency. It was because of lack of knowledge about nutrient foods especially source of heme and non heme among adolescent. This condition leads to have not sufficient foods which contain high iron level among adolescent. Besides that, low consumption of iron supplementation among adolescent also lead to suffered anemia. There was not proper monitoring iron supplementation from school also cause underestimated data of iron supplementation consumption by adolescent[7].

Improving the compliance of adolescent girls in consuming IST requires support from external parties, such as teachers. Teachers are the most influential factor in determining the level of compliance in the consumption of IST. Additionally, there is a need for a tool to monitor the compliance level of female adolescent students in taking the IST. This tool serves to indicate the schedule for consuming the tablets and marks when the consumption is completed, providing a clear representation of the compliance level of adolescent girls.

After two years of implementing the IST program by the Jember Regency Health Office, many complaints are still being reported by female adolescent students who exhibit symptoms resembling anemia, such as constant fatigue, tiredness, lethargy, weakness, and lack of energy. Based on interviews with teachers and several students, it has also been revealed that the eating patterns of the majority of adolescent girls are poorly structured or can be described as unhealthy. This can negatively impact their productivity, concentration, and academic performance.

This intervention is based on improving the existing government program, specifically focusing on the areas of monitoring and evaluation (IST supplementation), as well as implementing a new program that creatively educates students about anemia and related topics, while promoting healthy lifestyle practices. By implementing this monitoring program which conducted by smartphone monitoring alert system, it will help government to track iron supplementation consumed by adolescents. This program will help reducing anemia among adolescent in Jember Regency, because when government know the total iron distributed among the adolescent through their school and the real consumed by adolescent, it will give government projection and next step how to overcome anemia among adolescent in Jember Regency. Beside that another solution to reduce anemia among adolescent by giving them enlightenment and education to open their mind with new and interesting concept using tricky card game. Tricky card game is one of solution to make behavioral change through adolescent diet. So, this research should be implemented among adolescent in their school to reduce anemia in Jember Regency.

## MATERIALS AND METHODS

This research was a quasy experimental with a one group pretest-posttest design. This study was an experimental study using the tricky card game educational method, iron supplementation tablet administration for 8 weeks, and monitoring through the "Anemia No Prestasi Yes" WhatsApp group. This study was conducted over a 2-month intervention period from November to December 2021, in MTSN X Jember, Patrang Subdistrict, Jember Regency, East Java. Respondent of this study was female adolescent who categorized as student in first grade of MTSN X Jember selected using simple random sampling much as 30 person. Intervention in this study was education using the tricky card game method and iron supplementation tablet administration. Variable that be measured in this study consist of Hb levels, socio economic demographic, knowledge of foods source of iron, dietary diversity, adherence of IST before and after intervention.

Data analysis was conducted using SPSS Version 20.0. The difference in knowledge levels and hemoglobin levels before and after the intervention was assessed using the paired sample t-test. Changes in hemoglobin levels and knowledge levels were analyzed using the Paired T-test statistical analysis with a significance level of 0.05. The research received ethical approval with certificate number


*e-ISSN : 2338-3119, p-ISSN: 1858-4942*

No.1327/UN25.8/KEPK/DL/2021 and was conducted by the Community Service and Empowerment Division of the Faculty of Dentistry, University of Jember.

Research stages as follows, There is only one treatment group, and pre- and post-treatment assessments are conducted. One group consist of 30 female adolescent, began with measurements of hemoglobin levels, knowledge levels, and dietary diversity (food variety). It was followed by educational sessions on anemia prevention and healthy eating habits. The material was presented using PowerPoint slides. The activity then continued with a game called "Tricky Card Game", which respondent very enthusiast to join the game. Respondent was asked to choose pictures of foods or beverages that were prohibited, allowed, or limited in consumption for anemia prevention. The Tricky Card Game is a game that utilizes a deck of 60 cards. These cards contain images and names of recommended, restricted, and prohibited food items for the prevention and management of anemia. The game consists of 20 cards of recommended foods, 20 cards of restricted foods, and 20 cards of prohibited foods to prevent anemia. The game is easy to play, and facilitators can incorporate important messages while adolescent girls are engaged in playing. The Tricky Card Game is enjoyable and highly effective in providing education to adolescent girls. The girls, on average, show great enthusiasm in participating in each game. They are competitive among themselves and exhibit great enthusiasm in categorizing the cards. During the evaluation of the card categorization results, they actively provide explanations for their choices, whether they categorized the food cards as recommended, restricted, or prohibited. After the gaming session, a nutrition consultation session is conducted, followed by the distribution of the pocketbook "Pocketbook for Anemia Prevention in Adolescent Girls." The pocketbook is given to the girls to take home, serving as a guide for a healthy lifestyle among adolescent girls, and it is expected to be disseminated to promote these positive habits within their environment (Figure 1) that contains a guide to a healthy anemia-free lifestyle.


**Figure 1. Pocketbook of Prevention of Anemia in Adolescent Girls**

The activity concluded with taking the IST together. This session lasted for 60 minutes. The activities continued through a WhatsApp Group (WAG) formed with the research team. The WAG served as a means of monitoring compliance with taking the iron supplementation tablets every week and providing material updates through the pocketbook files shared via the WAG every Wednesday and Friday. After 8 weeks of intervention, measurements of hemoglobin levels, knowledge levels, and dietary diversity were conducted. In this study, the compliance of adolescent girls in taking iron supplementation tablets was monitored through the Monev TTD application (Figure 2) and motivated through a Whatsapp Group (Figure 3) created together with the Research Team and MTSN X Jember teachers.


*e-ISSN : 2338-3119, p-ISSN: 1858-4942*

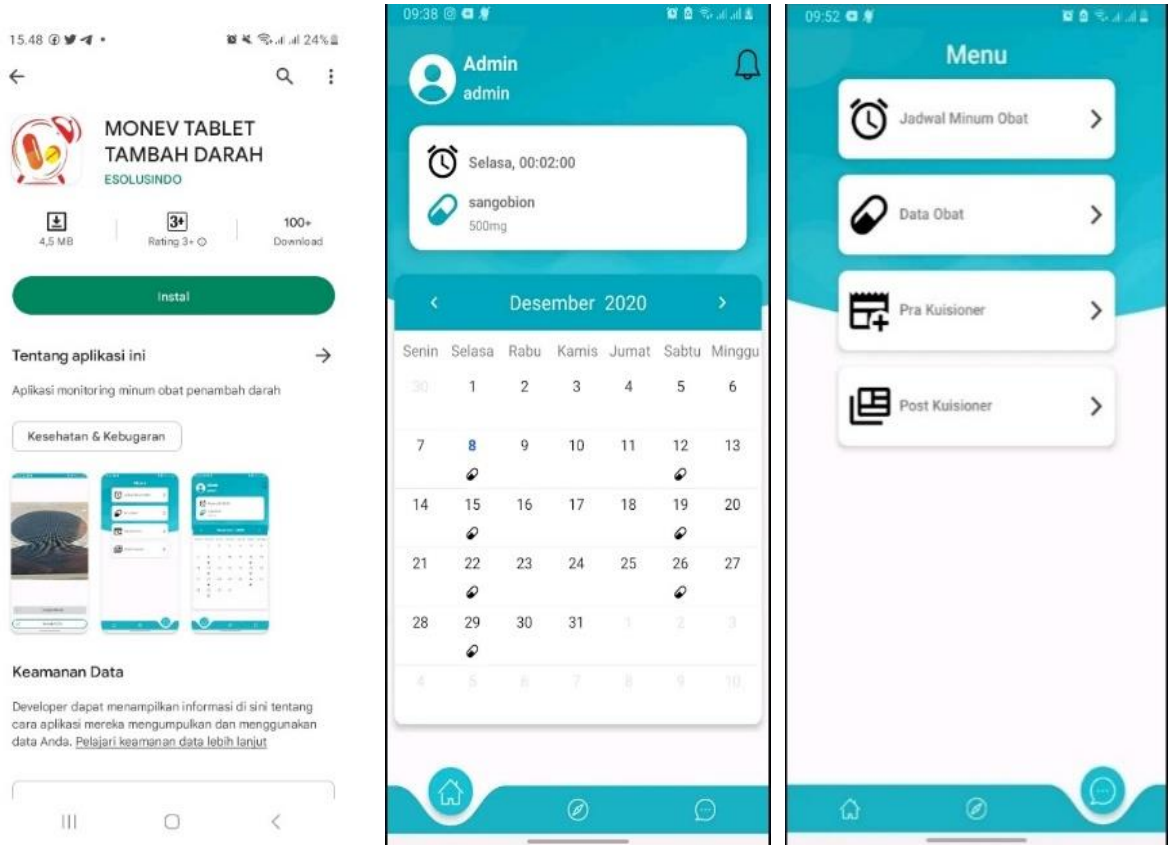


**Figure 2. Application for Monitoring and Evaluation of Iron Supplementation Tablets**

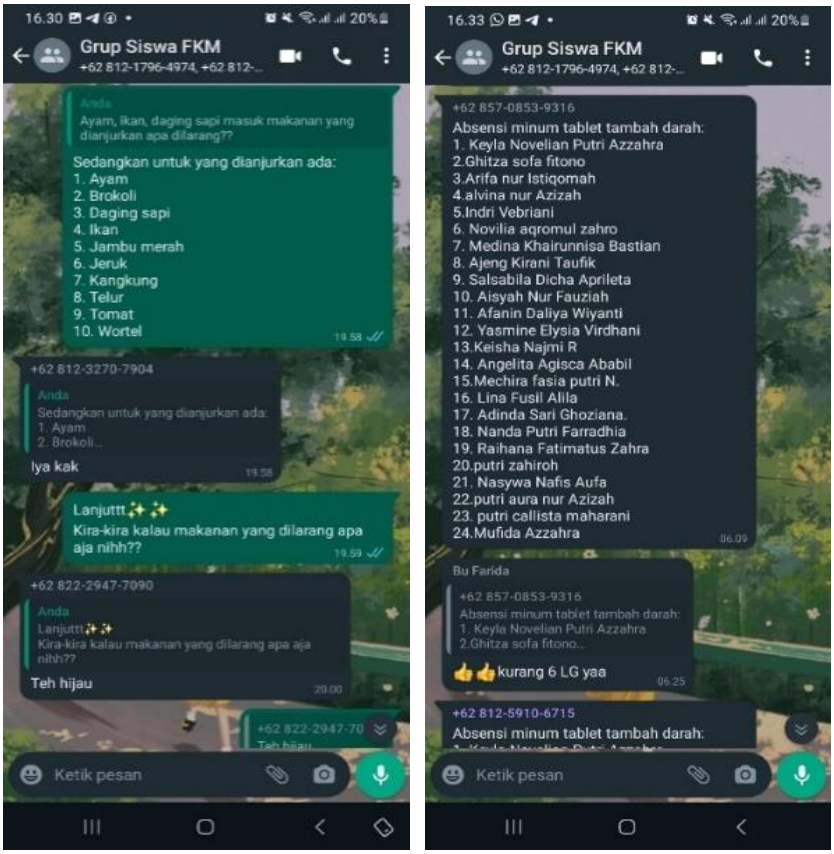


**Figure 3. Whatsapp Group**


*e-ISSN : 2338-3119, p-ISSN: 1858-4942*

Knowledge levels of adolescent girls were assessed using a structured questionnaire consisting of 20 questions related to anemia. Adolescent girls were considered to have excellent knowledge if they answered ≥ 80 questions correctly, good knowledge if they scored between 50-80, and inadequate knowledge if their score was < 50[8]. Dietary diversity was measured using the Minimum Dietary Diversity for Women Reproductive Age (MDD-W) questionnaire. Adolescent girls were categorized as having diverse diets if they consumed ≥ 5 types of food per week, and as having limited diversity if they consumed < 5 types of food per week[9]. This questionnaire had been used by several previous research. The researcher adapted and did questionnaires testing for 30 female adolescent who has same characteristic with respondent before collected the data. Validity and reliability of questionnaire using Cronbach alpha test. Hemoglobin level for respondent was measured by device with the brand name EasyTouch and was calibrated before it used.

## RESULTS

### *The Effectiveness of Iron Supplementation in Adolescent Girls at MTSN X Jember*

The results of the Hemoglobin (Hb) level measurements before the treatment are presented in Table 1. Out of the 30 adolescent girls, 5 of them (16.67%) were found to have anemia. The hemoglobin levels in the adolescent girls ranged from 9.1 g/dL to 16 g/dL, with a mean of 13.53 g/dL, indicating a value greater than 12 g/dL, which is considered normal. After the treatment, which involved the administration of iron supplementation for 8 weeks, the results showed that there were 6 cases (19.98%) of anemia. The hemoglobin levels in the adolescent girls ranged from 8.1 g/dL to 17.2 g/dL, with a mean of 13.67 g/dL, indicating a value greater than 12 g/dL, which is considered normal. There was an increase in the average hemoglobin level in the adolescent girls after the treatment.

**Table 1. Hemoglobin (Hb) Levels Before and After Treatment**

| Results of Hemoglobin (Hb) Levels Before and After Examination | Total Number (f=30) | Percentage (%) |
|---|---|---|
| **Before** | | |
| Not Anemia (> 12 gr/dL) | 25 | 83,33 |
| Anemia (< 12 gr/dL) | 5 | 16,67 |
| **After** | | |
| Not anemia (> 12 gr/dL) | 24 | 79,92 |
| Anemia (< 12 gr/dL) | 6 | 19,98 |

### *Comparison of Knowledge Level and Consumption Patterns of Female Adolescents at MTSN X Jember Before and After Intervention of Counseling and Tricky Card Game*

There was a significant increase in knowledge among female adolescents (p-value < 0.05), as indicated by a decrease in the percentage of adolescents categorized as having low knowledge from 53.28% before the intervention to 29.97% after the intervention. Additionally, an increase was observed in the percentage of female adolescents categorized as having excellent knowledge, which amounted to 19.98% after the intervention. The results can be seen in Table 2.

**Table 2. Knowledge Level Before and After the Intervention**

| Results | Total Number (f=30) | Percentage (%) |
|---|---|---|
| **Pre Test** | | |
| Grade ≥ 80 | 0 | 0 |
| Grade 50-80 | 14 | 46,62 |
| Grade < 50 | 16 | 53,28 |
| **Post Test** | | |
| Grade ≥ 80 | 6 | 19,98 |
| Grade 50-80 | 15 | 49,95 |
| Grade < 50 | 9 | 29,97 |

Female adolescent students are classified as having a good level of knowledge if their correct answers to the 20 given questions range from 50 to 80. They are classified as having a poor level of knowledge if the


*e-ISSN : 2338-3119, p-ISSN: 1858-4942*

number of correct answers is less than 50, and as having a very good level of knowledge if the number of correct answers is greater than 80. The difference in knowledge levels of female adolescent students regarding anemia and its prevention is obtained by comparing the results of the pre-test and post-test conducted during the educational program.

The question with the highest percentage of incorrect answers before the intervention (Table 3) was question number 12 (Taking iron tablets with orange juice is beneficial), with a percentage of 66.7%. Question number 17 (Symptoms of weakness, fatigue, lethargy, weakness, and listlessness are not indicative of anemia) had a percentage of 50%. Question number 7 (Non-Heme iron is more easily absorbed by the body than Heme iron) had a percentage of 46.7%. Question number 11 (Mothers with anemia can give birth to an anemic baby) had a percentage of 46.7%. These questions are crucial and highly relevant to the occurrence of anemia in female adolescents.

**Table 3. The Distribution of Knowledge Response Frequencies Before and After Intervention**

| No | Questions | Before | | After | |
|---|---|---|---|---|---|
| | | True f (%) | False f (%) | True f (%) | False f (%) |
| 1 | Anemia occurs when the body lacks iron for the production of hemoglobin | 29 (96,7) | 1 (3,33) | 30 (100) | 0 (0) |
| 2 | Anemia leads to an increased susceptibility of the body to diseases | 25 (83,3) | 5 (16,7) | 27 (90) | 3 (10) |
| 3 | Menstruation is one of the causes of anemia in adolescent girls | 26 (86,7) | 4 (13,3) | 30 (100) | 0 (0) |
| 4 | Consuming fatty foods is not a cause of anemia | 23 (76,7) | 7 (23,3) | 17 (56,7) | 13 (43,3) |
| 5 | Heme iron is a dietary source of animal origin | 26 (86,7) | 4 (13,3) | 27 (90) | 3 (10) |
| 6 | Non-heme iron is found in vegetables and legumes | 25 (83,3) | 5 (16,7) | 26 (86,7) | 4 (13,3) |
| 7 | Non-heme iron is more easily absorbed by the body compared to heme iron | 16 (53,3) | 14 (46,7) | 18 (60) | 12 (40) |
| 8 | It is better to consume blood iron tablets together with tea | 22 (73,3) | 8 (26,7) | 27 (90) | 3 (10) |
| 9 | The diseases related to anemia include parasitic infection | 19 (63,3) | 11 (36,7) | 23 (76,7) | 7 (23,3) |
| 10 | Pregnant women who have anemia can die from bleeding during childbirth | 29 (96,7) | 1 (3,3) | 27 (90) | 3 (10) |
| 11 | Mothers with anemia can give birth to babies with anemia as well | 16 (53,3) | 14 (46,7) | 21 (70) | 9 (30) |
| 12 | It is better to take blood iron tablets with orange juice | 10 (33,3) | 20 (66,7) | 18 (60) | 12 (40) |
| 13 | According to the government recommendation, the blood iron tablets should be taken daily | 17 (56,7) | 13 (43,3) | 19 (63,3) | 11 (36,7) |
| 14 | During menstruation, it is recommended to take blood iron tablets every day | 18 (60) | 12 (40) | 10 (33,3) | 20 (66,7) |
| 15 | Males are at higher risk of developing anemia compared to females | 28 (93,3) | 2 (6,7) | 27 (90) | 3 (10) |
| 16 | Anemia in adolescents leads to decline in academic performance | 22 (73,3) | 8 (26,7) | 20 (66,7) | 10 (33,3) |
| 17 | Symptoms of constant weakness, fatigue, lethargy, faintness, and weariness are not indicative of anemia | 15 (50) | 15 (50) | 24 (80) | 6 (20) |
| 18 | The method to determine anemia status is through a blood hemoglobin level test | 28 (93,3) | 2 (6,7) | 30 (100) | 0 (0) |
| 19 | The appropriate time to take blood iron tablets is in the evening | 24 (80) | 6 (20) | 23 (76,7) | 7 (23,3) |
| 20 | The schedule for taking blood iron tablets when not menstruating is once a week throughout the year | 21 (70) | 9 (30) | 30 (100) | 0 (0) |

**Table 4. Dietary Patterns Before and After Intervention**

| Results | Total Number (f=30) | Percentage (%) |
|---|---|---|
| **Before** | | |
| Diverse | 18 | 59,94 |
| Less Diverse | 12 | 39,96 |
| **After** | | |
| Diverse | 30 | 100 |
| Less Diverse | 0 | 0 |


*e-ISSN : 2338-3119, p-ISSN: 1858-4942*

The level of dietary diversity in adolescent girls can be assessed using the Minimum Dietary Diversity for Women Reproductive Age (MDD-W) questionnaire. The PPK (Community Health Workers) conducted food consumption measurements after providing counseling accompanied by the educational game Tricky Card Game. The results showed that 100% of the adolescent girls had diverse food consumption patterns after receiving the counseling and playing the Tricky Card Game. This means that they consumed more than 5 different food groups per week. This percentage increased from the previous value of only 59.94% who had diverse food consumption patterns.

Tricky Card Game is an educational game that can be used as an alternative to deliver messages and knowledge about the prevention and management of anemia to adolescent girls. The Paired t-test results showed a significant difference in the improvement of knowledge among adolescent girls after the education through the Tricky Card Game, with a p-value of < 0.05 (0.001). However, for hemoglobin levels and dietary patterns, the Paired t-test results showed p-values > 0.05, specifically for hemoglobin levels p = 0.669 and dietary patterns p = 0.167. This indicates that there were no significant differences in the improvement of hemoglobin levels and dietary patterns after the intervention through the Tricky Card Game.

## DISCUSSION

Measurement results of hemoglobin (Hb) levels showed an increase in the average Hb levels of adolescent girls after receiving an 8-week treatment of iron supplementation tablets. The Hb levels of adolescent girls before the treatment ranged from 9.1 g/dL to 16 g/dL, with an average of 13.53 g/dL. After the treatment, the Hb levels of adolescent girls ranged from 8.1 g/dL to 17.2 g/dL, with an average of 13.67 g/dL, indicating a level above 12 g/dL, which is considered normal. Eventhough, there was not significantly difference in hb level pre and post intervention (*p value* > 0.05), but the result show few improvement of average hb level. It because of low consumption of heme iron sources or animal-based sources, as observed in the measurement results of the relatively limited dietary diversity. Although there was a high consumption of plant-based iron sources, it was not accompanied by the consumption of iron enhancers. Therefore, high compliance IST consumption among respondent must be balanced with high consumption of iron source foods especially heme iron to maintance hb level.

Most of the female students who experienced anemia were caused by inadequate consumption of iron and protein-rich foods[10]. Based on the statistical test results, a p-value of 0.00 was obtained, indicating a relationship between iron consumption and anemia status. Similarly, for protein consumption, the statistical test yielded a p-value of 0.002, indicating a relationship between the level of protein consumption and the occurrence of anemia in adolescent girls. This result also revealed a relationship between protein consumption and anemia status in adolescent girls (p-value = 0.045). The level of protein consumption in adolescent girls needs to be considered as it is related to iron transportation in the body. Insufficient protein intake can hinder iron transportation, leading to iron deficiency and an increased risk of anemia[11].

In this study, the compliance of adolescent girls in taking the iron supplementation tablets was monitored through the Monev TTD (Tablet Tambah Darah Monitoring) application, and they were also motivated through a WhatsApp group created by the research team and the teachers of MTSN X Jember. The school faced challenges in monitoring medication compliance, and thus, social support from teachers and peers was needed to improve the compliance of adolescent girls in taking the iron supplementation tablets. The reminder application can serve as a tool to remind individuals to take the iron supplementation tablets at the recommended time by healthcare professionals. Additionally, the application can provide information about anemia and balanced nutritional intake[12]. The level of compliance among respondent who take iron supplementation tablets was monitor using Monev Tablet Tambah Darah application which can download by each adolescent smartphone and also connected with supervisor. After consuming IST each respondent should report to supervise once in a week during intervention. Improved compliance with taking iron supplementation tablets can be achieved through reminders provided by an application. Researchers can directly monitor the intake of tablets through the application by checking the evidence of tablet consumption.

There was a significant increase in the knowledge of adolescent girls (p-value < 0.05), as indicated by the decrease in the percentage of girls categorized as having insufficient knowledge from 53.28% before the intervention to 29.97% after the intervention. Another study showed a significant difference (p-value = 0.000 < 0.05) in the level of knowledge among adolescent girls before and after receiving anemia education. In addition to education, the prevention of anemia can be achieved by improving knowledge about balanced


*e-ISSN : 2338-3119, p-ISSN: 1858-4942*

menus and the benefits of iron supplementation tablets, enabling adolescent girls to have a better understanding[13].

One of the factors influencing the occurrence of anemia is the level of knowledge. Adolescent girls who have good nutritional knowledge related to anemia can influence their food consumption choices. Knowledge related to anemia includes familiarity with the term anemia, understanding its definition, causes, symptoms, consequences, prevention and treatment methods, the hemoglobin threshold for anemia, and foods that contain iron (Fe)[11].

In this study, the dietary patterns of adolescent girls in MTSN X Jember were examined based on the diversity of food consumption. The results showed an improvement in dietary patterns after counseling and the implementation of the tricky card game. A total of 100% of adolescent girls had diverse food consumption patterns, which increased from the initial 59.94% who had diverse consumption patterns. This is beneficial because dietary diversity facilitates the intake of all necessary nutrients. There is no single food item contains in all types of nutrients, it is important to have a varied food consumption. An individual's food diversity determines their nutritional adequacy, which impacts their health. Dietary diversity consistently correlates with a deficiency in micronutrients[13].

Some adolescent girls were previously unaware of the difference between heme and non-heme iron, it caused lack of knowledge among them. They think that all food have same nutrients. So they haven't appropriate dietary pattern for themselves. Heme iron is derived from animal protein sources and can be quickly absorbed by the body, with a higher bioavailability (>50%) compared to non-heme iron. Non-heme iron, on the other hand, comes from plant-based foods such as spinach and legumes, which are believed to have low bioavailability due to the presence of phytates. Therefore, regardless of the quantity consumed, only 10-20% of non-heme iron from these food sources will be absorbed by the body[14].

The Tricky Card Game is an educational game that can be used as an alternative method to convey messages and knowledge about the prevention and management of anemia to adolescent girls. The Paired t-test results showed a significant difference ($p < 0.05$, $p = 0.001$) in the increase of knowledge among adolescent girls after receiving education through the Tricky Card Game.

Various education methods, including lectures and gaming media, do not necessarily lead to improved dietary patterns in adolescents. This is because multiple factors influence dietary patterns, such as gender, knowledge, family purchasing power, and others. One of the factors affecting adolescent dietary patterns is the family's economic status. Higher family income can influence their ability to provide diverse foods. Additionally, the duration of the intervention also affects changes in adolescent dietary patterns. It takes 8-10 weeks to change adolescents' behavior towards vegetable and fruit consumption through educational games[15].

## CONCLUSIONS

There was increasing hemoglobin level among adolescent girl after taking 8 weeks iron supplementation tablets and monitoring their compliance using monitoring alert system called Monev Tablet Tambah Darah application. There was also significant increase in the knowledge of adolescent girls after Tricky card game intervention. In terms of dietary patterns, there was an improvement, with all adolescent girls having a diverse consumption pattern compared to the previous. All of the adolescent girls consumed more than 5 types of food ingredients per week. It is important to conduct innovation such as using tools in smartphone to improve monitoring compliance of consuming blood-boosting tablets among the recipient adolescent girls which is mandatory program from government. Besides that to improve adolescent girl knowledge about heme and no heme iron source foods, the school can use educational game such as Tricky card game. Social support from teachers and peers is needed to monitor the adolescent girls to ensure they consistently take the medication every week and continue doing so independently during their monthly menstruation.

## ACKNOWLEDGMENT

We would like to express our gratitude to the teachers and female students of MTSN X Jember who have assisted in the implementation of this research.


*e-ISSN : 2338-3119, p-ISSN: 1858-4942*

**REFERENCES**


1. Suryani D, Hafiani R, Junita R. Analysis of Diet and Iron Nutrition Anemia in Adolescent Girls in Bengkulu City. *Andalas Public Health Journal*. 2015;10(1):11–18. https://doi.org/10.24893/jkma.v10i1.157
2. Kemenkes RI. Riset Kesehatan Dasar 2018. Jakarta: Kementerian Kesehatan Republik Indonesia; 2018. https://dinkes.babelprov.go.id/sites/default/files/dokumen/bank_data/20181228%20-%20Laporan%20Riskesdas%202018%20Nasional-1.pdf.
3. Asrina SM, Setyarini AI, Novitasari R. Adolescents' Compliance with Taking Blood Increasing Tablets Before and After Using the Reminder Application. *Malang Journal of Midwifery*. 2021;3(1):35–42. https://doi.org/10.31290/majory.v3i1.2006
4. Dinkes Jawa Timur. Profil Kesehatan Provinsi Jawa Timur. Jawa Timur: Dinas Kesehatan Provinsi Jawa Timur; 2019. https://dinkes.jatimprov.go.id/userfile/dokumen/Profil%20Kesehatan%20Jatim%202019.pdf
5. Telisa I, Eliza. Macronutrient Intake, Iron Intake, Hemoglobin Levels and Risk of Chronic Energy Deficiency in Adolescent Girls. *Jurnal AcTion: Aceh Nutrition Journal*. 2020;5(1):80–86. https://doi.org/ 10.30867/action.v5i1.241
6. Muliani U. Differences in Protein, Fe, Vit B6 Intake, and CED Status in Anemic and Non-Anemic Adolescent Girls. HEALTHY: Jurnal Inovasi Riset Ilmu Kesehatan. 2021;1(2):81–90. https://doi.org/10.51878/healthy.v1i2.1115
7. Utomo ETR, Rohmawati N, Sulistiyani. Knowledge, Family Support, and Peers Are Associated with the Consumption of Blood Supplement Tablets in Adolescent Girls . *Ilmu Gizi Indonesia*. 2020; 4(1): 1-10. https://doi.org/10.35842/ilgi.v4i1.147
8. Ningrum ST, Sinaga T, Nurdiani R. Nutritional Knowledge, Changes in Eating Habits and Lifestyle, and Nutritional Status of Students During the Covid 19 Pandemic. *Jurnal Gizi Dietetik*. 2022; 1(3): 156-164. https://journal.ipb.ac.id/index.php/jgizidietetik
9. Syahradesi Y, Lestari F, Yusnaini. Comparison of Food Diversity Based on Minimum Dietary Diversity For Women (MDDW) for Women's Reproductive Health. *Journal of Telenursing*.2023; 5(2): 1719-1725. https://doi.org/10.31539/joting.v5i2.6992
10. Warda Y, Fayasari A. Food Consumption and Iron Bioavailability are Associated with Anemia Status of Adolescent Girls in East Jakarta. *Ilmu Gizi Indonesia*. 2021;04(02):135–146. https://doi.org/10.35842/ilgi.v4i2.198
11. Rahayu A, Yulidasari F, Setiawan MI, Ayu ADS. Implications of Providing Synbiotic Fermented Milk (Lactobacillus plantarum DAD13-FOS) with Protein Intake, Knowledge, and Reducing Anemia in Adolescent Girls. *Prosiding Seminar Nasional Lingkungan Lahan Basah*. Kalimantan Selatan: Universitas Lambung Mangkurat; 2021. https://jak.stikba.ac.id/index.php/jak/article/view/315/194.
12. Arifah N, Anjalina I, Febriana AI, Khairunnisa E, Amir NP, Aprilisa W, Muzhaffar Z, Manyullei S. Health Education about Anemia to Students at SMPN 2 Galesong Selatan Takalar Regency. *Jurnal Altifani Penelitian dan Pengabdian Kepada Masyarakat*. 2022;2(2):176–182. https://doi.org/10.25008/altifani.v2i2.222
13. Fitriani A. Education on the Contents of My Plate for Teachers and Parents to Increase Food Diversity from Vegetable and Fruit Aspects for Elementary School Students in Jakarta. *JMM (Jurnal Masyarakat Mandiri)*. 2021;5(5):2755–2769.https://doi.org/10.31764/jmm.v5i5.5315
14. Nurhayati, Perdani AL, Trismiyana E. Iron Deficiency Anemia and Current State of Knowledge Among Adolescent Girls, Lampung-Indonesia. *Malahayati International Journal of Nursing and Health Science*. 2019;2(1):20–24. https://doi.org/10.33024/minh.v2i1.878
15. Wijayanti TS, Fayasari A, Khasanah TS. Snakes and Ladders Educational Game Increases Knowledge and Consumption of Fruit and Vegetables among Adolescents in South Jakarta. *Journal of Nutrition College*, 2021;10(1):18-25. https://doi.org/10.14710/jnc.v10i1.29153