

The effectiveness of the "ANIMO" educational model using traditional games to improve vegetable and fruit consumption behavior in adolescents

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Abstract

Background: Consumption of vegetables and fruits in adolescents is still very low, especially at the age of 10-14 years which only reaches 0.36%. Teenagers tend to prefer fast food such as sausages, hamburgers, and meatballs to eating vegetables and fruits. **Objective:** This study aims to determine the effectiveness of the traditional game-based "ANIMO" educational model in improving vegetable and fruit consumption behavior in adolescents. **Methods:** The study used a quasi-experimental design with a two-group pre-test post-test design. The research locations were SMPN 6 Jambi City as the intervention group (n=52) and SMPN 11 Jambi City as the control group (n=51). Data analysis used the Wilcoxon test to see changes in the group and the Mann-Whitney test to see the differences between groups. **Results:** The Wilcoxon test showed a significant increase in vegetable and fruit consumption behavior in the intervention group (p=0.000), while the control group showed no significant change (p=0.188). The Mann-Whitney test showed that there was no significant difference between the two groups at the pre-test time (p=0.013), but there was a significant difference after the intervention (p=0.001). **Conclusion:** The traditional game-based "ANIMO" educational model was effective in improving vegetable and fruit consumption behavior in adolescents. This model is recommended to be implemented in health education in schools and health care facilities to support the improvement of healthy nutritional behavior in adolescents.

Keywords: ANIMO educational model; traditional gardening; consumption of fruits and vegetables; adolescent.

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INTRODUCTION

Vegetables and fruits are very important food sources for consumption by every individual because they are part of the recommendations of Balanced Nutrition which plays a role in meeting the needs of vitamins, minerals, and fiber for the body. According to the World Health Organization (WHO), the consumption of vegetables and fruits is 400 grams per person per day, namely 250 grams of vegetables (equivalent to 2.5 servings or 2.5 bowls of vegetables after cooking and draining) and 150 grams of fruit (equivalent to 3 medium-sized bananas or 1.5 medium-sized papayas or 3 medium-sized oranges). A sufficient portion of fruit is 200-300 grams or 2-3 pieces per person per day, while a sufficient portion of vegetables is 150-200 grams per day or 1 1/2 - 2 bowls per person per day [1].

The Indonesian population is categorized as having sufficient consumption of vegetables and fruits if they consume vegetables and/or fruits (a combination of both) at least five servings per day for seven days a week [2]. Lack of consumption of vegetables and fruits can weaken the immune system and increase the risk of chronic diseases such as hypertension, stroke, obesity, and cancer [3]. WHO (2016) reports that 31% of heart diseases and 11% of stroke cases in the world are caused by low fruit and vegetable intake, and estimates that about 3.9 million deaths per year are related to non-communicable diseases [4-5]. Research by Ferro et al. (2020) shows that higher consumption of fruits and vegetables is associated with a reduced risk of gastric cancer. In addition, fiber in vegetables and fruits plays an important role in maintaining intestinal health through the fermentation process in the colon and has anticarcinogenic properties [6-7].

Adolescents are an age group that tends to have a low level of vegetable and fruit consumption. Various global studies confirm this condition. Ziaei et al. (2020) in Iran reported that 71.6% of adolescents consumed fruit less than twice per day, and 23% consumed vegetables less than three times per day. Similar results were shown by Wambogo et al. (2020) in the United States in the period 2015–2018, which stated that the majority of children and adolescents have not met the consumption recommendations, with only 32% meeting the fruit consumption recommendations and 17% for vegetables [8-9].

A meta-analysis by Beal et al. (2019) in adolescents in various regions of the world also supports these findings, with an average consumption of fruit of 1.43 times per day and vegetables of 1.75 times per day. A study in Dhaka, Bangladesh, by Salwa et al. (2021) showed that the average consumption of fruit was 1.22 servings per day and vegetables was 1.99 servings per day, and only 21% of adolescents were able to achieve the recommendation of at least five servings per day [10-11].

In Indonesia, adolescents aged 10–14 years are the group with the lowest consumption of vegetables and fruits, which is 3.2% (Riskesdas, 2018) and decreases to 2.3% [12]. Similar conditions were also found in Jambi City, where only 2.5% [1-2] and 3.0% [13] adolescents who meet consumption recommendations. The results of an initial survey conducted by researchers at SMPN 6 Jambi City showed that only 4 out of 10 students (40%) consumed vegetables and fruits as recommended.

Other studies in Indonesia have also shown similar results. Qibtiyah (2021) reported that most adolescents at SMPN 3 South Tangerang did not meet the daily consumption recommendations, with an average of only one serving of fruit and one and a half servings of vegetables per day. In addition, a literature review by Rachmi et al. (2020) also confirmed that Indonesian adolescents generally have not reached the recommended amount of vegetable and fruit consumption [14-15].

Currently, adolescents tend to prefer instant and fast food such as meatballs, pizza, hamburgers, chocolate, and other similar products, while interest in the consumption of vegetables and fruits is relatively low [16]. Similar findings were reported by Kalsum et al. (2018) which stated that adolescents in Jambi City prefer ready-to-eat foods such as pizza, hamburgers, popcorn, chips, cakes, and sweet foods rather than consuming vegetables and fruits [17].

Adolescence is an important period in the formation of a body and healthy eating habits. An unhealthy diet in this phase can negatively impact growth, development, and increase the risk of future health problems. Therefore, the implementation of a healthy diet from adolescence is an important preventive measure against various health problems in the future [18].

One of the factors that contributes to the low consumption of vegetables and fruits in adolescents is the level of knowledge. Several studies have shown a relationship between nutritional knowledge and vegetable and fruit consumption behavior. Research by Rarastiti (2022) found a significant relationship between balanced nutritional knowledge and consumption of vegetables and fruits in grade IX students of SMP Negeri 8 Semarang City. In line with that, Schmitt et al. (2019) stated that nutrition education is an important factor in increasing fruit and vegetable intake, as it has been proven to be effective and sustainable in changing eating behavior [19-20].

Knowledge is the result of the process of knowing that occurs after a person senses an object, and becomes the basis for the formation of good behavior [21]. The government has made various efforts to overcome the low consumption of vegetables and fruits in Indonesia, including through health promotion in the Healthy Living Community Movement (Germas). The campaign was carried out with the use of educational media such as posters, leaflets, and videos regarding the recommendation for the consumption of vegetables and fruits known as the concept of "Piring Makanku." However, these efforts have not achieved optimal results. This can be seen from Riskesdas data (2018) which shows that only 4.6% of Indonesians consume vegetables and fruits as recommended, and even decreased to 3.3% in the 2023 Indonesian Health Survey (SKI) [1-2,12-13].

It is important to analyze the causes of low consumption of vegetables and fruits in the younger generation and strategies that can be done to increase their intake. In this context, behavior change theory and model-based intervention planning have become particularly relevant because they both play a role in directing behavior change in a healthier direction. The application of behavior change theory has been proven to increase the success of interventions aimed at encouraging changes in eating behavior, including the consumption of vegetables and fruits in adolescents [22].

Teori perubahan perilaku sangat penting dalam program promosi kesehatan, karena teori perilaku membantu dalam memahami situasi dan memberikan langkah-langkah untuk melakukan intervensi [23]. Several studies on the theory of behavior change used in improving the behavior of consuming vegetables and fruits in adolescents include, the study of Kamee Gur, et al. (2019) at Istanbul State High School in Turkey found that adolescents experienced an increase in the intake of vegetables and fruits through interventions based on the theory of the transtheoretical model (TTM) [24]. Research by Jeihooni, et al. (2017) which found that there was an increase in vegetable and fruit consumption behavior in adolescent girls of Phase City High School in Iran which was oriented to the theory of the previous model, in this study the researcher used an intervention with an emphasis on risk factors for changes in vegetable and fruit consumption [25].

The theory of behavior change in the Precede model consists of three domain factors, namely predisposition, reinforcer, and possibility. Aspects of individual behavior are assessed in these three domains [26]. Predisposing factors (knowledge, attitudes, beliefs, and values), precede behavior changes and generate motivation to behave. Enabling factors (such as the availability and accessibility of resources, or services and regulations), are the introduction of behavioral or environmental changes that facilitate the achievement of motivation to realize environmental policies. Reinforcing factors are factors that contribute to monitoring behavior and rewarding behavior (family, peers, teachers, employers, health workers, etc.) [27].

TTM argues that individuals move through five stages of change: pre-contemplation, contemplation, preparation, action, and maintenance. For each stage of change, different intervention strategies are considered to be most effective in pushing the individual towards the next stage of change, and subsequently achieving maintenance, the desired behavioral stage [28].

Based on the explanation of several theories of behavior change that have been presented above, the researcher conducted a health education model called ANIMO (Analysis, Implementation, Monitoring, and Evaluation). This model aims to improve the consumption behavior of adolescents vegetables and fruits. The researcher refers the word ANIMO to a combination approach of two complementary theories of health behavior, namely the TTM theory model, Precede, At the analysis stage is the stage of analyzing adolescents' intentions in consuming fruit analyzed from the TTM model, after it is known how much the intention and behavior of adolescents in consuming vegetables and fruits is then analyzed factors that affect intentions in eating behavior of vegetables and fruits in adolescents with a theoretical approach Previous. After the factors that cause the low consumption behavior of vegetables and fruits are found, the implementation stage will be carried out with the support of the traditional game media of snake and ladder combination, this is because the success is greatly influenced by the media used in accordance with the target [29].

Then at the evaluation stage, it is the final stage of all stages of providing the researcher's intervention, namely the researcher will evaluate the extent to which the adolescent consumption behavior improves after being given the intervention. The achievement or success of health promotion goals other than the theoretical approach also needs to be supported by educational media. One of the promotional and learning media is games [29].

One of the effective educational media for teenagers is games. Various studies show that educational games, especially snake and ladder games, are able to improve vegetable and fruit consumption behavior in students. In addition, this game has also been proven to support cognitive development as well as provide a fun learning experience, as students can learn while playing [30-31].

In addition to the snake and ladder game, the traditional game of engklek is also effectively used as a learning medium to improve student behavior. Several studies show the effectiveness of this game. Nugraha et al. (2015) reported that engklek games are suitable for use in learning digestive system materials at SMPN 1 Tulungagung. Fitriyah & Indah (2018) also found that modified engklek games were effective in improving problem-solving skills in grade VII MTs Uswatun Hasanah students. Engklek games have various benefits, such as training physical strength through jumping movements, encouraging social interaction and togetherness, and honing children's logic and skills [32-33].

Phenomena in the field show that traditional games are now increasingly rarely played due to the rapid development of technology. In fact, traditional games have

many benefits for children's growth and development. Technological innovations, especially the use of the internet and gadgets, make children tend to be passive and prefer digital games to physical activities [34-35]. Traditional play provides significant benefits to a child's physical and motor development, as well as contributes to heart, body, and mind health [22]. However, many people are still not aware of the importance of educational and health values contained in traditional games.

Based on the phenomenon of these problems and considering the benefits of traditional games as a health education medium, the researcher is interested in researching the effectiveness of health education "Animo" by using the traditional game media of snake and ladder combinations played in the field, with a focus on increasing the consumption of vegetables and fruits in adolescents. In this game, the ladder symbol represents positive behavior (eating vegetables and fruits as recommended), while the snake symbol represents negative behavior (not eating vegetables and fruits). Meanwhile, the engklek element provides additional physical activity in the form of jumping movements that can train concentration, coordination, cooperation, and social interaction between students. Through this combination, it is hoped that the educational model game "Animo" will be able to improve vegetable and fruit consumption behavior in a fun, interactive, and motivating adolescent to apply sufficient vegetable and fruit consumption behavior in daily life.

METHODS

This study uses a quasi-experimental method with a pretest-posttest control group design [13]. The research subjects were divided into two groups, namely the experimental/treatment group and the control group. The experimental group consisted of 52 students in grades 7K and 8C of SMPN 6 Jambi City who received treatment in the form of health education "Animo" through the media of a combination of snake and ladder games about the consumption of vegetables and fruits, and using a game guidebook that contains an explanation of the material on the media. The game was held in the school field area. Meanwhile, the control group consisted of 51 students in grades 7F and 8D SMPN 11 Jambi City which obtained health education about vegetables and fruits using the lecture method without the use of game media, namely using leaflet media. The interest model consists of 4 stages, namely analysis, implementation, monitoring and evaluation which are depicted in the image below:

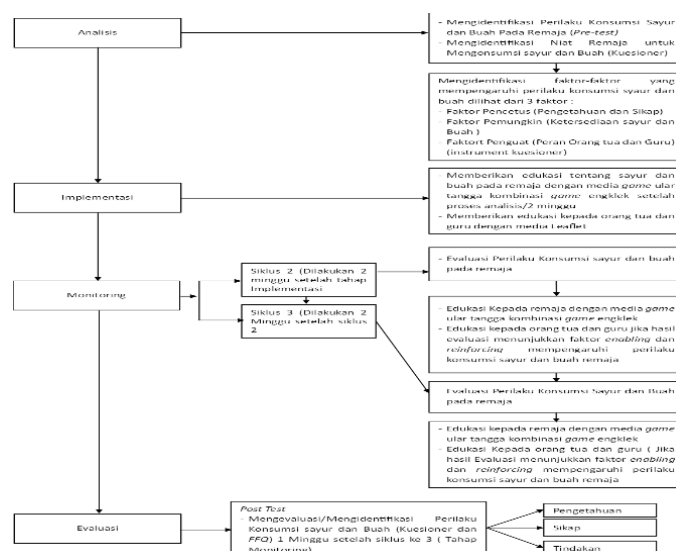


Figure 1. Animo Steps

The form and technique of this game is a combination of snake and ladder game media and engklek games that contain educational materials about vegetable and fruit consumption. The snake and ladder media was modified by adding pictures and educational information related to the consumption of vegetables and fruits. The game is carried out on the field, where students play the role of a piece and move from one box to another by jumping using one foot according to the engklek game technique. The provision of interventions was carried out from August to October 2025 in three meetings, with an interval of two weeks between each intervention [11]. Before the intervention, a pretest measurement is carried out, and after all interventions are completed, a posttest measurement is carried out to determine the effectiveness of the treatment given.

The size of the snake and ladder media is 400 cm x 400 cm, with the size of each box being 40 cm x 50 cm. The shape of the snake and ladder design is made to resemble a dragon fruit so that it is more attractive and in accordance with the theme of the material. The form of the media can be seen in the following image:



Figure 2. Snake Ladder Game Combination Engklek Game

Sampling in this study used a hypothesis formula by considering inclusion and exclusion criteria. The sampling technique is with the cluster random sampling technique. The measuring tool used in this study is the FFQ (Food Frequency Questionnaire) Form. Data processing was carried out using SPSS version 26, with univariate and bivariate analysis. The statistical test used was Wilcoxon and Mann-Whitney with a significance level of $p < 0.05$, because the data were not normally distributed [13].

RESULTS

The results of the study regarding the distribution of student characteristics based on gender, age, maternal education, and paternal education can be seen in the following table:

Table 1. Distribution of Treatment Group Students and Control Groups by Gender, Age, Paternal Education, and Maternal Educator.

Variable	Total			
	Treatment Group	%	Control Group	%
Sex				
Male	21	40,4	26	50,9
Female	31	59,6	25	49,1
Age				
11 year	3	5,7	4	7,8
12 year	22	42,3	19	37,2
13 year	24	46,1	24	47,2
14 year	3	5,7	4	7,8
Father's Education				
Did not complete school	0	0	0	0
Elementary school Completed	3	5,7	2	3,9
Elementary School Completed Junior High School	7	13,4	2	3,9
Completed Senior High School	32	61,5	18	35,3
College graduation	9	17,3	24	47,0
1	2,1	5	9,9	
Maternal Education				
Did not complete school	1	2,1	1	1,9
Elementary school Completed	3	5,7	1	1,9
Elementary School Completed Junior High School	6	11,5	1	1,9
Completed Senior High School	26	50,0	20	39,2
College graduation	15	28,6	25	49,1
1	2,1	3	6,0	
Total	52	100	51	100

Based on the table above, it can be seen that in the treatment group, the number of female respondents was higher (59.6%) than men. On the other hand, in the control group, the number of male respondents was more, namely 26 people (50.9%) than women. Based on age, the majority of respondents in both the treatment group and the control group were 13 years old, 46.1% and 47.2%, respectively. Based on the father's education level, in the treatment group, most of the respondents' fathers had the last education of high school/MA (61.5%). Meanwhile, in the control group, the majority of respondents' fathers had the last education of D3/D4/S1 (47.0%). The education of the respondents' mothers in the treatment group was also dominated by the last education of high school/MA (50%), while in the control group, the majority of respondents' mothers had the last education of D3/D4/S1 (49.1%).

Table 2. Distribution of behavior of students eating vegetables in the treatment group and control group

No	Vegetable Consumption	Treatment Groups				Control Group			
		Pre-Test		Post-Test		Pre-Test		Post-Test	
		n	%	n	%	n	%	n	%
1	Good	25	48,1	46	88,5	29	56,9	20	39,2
2	Less	27	52,9	6	11,5	22	43,1	31	60,8
Total		55	100,0	52	100%	51	100,0	51	100,0

Based on the table above, it can be seen that in the treatment group there was a significant increase in the category of vegetable consumption behavior. Respondents with a good category increased from 48.1% during the pre-test to 88.5% during the post-test. In contrast, the less category decreased from 52.9% to 11.5% after being given an intervention. In the control group, there was a decrease in the category of vegetable consumption behavior. The proportion of respondents with a good category decreased from 56.9% to 39.2% at the post-test, while the less category increased from 43.1% to 60.8%. These results show that the intervention of the "Animo" educational model supported by the traditional game media of snakes and ladders and engklek is more effective in increasing vegetable consumption than education with the lecture method assisted by leaflet media.

Table 3. Distribution of fruit-eating student behavior in the treatment group and control group

No	Fruit Consumption	Treatment Groups				Control Group			
		Pre-Test		Post-Test		Pre-Test		Post-Test	
		n	%	n	%	n	%	n	%
1	Good	25	48,1	46	88,5	36	70,6	16	31,4
2	Less	27	52,9	6	11,5	15	29,4	35	68,6
Total		52	100,0	52	100%	51	100,0	51	100,0

Table 3 shows that there was a significant increase in fruit consumption behavior in the treatment group after the intervention was given. Before the intervention, respondents with a good fruit consumption behavior category of 48.1%, then increased to 88.5% at the post-test. Meanwhile, respondents with the category of fruit consumption behavior decreased less from 52.9% to 11.5%.

In contrast to the treatment group, in the control group, a decrease in fruit consumption behavior was seen after education was carried out by the lecture method with leaflet media. In the control group, respondents with the category of good fruit consumption decreased from 70.6% during the pre-test to 31.4% during the post-test, and the less category increased from 29.4% to 68.6%.

The change in the direction of the percentage in these two groups shows that the provision of "Animo" education using traditional game media is able to create a more interesting and interactive learning atmosphere so that it has a positive impact on improving fruit consumption behavior. On the other hand, lecture education with leaflet media has less influence on changes in fruit consumption behavior in students. Thus, it can be concluded that health education "Animo" through the traditional game of snake and ladder combination has proven to be more effective in increasing fruit consumption in students than the lecture method with leaflet media.

Table 4. Distribution of behavior of students consuming vegetables and fruits in the treatment group and control group

No	Fruit Consumption	Treatment Groups				Control Group			
		Pre-Test		Post-Test		Pre-Test		Post-Test	
		n	%	n	%	n	%	n	%
1	Good	0	0,00	46	50,9	13	25,5	39	76,5
2	Less	52	100,0	6	49,1	38	74,5	12	23,5
Total		52	100,0	52	100%	51	100,0	51	100,0

Based on the table above, it can be seen that there is an increase in fruit consumption behavior in both groups. However, the improvement that occurred in the treatment group was much greater than that of the control group. In the treatment group, before the intervention, all respondents were in the category of low consumption (100%), then after the intervention it increased to 50.9% of respondents were in the category of good behavior, and only 49.1% were still in the category of poor behavior. Meanwhile, in the control group, there was also an increase although not as large as the treatment group. At the pre-test, respondents with the category of good behavior were 25.5%, and increased to 76.5% at the post-test. Meanwhile, the behavior of the less category decreased from 74.5% to 23.5%.

The differences in students' behavior in consuming vegetables and fruits before and after each group was given an intervention were analyzed using the statistical test wilcoxon signed rank test. This test is used because the data is dissected abnormally. The results of the test of differences in student behavior before and after being given the intervention are shown in the following table:

Table 5. Results of changes in student behavior eating vegetables and fruits in the treatment group and control group.

Knowledge	Mean Difference	SD	Std Error Mean	95% CI		p-value
				Lower	Upper	
Treatment Groups	1,95	0,85	0,118	4,67	5,15	0,000
Control Group	1,24	3,429	0,480	3,41	5,29	0,188

Table 5 shows the mean difference in the treatment group of 1.95. The results of the wilcoxon signed rank test showed a value of $p = 0.000 (< 0.05)$, which means that there was a significant difference between the behavior before and after the intervention. Thus, the interventions provided have a significant effect on improving students' vegetable and fruit consumption behavior. Meanwhile, in the control group, the mean difference was 1.24. The results of the wilcoxon signed rank test showed a value of $p = 0.188 (> 0.05)$, which means that there was no significant difference between the pre-test and post-test behavior in the control group.

The effectiveness of health education with the media of snake and ladder games in combination with the game of engklek on the behavior of students consuming vegetables and fruits was analyzed using the statistical test of the Mann-Whitney U test value of the sig (2-tailed). This test is used because the data is dissected abnormally. The results of the effectiveness test of providing health education "Animo" with the

media of snake and ladder games combined with engklek games are explained in the following table.

Table 6. The effectiveness of providing "Interest" health education with snake and ladder game media combination of *engklek* games on the behavior of students consuming vegetables and fruits in the treatment group and control group.

Behaviour	Group	Mean	SD	Std. Error Mean	p-value
Pre-Test	Treatment	2,96	3,00	0,90	0,013
	Control	3,26	3,00	85,66	
Post-Test	Treatment	4,91	0,85	0,11	0,001
	Control	4,50	3,42	0,48	

Table 6. It shows that based on the results of the statistical test, it can be analyzed that the behavioral variables before the intervention were obtained with a value of $p: 0.013 (> 0.05)$ which means that on average there was no significant difference between the consumption behavior of vegetables and fruits of students in the treatment group and the control group before the intervention was given. But after the intervention showed a $p: 0.000 (< 0.01)$ which means that on average there was a significant difference between the consumption behavior of vegetables and fruits in the treatment group and the control group after the intervention.

CONCLUSIONS

Based on the results of the research, it can be concluded that health education "Animo" using the traditional game media of snakes and ladders modified with pictures and materials about vegetables and fruits and combined with engklek games and the use of game manuals, has a positive influence on students. This is shown by an increase in the behavior of consuming vegetables and fruits after the intervention. For SMPN 6 and SMPN 11 Jambi City, the "interest" educational model using a snake and ladder game with a combination of engklek modified with vegetable and fruit materials can be used as a learning medium for students, especially about fruit and vegetable consumption so that it can improve students' behavior in consuming vegetables and fruits. For the Jambi City Health Center to be more active in educating about fruit and vegetable consumption in the school environment by using the "interest" educational model by using the media of snake and ladder games in combination with engklek games, especially at SMPN 6 and SMPN 11 Jambi City.

CONFLICT OF INTEREST

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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DECLARATION OF ARTIFICIAL INTELLIGENCE USE

This study used artificial intelligence (AI) tools and methodologies in the following capacities Manuscript writing support: AI-based language models, such as [for example, ChatGPT, Quillbot], were/was employed to: Language refinement (improving the grammar, sentence structure, and readability of the manuscript).

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