

## ORIGINAL ARTICLE

# INTERACTION OF PEER HEALTH EDUCATION AND ARCS KELLER METHOD TO REDUCE THE RISK OF DM TYPE II

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## ABSTRACT

*This study aims to determine the effect of the interaction of peer health education and the Keller's ARCS method on reducing the risk of type II diabetes mellitus. The research method used a quasi-experimental design, with peer health education variables and the ARCS Keller method to reduce the risk of type II DM, sample size of 78 people, purposive sampling technique, data analysis using the Anova test. The results of the study showed that there was a reduction in the risk of type II DM before and after education through peer health education. There was an increase in motivation and a decrease in the risk of type II DM after being given education using the ARCS Keller method and there was no interaction between peer health education and the ARCS Keller method on reducing the risk of type II DM, that is, it is possible that there were other variables that contributed to reducing the risk of DM.*

**Keywords:** Peer Health Education, motivation, ARCS Keller, Diabetes Mellitus, Motivation

## INTRODUCTION

Diabetes Mellitus (DM) is a dangerous disease that is often called the silent killer and is a major health problem. DM often causes long-term complications such as cardiovascular disease, chronic kidney failure (the main cause of dialysis), retinal damage that can cause blindness, and nerve damage that can cause impotence and gangrene with the risk of amputation. Diabetes in Indonesia is considered a major health problem and has been a concern since the early 1980s. With more than 10 million people living with diabetes, Indonesia has a prevalence rate of 6.2%<sup>1</sup> and diabetes is one major cause of death<sup>2</sup>. Indonesia was rated as one of the top ten countries globally with a high number of individuals living with diabetes in 2013<sup>3</sup>. It is predicted that the same pattern will continue<sup>3</sup> unless interventions to prevent and manage diabetes are implemented. The International Diabetes Federation (IDF) estimated there were 451m people with DM worldwide in 2017 and that number will increase to 693m by 2045. Moreover, it was estimated that almost half of all people living with DM are undiagnosed. This poses a great challenge to many countries' healthcare systems and resources<sup>4</sup>.

Diabetes Mellitus can be prevented, delayed or eliminated by controlling risk factors (Ministry of Health, 2010). There are several causes of Diabetes Mellitus, namely increasing age, age over 40 years, many vital organs weaken and the body begins to experience sensitivity to insulin. Gender, in women who have experienced

menopause have a tendency to be more insensitive to the hormone insulin. The prevalence of DM in women tends to be higher than in men. A family history of DM, heredity or genetics has a contribution to developing diabetes. Diet, exercise habits. The purpose of the DM control program in Indonesia is the implementation of risk factor control to reduce morbidity, disability and death caused by DM. DM control is prioritized on early prevention through efforts to prevent DM risk factors, namely promotive and preventive efforts by not neglecting curative and rehabilitative efforts.

In an effort to carry out primary prevention in community groups who are at risk of experiencing DM disease, Peer Health Education through education, training and mentoring activities can be used as a method to carry out health promotion in these community groups by carrying out the Healthy Living Community Movement (GERMAS). And focus on 4 sub-activities of GERMAS, namely increasing physical activity, culture of consuming fruit and vegetables, not smoking, conducting regular checks. This activity will be carried out through community mobilization to get involved starting from planning to evaluating activities, through education, training and mentoring, so it is hoped that this program will continue independently by the community even though the service activities have been completed.

Efforts to reduce the risk of DM are certainly strongly influenced by individual motivation, for that we need a method that can increase motivation at the risk of DM, for that a peer health educator in addition to acting as a facilitator and

mediator, but is also required to be able to act as a motivator who can generate enthusiasm and encouragement for DM risk by using various attractive presentation methods so as to create a comfortable and attractive atmosphere and support the formation of motivation and behaviour in terms of knowledge, skills and attitudes<sup>5</sup>. One of the learning methods that can be used is the ARCS learning method. This method is a form of problem solving approach to design aspects of motivation and learning environment in encouraging and maintaining student motivation to learn<sup>6</sup>.

## METHODS

This study uses a quasi-experimental design, with a one group pretest - posttest approach. The research was carried out in the Malang City area in May-October 2021. The research subjects were 78 people who were at risk of DM, using purposive random sampling technique. Samples were taken from some community groups who have a risk of developing DM, starting at the age of 40 years and participating in group associations in the research area. Samples were taken by purposive sampling technique amounted to 78 people, male 40 and female 38.

### Variable

The independent variable in this study is the health promotion model: Peer Health Education and the Keller ARCS method is the provision of health education conducted by peers about modifying healthy lifestyles to community groups who have a risk of DM disease with media modules and booklets. Through an attractive presentation includes attention, relevance, confidence and self confidence. Variabel independen dalam penelitian ini adalah *Peer Health Education dan metode ARCS K*. Peer Health Education is the provision of health education about modifying healthy lifestyles to community groups who are at risk of developing DM by using modules and booklets. The provision of health education will be carried out by Peer Health Educators who are representatives of community groups appointed by researchers with certain criteria. The criteria for Peer Health Educators are someone who is trusted and considered by community groups at risk to have the ability to influence community groups in their community. The dependent variable in this study is the risk of type II DM. The risk of developing DM is the emergence of factors that can increase the likelihood of developing DM, which is indicated by the results of the DM risk score assessment. The measurement parameters of this variable are based on the Finnish Association Diabetes.

### Instrument

1. Questionnaire. The questionnaire contains 15 closed questions regarding the modification of the respondent's lifestyle including: diet / diet, physical activity / exercise, stress management, smoking habits.
2. Questionnaire to identify motivation
3. Tensimeter. Tensimeter is used to measure the respondent's blood pressure. The sphygmomanometer used is an automatic sphygmomanometer
4. Blood Sugar Test. Blood sugar test is used to measure the level of sugar in the respondent's blood. Measurement of this level will use glukotest.
5. The DM Score checklist sheet is used to assess the risk of developing DM which may occur in respondents in the next 10 years. Respondents were asked to provide a checklist (✓) on the choice of predetermined risk factors

### Analysis

The analysis was carried out to analyze the data whether there was an effect of interaction between Peer Health Education and the Keller ARCS method on reducing the risk of DM in at-risk groups. analysis test with Anova. Bivariate analysis was carried out to analyze the data whether there was an influence of Peer Health Education on reducing the risk of DM in at-risk community groups. The first data analysis is to identify whether there is a difference in the risk of DM before the respondent is given Peer Health Education treatment and after being given treatment, namely in the first 1 month. This data analysis used paired t-test analysis. Furthermore, the results are identified again compared to the following 1 month. In addition, data analysis will be carried out to determine the difference in the risk of DM in the treated group and the control group. Data analysis was carried out using Unpaired t-test. This data analysis was used to measure differences before and after education. For data analysis, comparing the results of measurements at 1 month after treatment, was carried out using paired t-test. The whole process of data analysis is using SPSS. To test and analyze whether there are differences in the motivation of DM risk respondents before and after being given the Keller ARCS method using paired t-test. To see the interaction, the data will be analyzed statistically using 2x2 factorial ANOVA through the SPSS 20 program. Tests on statistical values are carried out at a significance level of 5%.

RESULTS

Table 1: Table of frequency and percentage of demographic

Demography Characteristic	Frequency	Percentage (%)
<b>Age</b>		
< 45 years	20	25.6%
45-54 years	19	24.4%
55-64 years	39	50.0%
<b>Gender</b>		
Men	40	51.3%
Women	38	48.7%
<b>History of DM</b>		
No	64	82.1%
Descendants of parents	5	6.4%
Descendants of grandparents	9	11.5%
<b>Total</b>	<b>78</b>	<b>100%</b>

Table 2 : Effective Donation Calculation

Variabel	R	x	Beta	SE
X <sub>1</sub>	0.303	x	0.066	2.00%
X <sub>2</sub>	0.553	x	0.444	24.57%
X <sub>3</sub>	0.307	x	0.212	6.52%
X <sub>4</sub>	0.421	x	0.187	7.86%
X <sub>5</sub>	0.452	x	0.216	9.75%
X <sub>6</sub>	0.611	x	0.306	18.68%
X <sub>7</sub>	0.133	x	-0.002	-0.02%
X <sub>8</sub>	-0.284	x	-0.269	7.64%
<b>Total Effective</b>				<b>76.99%</b>

Table 3 : Results Comparison of Total Risk Score Dm Between Pre and Post Treatment

	Experiment		p Value
	(Pre)	(Post)	
<b>Total risk score <sup>t</sup></b>	8.45±4.59	7.33±3.56	0.000

Based on table 2, family history (X2) shows the largest effective contribution, which is 24.57%, and Blood Sugar Levels (X6) provides an effective contribution of 18.68%.

At the time before (pre-treatment) the learning strategy of peer health education was given, the average DM total risk score was 8.45, while after

(post-treatment) the learning strategy was given peer health education, the average total risk score for DM was 7.33. Then the comparison was tested using paired t-test and obtained a significance value of 0.000 (p<0.05), so it can be concluded that there is a significant or significant difference in the DM total risk score between before and after being given a peer health education learning strategy.



Graph 1: The difference in the total DM risk score before and after peer health education

Based on the graph above, the average DM risk total score after the experiment (post) is lower

than the average DM risk total score before the experiment (pre).

Table 4: Frequency and percentage of data on BMI, abdominal circumference, blood pressure, blood sugar levels, fruit consumption, exercise activities, and interpretation of Risk Score during Pre and Post Treatment

	Pre experiment		Post experiment	
	Frequen cy	Percentage (%)	Frequen cy	Percentage (%)
<b>BMI</b>				
< 25 kg/m <sup>2</sup>	27	34.6%	29	37.2%
25 -30 kg/m <sup>2</sup>	37	47.4%	44	56.4%
> 30 kg/m <sup>2</sup>	14	17.9%	5	6.4%
<b>Abdominal Circumference</b>				
<b>Men</b>				
<94 cm	21	52.5%	23	57.5%
94-102 cm	12	30.0%	13	32.5%
>102 cm	7	17.5%	4	10.0%
<b>Women</b>				
<80 cm	3	7.9%	7	18.4%
80-88 cm	15	39.5%	17	44.7%
>88 cm	20	52.6%	14	36.8%
<b>Systolic Blood Pressure Value</b>				
<150	62	79.5%	66	84.6%
>150	16	20.5%	12	15.4%
<b>Blood Sugar Level</b>				
<200	66	84.6%	72	92.3%
>200	12	15.4%	6	7.7%
<b>Consumption of Fruits</b>				
everyday	48	61.5%	52	66.7%
Not everyday	30	38.5%	26	33.3%
<b>Sports activities in a week</b>				
Exercise regularly every day for at least 30 minutes	43	55.1%	48	61.5%
Not Exercise regularly every day for at least 30 minutes	35	44.9%	30	38.5%
<b>Interpretasi RISK SCORE</b>				
Low	28	35.9%	36	46.2%
Slightly	33	42.3%	35	44.9%
Moderate	8	10.3%	2	2.6%
High	8	10.3%	5	6.4%
very high	1	1.3%	-	0.0%
<b>Total</b>	<b>78</b>	<b>100</b>	<b>78</b>	<b>100</b>

Based on the table above, for pre-treatment BMI from 78 respondents, it can be seen that there were 27 people (34.6%) with BMI <25 kg/m<sup>2</sup>, 37 people (47.4%) with BMI 25-30 kg/m<sup>2</sup>, and 14 people. (17.9%) with BMI >30 kg/m<sup>2</sup>. While at the

time of post treatment, the BMI of the 78 respondents experienced a change, where as many as 32 people (37.2%) with a BMI <25 kg/m<sup>2</sup>, 44 people (56.4%) with a BMI of 25-30 kg/m<sup>2</sup>, and 5 people (6.4%) with a BMI >30 kg/m<sup>2</sup>.

**Table 6: Comparison of total results for motivation pre and post experiments using the Keller ARCS method**

	Experiment		p-value
	(Pre-test)	Post-test	
<b>Total risk score</b>	Mean: 8.55±1.96 median, min, max): 10 (2 - 10)	Mean: 9.18±1.19 median, min, max): 10 (2 - 10)	0.000

In the pre-treatment of the Keller ARCS method, the average total risk score for motivation was 8.55 with a median of 10, while after (post-treatment) the learning strategy of the Keller ARCS method was given, the average total risk score for motivation was 9.18 with a median of

10. Then tested comparison using the Wilcoxon test and obtained a significance value of 0.000 (p <0.05), so it can be concluded that there is a significant or significant difference in the total risk score of motivation between before and after being given the Keller ARCS learning strategy.

**Table 7: The results of the analysis of the effect of the interaction of peer health education and the Keller ARCS method on reducing the risk of DM**

	F	p-value
Peer health education and the Keller ARCS method	1.554	0.190

Based on table 7, the p-value is 0.190 (p>0.05), so it can be concluded that there is no difference in the total DM risk score on the interaction between peer health education and motivation with the Keller ARCS method. This is because the difference in the average total risk score in each category of interaction between peer health education and motivation with the ARCS Keller method is only small, so it can be said that the interaction between peer health education and motivation with the ARCS Keller method has no major effect on the reduction in total risk DM scores.

**DISCUSSION**

Based on the analysis test to identify the dominant risk factor for DM, it was found that family history (X2) showed the largest effective contribution of 24.57%, and Blood Sugar Levels (X6) provided an effective contribution of 18.68%. Furthermore, from the results of these calculations, it can be seen that age, family history, BMI, abdominal circumference, blood pressure, blood sugar levels, fruit consumption, and exercise activities were able to provide an effective contribution of 76.99% to DM risk. The total effective contribution is equal to the coefficient of determination (R-square=R<sup>2</sup>), which is 77.0%. The implication is that there are several other variables that also affect the risk of DM besides age, family history, BMI, abdominal circumference, blood pressure, blood sugar levels, fruit consumption, and exercise activities<sup>7</sup>.

Based on the results of the paired t test and obtained a significance value of 0.000 (p <0.05),

so it can be concluded that there is a significant or significant difference in the total risk score for DM between before and after being given a peer health education learning strategy. Based on the results of the analysis of the calculation of the score to determine the risk of DM after education there is a reduction in risk, based on the Diabetes risk assessment from the Finnish Diabetes Association from risk factors that are persistent (age and family history) and some can be changed through reducing risk factors such as body mass index, circumference stomach, exercise, consumption of vegetables and fruit. From the results of the study, it was found that the risk of a decrease occurred in the factor of consumption of vegetables and fruit, exercise and weight loss. This will certainly contribute to a decrease in body mass index and abdominal circumference <sup>1</sup>.

One of the factors related to a person experiencing diabetes mellitus is the age factor where over the age of 40 years many vital organs weaken and the body begins to experience insulin sensitivity. Even women who are old (more than 40 years) and have experienced menopause have a tendency to be more insensitive to the hormone insulin<sup>8</sup>. The age group most suffering from DM is the age group 55-64 years. Diabetes risk increases with age, especially at the age of more than 40 years, because at that age, glucose intolerance begins to increase. The aging process causes a decrease in the ability of pancreatic cells to produce insulin. In addition, in older individuals there is a decrease in mitochondrial activity in

muscle cells by 35%. This is associated with an increase in muscle fat levels by 30% and triggers insulin resistance <sup>9</sup>.

Gender is one of the factors related to the occurrence of Diabetes Mellitus in which women who have experienced menopause have a tendency to be more insensitive to the hormone insulin. Diabetes in general for men comes more quickly than women. Women can be protected from diabetes until they reach menopause because of the influence of the female hormone estrogen, a reproductive hormone that helps regulate blood sugar levels in the body <sup>10,11</sup>. The results of research conducted by Shara Kurnia Trisnawati (2012) showed the prevalence of Type 2 DM in women was higher than in men. Women are more at risk of developing diabetes because physically women have a greater chance of increasing their body mass index. Monthly cycle syndrome (premenstrual syndrome), post-menopausal which makes the distribution of body fat easily accumulate due to the hormonal process so that women are at risk of suffering from type 2 diabetes mellitus <sup>12</sup>.

Hereditary or genetic factors have a contribution that cannot be underestimated for someone developing diabetes<sup>13</sup>. Eliminating genetic factors is very difficult. What can be done for someone to avoid Diabetes Mellitus due to genetic causes, is to improve lifestyle and diet<sup>14</sup>. People with Diabetes Mellitus do not inherit type I diabetes itself but inherit a predisposition or genetic predisposition towards the occurrence of type I diabetes. This genetic predisposition is determined in individuals who have a certain type of HLA antigen (Human leukocyte antigen) <sup>15</sup>. HLA is a collection of genes responsible for transplant antigens and other immune processes <sup>16</sup>. Prevention efforts can be done through health promotion efforts. Health promotion in connection with providing information content to the public in relation to health problems. And in DM prevention efforts, actions that can be taken are early diagnosis and prompt treatment. Early diagnosis and prompt treatment is carried out in connection with early detection of individuals who will experience DM in the future so that prevention efforts can be carried out as early as possible to prevent the risk from developing the disease from developing<sup>17</sup>.

Type II diabetes generally occurs when lifestyle and behavior patterns have been firmly established. Successful self-management of diabetes requires the active participation of patients, families, and communities. The health team must accompany the patient in the direction of behavior change. To achieve successful behavior change, comprehensive education, skills development and motivation are needed <sup>18</sup>. The education includes an understanding of DM disease, the meaning and need for controlling and monitoring DM <sup>19</sup>, complications of DM,

pharmacological and non-pharmacological interventions. hypoglycemia, specific problems encountered, foot care in diabetes, ways of developing support systems and teaching skills <sup>20</sup>. Peer education is a popular concept that refers to various approaches such as communication channels, methodologies, philosophies, and strategies. The term 'peer education' refers to an understanding of something that stands together with others, something that belongs to the same or in simple words as peer education. The intended groups are mainly community groups categorized by age, class or status <sup>21</sup>. Peer education usually involves using members of a particular group to bring about change among other members of the same group <sup>22</sup>. Peer education is often used to change the level of behavior in individuals by modifying one's knowledge, attitudes, beliefs, or behavior. However, peer education can also influence change at the group or community level by modifying norms and stimulating collective action that leads to changes in existing programs and policies in society <sup>23</sup>.

The learning model applied in peer education is communication, information, and education (IEC) <sup>24</sup>. Peer education is identified as an important means of disseminating information about DM, preventing risks and possible complications that arise <sup>25</sup> <sup>14</sup>. Peer education can overcome some difficulties, can transfer knowledge and communicate more freely and openly in peer groups <sup>26</sup>. In the process of education and control, of course, strong motivation is needed. ARCS strategies are developed on the basis of the theories and real experiences of the instructors so that they are able to generate enthusiasm for learning optimally by motivating themselves so that optimal learning outcomes are obtained. ARCS learning model is a form of problem solving approach to design aspects of motivation and learning environment in encouraging and maintaining student motivation to learn. The ARCS learning model also prioritizes attention, adapts learning materials to the learning experience, creates self-confidence in students, and creates a sense of satisfaction in these students <sup>27</sup>.

The ARCS learning model was developed based on the expectancy value theory which contains two components, namely the value of the goal to be achieved and the expectation of successfully achieving that goal. Of the two components by Keller developed into four components. The four components of the learning model are attention (generating & maintaining attention), relevance (linking learning to needs), confidence (growing self-confidence) and satisfaction (generating a sense of satisfaction in learning). To support and increase the motivation of respondents, education is presented in an attractive manner with various media such as modules and booklets <sup>8</sup>. The ACRS can also be scored for each of the four

categories. Thus, to analyze the results obtained through the scale in detail each ARCS category was evaluated separately to see if there was a significant difference in mean scores and whether the strategies of each category was successfully applied into the classroom instruction <sup>28</sup>.

## CONCLUSION

Reduction of Risk DM Type II Before and After Education through Peer Health Education. There is an increase in motivation and reduced risk of type II DM after being given education using the Keller Arcs method. There is no interaction between peer health education and the Keller method to reduce the risk of type II DM, there is a possibility that there are other variables that contribute to reducing the risk of DM.

This research is the basis for determining policies in health education that is suitable for type 2 DM. In addition, in the world of education focused education the peer group method as the focus of health education.

## Declarations Ethics

All participants and their respective guardians gave written consent to participate in the study. This study has been approved by the regional review board in Poltekkes Kemenkes Malang (1806/KEPK-POLKESMA/2021). The study was conducted in line with research ethics based on Declaration of Helsinki.

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