



The Effectiveness Of Media “Remaja Cerdik Mobile” Android-Based Application On Adolescents’ Knowledge, Attitude And Self Efficacy On Prediabetes Prevention

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Article details:

Received: 6th September, 2019

Revision: 10nd September, 2019

Accepted: 12nd September, 2019

Published: 17nd September, 2019



ABSTRACT

Adolescent lifestyle is believed to be the factor most dominantly contributing to the increasing prediabetes incidence among adolescents. Such condition potentially develops into Diabetes Mellitus when the lifestyle is not changed. The organization of health promotion through utilizing technology sophistication in the form of android-based application can be health promotion media among adolescents. This research aimed to find out the effect of “Remaja Cerdik

Mobile (Mobile Smart Adolescent)” android-based application on adolescents’ knowledge, attitude, and self-efficacy on Prediabetes Prevention.

This study employed quasi-experimental method with equivalent control group design with pretest-posttest. The number of respondents consisted of 100 Senior High School students in Semarang City. Data analysis was conducted using One Way repeated measures ANOVA. The result of android application media was material concerning knowledge and prediabetes prevention including article, image, quiz, animation video, and update tracker. The result of qualitative research showed that there is an effect of “Remaja Cerdik Mobile” android-based application on the adolescents’ improved knowledge, attitude, and self-efficacy on Prediabetes Prevention. The “Remaja Cerdik Mobile” android-based application can be an alternative in utilizing health promotion media as a means of Communication, Information, and Education (CIE) in adolescents in preventing Prediabetes.

Keywords: Adolescent, Prediabetes, “Remaja Cerdik Mobile” android-based application.

To cite this article:

Dwi Rizky Novianto, Antono Suryoputro, B. W. (2019). The Effectiveness Of Media “Remaja Cerdik Mobile” Android-Based Application On Adolescents’ Knowledge, Attitude And Self Efficacy On Prediabetes Prevention. *The International Journal of Health, Education and Social (IJHES)*, 2(9), 41–55.



Introduction

Prediabetes is an individual's condition with blood glucose level ranging between normal and Diabetes Mellitus (PERKENI, 2015). It is because individual with Impaired Glucose Tolerance (IGT) and Impaired Fasting Glucose (IFG) highly risky of developing into type-2 DM (Soegondo, Soewondo & Subekti, 2015).

The result of *Riskesdas* (Primary Health Research) in 2013 shows that the number of Indonesian populations aged more than 15 years having IGT and IFG problems is so high, 29.9% and 36.6%, respectively. In Central Java Province, 72,268 (0.3%) people develop prediabetes cases (RI's Ministry of Health, 2013). The organization of health promotion is important to be a domain of prediabetes prevention among adolescents.

Adolescence now becomes the most vulnerable group because in addition to genetic factor, adolescents' lifestyle is believed to be the factor most dominantly contributing to the increasing prediabetes incidence among adolescents (Anies, 2018). Sedentary lifestyle is most preferred by adolescents today, that is, consumptive lifestyle and laziness to do activities outdoor (Rahmayanti & Hargono, 2017). In addition, smoking habit and stress that can disturb resting and sleeping patterns are the factors trigger the increased obesity case leading directly to prediabetes incidence among adolescents (Wulandari & Hadiati, 2017).

It disables body cells to respond to insulin normally making pancreas working harder in producing insulin. It also impacts on the pancreas damage gradually that can increase glucose level abnormally. However, it has not been diagnosed as DM despite surpassing the normal limit (Soegondo, Soewondo & Subekti, 2015).

The more rapidly developing technology can be utilized to help education, to improve knowledge, and to disseminate information as an alternative way of utilizing health promotion media. Smartphone is used by adolescents as communication and information media more widely so far. The result of survey shows that 8.7% adolescents use smartphone equipped with android system (Muflih, Hamzah & Puniawan, 2017). This system can provide opened platform to developers in creating some applications that can be used in various Smartphone sets (Siregar, 2011).



In its process, android-based application in smartphone can be used as a health promotion media to help adolescents improve their knowledge and apply healthy lifestyle. Thus, it is expected to be a media to prevent prediabetes among adolescents (American Diabetes Association, 2014).

“Remaja Cerdik Mobile” android-based application is the one adopted through “CERDIK” program released by RI’s Ministry of Health involving “Check health periodically, Go cigarette smoke, do physical activities diligently, balanced diet, enough rest, and manage stress well” (RI’s Ministry of Health, 2013).

This application is developed through mapping intervention using reference study and need assessment on the target (Bartholomew, Parcel & Gottlieb, 2013). In addition, before used by users, this application has passed through media pretesting, so that it can summarize a series of activities consisting of data collection concerning respondents’ characteristic, examination, knowledge on Prediabetes prevention and intervention in the form of healthy lifestyle implementation as the attempt of preventing Prediabetes among adolescents (Trisnowati, 2018). In addition to containing content of Prediabetes knowledge and prevention, this application is also equipped with supporting features like image, quiz, animation video, and update tracker to monitor daily life, along with the feature of daily calorie calculation according to the activities done, so that adolescents as users can monitor their health development.

This research aims to develop and to analyze the effect of health promotion media application through “Remaja Cerdik Mobile” android-based application on adolescents’ knowledge, attitude and self efficacy on Prediabetes prevention.

Research Method

This research employed a quasi-experimental quantitative approach with *non equivalent control group design with pretest-posttest*. This research was conducted on adolescents in Senior High School 2 Semarang and Senior High School 9 Semarang because the areas where the two Senior High Schools are located have highest number of Diabetes Mellitus case in Semarang City in last year: Pedurungan and Banyumanik Sub Districts. The research was conducted from



March to April 2019. The sample consisted of 100 respondents, taken using purposive sampling method, including 50 adolescents in Senior High School 2 Semarang as intervention group and 50 adolescents in Senior High School 9 Semarang as control group. The sampling criteria used were: 10th and 11th graders of Senior High School 2 Semarang and Senior High School 9 Semarang, non-Natural Science students, aged 16-19 years, and having smartphone equipped with android system.

The instrument of research used was questionnaire made with questions around knowledge on Prediabetes and DM and the statement related to adolescents' attitude and self-efficacy in applying healthy lifestyle to prevent prediabetes based on Prediabetes and DM concepts among adolescents and "CERDIK" program guidance from RI's Ministry of Health. Questionnaire tryout was conducted on 30 students in Senior High School 15 Semarang in Tembalang Sub District of Semarang City.

The development of "Remaja Cerdik Mobile" android-based application is initiated with the implementation of first-stage FGD on adolescents in Senior High School 2 Semarang as polite project and intervention group all at once in this research. It aims to collect the assessment on targeted need; thereafter, revision was conducted by IT developer on the application. The result of revision then passed through 2nd-step FGD in the implementation of media tryout in order to get critique and recommendation in detail from users, so that an application corresponding to the adolescents' need was yielded. In addition to FGD stages, the application was consulted with material expert through interview stage in Non-Infectious Disease Section of Health Office of Semarang City.

Before intervention, application launching and adolescent health screening were conducted in intervention group, while in control group adolescent health screening because in this group no intervention was conducted during the research process. The objective of research was to socialize how to operate application to the users and to grow concern and consciousness of maintaining health earlier.



Pretest was conducted concomitantly with adolescent health screening in the two groups. After 1-week application use, measurement was conducted through posttest 1. The final measurement was conducted through Posttest 2 conducted after 1-month- application use thereby can measure users' understanding on the content contained in the application. It also aims to find out the effect of application in improving adolescents' knowledge, attitude, and self-efficacy in preventing Prediabetes. Multivariate Data was analyzed using *One Way repeated measures ANOVA* to see the change during the treatment was conducted several times on both groups.

This research has been approved by Health Research Ethical Commission of Faculty of Medicine of Universitas Diponegoro Number 42/EA/KEPK-FKM/2019.

Result and Discussion

Characteristics of Respondents

Table 1 shows that most or 62% of respondents are female in intervention group and 60% in control group. Most (58%) respondents are 16 years old in intervention group and 40% in control group. It indicates that majority respondents belong to early adolescent group beginning to care about anything previously never considered as interesting like health and disease. The result of research shows that majority respondents have parents with last education of Senior High School, most parents are employees and entrepreneurs with income higher than IDR 2,400,000. It indicates that parents' high education, occupation, and income become social economic indicators of family thereby can encourage their children positively to give the best performance vigorously in school. With good performance, adolescents can have knowledge with broad insight. The after school activity attended by majority respondents is Scouting (*Pramuka*), 59% in intervention group and 56% in control group, because the schools have a similarity, full day school requiring all students to attend extracurricular activity compulsory after school hour. The school does not prohibit students from bringing smartphone to school, but during learning process it should be inactivated. The android-based application for health has been used in both groups: 16% in intervention group and 6% in control group, so that android-based health application begins to be preferred by adolescents so far.



Table 1. Distribution of Respondents' Characteristics and Adolescent Health Screening

Variable	Research Group				<i>p-value</i>
	Intervention Group (n=50)		Control Group (n=50)		
	n	(%)	n	(%)	
Characteristics of Respondents					
Sex					
Male	19	(38)	20	(40)	0.838
Female	31	(62)	30	(60)	
Age					
15 years	11	(22)	12	(24)	0.324
16 years	29	(58)	20	(40)	
17 years	9	(18)	17	(34)	
18 years	1	(2)	1	(2)	
Parents' Education					
Not studying at school	0	(0)	0	(0)	0.412
Graduated from Elementary School	2	(4)	4	(8)	
Graduated from Junior High School	2	(4)	2	(4)	
Graduated from Senior High School	22	(44)	19	(38)	
Graduated from Undergraduate Program	8	(16)	4	(8)	
Graduated from Graduate Program	16	(32)	21	(42)	
Parents' Occupation					
Not working	0	(0)	0	(0)	0.187
Civil Servant /TNI /POLRI	7	(14)	15	(30)	
Employee/Private	31	(62)	24	(48)	
Entrepreneur/Merchant	12	(24)	11	(22)	
Parents' income					
None	0	(0)	0	(0)	0.222
< IDR 2,400,000.-	12	(26)	8	(16)	
> IDR 2,400,000.-	37	(74)	42	(42)	



Variable	Research Group				p-value
	Intervention Group (n=50)		Control Group (n=50)		
	N	(%)	n	(%)	
After school activity					
Scouting	24	(48)	25	(50)	0.116
Private course	14	(28)	12	(24)	
Sport	12	(24)	13	(26)	
The use of application for health					
Using	8	(16)	3	(6)	0.112
Not Using	42	(84)	47	(94)	
Activity related to prediabetes prevention					
Seminar	0	(0)	0	(0)	1.000
Talk Show	0	(0)	0	(0)	
Education	0	(0)	0	(0)	
Information on prediabetes prevention					
Health workers	3	(6)	9	(18)	0.066
Family	12	(24)	13	(26)	
School	13	(26)	12	(24)	
Internet/Social Media	22	(44)	16	(32)	
Adolescent Health Screening					
Body Mass Index					
Underweight	10	(20)	8	(16)	0.333
Normal	27	(54)	36	(72)	
Overweight	7	(14)	6	(12)	
Obesity	6	(12)	0	(0)	
Ideal Body Weight					
Low BW	7	(14)	4	(8)	0.324
Normal BW	25	(50)	36	(72)	
Excessive BW	18	(36)	10	(20)	
Blood Pressure					
Normal	42	(84)	43	(86)	0.781
Pre Hypertension	8	(16)	7	(14)	
Hypertension	0	(0)	0	(0)	
Blood Glucose					
Normal	47	(94)	49	(98)	0.310
Pre Diabetes	3	(6)	1	(2)	
Diabetes Mellitus	0	(0)	0	(0)	



Both groups have never gotten prediabetes prevention-related activities. Meanwhile, internet/social media is information media accessed mostly by respondents: 28% in intervention and 20% in control groups. Adolescents like anything related to information technology very much so that individual's knowledge, attitude, and self-efficacy can be created from the information acquired from non-formal education. Intervention and control groups have same characteristics because both of them have p value > 0.05 , so that there is no confounding variable. It is because majority respondents have not gotten health education yet about Prediabetes and Diabetes Mellitus.

The result of adolescent health screening shows that body mass index and ideal weight largely belong to normal category in both groups. Meanwhile, only 12% respondents in intervention group belong to obesity category. Adolescent obesity can decrease insulin sensitivity leading to insulin resistance as the onset of Prediabetes. The result of blood pressure measurement shows majority respondents belonging to normal category, 16% to prehypertension in intervention group and 14% in control group. Meanwhile, the measurement of blood glucose level shows that majority respondents belong to normal category, and 3% belong to Prediabetes in intervention and only 1% in control groups. Such examination is very important to predict health condition. It can also grow adolescents' concern with prioritizing the importance of applying healthy lifestyle earlier.

Knowledge, Attitude, and Self Efficacy

Analysis on Adolescents' Knowledge, Attitude, and Self-Efficacy on Prediabetes Prevention before and after Intervention

Table 2 shows that the distribution of mean scores of adolescents' knowledge, attitude, and self-efficacy on Prediabetes prevention before and after 1 week and 1 month using "Remaja Cerdik Mobile" android-based application indicates a significant increase. The result of pretest shows that knowledge, attitude, and self-efficacy in both groups are homogeneous and there is no difference of values, $p=0.494$; 0.097 ; 0.408 (p value >0.05). It is the advantage of research design.



Table 2. Distribution of Mean score difference of knowledge, attitude, and self-efficacy in the two groups

Variable	Score	Pretest		Posttest 1		Posttest 2	
		Control Group	Intervention Group	Control Group	Intervention Group	Control Group	Intervention Group
Knowledge	Mean	60.61	62.61	61.57	77.91	62.78	92.09
	Min.	17	9	22	74	35	87
	Max.	83	83	78	87	87	100
	<i>p value</i>	0.494		0.000		0.000	
Attitude	Mean	76.52	78.80	76.75	81.36	77.36	87.98
	Min.	56	67	65	66	67	81
	Max.	92	93	89	92	89	95
	<i>p value</i>	0.097		0.000		0.000	
Self Efficacy	Mean	72.31	73.56	72.89	80.91	74.82	86.24
	Min.	51	58	66	76	63	81
	Max.	82	93	81	88	83	93
	<i>p value</i>	0.408		0.000		0.000	

Posttest 1 measurement stage was conducted 1 week after the application use showing that there is a difference of knowledge, attitude, and self-efficacy between two groups. Similarly, posttest 2 conducted 1 month after intervention indicates the result as same as the posttest 1 shows with *p value* of 0,000 (*p value* <0.05), respectively. .

Variance Analysis on Adolescents' Knowledge, Attitude, and Self-Efficacy on Prediabetes Prevention Before and After intervention

Considering the data as shown in table 3, the result of *Multivariate Analysis of Variance* proves that there is no difference of knowledge, attitude, and self-efficacy in control group with *p values* of 0.352; 0.413; 0.099 (*p value* >0.05), respectively .

In contrast, the result of analysis on intervention group, the one using “Remaja Cerdik Mobile” android-based application for one-month use shows that there is a significant increase in knowledge, attitude, and self- efficacy after intervention with *p values* of 0.000 (*p value* <0.05), respectively.



Table 3. The difference of knowledge, attitude, and self-efficacy scores between before and after intervention

Variable	Result of measurement			<i>p value</i>
	Mean			
	<i>Pretest</i>	<i>Posttest 1</i>	<i>Posttest 2</i>	
Knowledge				
Control Group	60.61	61.57	62.78	0.352
Intervention group	62.61	77.91	92.09	0.000
Attitude				
Control Group	76.52	76.75	77.36	0.413
Intervention group	78.80	81.36	87.98	0.000
Self Efficacy				
Control Group	72.31	72.89	74.89	0.099
Intervention group	73.56	80.91	86.24	0.000

Table 4. Comparison of mean score of knowledge, attitude, and self-efficacy between the two groups

Variable	Result of measurement	
	Mean Difference	
	<i>Pretest to Posttest 1 (one-week treatment)</i>	<i>Pretest to Posttest 2 (two-week treatment)</i>
Knowledge		
Control Group	0.95	2.17
Intervention group	11.04	25.21
Attitude		
Control Group	0.23	0.84
Intervention group	2.56	9.17
Self Efficacy		
Control Group	0.57	2.51
Intervention group	7.35	12.68

From table 4, it can be seen that there is an increase in knowledge, attitude, and self-efficacy scores in both groups in *pretest*, *posttest 1* dan *posttest 2* measurements. Knowledge score increase by 11.04 from pretest to posttest (one-week treatment) and by 25.21 from pretest to posttest 2 (one month treatment), while it increases by 0.95 from pretest to posttest 1 and 2.17 from pretest to posttest2 in control group. In this research, respondent successfully applies the



application so that knowledge is on “knowing” level, constituting the part of cognitive knowledge at lowest level. In this stage, respondents will retrieve anything special related to the object delivered. Having passed through “knowing level”, the respondents have just arrived at “understanding” stage, individual’s capacity to elaborate an answer to question given appropriately from posttest 1 to posttests 2 (Notoatmodjo, 2012). In 2013, Empar Valdivieso Lopez conducts a similar research with different focus related to the application of mobile application as the form of media to help cease smoking habit in adolescents. This study found the significant effect of mobile application on the adolescents’ improved knowledge and consciousness of ceasing smoking habit (Domingo-Salvany etc, 2013).

There is also an increase in attitude variables in the two groups. Attitude score increases by 2.56 from pretest to posttest 1 (one week treatment) and 9.17 from pretest to posttest 2 (one month treatment) in intervention group, and by 0.23 from pretest to posttest 1 and 0.84 from pretest to posttest 2 in control group. The result of analysis shows that most groups in this study has positive attitude in the attempt of preventing Prediabetes. The result of calculation shows that the mean score of attitude in intervention group is higher than that in control group. The better the attitude, the more positive is an individual’s attitude. In this study, respondents’ attitude in on accepting and responding levels. The word *accepting* means that respondents are willing to accept the treatment given, while the word *responding* is the form of answer given by respondent by applying the application to daily life (Fitriani, 2011). Similar study has been conducted by Elly Nuwamanya in 2018 with different theme related to the use of smartphone application as a media to improve attitude and consciousness in reproduction organ health among adolescents in Uganda. This study found a significant effect of smartphone application on the improved attitude and consciousness in reproduction organ health (Nuwamanya etc, 2018).

In self-efficacy variable, there is an increase by 7.35 from pretest to posttest 1 (one week treatment) and 12.68 from pretest to posttest 2 (one month treatment) in intervention group, and by 0.57 from pretest to posttest 1 and 2.51 from pretest to posttest 2 in control group. Adolescents with high self efficacy will tend to endeavor more strongly to apply health lifestyle compared with those with lower self efficacy. Good self-efficacy can support self belief and



confidence to try. It can be a factor inherent and motivating the self to perform some behavior. In this research, respondents are on self-efficacy level or initiative, the individual's willingness to initiate behavior that has not been proven through practice in applying health life among adolescents, becoming the limitation of current research (Anggai, 2015). It is in line with a study conducted by Arturo Direito on the use of *Improving FITness* (AIMFIT) application as a media helping modify lifestyle to improve physical activities among adolescents. In this research self-efficacy, satisfaction, enjoyment, and fitness to the use and the acceptance improve significantly among adolescents (Direito, 2015).

Conclusion

Health promotion media through "Remaja Cerdik Mobile" android-based application can be implemented to adolescents as the early stage to equip adolescents with knowledge, attitude and self-efficacy on Prediabetes prevention and healthy lifestyle in early adolescence. Thus, good knowledge can make adolescents' attitude and self-efficacy more positive. The application developed along with the target can fulfill the users' need so that the product yielded can be applied directly by adolescents. Moreover, adolescents are the largest number of android application users, due to their wish to keep learning new things. The complete content and feature of application including article, image, quiz, animation video, and tracker update can attract adolescents' interest in applying such application media to their daily life. Thus adolescents' positive understanding, willingness, and self-efficacy are the attempt of applying healthy lifestyle.

Acknowledgment

The author expresses his gratitude to Health Human Resource Development and Empowerment Office (BPPSDMK) of Republic of Indonesia's Ministry of Health for funding this research and to all of those participating actively in this research completion, including licensing division of school, and respondents.



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International Journal of Health, Education and Social (IJHES)