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WHATSAPP MESSAGE EDUCATION IN STUDY: SOCIAL COGNITIVE THEORY TO PROMOTE PHYSICAL ACTIVITY AMONG RURAL PEOPLE WITH TYPE 2 DIABETES MELLITUS TAKALAR, INDONESIA

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Abstract

Background: Social media (Whatsapp) is increasingly being used by older adults throughout the world. The question is whether they can be successfully incorporated into health programs to promote physical activity via WhatsApp applications in T2DM patients living in rural areas.

The aim of this study was to measure the effect of an intervention via WhatsApp messages adapted from SCT theory to promote physical activity in T2DM patients living in rural areas.

Method: Quantitative research design using Quasi-experiment. A non-probability sampling technique, namely purposive sampling, was carried out from May to August 2022 involving 60 T2DM patients. The intervention group received messages via educational WhatsApp messages or promotions on the importance of physical activity through SCT (Social Cognitive Theory) studies, namely (Cognitive (Knowledge), self-efficacy, and Physical Activity. Physical activity promotional messages were sent 3 messages per week for 6 weeks via the WhatsApp application

so that a total of 18 messages would be sent during the intervention. Physical activity is only assessed at the beginning of week 7 to be followed up for 12 weeks with direct monitoring using the IPAQ (International Physical Activity Questionnaire) and the ESES (Exercise Self Efficacy) Questionnaire.

Results: The PA program through SCT intervention with a mobile application showed a comparative change in reducing HbA1C between the intervention and control groups with an average score 8,766 ± 1,869 versus 9,743± 1,938 HbA1c mg/dl at 12 weeks. SCT intervention via mobile application (WhatsApp) causes changes in PA (MET (Metabolic Equivalents of Task), self-efficacy (p= large effect size on diastolic blood pressure (BP), Based on comparative analysis via Independent T Test significant decrease in (PA, HbA1C, self-efficacy) was found in the intervention group compared to the control group.

Conclusion: The SCT Whatsapp message intervention via the mobile application (Group Whatsaap) increases physical activity, and can be included in health programs targeted for T2DM in rural areas.

Keywords; Health promotion, SCT, mobile applications, physical activity, social media, WhatsApp

Background

Diabetes is an epidemic causing several major public health problems throughout the world (1). Diabetes Mellitus Type 2 (T2DM) is a chronic metabolic disorder with the body's inability to produce or even respond to insulin, characterized by hyperglycemia. (2,3) which causes microvascular and macrovascular complications and has an excessive impact (4,5). The prevalence of T2DM has increased rapidly in recent decades. According to estimates, 463 million adults will be diagnosed with diabetes, predicting that by 2045 there will be an increase of 51% or around 700 million people diagnosed with diabetes. (6,7). It is estimated that 35% of US adults older than 20 years and 50% of people older than 65 years have T2DM. An estimated 5 million deaths are related to T2DM with a percentage representing 12.8% of all causes of morbidity and mortality (8).

The prevalence of T2DM in 2019 is estimated at 9.3% (463 million people), increasing to 10.2% (578 million) in 2030 and 10.9% (700 million) in 2045 (7). On the Asian continent, the prevalence of T2DM continues to increase, which is projected to increase from 78 million in 2015 to 140 million in 2040 (6,7). Meanwhile, the prevalence of T2DM in Indonesia increased from 10.3 million in 2017 to 16.7 million in 2045. Based on 2018 basic health research data (Riskesdas), Indonesia showed an increase in T2DM from 6.9% in 2013 to 10.9% in 2018. The latest data for 2019 by the Indonesian Endocrinology Association (PERKENI) shows that the number of T2DM sufferers in Indonesia reached 9.1 million people and ranks 7th in the world. South Sulawesi ranks 16th out of 34 provinces in Indonesia (9).

The prevalence of T2D has increased worldwide in the last 2 decades, especially at a very fast rate in some developing countries such as China and India Indians who live in rural areas are characterized by being more susceptible to diabetes and complications because of the limitations they have such as long distances to cities and lack of sports facilities. The situation becomes even more serious with populations in rural areas who do not have access to health services and expect them to have fewer medical visits from health service facilities, with this exposure the impact will be greater for T2DM patients who live in rural areas. (10,11)

Promoting regular physical activity (PA) has been shown to be beneficial in the management of T2DM (12–16). Some research results (17–21) shows that physical activity is an alternative sport that can have a significant impact on changes in blood glucose and HDL. Several studies also explain that physical exercise can reduce HbA1c by around 6.6 mmol / mol (0.6%) around 6.6 mmol / mole (0.6%) (22–25). Based on meta-analysis results (26) demonstrated an overall decrease in HbA1c of 0.8% with resistance training and an 11.8% increase in peak VO2 with aerobic exercise. Carrying out physical activity increases the use of glucose by active muscles so that it can directly cause a decrease in blood glucose (12–14).

Regular physical activity with guidelines recommends that adults should accumulate 150 minutes of moderate physical activity a week (27). However Nearly a third of the world's population fails to meet the recommended levels of PA to stay healthy and Up to 80% of people with T2DM do not meet these recommendations (28) (27). Several epidemiological studies suggest that most patients are underactive, with only 23–37% of patients achieving recommended exercise levels in the US, 21% in Canada, and 15.3% in mainland China (29–31).

Meanwhile, the majority of T2DM patients in Indonesia are based on study results (32) Common barriers to PA in adults in Indonesia are behavioral problems related to self-efficacy, lack of time, low self-motivation, feelings of discomfort, feelings that physical activity is unpleasant or boring, fear, injury, lack of support from family and friends, and the environment. which is not supported and health facilities are far away. DMT2 Indonesia 89.3% of participants have low levels of PA and 58.9% have a habit of more than 3 hours of sedentary activity per day which can affect the patient's inability to carry out controlled physical activity.

Seeing the various problems and various causal factors, both from individual factors, time, and motivation the situation becomes more widespread for T2DM patients who do not have access to health services which causes someone with T2DM to not have a special program for physical activity and is not encouraged to want to carry out activities. physique. So effective interventions are needed that must be applied to T2DM sufferers with the aim of being able to improve health and able to get PA promotions such as interventions based on SCT theory through short educational messages via (WhatsApp) for T2DM patients in rural areas.

SCT is well suited to understanding PA health behavior due to the interaction of individual, environment, and behavior (33,34). Self-efficacy, which is one of the main constructs of this

theory, means the confidence a person has in his ability to perform certain behaviors successfully and obtain desired results. Self-efficacy is an important prerequisite for behavior change. Other constructs from this theory are task, planning, and coping self-efficacy. SCT-oriented interventions have been observed based on systematic reviews (33,35) found that the most effective intervention for improving health behavior has been proven to be able to control glycemic levels for longer and be able to last long in T2DM. In a cluster randomized controlled trial (RCT) conducted (36) di in Ahar, East Azerbaijan Province, Iran found that SCT-based interventions were able to reduce the risk of prediabetic progression to T2DM.

Researchers will conduct a trial by presenting integrated/programmed PA promotion through educational interventions via WhatsApp messages with standard PA recommendations adapted through SCT in rural populations with T2DM, which in turn will result in reducing and minimizing complications of T2DM.

Description of SCT as a theory that is proven to be able to improve PA health behavior which is believed to be able to create improvements in several technology-based interventions, for example, the use of the WhatsApp application. It is not surprising that the use of WhatsApp provides a solution and is able to offer several benefits such as increasing the ability of diabetes sufferers to manage the disease and ensuring convenience. their access to Health care services and cost control interventions (37)(38) (39).

Several studies have developed interventions using technology that are cost-effective and have been successfully implemented in promoting diabetes self-management (39–41) However, these interventions often result in suboptimal levels of user engagement and unsustainable use of the technology associated with the application, another consideration is the limited and little data available on PA interventions among high-risk groups, especially rural patients with T2DM.

On this basis, we will conduct a trial by presenting a health program to promote physical activity via the WhatsApp application adapted through SCT to T2DM patients living in rural areas.

Materials and Methods

Study Design and Subjects

This research uses a quantitative method using Quasi-experiment with pretest-posttest with a control group with a non-probability sampling technique, namely purposive sampling involving 60 T2DM patients conducted in Takalar, South Sulawesi Province, Indonesia. This study was designed to assess physical activity through WhatsApp DMT2 education in the rural area of Takalar, South Sulawesi Province, Indonesia.

Intervention

Intervention Group

The intervention group is a group that is joined via the WhatsApp group, and will receive messages via WhatsApp messages by providing promotions on the importance of physical activity through SCT studies (Cognitive (Knowledge of DM Concepts), physical activity, complications, self-efficacy and social support), each message promotes physical activity sent 3 messages per week for 6 weeks via the WhatsApp application, so a total of 18 messages will be sent during the intervention. Physical activity is only assessed at the beginning of week 7 to be followed up for 12 weeks with direct monitoring. They were invited to take an HbA1c test at the beginning and end of the study period (12 weeks). As an incentive, all tests and measurements are provided free of charge. Furthermore, patients are allowed to see the clinic doctor if necessary without paying an entrance fee. Free doses of diabetes medication are planned and offered to those who complete the study.

The control group

The control group is the group that did not receive WhatsApp messages.

Both groups in the study, however, received a physical activity diabetes care instruction booklet at the start of the study. This booklet is intended to introduce patients to physical activity before receiving a short WhatsApp message on the subject. It also aims to ensure that patients in the control group feel they belong in the program and encourage them to continue participating until the end of the study.Lokasi penelitian

This research was carried out in rural areas in the Takalar Regency. Takalar Regency has 8 community health centers by using 2 community health centers as research sites which were randomly selected for the intervention group and control group. In the RCT, the RCT was randomly carried out by selecting community health centers located in rural areas with data collected through the prolanis program data at each community health center, and the prolanis program at the community health center to make it easier to recruit respondents. A total of ≥ 160 patients could be recruited per random location from 2 health center locations, the results were carried out by HbA1C screening and inclusion criteria. The results were a total of 60 T2DM patients recruited from 2 health center locations during the period April - September 2022. Inclusion criteria for participants included a clinical diagnosis of T2DM, HbA1c ≥ 6.5% (preferably in the last 3 months), Willingness to be a respondent by signing an informed consent and being willing to fill out a form questionnaire, no history of major surgical procedures in the previous 5 months or planning any major surgical procedures in the next 5 months, Type 2 Diabetes mellitus patients on oral and injection medication and patients who do not experience cognitive impairment. Patients were excluded if they had a medical condition that prevented them from walking for 15 minutes to 30 minutes a day.

Data Collection and Assessment

Information about the demographic characteristics of Diabetes diagnosis is based on primary data from community health centers. The description starts from Univariate analysis: The description

of respondent characteristics used in this research includes the distribution of respondents based on gender, age, education, occupation, length of time suffering from DM, and treatment. Continuous variables are presented in the form of means and standard deviation (SD) or Median while categorical variables are presented in the form of frequencies and percentages. Meanwhile, the variables for the 2 intervention groups used the T-test based on the results of the normality test if the data showed a normal distribution

Intervention via WhatsApp messages in providing support to T2DM patients to increase PA levels by recommending activities in the daily life of T2DM patients

Research Instrument

We assessed PA levels using the IPAQ physical activity questionnaire using MET (Metabolic equivalents of task) (42) and is intended for special IPAQ runs (43). As for clinical measures, the HbA1c test was carried out using the Afinion™ AS100 Analyzer (Alere Technologies) and DCA Vantage™ Analyzer (Siemens Medical Solutions Diagnostics) which are National Glycohemoglobin Standardization Program (NGSP) certified POC devices for evaluating HbA1c(44)(45) while PA self-efficacy was measured using the ESES (Exercise Self Efficacy Scala) Questionnaire, which is a valid, reliable, and stable measuring tool for assessing SE in T2DM in Indonesia (46). This instrument has a content validity index (CVI) score of 0.80-1.00. The Cronbach alpha of the Indonesian version of the DQoL-BCI is A Cronbach is .78, .80, and .92 which means it shows adequate results

Ethics

The research protocol has been reviewed and approved by the Ethics Committee of the Faculty of Public Health, Hasanuddin University, and then registered in the Clinical Trial Registration Number: 3179/ UN4.14.1/TP.01.02/2022. Informed consent was obtained from all participants, and data confidentiality was considered.

Hasil

Table 1 Sample characteristics between the two groups (Intervention and Group)

Variabel	N	Min	Max	Mean	Std Deviation
Age intervention group	30	45	69	56.13	9.145
Age control group	30	50	79	58.73	6.772

Characteristic	Group			
	Intervention		Control	
	n	%	n	%
Sex				
Women	23	77	25	83,3
Man	7	23	5	16,7
Total	**30**	**100**	**30**	**100**
Education				
Never went to school	0	0	3	10
Did not finish elementary school	0	0	3	10
Elementary school	1	3,5	5	16,6
Junior high school	5	16,6	6	20,1
Senior high school	13	43,3	6	20,1
Diploma	2	6,6	2	6,6
University	9	30	5	16,6
Total	**30**	**100**	**30**	**100**
Occupation				
Not working	8	26,6	6	20,1
PNS/TNI/Polri/BUMN/BUMD	5	16,6	5	16,6
Private employees	2	6,6	0	0
Entrepreneur	3	10	1	3,4
Farmer	0	0	2	6,6
Fisherman	0	0	0	0
Laborer/Driver/Housewive	4	13,6	12	39,7
Retired	8	26,6	4	13,6

Total	**30**	**100**	**30**	**100**
Period had DM				
≤ 5 years	7	23	9	30
≥ 5 years	23	77	21	70
Total	**30**	**100**	**30**	**100**
Medication				
Oral	15	50	21	70
Injection	11	22,8	7	23
Oral/injection	4	13,6	2	3,6
Total	**30**	**100**	**30**	**100**

Table 1 presents information on the sociodemographic characteristics of the 60 participants. In the intervention group, the average age was 56.13 years; SD 9.145 was significantly younger than the control group (mean age 58.73 years; SD = 6.772). Information on characteristics based on gender shows a high average percentage difference between male and female T2DM patients, namely an average of 80% of T2DM sufferers are female. The results of the data on the characteristics of T2DM patients who live in rural areas generally use oral medication with an average percentage of 60%.

Based on Table 2 Comparison of average HbA1c, exercise self-efficacy and physical activity parameters in the intervention and control groups before and after the intervention

Paramater	Intervention				Control				PValue*	
	Before (n=30)		After (n=30)		Before (n=30)		After (n=30)		Intervensi	Control
	M	SD	M	SD	M	SD	M	SD		
HbA1C	9,613	2,235	8,766	1,869	9,716	1,960	9,743	1,938	0,0001	0,904
Self Efficacy	33.6	3.99	51.33	6.92	33.63	8.38	42.13	10.74	0,0001	0.002
Physical Activity (PA) Parameter										

Tot Days Of Activity	5,467	20,965	7,00	0,000	1,600	0,6747	6,87	0,434	0,0001	0,001
Tot PA_MIN,WEEK	47,133	36,840	83,50	30,994	40,033	20,342	55,90	18,447	0,0001	0,180
Met_Vigorous Met/week	342,66	588,31	798,67	523,69	208,00	323,32	301,33	343,24	0,0001	0,716
Met Moderate_Min/week	217,33	313,63	409,33	262,65	177,33	229,28	176,67	126,28	0,0001	0,456
Met Walk_Min/Week	190,85	177,37	618,20	273,73	191,95	1,98,401	416,35	319,40	0,0001	0,001
Met Total PA_Min/Week	750,85	721,90	1826,2	714,81	577,28	423,84	894,35	607,06	0,0001	0,381

* p value for comparison of mean changes before and after the intervention group and the control group. obtained from HbA1C and Physical Activity (PA) parameters.

CI confidence interval, M mean, SD standard deviation.

Table 3 Comparison between Two Groups (Post Intervention- Post Control) in the Intervention Group and Control Group

Paramater	Intervention		Control		PValue*
	Post Intervention (n=30)		Post Control (n=30)		
	M	SD	M	SD	
HbA1C	8,766	1,869	9,743	1,938	0,854
Self Efficacy	51.33	6.92	42.13	10.74	0.002
Physical Activity (PA) Parameter					
Tot Days Of Activity	7,00	0,000	6,87	0,434	0,103
Tot PA_MIN,WEEK	83,50	30,994	55,90	18,447	0,000
Met_Vigorous Met/week	798,67	523,69	301,33	343,24	0,000
Met Moderate_Min/week	409,33	262,65	176,67	126,28	0,000
Met Walk_Min/Week	618,20	273,73	416,35	319,40	0,002
Met Total PA_Min/Week	1826,2	714,81	894,35	607,06	0,000

* p-value for the comparison of the mean change (Post Intervention-Post Control) for the intervention group and the control group was obtained from the parameters HbA1C, Self-efficacy and Physical Activity (PA).

The effects of PA intervention on the clinical parameter HbA1c between the intervention and control groups after 12 weeks of PA intervention in T2DM patients are shown in Table 2. There were statistically significant differences in the clinical outcomes of HbA1C and PA. Changes in HbA1c decreased significantly in the intervention and control groups after the intervention but were not statistically significant between groups, namely ($p < 0.05$) with the results (Intervention = 0.0001; Control 0.904).

A comparison of PA parameters between the two groups is presented in Table 2. Significant increases in Total PA_Min, Week and Met Total PA_Min/Week (MET-min/week) were observed at 12 weeks for the intervention group compared to the control group. The mean total PA scores for the intervention and control groups were 83.50 ± 30.994 versus 55.90 ± 18.447, respectively. Also, the average Met Total PA_Min/Week was able to reach 1826.2 ± 714.81 in the intervention group versus 894.35 ± 607.06 in the control group, PA parameters are shown in Table 2.

Discussion

This study assessed the effectiveness of a PA intervention based on a mobile application (Whatsapp) in T2DM patients among a rural population. After 12 weeks, the intervention showed a positive impact in changing HbA1c parameters through increasing PA in the intervention group compared to the control group. Education via mobile applications (WhatsApp) is very feasible and acceptable, the method presented by developing monitoring and reminders via WhatsApp groups is able to improve glycemic control and activity behavior of T2DM sufferers in Indonesia. For 12 weeks, patients are directed to be able to absorb education and change behavior to be able to do PA, they are made aware of the risk of diabetes and even further complications from T2DM, and they will be encouraged to do PA as a simple way to reduce the possibility of complications and the inability to control their blood sugar. Our findings suggest that the implementation of an SCT intervention using a mobile application (WhatsApp) to promote PA has potential benefits for people with T2DM who have no awareness of the importance of PA, and hard-to-reach T2DM patients in rural areas. This finding is in accordance with the results of the study conducted (34) by promoting PA using WhatsApp which is able to change knowledge and control of HbA1c.

The most important finding of this study was the change in HbA1c parameters among rural individuals with T2DM. Comparative changes in HbA1C reduction between the intervention and control groups with an average score of 8.766 ± 1.869 versus 9.743 ± 1.938, with these results the researchers assumed that with the indirect change in decreasing HbA1c apart from being able to control blood sugar through PA habits, they would also be able to reduce the economic burden through T2DM treatment costs. This is based on characteristic data showing that the average rural patient uses oral medication so that with PA promotion interventions they are able to change their self-management to continue to control their blood sugar. At least 150 minutes/week of PA reduces the risk of developing T2DM complications by 40-70% in people with impaired glucose tolerance (47)(17)

Several studies have recommended PA for T2DM patients by doing PA for 150 minutes/week (48)(19)(48) have been done. Our research actually uses a theory-based intervention developed through a mobile application (WhatsApp) by developing PA Health Promotion which is able to change the behavior of T2DM patients in rural areas for PA.

Using the SCT intervention in promoting PA through a mobile application was successful in increasing awareness, and was able to build PA behavior through daily monitoring and reminders. The most important finding from this study was that by increasing Exercise self-efficacy (ESE) for 12 weeks, the intervention led to an increase in Exercise self-efficacy, and the change in exercise self-efficacy of the intervention group was higher than the control. The average self-efficacy of the intervention group increased from 33.60 at the pretest to 51.33 at the posttest. Meanwhile, the control group increased from 33.63 on the pretest to 42.13 on the posttest. This is influenced by several factors, one of which is the willingness of the respondents and reminder activities that are delivered every day via the mobile application (Whatsapp) during the research. According (46), exercise self-efficacy is based on an individual's belief in his or her ability to be willing to do it and one possible explanation related to this is that it is also influenced by the characteristics of the respondent (Table 1) such as the level of education. Bandura explained that the process of forming self-efficacy is the cognitive process, motivational process, affective process, and selection process. The cognitive process in this research is clearly aimed at providing PA promotion via a mobile application (WhatsApp) which can increase PA behavior and exercise self-efficacy.

SCT is a theory-based intervention emphasizing constructs such as self-efficacy, and cognitive aims to promote self-management behavior such as PA. Our study seeks to include the core constructs of SCT by developing self-efficacy and cognitive processes specifically in this study. The strength of this study, we specifically used the ESES instrument with a valid, reliable, and stable measuring tool to assess SE in T2DM in Indonesia (46). In this study, we sought to develop an SCT intervention by seeking to increase confidence and intention in behavior change and be able to produce blood sugar control through PA. Another strength of this research is that we combined theory-based interventions (SCT) with technology-based interventions that were tried in rural areas. This RCT study has several strengths with a population that is difficult to reach and at high risk of experiencing complications with diverse characteristics of respondents.

Limitations

The lack of previous research in people with T2DM using SCT with eHealth makes it difficult to compare the results of the study with others. This study was conducted in a rural population, which may limit the generalizability of the findings to urban populations. Another limitation raised by our study is that there were significant differences between the characteristics of the control and intervention groups.

Conclusion

Our study results support the effectiveness of an SCT-based PA intervention via a mobile app among rural patients with T2DM to reduce complications through an RCT design study.

Findings suggest that implementation of SCT-based PA interventions in rural populations at risk for diabetes has the potential to benefit these populations. Further long-term research is needed to determine the maintenance of PA interventions and their impact on diabetes prevalence among rural residents

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Conflict of interest

The researcher states there is no conflict of interest in this research.

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