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ORIGINAL RESEARCH

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## INCREASING SELF-EFFICACY TO REGULATE EXERCISE IN ADULT PATIENTS WITH TYPE 2 DIABETES MELLITUS

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### Abstract

**Background:** Self-efficacy has been described as dominant factor associated with physical exercise in adult patients with type 2 diabetes mellitus, but to improve self-efficacy to regulate exercise of adult patients with type 2 diabetes mellitus is a challenge for health workers.

**Objective:** This study was to determine the effect of exercise consultation program on self-efficacy to regulate exercise in adult patients with type 2 diabetes mellitus.

**Methods:** A quasi-experimental study with two comparison groups was purposively designed for pre-test and post-test procedures. Sixty-one patients of type 2 diabetes mellitus were allocated into the experimental group (31 patients) and the control group (29 patients). While the experimental group received the exercise consultation for 12 weeks and routine care, the control group received routine care only. Comparative assessments on differences in self-efficacy to regulate exercise were examined both within and between groups using paired or unpaired t-test.

**Results:** After receiving exercise consultation program, self-efficacy to regulate exercise significantly increased within the experimental group ( $p < .05$ ), but there was no significant change with in the control group. Between groups, there was a significant difference self-efficacy to regulate exercise in adult patients with type 2 diabetes mellitus ( $p < .05$ ).

**Conclusion:** The exercise consultation program could increase self-efficacy to promote the physical exercise among adult patients with type 2 diabetes mellitus.

**Keywords:** transtheoretical model; self-efficacy; physical exercise; type 2 diabetes mellitus

## INTRODUCTION

Physical exercise is one of essential diabetes management strategies for type 2 diabetes mellitus (T2DM) ([Colberg et al., 2010](#); [Sigal, Kenny, Wasserman, Castaneda-Sceppa, & White, 2006](#)), but it is very difficult to maintain performing exercise in everyday ([Morrato, Hill, Wyatt, Ghushchyan, & Sullivan, 2007](#)). Self-efficacy is strongest predictor of physical exercise ([Plotnikoff, Trinh, Courneya, Karunamuni, & Sigal, 2011](#)).

The physical exercise program based on Exercise consultation of Transtheoretical Model (TTM) has been used in western countries including exercise consultation. Rather standard exercise information, the exercise consultation intervention based on TTM both in the short- and long-term has effectively promoted the exercise behavior in people with T2DM ([Jackson, Asimakopoulou, & Scammell, 2007](#); [Kirk, MacMillan, &](#)

[Webster, 2010](#); [Plotnikoff et al., 2011](#)). The exercise consultation has been developed on the basis of physical activity counseling guided by the TTM and cognitive behavioral approach ([Dalle Grave, Calugi, Centis, El Ghoch, & Marchesini, 2010](#); [Kirk et al., 2010](#)). However, it has never been used in Indonesia. Using the exercise consultation for physical exercise with Diabetes Exercise based on TTM approach is first study in Indonesia. The majority of people with T2DM living in Medan (73%), North Sumatera, Indonesia did not participate in diabetes exercise ([Sinaga & Hiswani, 2012](#)). Regard to increase of patients with T2DM in Indonesia ([Pramono et al., 2010](#); [Wild, Roglic, Green, Sicree, & King, 2004](#)) especially in Medan ([Sinaga & Hiswani, 2012](#)), North Sumatera province, the researchers were interested in improving the physical exercise behavior of Indonesians with T2DM through exercise consultation. Diabetes Exercise integrated in exercise consultation would promote changes in physical activity behaviors. This study was to examine the effect of exercise consultation program on changes of exercise behavior, self-efficacy and health outcome blood glucose and body mass index among people with T2DM. This knowledge would be better applying the exercise consultation program for improving exercise behavior and self-efficacy among people with T2DM at the Community Health Centre, in Medan, Indonesia.

## METHODS

### *Study design*

A quasi-experimental was utilized in this study, with pre-test and post-test comparison group design. The purpose of this study was to determine the effect of exercise consultation program on self - efficacy to regulate exercise adults' patients of type 2 diabetes mellitus.

### *Sample and setting*

All 66 participants were recruited from Darussalam Public Health Center with purposive sampling. Participants who were met the criteria inclusion were type 2 aged between 40 to 59 years, blood glucose level

ranging from 140 to 250 mg/dl as per physical check-up at Public Health Center, were in the stages of preparation of Transtheoretical Model stage of change (e.g., they did not meeting current physical exercise guidelines, but intended to become more active). Diabetic with severe cardiovascular problems and other serious complications of diabetes (e.g. going blind, marked neuropathy, osteoporosis, or impending renal failure) were excluded. The participants were randomly assigned into two groups of the experimental group and the control group consisting of 33 subjects each. Six diabetic patients were withdrawal due to personal reasons from the study, two of the experimental group and three of the control group. Only 60 participants remained in the study, 31 of the experimental group completed the 12-week exercise consultation program adding to usual care and 29 participants received usual care.

### *Intervention*

The exercise consultation program involving one-by-one discussion guideline ([Kirk et al., 2010](#); [Loughlan & Mutrie, 1996](#); [Prochaska & Velicer, 1997](#)) has been adopted for use in this study with certain modifications to meet the goals of motivating and enhancing confidence to change. Participants were able to take the important first step to ensure the plan for a programmed exercise, while the consulting practices have focused on promoting increase in physical exercise, as for example, Diabetes aerobic. The exercise consultative session adhered to the strategies of Part 1 and Part 2. For part 1, it starts with discussing or assessing the participant's current physical exercise activity, followed by identifying benefits and hopes to obtain benefits from physical exercise, perceived social support and the mental barriers to exercise, then move onto making commitment to exercise. Finally, at the end of each exercise consultation, the principal researcher summarized of discussions and solutions to any foreseeable problems for individual participant. The logical solution of problem is 1) to discuss/ explore the benefits of becoming more active in doing physical exercise, 2) to give clear advice how to begin a diabetes aerobic program, 3) to make

recommendation to people with type 2 diabetes for physical exercise which includes frequency, duration and intensity of physical exercise.

For part 2, making demonstration of diabetes aerobic procedures stage by stage with the help of booklet/leaflet and VCD, the booklet/leaflet referred to diabetes aerobic 5 series developed by Indonesian Diabetes Association ([Santoso, 2010](#)), whose contents cover essential information about the postures and steps of Diabetes aerobic movements. Guidelines for doing Diabetes aerobic for type 2 diabetes started with warm-up (5 to 10 minutes), followed by core movement (20 minutes) and final cool-down (5 to 10 minutes). Participants with T2DM should do this Diabetes aerobic regularly making gradual progress. While the VCD referred to Diabetes aerobic 5 series" developed by Indonesian Diabetes Association ([Santoso, 2010](#)).

#### *Instrument*

Self-efficacy towards regular exercise was assessed by using the five items of the ESQ ([Marcus, Selby, Niaura, & Rossi, 1992](#)). The item response is identifying the level of confidence of carrying out certain behaviors with numerical rating from '0' (not applicable) to '10' (very confident). Internal consistency reliability was 0.82 and test-retest reliability was 0.90 ([Ferguson, 1997](#)). The sum score of self-efficacies of exercise varies from 0 to 50, the higher score implies a higher level of self-efficacy towards regular exercise.

Blood glucose refers to the level of glucose in the blood of the patients with T2DM. Blood glucose level was measured in the morning before breakfast (Fasting Blood Sugar or FBS) as well as being measured before and after the programmed intervention. All blood samples were taken from finger peripheral blood. Fasting implies that absolutely no food intake eight hours prior to BGT. Blood Glucose Tests were administered on patients using biochemical analyzer - Blood Glucose Test Meter One Touch BASIC Plus Life Scan 2000 (Manufactured by Standard Prodia Laboratory).

#### *Ethical consideration*

Prior to collecting data, the Ethic Review Committee for Research Involving Human Research Subject, Universitas Sari Mutiara Indonesia has approved the study and written informed consent was obtained from all participants.

#### *Data analysis*

Saphiro wilk test was used to check the normal distribution of the self-efficacy and blog glucose, and the data were normal distributed. The mean differences of self-efficacy, blood glucose both pre- and post-intervention within the same group were examined using dependent t-test. The mean differences between the two groups were examined by using the independent t-test at significant level of .05.

## RESULTS

The mean age of the participants was 54.45 years (SD= 5.29) for the experimental group and 54.46 years (SD= 4.42) for the control group. Majority of the participants were female in both groups. The average blood glucose levels were 207.52 mg/dl (SD=27.68) in the experimental group and 207.70 mg/dl (SD=15.31) in the control group. The participants in the experimental group (68%) and control group were in the preparation stage of change (60 %).

At the baseline, there was no significantly different means score of self-efficacy between the two groups. In **Table 1**, the mean score of self-efficacy to regulate exercise, post-intervention of exercise consultation program, among the experimental and the control group was 38.13 (SD = 5.29) and 25.27 (SD = 6.74), respectively. Self-efficacy for those participated in the exercise consultation program was higher over those who did not participate. The independent t -test was significant difference for self-efficacy towards regulate exercise in the experimental group when compared to the control group ( $t= 8.305$ ,  $p < .05$ ).

**Table 1** Comparison of mean score of Self-efficacy and blood glucose in subjects between the experimental (n=31) and control (n=29) groups using Independent t-test

	Experimental group		Control group		t	P value
	M	SD	M	SD		
<b>Self-efficacy</b>						
Pre intervention	23.94	5.72	25.10	5.75	-.792	.431
Post intervention	38.13	5.29	25.27	6.74	8.305	.000
<b>Blood Glucose</b>						
Pre intervention	207.52	27.68	207.70	15.31	-.974	.338
Post intervention	23.20	2.97	24.92	1.58	10.199	.000

Mean scores of blood glucose levels (**Table 1**), post-intervention of exercise consultation was 171.94 (SD = 30.86) and 213.53 (42.73) for the experimental and the control group respectively. This result showed that blood glucose levels of participants participated in an exercise consultation program was lower than those who did not. The result of independent *t*-test obtained has also confirmed the significant differences of blood glucose levels between participants in the experimental group and those in the control group ( $t = 10.199, p < .05$ ).

## DISCUSSION

This study has been undertaken with the primary aim of assessing the effects of conducting exercise consultation program to influence self-efficacy to regulate exercise among patients of T2DM, by comparing two groups - one designated as the experimental group receiving exercise consultation program and the other designated as the control group receiving usual care. The exercise consultation might motivate subjects to become more physically active and increase self-efficacy and awareness of the benefits of physical exercise, thereby lowering mental barriers to exercise. Limited motivation and exercise knowledge could be barriers to taking up regular exercise among adults with T2DM ([Korkiakangas, Alahuhta, & Laitinen, 2009](#)). Therefore, the exercise consultation should aim to support and motivate patients taking up exercise, as well as helping patients to recognize their unhealthy behaviors. Enhancing patient's motivation and educating patients about the benefit of exercise are the

most successful strategies for patients to engage the exercise ([Kirk et al., 2010](#)). High levels of physical exercise have correlation with patients progressed their stage of change ([Kirk et al., 2010](#)), and it would be good if they could maintain their exercise behavior changes ([Jackson et al., 2007](#); [Kirk et al., 2010](#)). It is clear that exercise consultation program increases the participant's self-efficacy to exercise regularly.

Self-efficacy is an important factor of progressing individuals from the lower stages to upper stages through behavioral changes ([Burbank & Riebe, 2001](#); [Lenio, 2006](#)) like the instance of individuals moving from the contemplation or preparation stages to the 'Action' stage. Individuals in the contemplation or preparation stages may struggle to change due to lack of exercise knowledge ([Lenio, 2006](#)) and lack of self-confidence in his or her ability to change. Individuals are able to move to the next stage of change whenever being comfortable with the selected exercise plan which is practical to follow. Therefore, for individuals in preparation stages their self-efficacies need to be enhanced. Previous study ([Allen, Fain, Braun, & Chipkin, 2008](#)) found that individuals with higher self-efficacies had shown more confidences in maintaining their physical activity program. In addition, self-efficacy has proven to be the strongest predictor for maintaining regular exercise behavior amongst adults of type 2 diabetes ([Plotnikoff et al., 2011](#)).

Controlling blood glucose level might be improved by doing diabetes aerobic for at least

30 minutes each session 3 times a week in a short period of 12 weeks. The findings in this study had shown that blood glucose levels became lowered amongst participants participated in regular diabetes exercise. These findings were consistent with several previous studies which highlighted that a 4-6 weeks of performing diabetes aerobic for 30 minutes each session 3 times a week had significantly reduced blood glucose levels ([Indriyani, Supriyatno, & Santoso, 2010](#); [Mawarti & Sriwahyuniati, 2005](#); [Unairawati & Soetjatie, 2011](#); [Utomo, Azam, & Ningrum, 2012](#)). Physical exercise undertaken by patients of T2DM can lead to increased glucose utilization because of active muscles movement and lowered blood glucose levels ([Colberg et al., 2010](#)).

This study may have some limitations that some factors were not measured in this study. Individual physical environment that may be the barrier in attending diabetes exercise program and may influence the results was not measured such as distance between home and community health center. In addition, Emotions and mood may affect differences in diabetes control but it is not measured in this study. Secondly, decrease blood glucose levels after exercise was higher than the recommended by American Diabetes Association (ADA) guideline. The possible factors would be several caused by: 1) Amount of food intake and exercise intensity was not in balance. 2) Difference in individual's metabolic rate. 3) Culture of eating behaviors such as kind of food in most common in person in Indonesia all are high carbohydrate. And 4) may be related to exercise intensity and duration of exercise. However, assessment of the food intake, individual's metabolic rate, culture of eating behavior and exercise intensity of the participants was not performed in this study. In addition, participant's emotions and mood may also affect diabetic controls, but these mental factors are outside the scope of this study. Records of participant's personal preference on diet and their medication discipline were not included in this study either. These aforementioned factors could well be accountable for the differences

in blood glucose levels. Other possible limitations related to variables were not measured including A1C, lipid, blood pressure, and quality of life as well as small sample size. For the future research, the exercise consultation program should be studied with longer follow-up period to measure these objectives and to evaluate the maintenance of physical exercise behavior change in a large sample size of patients of T2DM under different setting in Indonesia.

## CONCLUSION

Exercise consultation program could improve self-efficacy to regulate exercise and health outcome on blood glucose in patients of T2DM. This program is a feasible to encourage sedentary people with type 2 diabetes to perform physical exercise. Health care providers consider using this program for life style modification to be better diabetes control and prevent diabetes complication.

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## Declaration of Conflicting Interest

None declared.

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## Author Contribution

All authors contributed equally in this study.

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