ผลของโปรแกรมส่งเสริมความยืดหยุ่นต่อพฤติกรรมการจัดการตนเอง และระดับฮีโมโกลบินเอวันซี ของผู้สูงอายุโรคเบาหวาน
Effects of the Resilience Promoting Program on Self-management Behavior and Hemoglobin A1C Level among Older People with Diabetes

นิพนธ์ต้นฉบับ

Original Article

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วารสารไทยเภสัชศาสตร์และวิทยาการสุขภาพ2564;16(2):139-148.

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บทคัดย่อ

วัตถุประสงค์: เพื่อศึกษาผลของโปรแกรมส่งเสริมความยืดหยุ่นต่อพฤติกรรมการจัดการตนเอง และระดับฮีโมโกลบินเอวันซี ของผู้สูงอายุโรคเบาหวาน **วิธีการศึกษา:** กลุ่มตัวอย่างคือผู้สูงอายุโรคเบาหวานชนิดที่ 2 ที่มีคุณสมบัติตามเกณฑ์ที่กำหนดจำนวน 30 คน สุ่มตัวอย่างแบบง่ายเข้ากลุ่มทดลองและกลุ่มควบคุมกลุ่มละ 15 คน กลุ่มทดลองได้รับโปรแกรมส่งเสริมความยืดหยุ่น ส่วนกลุ่มเปรียบเทียบได้รับการดูแลตามปกติ รวบรวมข้อมูลในระยะก่อนการทดลอง ระยะหลังการทดลอง และระยะติดตามผล โดยใช้แบบสัมภาษณ์การจัดการด้วยตนเอง และตรวจระดับฮีโมโกลบินเอวันซีด้วยเครื่องมือ H9 HbA1c Analyzer วิเคราะห์ข้อมูลด้วยสถิติพรรณนา สถิติการทดสอบค่าที สถิติวิเคราะห์ความแปรปรวนแบบทางเดียววัดซ้ำ ประเภทหนึ่งตัวแปรระหว่างกลุ่มและหนึ่งตัวแปรภายในกลุ่ม **ผลการศึกษา:** คะแนนเฉลี่ยพฤติกรรมการจัดการตนเองในระยะหลังการทดลองและระยะติดตามผล ของกลุ่มทดลองแตกต่างจากกลุ่มควบคุมอย่างมีนัยสำคัญทางสถิติ (*P*-value < 0.01) โดยในกลุ่มทดลองมีคะแนนเฉลี่ยพฤติกรรมการจัดการตนเองในระยะหลังการทดลองและระยะติดตามผลมากกว่าระยะก่อนการทดลองอย่างมีนัยสำคัญทางสถิติ (*P*-value < 0.01) และค่าเฉลี่ยฮีโมโกลบินเอวันซีของกลุ่มทดลองในระยะติดตามผลน้อยกว่าระยะก่อนการทดลอง และน้อยกว่ากลุ่มควบคุมอย่างมีนัยสำคัญทางสถิติ (*P*-value < 0.01) และพบว่ามีปฏิสัมพันธ์ระหว่างวิธีการทดลองกับระยะเวลาการทดลองอย่างมีนัยสำคัญทางสถิติ (*P*-value < 0.01) **สรุป:** โปรแกรมส่งเสริมความยืดหยุ่นมีผลเพิ่มคะแนนพฤติกรรมการจัดการตนเองและลดค่าเฉลี่ยฮีโมโกลบินเอวันซี ดังนั้นควรนำโปรแกรมส่งเสริมความยืดหยุ่นไปใช้กับผู้สูงอายุโรคเบาหวาน เพื่อให้ผู้สูงอายุโรคเบาหวานมีพฤติกรรมการจัดการตนเองที่เหมาะสม และค่าระดับฮีโมโกลบินเอวันซีลดลง

คำสำคัญ: โปรแกรมส่งเสริมความยืดหยุ่น, พฤติกรรมการจัดการตนเอง, ฮีโมโกลบินเอวันซี, ผู้สูงอายุ, โรคเบาหวานชนิดที่ 2

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Abstract

Objective: To determine effects of resilience promoting program on self-management behavior and hemoglobin A1C level in the older adults with diabetes. **Method:** Sample was 30 older people with type 2 diabetes who met the requirements selected by simple random sampling, with 15 each in the test group (resilience promoting program) and control group (usual care). Data were collected at pre-intervention, ost-intervention and follow-up using using self-management interview questionnaire and hemoglobin A1C level was monitored by H9 Hemoglobin A1C Analyzer at pre-intervention and follow-up. Data were analyzed by using descriptive statistics, dependent t-test, independent t-test, and repeated one-way ANOVA with between-group and within-group variance. **Results:** Self-management behavior average scores of the test group at post-intervention and follow-up were significantly different from those of control group (*P*-value < 0.01). In the testgroup, scores at post-intervention and follow-up were significantly higher than that at pre-intervention (*P*-value < 0.01). HbA1C level of the test group at follow-up was significantly lower than that at pre-intervention, and significantly lower than that of control group at follow-up (*P*-value < 0.01). Significant interaction between intervention and time point was found. **Conclusion:** Resilience promoting program could improve scores of self-management behavior and HbA1C level. The program should be implemented to enhance proper self-management behavior and HbA1C level.

Keywords: resilience promoting program, self-management behavior, hemoglobin A1C, older adults, type 2 diabetes

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Introduction

Type 2 diabetes mellitus (type 2 DM) is a chronic disease with an increasing number among the elderly patients worldwide with 94.2 million cases in 2015 and 135.6 million cases in 2019.[1] in Thailand, the number of type 2 DM among the elderly has been increasing from 17.47% to 19.6% of all the elderly during the period of 2015 to 2019.[2] In Petchaburi province, the number of diabetes cases increased from 15.07% of the elderly population in 2015 to 17.66% in 2019; while mortality associated with diabetes in the elderly was 2.12% in 2015 and increased to 2.90% in 2019.[2] Obviously more old adults have had diabetes and died of the disease continuously. Hence the problem has been intensified and deserves more understanding and better strategies to manage

and alleviate the burden especially among the elderly population.

About 90% of type 2 diabetes in the elderly is related to physiological changes according age, genetic and daily living behaviors.[3] The decline of pancreas function, specifically that of beta cells, results in a depletion of insulin, more accumulation of serum glucose, and metabolic syndrome.[4-6] Since such changes could also be induced genetically, the elderly with family history of diabetes had a higher likelihood of developing diabetes.[5,6] According to behaviors, the major cause could be the decrease in or limitation of daily activities which weaken insulin sensitivity and hence the higher level of serum glucose.[4-6] This almost unavoidable factor makes the elderly more vulnerable to the disease.

Diabetes in the elderly could pose physical, psychological, social and economic impact on their lives. Physically, diabetes leads to micro- and macrovascular complications. Cardiovascular and cerebrovascular complications, which are macrovascular in nature, are the major cause of morbidity and mortality of diabetes.[7] The complications could be prevalent in cases of frequent and severe hypoglycemia and hyperglycemia with poor glycemic control behavior.[8] All of these undesirable events lead to hospitalization, pose an economic burden on the elderly diabetic patients and their family, especially cost of hospitalization. Frequent hospitalizations could also pose a social drawbacks. The elderly could also face stress from the need for lifestyle changes and diabetic complications.[9] The elderly diabetic patients could thus face change and loss of social role, dependence on others, burden to others, loss of self-care. As result, they could have less self-worth and more social withdrawal.[10] To prevent and alleviate such adversities, the elderly diabetic patients should adopt more appropriate behaviors for self-management.

Promoting appropriate resilient self-management behaviors could help slower disease progress and complications. Six components of self-management behaviors for diabetes patients are as follows. First, diet control is crucial behavior for diabetes it directly dictates serum glucose level.[11] Diabetic patients sometimes could not control their diet since they do not prepare food by themselves, so the choices could not be made and inappropriate food could not be avoided.[12] Second, exercise behavior could be much less than optimal among the elderly diabetic patients. They also lack knowledge about appropriate exercise.[12] Third, medication taking behavior could be less effective since the elderly diabetic patients could have poorer vision for label reading, forget to take medications, and not take medications on the right prescribed time. Some patients discontinue taking medications because of false fear of kidney damage caused by medications and of poor understanding on benefits of medications.[13] Fourth, general self-care behavior could be appropriate. For example, poor diabetic foot care could cause wounds which could ultimately require foot or leg amputation.[14] Fifth, follow-up visit of the elderly diabetic patients could be imperfect and result in a poor glycemic control. Some patients forget the appointment, while others might not want to follow the appointment.[15] Sixth, stress management among the elderly diabetic patients is needed to adjust themselves in self-care and to cope with complications. Inappropriate behaviors in any of these six aspects could bring the elderly diabetic patients stress which could further progress the poor glycemic control. If the elderly diabetic patients have inadequate strength and skill to handle the stress, resilience could be decreased and the patients are unable to adjust to the illness and to face life difficulties. On the other hand, the elderly diabetic patients with sufficient psychological strength, calmness, equanimity, and resilience could adapt to the illness of diabetes and difficulties in life.[16]

Resilience is referred to the individual ability to adapt to change, loss and adversity such as stress, and alleviate negative impacts of such stress. Resilience is also rehabilitating the balance once confronting difficulties. Individuals with high resilience could handle problems and manage their problems of chronic illness better than those with low resilience level.[16] In encountering problems and complications of diabetes, the elderly diabetic patients use their personal protective factors such as pride, self-reliance, and mental stamina, problem-solving strategies, physical exercise, and receiving social support to achieve life balance.[16] If all could be carried out according to plan, they are considered successful in self-management which could result in well controlled HbA1C level, lowered complication rate, and lowered mortality. Thus there is a need to promote resilience among the elderly diabetic patients to help them achieve continuous and sustainable health management behaviors.

Based on literature review, factors associated with resilience in the elderly diabetic patients include social support[17,19,20], perceived physical health status[17-20], mental

health status[17,18], and ability to perform daily activities.[20] Resilience in 45.4% of Thai elderly diabetic patients was at low to moderate level.[20] The study by Steinhardt and colleagues found that resilience promoting program combined with self-management resulted in more knowledge and better HbA1C level than those receiving only self-management.[21] This finding was consistent with the study of Bradshaw and co-workers et al where resilience promoting program could improve the patient ability to handle and manage stress related to diabetes and their HbA1C level, when compared with those receiving the usual care.[22] The study of Joyce and colleagues also reported that diabetic patients had a certain level of stress and those with high resilience were able to reduce stress by adapting to the difficult situation and had lower HbA1C level.[23]

It is obvious that has is a need to improve resilience among the elderly diabetic patients for Thai patients. There has been an effort to implement policy and develop various kinds of intervention program to improve health behavior among Thai elderly diabetic patients. These interventions included self-management promoting program for the elderly diabetic patients[24,25] and self-modification on lifestyle program for the elderly type 2 diabetic patients.[26] Even though these program were found effective in improving health behavior and HbA1C level, some elderly patients had improper adaptation to diabetes illness. Based on the fact that patients with high resilience could adapt to difficulties better than those with low level[16], we aimed to develop the resilience promoting program for the elderly diabetic patients and to test the program efficiency.

In this present study, the concept of resilience in the elderly of Wagnild and Young was used.[16] This concept of resilience consists of 5 components including self-reliance, equanimity, meaningfulness of life, perseverance and existential aloneness. We also employed knowledge from literature review to apply in developing resilience promoting program for the elderly diabetic patients to promote continuous self-care and proper diabetes management. In this 8-week program, the independent factors corresponding to the 5 resilience components as activities to promote (1) self-reliance (called “I’m confident, so I can do it”), (2) equanimity (called “despite diabetes, I can mend”), (3) meaningfulness of life (called “how to live happily with diabetes”), (4) perseverance (called “with perseverance, I can do it”), and (5) existential aloneness (called “how to live independently”). These five groups of activities corresponding to the five components of resilience independently affect the two dependent outcome variables namely (1) self-management behavior and (2) HbA1C level.

Specifically, this study aimed to compare (1) scores of self-management behavior of the elderly diabetic patients at post-intervention and follow-up between the group receiving the resilience promoting program (test group) and the group receiving the usual care (control group), (2) scores of self-management behavior of the elderly diabetic patients in the test group at pre-intervention, post-intervention, and follow-up, (3) HbA1C levels at follow-up between the test group and control group, and (4) HbA1C levels of the elderly diabetic patients in the test group at pre-intervention and follow-up.

Methods

In this quasi-experimental research with two-group repeated measures design, study population was men and women aged 60 years or older diagnosed with type 2 diabetes mellitus residing in Thayang district, Petchaburi province. Sudy sample was those of the study population who were in the district in the year 2018. The participants were individuals in the study population who met the following inclusion criteria: 1) complete consciousness, no abnormal cognitive function, and a score Chula Mental test (CMT) of 15 points or higher, (2) being able to perform daily activities independently, 3) being able to communicate in Thai language, 4) having an HbA1C level of not more than 7.5%, and 5) taking oral glucose lowering agents.

Sample size was estimated using the software program G*Power 3.0.10. The power of test of 0.9 and a type I error of 95% or P-value of 0.05 were used.[25] Based on the work of Lalam and colleagues[26], and effect size of 0.34 was estimated.[27] As a result, a sample size of 10 participants per group was required. To compensate for a 50% attrition rate, a total of 30 participants (15 for each group) were required. Participants were selected by simple random sampling by randomly selecting one district in Petchaburi province. With 20 sub-district health promoting hospitals in the selected district, 10 pairs of 2 hospitals with comparable context of location, community, and number of elderly diabetic patients were formed. Once a pair of the hospitals was selected, the test group and control group were randomly assigned to each of the two hospitals. In each group, prospective participants

(elderly diabetic patients) were selected with simple random sampling without replacement until a required number of participants was met.

Research instruments

The **first instrument**, the Chula Mental Test (CMT), was used to screen the potential participants. CMT could discriminate the elderly with dementia from the normal ones. One point was given for a correct answer on each of 19 questions. With a possible total score of 19 points, a score of 15 points or higher indicates no cognitive problems in the elderly.[29]

The **second instrument** was the questionnaire consisting of two sections. The first section collected demographic and clinical characteristics including age, gender, marital status, religion, education, occupation, income sufficiency, duration of diabetes since diagnosis, co-morbidities, and glucose lowering medications. The second section was the questionnaire to ask about the self-management behavior among the elderly diabetic patients. We modified the self-management questionnaire of Tookaew.[24] The scale contained 27 questions evaluating self-management behaviors regarding diet control, compliance with follow-up appointment, medication use, general self-care, exercise, and stress management. With a 4-point rating scale ranging from 0-never practice to 1-practice sometimes, 2-practice frequently, and 3-always practice based on weekly frequency of performing each of the behaviors. With a possible total score of 0 – 81 points, the higher scores indicated the higher level of self-management behavior.[24]

In this second section of the second instrument, HbA1C level was measured. HbA1C was measured using the H9 HbA1c Analyzer using the high performance liquid chromatography (HPLC) technique. A 3-ml blood sample was mixed with EDTA and undergone the HPLC, and resulted in concentration of HbA1C (%). With a normal range of HbA1C of 4.00 – 6.00%, HbA1C concentration indicates glycemic control within the last 2 – 3 months.[1] All HbA1C measures were supported by Thayang Hospital.

The **third instrument** was the program and evaluation of the 8-week resilience promoting intervention for the elderly diabetic patients consisting of 4 components. The first component was the resilience promoting program for the elderly diabetic patients. The program was systematically designed to promote resilience which supposedly could promote sustainable proper self-management behavior. The researchers developed the program as guided by literature review and related research. Based on the concept of resilience of Wagnlid and Young[16], the program consisted of five groups of activities to promote five respective components of resilience as follows: (1) self-reliance (called “I’m confident, so I can do it”), (2) equanimity (called “despite diabetes, I can mend”), (3) meaningfulness of life (called “how to live happily with diabetes”), (4) perseverance (called “with perseverance, I can do it”), and (5) existential aloneness (called “how to live independently”). The program detailed the overall protocol, target population, objectives, time, venue, practical steps and theoretical rationale.

The second component of the third instrument was the manual for resilience promotion in relation with self-management behavior for the elderly diabetic patients. The researcher developed this document based on literature review and related research. The manual contained knowledge and advice for self-study including diet control, exercise, diabetes medication use, general self-care, follow-up care, and stress management.

The third component of the third instrument was the teaching materials on the self-management practice for the elderly diabetic patients. The package consisting of PowerPoint™ slide and logbook was used by the researcher. The fourth component of the third instrument was self-monitoring diary of the elderly diabetic patients. It was developed by the researcher to monitor self-management behavior of the participants. This diary was expected to help the participants record their goal in diabetic control, diet control, diabetes medication taking, exercise, and general self-care. The participants were instructed to self-record the information weekly.

Research instrument quality assurance

The self-management behavior questionnaire was tested for content validity by three experts in geriatric nursing care, specifically two nursing instructors and a practicing nurse. It was found to have high validity with a content validity index of 0.93. In addition, the questionnaire was also revised according to the comments and suggestions from the experts. For reliability, the questionnaire was tested in a total of 20 patients in Banlad district, Petchaburi province, who were comparable with the prospective participants. It was found to have a high internal consistency reliability with a Cronbach’s alpha coefficient of 0.91.

All other instruments including the resilience promoting program for the elderly diabetic patients, the manual for resilience promotion, teaching materials, and diary for self-monitoring, were also tested for practicality with five patients in Banlad district, Petchaburi province, who were comparable with the prospective participants. It was found that the patients found the program interesting, helped them better understand diabetes. They found the manual and teaching materials to be easy to follow, with adequately large font size, and visually comprehensible graphics.

For HbA1C measurement, good laboratory practice was routinely followed. The measurement for all participants were done by the same laboratory technician and on the same machine.

Experiment and data collection procedure

This study was approved by the Ethic Committee, Faculty of Nursing, Burapha University (approval number: 03-08-2561) and by the Ethic Committee of Petchaburi Provincial Health Administration Office (approval number: PBEC 020/2561). To prevent bias, two researcher assistants were employed, one for assisting during the intervention program and the other for data collection at pre-intervention, post-intervention and follow-up. Both assistants were nurses experienced in the care of elderly diabetic patients.

In conducting the experiment, the researcher explained the study objectives and study steps to the participants and the dates for experimental intervention were agreed upon by both the researcher and participants. Before the experiment, participants in both groups were asked to complete all parts of the questionnaire and have their HbA1C measured. In the experiment phase, participants in the test group participated the resilience promoting program on agreed dates (Table 1). On the other hand, participants in control group received no resilience promoting program but usual care only. At post-intervention (week 8), participants in both groups were asked to complete the self-management behavior questionnaire. At follow-up (week 12), participants in both groups were asked to complete the self-management behavior questionnaire and have HbA1C measured. To protect rights of participants in the control group, they were given the manual for resilience promotion at follow-up.

Table 1 Resilience promoting program for the elderly diabetic patients.

Activities	Week	Class number	Duration (minutes)
Activity 1: activity to promote self-reliance (called "I'm confident, so I can do it")	1	1	
1. Relationship between patients and instructor was built.			10
2. Knowledge about diabetes was provided to patients.			60
3. Strengths of individual patients were identified.			20
Activity 2: activity to promote equanimity (called "despite diabetes, I can mend")	1	2	
1. Situational analysis on diabetes scenario by identifying causes and ways to solve the problems.			30
2. Experience sharing on problems and obstacles in managng diabetic signs and symptoms.			20
3. Proper problem-solving and management in diabetic control.			10
Activity 3: activity to promote meaningfulness of life (called "how to live happily with diabetes")	2	3	
1. Knowledge sharing on the topic "how to live happily with diabetes."			15
2. Goals of life were set.			20
3. Life goals were prioritized.			15
4. Means or ways to reach the goals were determined.			10
Activity 4: activity to promote perseverance (called "with perseverance, I can do it")	2	4	
1. Situational analysis on diet control.			30
2. Daily menu and dish for one day were set.			20
3. Stress releasing skills were trained.			30
4. Role-model diabetic patienst demonstrated exercise and actual practice was done.			30
Activity 5: activity to promote existential aloneness (called "how to live independently")	3 - 8	5 - 10	
Summary of activities in the past week and practical capability was evaluated.			30

Data analysis

Descriptive statistics including frequency with percentage and mean with standard deviation were used to present demographic and clinical status characteristics, scores of self-management behaviors, and concentration of HbA1C. Differences between groups were tested using chi-square test for categorical variables and independent t-test for continuous variables. Dependent t-test was used to compare within-group difference. To compare differences of scores of self-management behavior at post-intervention and follow-up accounting for pre-intervention score, repeated measure analysis of variance with one between-subjects variable and within-subjects variable was used with Bonferroni's adjustment method for post hoc pairwise comparisons. Statistical significance was set at a type I error of 5 (or P-value < 0.05). All statistical analyses were prerformed using software program SPSS for Windows version 26.

Results

Participants in the test group were more likely to be in their 65 – 69 years of age (53.3%) while those in control group were in their 60 – 64 years (73.3%). The majority of them was women (867% in both groups). Regarding marital status, the majority in both was married (60.0% in both groups). All participants in both groups were Buddhist (100.0% in both

groups) and had primary education (100.0% in both groups). The majority of participants in test group was farmers (53.3%) while those in control group was not working (60.0%). Most participants in test and control groups had sufficient family income (86.7% and 93.3%, respectively). Regarding the duration since diagnosed with diabetes, the majority of participants in test group had been diagnosed for 5 – 10 years (53.3%) while those in control group had been diagnosed for more than 10 years (40.0%). The majority in both groups had hypertension as co-morbidity (83.3% and 60.0% in test and control groups, respectively). Most of participants in test group (53.3%) and control group (60.0%) used metformin with glipizide for their diabetes. No statistical significance was found between the two groups in any of these characteristics.

Table 2 Demographic and clinical status characteristics of participants (N = 30).

Characteristics	Test group (n = 15)		Control group (n = 15)		X^2	*P*-value
	n	%	n	%		
Age (years)					3.74	0.15
69 – 60	6	40.0	11	73.3		
79 – 70	8	53.3	3	20.0		
80or older	1	6.7	1	6.7		
Gender					-	-
Women	13	86.7	13	86.7		
Men	2	13.3	2	13.3		
Marital status					2.4	0.30
Married	9	60.0	9	60.0		
Widowed/divorced/separated	4	26.7	6	40.0		
Single	2	13.3	-	-		
Religion					-	-
Buddhism	15	100	15	100		
Education					-	-
Primary school	15	100	15	100		
Occupation					3.95	0.27
Not working	4	26.7	9	60.0		
Farmer	8	53.3	5	33.3		
Small business	2	13.3	1	6.7		
Labor	1	6.7	-	-		
Income sufficiency					0.37	0.54
Sufficient	13	86.7	14	93.3		
Insufficient	2	13.3	1	6.7		
Duration since diagnosis of diabetes (years)					1.24	0.54
Less than 5	3	20.0	4	26.7		
ปี 10 - 5	8	53.3	5	33.3		
More than 10	4	26.7	6	40.0		
Co-morbidity)more than one was applicable)						
Hypertension	15	83.3	12	60.0	1.48	0.22
Hyperlipidemia	2	11.1	8	40.0	3.75	0.053
Heart disease	1	5.6	-	-	.00	1.00
Oral glucose lowering agents					1.39	0.50
Metformin	7	46.7	5	33.3		
Glipizide	-	-	1	6.7		
Metformin plus glipizide	8	53.3	9	60.0		

Scores self-management behavior in the test group increased from 64.27 ± 4.68 points at pre-intervention to 77.40 ± 2.20 points at post-intervention, but decreased to 75.13 ± 4.29 points at follow-up. On the other hand, scores in control group seemed to slightly decrease over time (67.07 ± 7.46, 62.07 ± 5.78 and 66.33 ± 8.24 points at pre-intervention, post-intervention and follow-up, respectively). At pre-intervention, score of the behavior of test group (64.27 ± 4.68 points) was slightly lower than that of control group (67.07 ± 7.46 points) with no statistical significance (*P*-value = 0.23). At post-intervention, score of the behavior of test group was significantly higher than that of control group (77.40 ± 2.20 and 62.07 ± 5.78 points, respectively, *P*-value < 0.01). At follow-up, score of the behavior of test group was significantly higher than that of control group (75.13 ± 4.29 and 66.33 ± 8.24 points, respectively, *P*-value < 0.01).

Table 3 Scores of self-management behavior at pre-intervention, post-intervention, and follow-up of test and control groups (N = 30).

Time point	Test group		Control group		*P*-value*
	Mean	SD	Mean	SD	
Pre-intervention	64.27	4.68	67.07	7.46	0.23
Post-intervention	77.40	2.20	62.07	5.78	< 0.01
Follow-up	75.13	4.29	66.33	8.24	< 0.01

* Independent t-test.

Over the entire study period, scores of self-management behavior between the two groups were statistically different (F = 15.15, *P*-value < 0.01) (Table 4). The change of behavior scores over time in both groups combined was statistically significant (F = 16.69, *P*-value < 0.01). In addition, the change of scores over time between the two groups was also statistically significant (F = 48.88, *P*-value < 0.01) (Table 4). This suggested the opposite or non-parallel changes over time of the scores in the two groups. Such interaction is also visually depicted in Figure 1.

Table 4 Analysis of variance on scores of self-management behavior at pre-intervention, post-intervention, and follow-up of test and control groups (N = 30).

Source of variance	SS	df	MS	*F*	*P*-value*
Between subjects					
Group	1137.78	1	1137.78	15.15	< 0.01
Within group	2102.71	28	75.097		
Within subjects					
Time	432.09	2	216.04	16.69	< 0.01
Time X Group	1265.16	2	632.58	48.88	< 0.01
Time X Within group	724.76	56	12.94		

* Repeated measure analysis of variance.

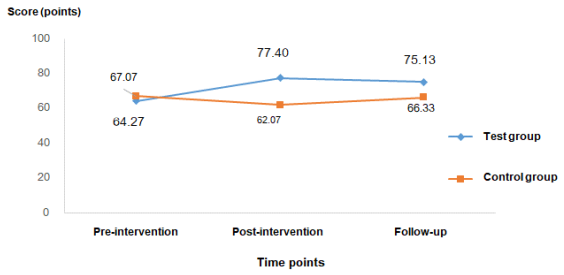

Figure 1 Changes of self-management behavior at pre-intervention, post-intervention, and follow-up of test and control groups (N = 30).

Among participants in test group, an increase of 13.13 points from pre-intervention to post-intervention was found with statistical significance (*P*-value < 0.01) (Table 5). However, there was a decrease of 2.27 points from post-intervention to follow-up, but with no statistical significance (*P*-value < 0.09). The overall increase of 10.87 points was found from pre-intervention to follow-up with statistical significance (*P*-value < 0.01).

Table 5 Pairwise comparisons of scores of self-management behavior at pre-intervention, post-intervention, and follow-up of participants in test group (N = 15).

Time point	Mean difference (points)	Standard error	*P*-value*
Pre-intervention → post-intervention	+13.13*	1.00	< 0.01
Pre-intervention → follow-up	+10.87*	1.23	< 0.01
Post-intervention → follow-up	-2.27	.93	0.09

* Repeated measure analysis of variance with Bonferroni's adjustment for post hoc comparisons.

It was found that at pre-intervention, HbA1C levels in test group (6.69 ± 0.90%) was slightly higher than that in control group (6.49 ± 0.73%) with no statistical significance (*P*-value = 0.52) (Table 6). At follow-up, however, HbA1C level in test group (5.65 ± 0.70%) was lower than that in control group (6.76 ± 0.97%) with statistical significance (*P*-value < 0.01). This indicates an interaction between intervention (the resilience promoting program vs. usual care) and time point.

For within-group change, HbA1C level in test group at pre-intervention of 6.69 ± 0.90% decreased to 5.65 ± 0.70% at follow-up with statistical significance (*P*-value < 0.01). On the other hand, HbA1C level in control group at pre-intervention of 6.49 ± 0.73% increased to 6.76 ± 0.97% at follow-up with no statistical significance (*P*-value = 0.19).

Table 6 HbA1C concentrations at pre-intervention and follow-up of participants in test and control groups (N = 30).

Time point	Test group (N = 15)		Control group (N = 15)		Independent t-test#	*P*-value
	Mean	SD	Mean	SD		
Pre-intervention	6.69	0.90	6.49	0.73	*0.65*	*0.52*
Follow-up	5.65	0.70	6.76	0.97	*-3.58*	*< 0.01*
Dependent t-test*	*5.18*		*-1.38*			
P-value	*< 0.01*		*0.19*			

* Dependent t-test comparing Hb1C level at pre-intervention vs. follow-up.
\# Independent t-test comparing Hb1C level at pre-intervention vs. follow-up.

Discussions and Conclusion

In this quasi-experimental research, resilience promoting program was effective to improve scores of self-management behavior. The score of self-management behavior in test group (i.e., resilience promoting program) was significantly higher than that in control group (i.e., usual care) both at post-intervention (77.40 ± 2.20 and 62.07 ± 5.78 points, respectively) and at follow-up (75.13 ± 4.29 and 66.33 ± 8.24 points, respectively). In addition, the scores of self-management behavior in test group at post-intervention and follow-up were significantly higher than that at pre-intervention.

The benefit of the resilience promoting program was evident. The contribution of each of five components of resilience concept of Wagnild and Young[16] on self-management behavior could be as follows. The activities based on the first component "self-reliance" which was called "I'm confident, so I can do it" could have certain contributions. The elderly diabetic patients were provided with knowledge about diabetes. Since the patients were prepared with such knowledge, it was the first step of building self-reliance for the self-management behavior. Knowledge is the crucial part of self-management behavior since adequate level of relevant knowledge could help in the decision making and problem-solving and ultimately results in self-management behavior suitable for the patient's illness.[32] In this component, the activity of identifying the patient's strengths and weaknesses helped the patient know their advantages and limitations, enhanced their self-reliance[16], and allowed them to perform activities to promote their resilience.[33] All activities in this component could help the patients acquire more knowledge for self-care, more self-reliance in taking care of themselves with diabetes, and more understanding on and examination of their past behavior. All of these processes could help the

elderly patients change their behavior which could lead to self-reliance to handle life difficulties.[21]

The activities based on the second component "equanimity" which was called "despite diabetes, I can mend" could affect the resilience and the self-management behavior. The patients were trained to analyze situations relating to their diabetes. This experience could enhance their decision making ability to manage difficult life situations. This ability could help alleviate the severity of the impacts from the problem the patient was facing.[34] Being able to share their experience in managing diabetes helped promote proper perception and more understanding on their own health status. Perceived health status is a factor promoting resilience in the elderly.[17,19,20,34,40] Elderly diabetic patients with high perceived health status would have equanimity which could enhance performing activities that can promote appropriate health behavior and continuous treatment as planned.[34]

The activities based on the third component "meaningfulness of life" which was called "how to live happily with diabetes" could enhance the resilience and the self-management behavior. Since the patients were encouraged to set their life goals, they were driven to live their life. Knowing the benefit of having goal in their life and how to live their life according to the goal could help the elderly patients have a clear goal in life.[35] Having a clear goal could encourage the patients to have proper self-care behavior, better perceived severity of the illness, and ability to continuously comply with treatment plan, and self-reliance.[39]

The activities based on the fourth component "perseverance" which was called "with perseverance, I can do it" could enhance the resilience and the self-management behavior. All activities in this component could enhance confidence in carrying out the activities correctly and continuously. Such confidence could make the patient more determined to continue their living even with life difficulties.[21,22] The training on diabetic diet plan could help the patient set appropriate dishes which could enhance their confidence in continuous diet control. The success could help build up determination and effort to continue their life.[21,22] The training for stress releasing could help enhance resilience of the elderly.[35] The exercise training by the role-model diabetic patient could promote perceived capability of the elderly by role model or experience of other people.[36] The elderly diabetic patients with more perceived capability to reach the goal would express their capability with their full effort. As a result, their resilience could be enhanced.[43]

The activities based on the fifth component "existential aloneness" which was called "how to live independently" could enhance the resilience and the self-management behavior. The ability to live independently was enhanced by the program which could foster the capability to perform activities independently to reach the goal as planned. They were encouraged to learn more and understand more about the path of their life and how to evaluate the difficult situations in their life. All of these improvements could help the elderly manage their problem appropriately.[44]

After the elderly diabetic patients participating with the resilience promoting program, they had five important positive experiences. First, they acquired more knowledge and understanding on diabetes. Second, they had more self-reliance in self-care decision making. Third, they were proud to be able to achieve a better glycemic control and less or no complications. Fourth, they had a desirable relationship with other patients in their group which allowed for a network of sharing, consultation, and encouragement for promoting each other health behavior. Fifth, they had happiness from participating the program since the activities were practice and positive relationship with other patients was built. Such relationship was stimulating to each other to maintain proper health behavior, offering help, sharing information, encouraging each other, fostering positive emotions, and promoting the perceived benefits of the elderly social network such as village health volunteers and communication channel with healthcare providers. All of these activities and perceptions could result in their self-worth and self-reliance to perform the health behavior for a better health status.[40] Findings from literature review indicated that social support positively affect resilience in the elderly.[17,19,20,22,39]

Our findings suggested that the elderly diabetic patients participating resilience promoting program and were able to adopt proper behavior successfully were proud of themselves, had positive feelings, and were motivated to continuously adjust to and sustain such proper behavior. In addition, the elderly patients received the manual for promoting resilience and the diary for home self-monitoring. This could encourage themselves to maintain proper behavior. The regular weekly home health care by the researcher could also motivate the patients to maintain the behavior resulting in sustainable self-management behavior.

The resilience promoting program resulted in a significantly lower HbA1C level (5.65 ± 0.70%) than that among patients receiving the usual care (6.76 ± 0.97%) ((*P*-value < 0.01) at follow-up. In addition, patients participating the program had their HbA1C at pre-intervention (6.69 ± 0.90%) decreased to 5.65 ± 0.70% at follow-up with statistical significance (*P*-value < 0.01). The program duration of eight weeks was sufficient to capture the physiological change of HbA1C level. HbA1C physiological change is dependent on the age of red blood cells which is about 120 days. The measure of Hb1C is thus indicating glycemic control in the last 2 – 3 months. The study lasted 12 weeks with 8 weeks of the program and another 4 weeks of follow-up. The whole 12 weeks could be relatively sufficient to account for the physiological change of HbA1C, hence the good measure of glycemic control.[30,31] Our finding was consistent with the study of Steinhardt and colleagues where patients participating resilience promoting program combined with self-management resulted in a better HbA1C level than those receiving on self-management.[21] The study of Bradshaw and co-workers also demonstrated that diabetic patients taking resilience promoting program emphasizing the adjustment to the illness could handle stress better and had better HbA1C level than those receiving the usual care.[22] The study of Joyce and colleagues also reported that diabetic patients had adjustment-related stress and those with high resilience could reduce such stress and further reduce HbA1C level.[23]

In short, our findings indicated that resilience promoting program could help the elderly diabetic patients to have better self-management behavior and better HbA1C level compared with the usual care. The program could improve resilience by encouraging the individual analyze their own problems, enhancing decision making ability to handle their problems in glycemic control. This program should be implemented in the actual practice of diabetic care.

This study had certain limitations. Since most of the participants were the early elderly stage, their physical strength is relatively intact hence their daily activity performance is well preserved. Therefore, application of the findings to those with middle or late elderly stage should be cautious. In addition, a duration of 12 weeks of the study could be somewhat short. Sustainable results could not be confirmed. Thus future studies with a wider range of the age of the elderly and a longer study period should be conducted.

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