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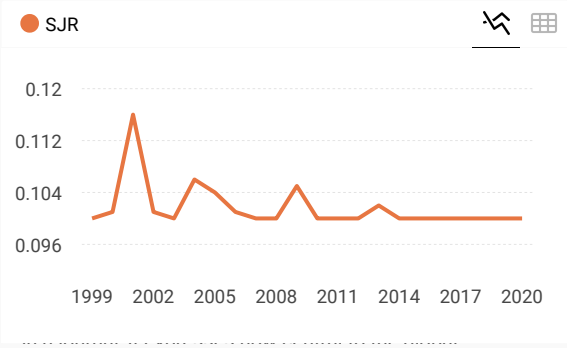

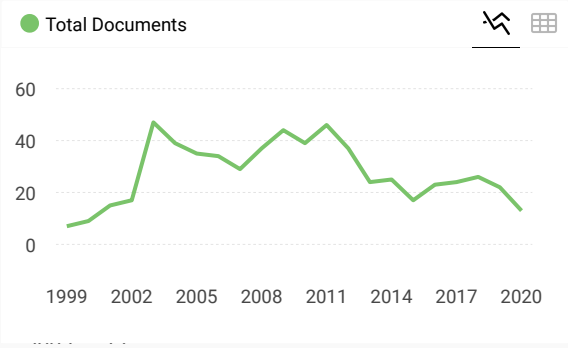

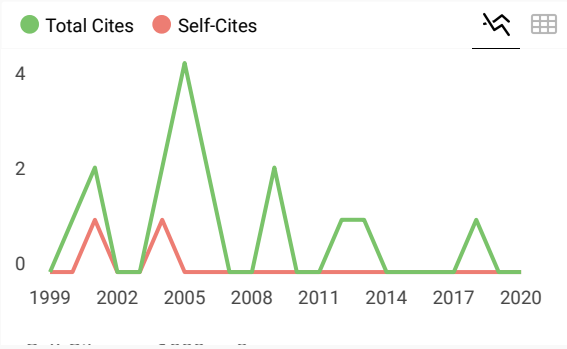

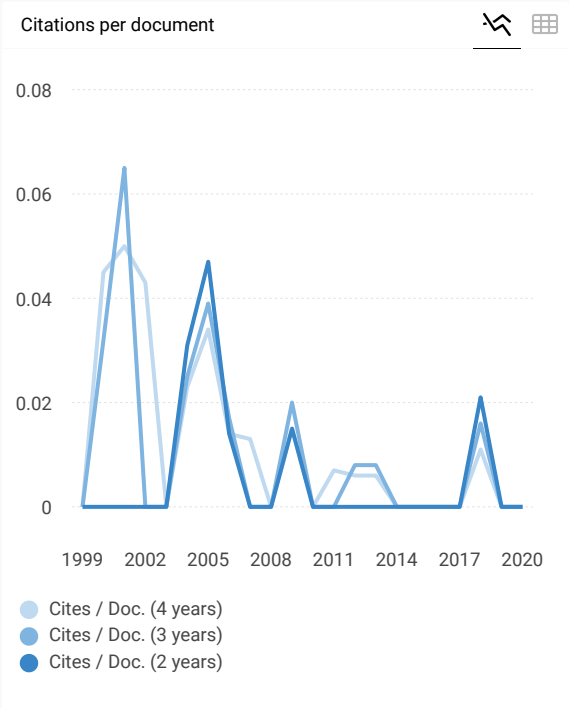

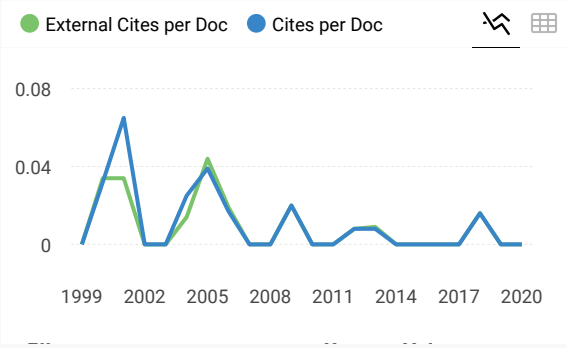

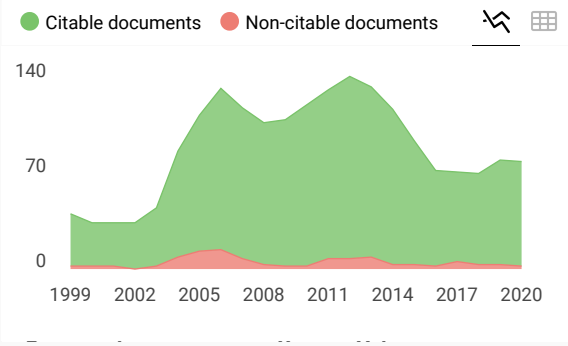

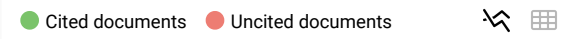

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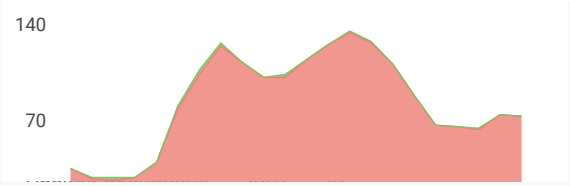

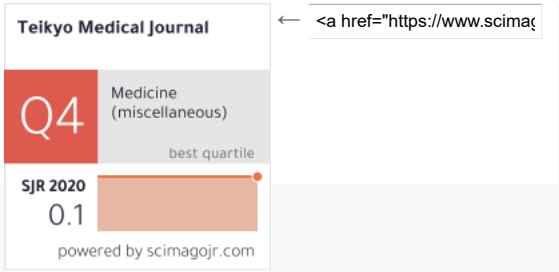

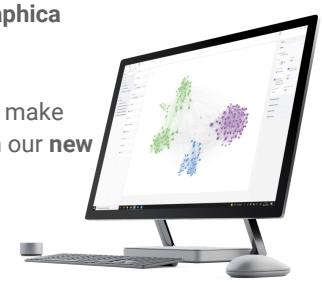

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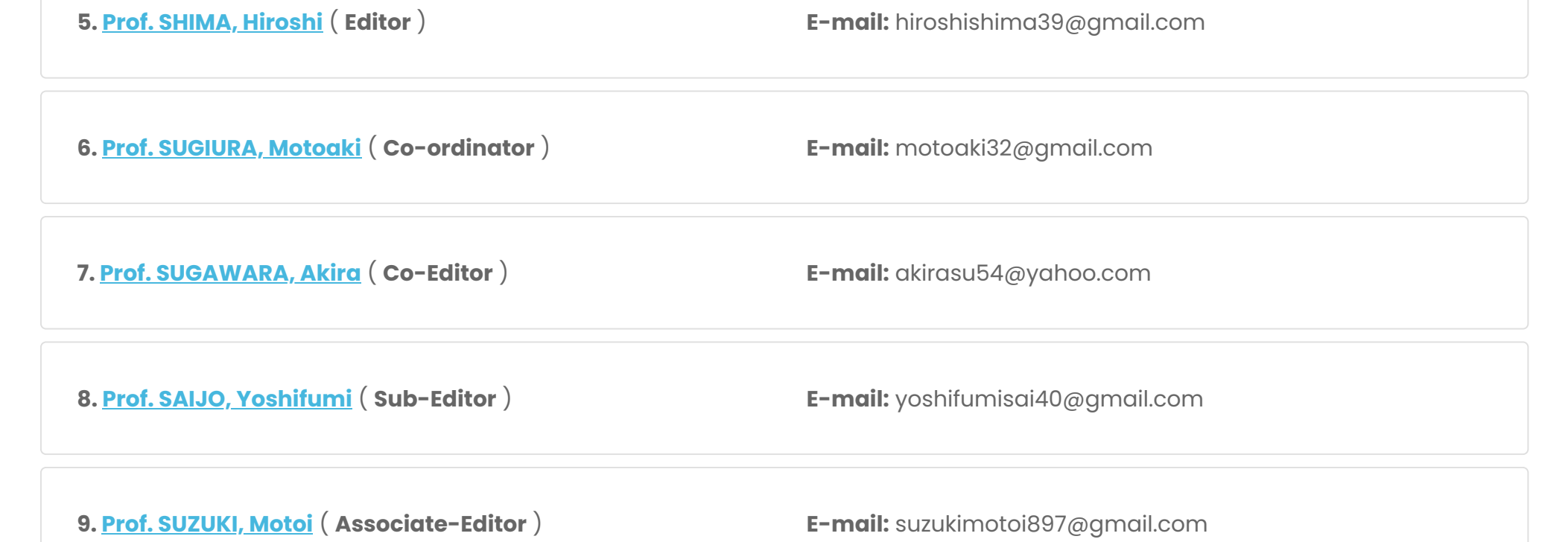

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Title : Effectiveness of Diabetes Education in Increasing Knowledge, Self-Care Activity and HBa1c in Diabetes Mellitus Outpatients

Abstract :

Increased knowledge and ability of patients to understand and implement self-care, will determine the success of diabetes control. Diabetes patients often have less knowledge about their disease and self-care activities, which results in low ability in self-management. Diabetes Education is a program aimed at diabetes patients which aimed increasing their knowledge and ability to effectively manage their diabetes, as well as to change the patient's behavior. This study aimed knowing effectiveness of Diabetes Education program in increasing knowledge and self-care activities, and reducing HbA1c levels. This research was a quantitative research conducted in the community, at Century Pakuwon Darmo Pharmacy with purposive sampling. Data was collected using the questionnaire instrument The Summary of Diabetes Self-Care Activities (SDSCA) and Diabetes Knowledge Test (DKT). The number of patients who met the inclusion criteria were 26 people, divided into test and control groups randomly. The mean age of the patients was 52.04 ± 9.03 and diabetes diagnosed from 3.45 ± 2.43 years. All patients were patients with type 2 DM. Knowledge of patients in the test group increased with an average pre-test value of 59.92% to 86.77% after post-test. The value of self-care activity in the test group during the pre-test was 13.008 to 21.923. The decreased in HbA1c level was 9.168% to 8.208%. All changed that occur are significant. Diabetes Education services can increase knowledge and self-care activities in DM patients, and significantly reduce HbA1c levels.

Full article

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Effectiveness of Diabetes Education in Increasing Knowledge, Self-Care Activity and HBa1c in Diabetes Mellitus Outpatients

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Keywords:
diabetes education, knowledge, self-care activities, self-care activities

ABSTRACT

Increased knowledge and ability of patients to understand and implement self-care, will determine the success of diabetes control. Diabetes patients often have less knowledge about their disease and self-care activities, which results in low ability in self-management. Diabetes Education is a program aimed at diabetes patients which aimed increasing their knowledge and ability to effectively manage their diabetes, as well as to change the patient's behavior. This study aimed knowing effectiveness of Diabetes Education program in increasing knowledge and self-care activities, and reducing HbA1c levels. This research was a quantitative research conducted in the community, at Century Pakuwon Darmo Pharmacy with purposive sampling. Data was collected using the questionnaire instrument The Summary of Diabetes Self-Care Activities (SDSCA) and Diabetes Knowledge Test (DKT). The number of patients who met the inclusion criteria were 26 people, divided into test and control groups randomly. The mean age of the patients was 52.04 ± 9.03 and diabetes diagnosed from 3.45 ± 2.43 years. All patients were patients with type 2 DM. Knowledge of patients in the test group increased with an average pre-test value of 59.92% to 86.77% after post-test. The value of self-care activity in the test group during the pre-test was 13.008 to 21.923. The decreased in HbA1c level was 9.168% to 8.208%. All changed that occur are significant. Diabetes Education services can increase knowledge and self-care activities in DM patients, and significantly reduce HbA1c levels.

1. INTRODUCTION

Diabetes Mellitus (DM) is a serious, long-term condition with a major impact on the lives and well-being of individuals, families, and societies worldwide. It is among the top 10 causes of death in adults, and was estimated to have caused four million deaths globally in 2017. Just under half a billion people are living with diabetes worldwide and the number is projected to increase by 25% in 2030 and 51% in 2045 [1]. With more than 10 million people living with diabetes, Indonesia has a prevalence rate of 6.2% and diabetes is

one major cause of death. Indonesia was rated as one of the top ten countries globally with a high number of individuals living with diabetes in 2013 [2]. The link between diabetes and lifestyle has long been believed, and this theory has been reinforced by the results of a study from the United States that analyzed the relationship between lifestyle and lifestyle. living with diabetes incidence. Lifestyle factors analyzed were physical activity, diet, smoking and alcohol consumption, and body weight. And the results of the study concluded that the group that had physical activity and an ideal diet, and did not drink alcohol or smoke, had lower risk of developing diabetes [3- 6]. Proper diagnosis, selection and correct administration of drugs from health workers are not enough to guarantee the success of a therapy [7]. Patient compliance in taking the medicine, sufficient information from health workers regarding the patient's illness and the necessary interventions, as well as education related to lifestyle changes, are also needed to support the success of therapy [8]. Behavior and lifestyle changes are the keys to the success of DM management, and to achieve a change in lifestyle/behavior, knowledge related to disease, treatment, prevention of complications or changes in lifestyle is required [6], [9]. Increased knowledge and ability of patients to understand and implement self-care, will determine the success of diabetes control [10], [11]. However, DM sufferers often have less knowledge about their disease and self-care activities, which results in low ability in self-management [12].

Education programs for diabetic patients prioritize the achievement of independence and confidence/confidence in patients, so that they can carry out a self-care activity to achieve the expected therapeutic goals. regularly, and foot care and avoid smoking [13]. Based on a study related to increasing knowledge of a diabetes education program, it was concluded that diabetes education significantly increased patient knowledge [14]. With increased knowledge of diabetes patients regarding disease, treatment, prevention of complications, or lifestyle changes, it is expected that patient compliance with therapy will also increase. more increasing. And in the end the diabetes education program aims to support the success of therapy, and the prevention of long-term diabetes complications [13].

Currently, education programs for people with DM are still being implemented at the hospital and clinic level. Several hospitals already have this educational facility. Meanwhile, education services in the community are still very rare. Pharmacists as care givers are also expected to be able to provide pharmaceutical services that are home visits, especially for the elderly group and patients with chronic disease treatment [15]. Pharmacists are one of the health professions that can be involved in providing education. In the research conducted, it is known that providing education by pharmacists can reduce the HbA1c value of DM patients [16], in addition to other studies it is known that intervention by pharmacists can improve the quality of life of DM patients [17]. In Indonesia, this pharmaceutical service has received support from the government through the Decree of the Minister of Health Number 1027 of 2004 [18], which states that pharmaceutical services have shifted their orientation from drugs to patients who refer to pharmaceutical care [19]. Pharmacy service activities which initially only focused on managing drugs as a commodity, have become a comprehensive service to improve the quality of life of patients. As a consequence of the change in orientation, pharmacists are required to improve their knowledge, skills, and behavior to be able to carry out direct interactions with patients [20], [21]. The focus of this study was to know effectiveness diabetes education is in increasing knowledge related to diabetes, self-care activities and glycemic control in patients with diabetes mellitus. This study aimed to determine the effectiveness of the diabetes education program in increasing knowledge and self-care activities, as well as reducing HbA1C levels in patients with diabetes mellitus.

2. METHODS

2.1 Research Design

This research was an experimental study using a Randomized Controlled Trial (RCT) design. The location of this research was the Century Pakuwon Darmo Pharmacy as a place to get data on research subjects and the research subject's residence to conduct assessments and interventions. The sample was divided into two groups randomly, namely the test group and the control group. This research will be divided into two stages, the first stage will be started by using quantitative methods using two kinds of questionnaires, namely Summary of Diabetes Self-Care Activities (SDCSA) questionnaire to assess the activity level of diabetic patients in carrying out self-care and the Diabetes Questionnaire. Diabetes Knowledge Test (DKT) to measure the level of patient knowledge related to self-care practices. The second stage (intervention) was providing education to patients with diabetes mellitus who are included in the test group.

This education aimed to increase patients' understanding of diabetes and self-care activities. Questionnaires will be given to the test group at the first visit (pre-test), then the test group will receive an educational program for two weeks (4x visits). Six weeks (1.5 months) after the education program was completed, the test group filled out the questionnaire again (post test). As for the control group, the questionnaire was given at the first visit and will be given again eight weeks (2 months) later. Regular telephone communication was carried out by researchers to both groups. In the control and test groups, HbA1C was measured twice, namely at the beginning of the meeting and two months later. The outcome that will be measured from this study was an increase in knowledge related to diabetes, an increase in self-care activities, and an increase in glycemic control as measured by the HbA1C value.

2.2 Diabetes Education Service

1. Conducted for two intensive weeks with a schedule of home visits patients twice a week.
2. Diabetes Education activities were:

a) Establishing relationships with patients: introductions, explanations of the educational process for the next two weeks, and listening to problems faced by patients and finding solutions.

b) Provide health education programs for patients in diabetes management, using guidelines to increase knowledge about diabetes and self-care activities; behavioral intervention and patient skills in dealing with diabetes by increasing the patient's healthy behavior through monitoring blood sugar levels independently, planning meals (diet), suggesting physical exercise and adequate rest, foot care, avoiding smoking and consuming antidiabetic drugs correctly.

c) Train and test patients to use blood sugar measuring devices, as well as interpret the results of each measurement.

2.3 Research Instruments

The instruments used in this study consisted of two kinds, namely questionnaires as a tool to collect data, and educational modules as a tool for educational programs. The questionnaires used were The Summary of Diabetes Self-Care Activities (SDSCA) and Diabetes Knowledge Test (DKT). The Summary of Diabetes Self-Care Activities (SDSCA) was questionnaire used to measure the intensity of patients' self-care activities in seven days. The self-care activities that were measured included: diet, exercise, blood sugar measurement, foot care and smoking which were assessed based on the difference in scores before and after education. Meanwhile, Diabetes Knowledge Test (DKT) was an instrument to measure the patient's level of knowledge. This questionnaire was from the Michigan Diabetes and Research Training Center which consists of 23 questions related to general patient knowledge regarding diet, monitoring blood sugar levels, foot care, disease complications, proper use of insulin, insulin side effects, and factors that can cause diabetes. affect blood sugar levels.

The validity of the questionnaire was tested by discussing the contents of the questionnaire with a research consultant (judgments expert). After that, the questionnaire was tested on 20 patients who met the study criteria, while discussing whether there were statements or terms that were not understood. The questionnaire was then tested statistically using reability analysis by assessing the Corrected Item-Total Correlation of each question item.

2.4 Population and Sample

The population in this study were all diabetic patients whose data were recorded in the Master Member Card for chronic diseases at the Century Pakuwon Darmo Pharmacy, during the period January 2010-June 2010. The sample was part of the population, who met criteria: (1) Adult type 2 diabetes mellitus patients (>18 years) with HbA1c value in the last 3 months 7% or fasting sugar level >130 mg/dL which indicates that therapy management goals have not been achieved; (2) The patient had no cardiovascular complications and other severe complications such as renal failure, gestational diabetes; and (3) Patients did not experience any change in therapy during the study period. For simple experimental research, which uses a test group and a control group, the number of sample members is between 10-20 each.

In this study, a non-probability sampling technique was used, namely purposive sampling because the sample taken was based on certain considerations, namely from Master Member Card data. The data taken included names, ages, addresses and telephone numbers of diabetic patients. The patient was then interviewed by telephone regarding the last HbA1C value and activity in the past week. Patients who meet the criteria, were asked to be willing to be the subject of research on Diabetes Education services. Subjects were then divided into two groups, namely the test group and the control group at random.

2.5 Data Collection Techniques and Data Analysis Techniques

Data collection was done by using primary sources through questionnaires. Questionnaire was a data collection technique that was done by giving a set of questions, or a written statement to the subject to be answered. Questionnaires were administered before and after the intervention. Data analysis used paired t-test by comparing the mean price between before and after treatment/intervention, and independent t-test to assess the effect of the intervention on the variables measured by looking at the significance of the change value (delta). Quantitative research, using measurements of the level of knowledge, self-care activities, and HbA1c values of patients before and after the intervention were compared with the control group. To find out before and after the intervention, paired t-test statistics were used. The test statistic used to see the effect of the given intervention using an independent t-test.

3. RESULTS

The number of samples in this study were 26 people, who were diabetic patients whose data were recorded in the master member card for chronic diseases at the Century Pharmacy, during the period January 2010-June 2010 who met the research criteria. The sample was then divided into the test and control groups randomly.

3.1 Characteristics of Research Patients

The number of patients with diabetes mellitus who met the research criteria, based on age and gender groupings can be seen in Table 1.

Table 1: Characteristics of Respondens

Characteristics of Respondens	Frequency (n: 26)	Percentage (%)	Average

Gender	**Male**	10	38.46	
	Female	16	61.54	
Age (years)	**20-44**	7	26.92	52.04-9.03
	45-64	16	65.39	(43.01-61.07)
	≥65	2	7.69	
Length of diabetes (years)	**<1**	7	26.92	3.45-2.43
	1-3	9	34.62	(1.02-5.90)
	>3	10	38.46	

3.2 Knowledge Level

Table 2 described the classification of patients based on their level of knowledge before diabetes education in the test and control groups. In this study, it is necessary to test for normality to determine whether a variable was normal or not. The data was considered to be representative of the population. Normality test with Kolmogorov-Smirnov showed Pvalue=0.988 with probability (sig.) 0.283. Because the probability was >0.05, it can be concluded that the data was normally distributed. Based on the results of the independent t-test statistical test, with Pvalue=0.000 (<0.05), this indicated that diabetes education services provide significant increase in knowledge level of diabetic patients. There was a significant increase in knowledge level after treatment, while in the control group there was no significant increase in the level of knowledge after treatment.

Table 2: Changes in the Knowledge Level of Before and After Intervention

Score (%)	Before Intervention				After Intervention			
	Test Group		Control Group		Test Group		Control Group	
	Frequency (n:13)	Perentage (%)	Frequency (n:13)	Perentage (%)	Frequency (n:13)	Perentage (%)	Frequency (n:13)	Perentage (%)
≤59	6	23.08	3	11.54	0	0	4	15.38
60-74	4	15.38	8	30.77	1	3.85	6	23.08
>75	3	11.	2	7.69	12	46.15	3	11.54

3.3 Self-Care Activity Level

Table 3 described the classification of patients based on the respondents' self-care activity levels from before diabetes education in the test and control groups. Normality test with Kolmogorov-Smirnov showed Pvalue=0.566 with probability (sig.) 0.906. Because the probability was >0.05, it can be concluded that the data was normally distributed. Based on the results of the independent t-test statistical test, with Pvalue=0.000 (<0.05), this indicated that diabetes education services provide significant increase in self-care activity of diabetic patients. There was a significant increase in self-care activity after treatment, while in the control group there was no significant increase in self-care activity after treatment.

Table 3: Changes in the Knowledge Level of Before and After Intervention

Self-Care Activity Level	Before Intervention				After Intervention			
	Test Group		Control Group		Test Group		Control Group	
	Frequency (n:13)	Perentage (%)	Frequency (n:13)	Perentage (%)	Frequency (n:13)	Perentage (%)	Frequency (n:13)	Perentage (%)
0-10	5	19.23	5	19.23	0	0	3	11.54
11-25	7	26.92	8	30.77	10	38.46	10	38.46
26-35	1	3.85	0	0	3	11.54	0	0

3.4 HbA1c Level

HbA1c levels vary between individuals. Broadly speaking, they are grouped into 3, namely: bad (>8%), moderate 96.5-8%), and good (<6.5%). None of the respondents had good HbA1c levels, and most were poor (Table 4). Normality test with Kolmogorov-Smirnov showed Pvalue=1.087 with probability (sig.)

0.188. Because the probability was >0.05, it can be concluded that the data was normally distributed. Based on the results of the independent t-test statistical test, with Pvalue=0.000 (<0.05), this indicated that diabetes education services provide significant improve in HbA1c levels of diabetic patients. There was a significant decrease in HbA1c levels after treatment, while in the control group there was no significant decrease in HbA1c levels after treatment.

Table 4: Changes in the HbA1c Level of Before and After Intervention

HbA1c		Before Intervention				After Intervention			
		Test Group		Control Group		Test Group		Control Group	
Classification	(%)	Frequency (n:13)	Perentage (%)	Frequency (n:13)	Perentage (%)	Frequency (n:13)	Perentage (%)	Frequency (n:13)	Perentage (%)
Bad	>8	8	30.77	11	42.31	6	23.08	10	38.46
Moderate	6.5-8	5	19.23	2	7.69	7	26.92	3	11.54
Good	<6.5	0	0	0	0	0	0	0	0

4. DISCUSSION

The research subjects consisted of 38.46% men and 61.54% women. The mean age of the subjects was 52.04±9.03 (43–61 years). The mean of being diagnosed with diabetes since 3.45±2.43 (1.02–5.90 years). Based on the etiology, 100% of the subjects were patients with Diabetes Mellitus (DM) type 2. Diabetes Education was a program aimed at diabetic patients which aims to increase their knowledge and ability to effectively manage their diabetes, as well as to change the patient's behavior (behavior change). Diabetes education allows patients to participate more actively in the care and prevention of complications. Diabetic patients need opportunities to acquire knowledge and skills that enable and empower them to perform self-care effectively [13], [22], [23]. In managing diabetes with this educational service, researchers improve the patient's ability to self-care by providing health education for individuals in managing diabetes. This educational service uses guidelines, counseling, and behavioral interventions to increase knowledge about diabetes, and improve individual skills in managing diabetes, thereby influencing the improvement of healthy behavior in diabetic patients [2], [22], [24], [25]. These healthy behaviors consist of independent monitoring of blood sugar levels, meal planning (diet), regular exercise, foot care, regular drug consumption, and avoiding smoking. Outcome was measured by the presence or absence of an increase in the level of knowledge and self-care activities, as well as a significant decrease in HbA1c levels [26], [27].

The study was conducted for two intensive months with a frequency of visits twice a week for two weeks. Each meeting is approximately 60-90 minutes. After providing the intervention in the form of educational services, it turned out that there were significant changes in knowledge, self-care activities, and HbA1c values in the test group. This showed that diabetes education can have a positive influence on people with diabetes. The level of knowledge was measured using the Diabetes Knowledge Test questionnaire which contains a number of questions related to diabetes and self-care activities. The average score in the test group experienced a significant increase, from the initial value of 59.92% to 86.77%. The significance of the increase in the level of knowledge has been tested and shows significant results, which means that diabetes education services provide a significant increase in the level of knowledge of diabetic patients. While in the control group, there was no significant increase in the level of knowledge after treatment. An increase in the average self-care activity also occurred in the test group and diabetes education provided a significant increase in self-care activities for diabetic patients. Self-care activities that were measured include a healthy diet, exercise, self-measurement of sugar, foot care, and drug therapy. Although there was a significant increase in overall activity, but if observed individually, there were patients who did not experience an improvement in eating patterns [13], [28]. Evidenced by the absence of an increase in healthy eating patterns. This can happen because of the many factors that influence a person's behavior. In addition,

some patients do not adhere to therapy, and non-adherence in taking these drugs can be a major cause of therapy failure [29]. And this was seen in some patients before receiving intervention. Diabetes education provides understanding to patients about the importance of controlling blood sugar levels, as well as discipline in taking drugs so that complications do not occur. However, the lifestyle changes required of diabetic patients require adequate self- management, as well as social-environmental factors, including health care and community support, which are actually very important [11], [12], [22], [30]. The social support in diabetic patients plays a very important role. Based on research, support from the media is the most influential thing, followed by support from a team of health workers, personal support, family and relatives, and the community. Therefore, it would be better if in an educational service, many parties were involved in it [13], [31].

In this study, the average age of the patients was 52 years, where at that age many obstacles were faced in carrying out self-care activities [32]. Statements from some patients who said that it was very difficult to implement a healthy diet every day because they only eat what is provided. It was the family or nurse who provides food for the patient, and therefore the people closest to the patient must understand the importance of a healthy diet for the patient. Families may be better off if they were included in the educational process [33- 35]. Apart from eating patterns, other obstacles they face were related to sports. Elderly patients will find it difficult to increased sports activities due to their limitations in movement, for example due to osteoarthritis [36], [37]. Limited vision, tremors in the hands, stroke or other physical limitations also affect patients in controlling blood sugar levels independently at home [38]. Some patients had to rely on someone else to measure blood sugar levels at home.

HbA1c value was strongly influenced by patient compliance in carrying out self-care activities. Before treatment, the HbA1c value of 30.77% of patients was in the bad category and 19.23% of the patients were in the moderate category. After the intervention, particularly related to diet, exercise and adherence to medication, there was an increase, namely 23.08% of patients in the poor category and 26.92% of patients in the moderate category. The decreased in HbA1c indicates success in regulating blood sugar which is actually inseparable from the effect of self-care activities. It turned out that the increase in self-care activity that occurred in the test group caused a significant decrease in the average HbA1c level [39]. The educational process provides encouragement to patients to always carry out a healthy lifestyle and interpret the importance of self-care activities, and this is very much needed by patients to be able to run it [40], [41]. So it can be concluded that patients will want to live a healthy lifestyle if they know and have the desire to run it. The pre- test measurement for the HbA1c level was 9.168% to 8.208% during the post test. However, the correlation between increased knowledge, self-care activities and decreased HbA1c levels should be investigated further. In conducting Diabetes Education, there were obstacles felt by researchers, one of which is the subjectivity factor of research subjects in measuring using questionnaires. However, this can be overcome by measuring clinical outcomes such as HbA1c. In addition, constraints in time management complicate the research. Elderly patients require longer time in the educational process, and require repetition of material. In research on the management of a chronic disease with pharmaceutical intervention in the form of pharmaceutical care, namely the Diabetes Education service, it will provide maximum results if it is carried out for more than 2 months, especially to see effectiveness of educational services on HbA1c levels. Although there had been decrease, the post-test HbA1c value still has an average value of 8.208%. The magnitude of the decrease in HbA1c after the post-test had an average value of 0.992. In the future, research can be carried out to explore things that affect/impede patients in carrying out self-care activities. In addition, the family should be involved in the educational process, because the role of the people around the patient also affects the patient's compliance in carrying out self-care activities.

5. CONCLUSION

Diabetes Education services had good influence on the level of knowledge of diabetic patients. This is indicated by the increasing level of patient knowledge significantly after the intervention. Diabetes Education services can also increase self-care activities that included a healthy diet, regular exercise, self-measurement of blood sugar, foot care and adherence to therapy. In addition, the Diabetes Education service has a positive effect on the patient's HbA1c level, namely a decrease in the HbA1c value which indicates that the patient's glycemic control is getting better.

6. CONFLICT OF INTEREST

The authors have no conflicts of interest regarding this investigation.

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Effectiveness of Diabetes Education in Increasing Knowledge, Self-Care Activity and HBa1c in Diabetes Mellitus Outpatients

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Effectiveness of Diabetes Education in Increasing Knowledge, Self-Care Activity and HBa1c in Diabetes Mellitus Outpatients

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ABSTRACT

Increased knowledge and ability of patients to understand and implement self-care, will determine the success of diabetes control. Diabetes patients often have less knowledge about their disease and self-care activities, which results in low ability in self-management. Diabetes Education is a program aimed at diabetes patients which aimed increasing their knowledge and ability to effectively manage their diabetes, as well as to change the patient's behavior. This study aimed knowing effectiveness of Diabetes Education program in increasing knowledge and self-care activities, and reducing HbA1c levels. This research was a quantitative research conducted in the community, at Century Pakuwon Darmo Pharmacy with purposive sampling. Data was collected using the questionnaire instrument The Summary of Diabetes Self-Care Activities (SDSCA) and Diabetes Knowledge Test (DKT). The number of patients who met the inclusion criteria were 26 people, divided into test and control groups randomly. The mean age of the patients was 52.04 ± 9.03 and diabetes diagnosed from 3.45 ± 2.43 years. All patients were patients with type 2 DM. Knowledge of patients in the test group increased with an average pre-test value of 59.92% to 86.77% after post-test. The value of self-care activity in the test group during the pre-test was 13.008 to 21.923. The decreased in HbA1c level was 9.168% to 8.208%. All changed that occur are significant. Diabetes Education services can increase knowledge and self-care activities in DM patients, and significantly reduce HbA1c levels.

1. INTRODUCTION

Diabetes Mellitus (DM) is a serious, long-term condition with a major impact on the lives and well-being of individuals, families, and societies worldwide. It is among the top 10 causes of death in adults, and was estimated to have caused four million deaths globally in 2017. Just under half a billion people are living with diabetes worldwide and the number is projected to increase by 25% in 2030 and 51% in 2045 [1]. With more than 10 million people living with diabetes, Indonesia has a prevalence rate of 6.2% and diabetes is

one major cause of death. Indonesia was rated as one of the top ten countries globally with a high number of individuals living with diabetes in 2013 [2]. The link between diabetes and lifestyle has long been believed, and this theory has been reinforced by the results of a study from the United States that analyzed the relationship between lifestyle and lifestyle. living with diabetes incidence. Lifestyle factors analyzed were physical activity, diet, smoking and alcohol consumption, and body weight. And the results of the study concluded that the group that had physical activity and an ideal diet, and did not drink alcohol or smoke, had lower risk of developing diabetes [3- 6]. Proper diagnosis, selection and correct administration of drugs from health workers are not enough to guarantee the success of a therapy [7]. Patient compliance in taking the medicine, sufficient information from health workers regarding the patient's illness and the necessary interventions, as well as education related to lifestyle changes, are also needed to support the success of therapy [8]. Behavior and lifestyle changes are the keys to the success of DM management, and to achieve a change in lifestyle/behavior, knowledge related to disease, treatment, prevention of complications or changes in lifestyle is required [6], [9]. Increased knowledge and ability of patients to understand and implement self-care, will determine the success of diabetes control [10], [11]. However, DM sufferers often have less knowledge about their disease and self-care activities, which results in low ability in self-management [12].

Education programs for diabetic patients prioritize the achievement of independence and confidence/confidence in patients, so that they can carry out a self-care activity to achieve the expected therapeutic goals. regularly, and foot care and avoid smoking [13]. Based on a study related to increasing knowledge of a diabetes education program, it was concluded that diabetes education significantly increased patient knowledge [14]. With increased knowledge of diabetes patients regarding disease, treatment, prevention of complications, or lifestyle changes, it is expected that patient compliance with therapy will also increase. more increasing. And in the end the diabetes education program aims to support the success of therapy, and the prevention of long-term diabetes complications [13].

Currently, education programs for people with DM are still being implemented at the hospital and clinic level. Several hospitals already have this educational facility. Meanwhile, education services in the community are still very rare. Pharmacists as care givers are also expected to be able to provide pharmaceutical services that are home visits, especially for the elderly group and patients with chronic disease treatment [15]. Pharmacists are one of the health professions that can be involved in providing education. In the research conducted, it is known that providing education by pharmacists can reduce the HbA1c value of DM patients [16], in addition to other studies it is known that intervention by pharmacists can improve the quality of life of DM patients [17]. In Indonesia, this pharmaceutical service has received support from the government through the Decree of the Minister of Health Number 1027 of 2004 [18], which states that pharmaceutical services have shifted their orientation from drugs to patients who refer to pharmaceutical care [19]. Pharmacy service activities which initially only focused on managing drugs as a commodity, have become a comprehensive service to improve the quality of life of patients. As a consequence of the change in orientation, pharmacists are required to improve their knowledge, skills, and behavior to be able to carry out direct interactions with patients [20], [21]. The focus of this study was to know effectiveness diabetes education is in increasing knowledge related to diabetes, self-care activities and glycemic control in patients with diabetes mellitus. This study aimed to determine the effectiveness of the diabetes education program in increasing knowledge and self-care activities, as well as reducing HbA1C levels in patients with diabetes mellitus.

2. METHODS

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2.1 Research Design

This research was an experimental study using a Randomized Controlled Trial (RCT) design. The location of this research was the Century Pakuwon Darmo Pharmacy as a place to get data on research subjects and the research subject's residence to conduct assessments and interventions. The sample was divided into two groups randomly, namely the test group and the control group. This research will be divided into two stages, the first stage will be started by using quantitative methods using two kinds of questionnaires, namely Summary of Diabetes Self-Care Activities (SDCSA) questionnaire to assess the activity level of diabetic patients in carrying out self-care and the Diabetes Questionnaire. Diabetes Knowledge Test (DKT) to measure the level of patient knowledge related to self-care practices. The second stage (intervention) was providing education to patients with diabetes mellitus who are included in the test group.

This education aimed to increase patients' understanding of diabetes and self-care activities. Questionnaires will be given to the test group at the first visit (pre-test), then the test group will receive an educational program for two weeks (4x visits). Six weeks (1.5 months) after the education program was completed, the test group filled out the questionnaire again (post test). As for the control group, the questionnaire was given at the first visit and will be given again eight weeks (2 months) later. Regular telephone communication was carried out by researchers to both groups. In the control and test groups, HbA1C was measured twice, namely at the beginning of the meeting and two months later. The outcome that will be measured from this study was an increase in knowledge related to diabetes, an increase in self-care activities, and an increase in glycemic control as measured by the HbA1C value.

2.2 Diabetes Education Service

1. Conducted for two intensive weeks with a schedule of home visits patients twice a week.
2. Diabetes Education activities were:

a) Establishing relationships with patients: introductions, explanations of the educational process for the next two weeks, and listening to problems faced by patients and finding solutions.

b) Provide health education programs for patients in diabetes management, using guidelines to increase knowledge about diabetes and self-care activities; behavioral intervention and patient skills in dealing with diabetes by increasing the patient's healthy behavior through monitoring blood sugar levels independently, planning meals (diet), suggesting physical exercise and adequate rest, foot care, avoiding smoking and consuming antidiabetic drugs correctly.

c) Train and test patients to use blood sugar measuring devices, as well as interpret the results of each measurement.

2.3 Research Instruments

The instruments used in this study consisted of two kinds, namely questionnaires as a tool to collect data, and educational modules as a tool for educational programs. The questionnaires used were The Summary of Diabetes Self-Care Activities (SDSCA) and Diabetes Knowledge Test (DKT). The Summary of Diabetes Self-Care Activities (SDSCA) was questionnaire used to measure the intensity of patients' self-care activities in seven days. The self-care activities that were measured included: diet, exercise, blood sugar measurement, foot care and smoking which were assessed based on the difference in scores before and after education. Meanwhile, Diabetes Knowledge Test (DKT) was an instrument to measure the patient's level of knowledge. This questionnaire was from the Michigan Diabetes and Research Training Center which consists of 23 questions related to general patient knowledge regarding diet, monitoring blood sugar levels, foot care, disease complications, proper use of insulin, insulin side effects, and factors that can cause diabetes. affect blood sugar levels.

The validity of the questionnaire was tested by discussing the contents of the questionnaire with a research consultant (judgments expert). After that, the questionnaire was tested on 20 patients who met the study criteria, while discussing whether there were statements or terms that were not understood. The questionnaire was then tested statistically using reability analysis by assessing the Corrected Item-Total Correlation of each question item.

2.4 Population and Sample

The population in this study were all diabetic patients whose data were recorded in the Master Member Card for chronic diseases at the Century Pakuwon Darmo Pharmacy, during the period January 2010-June 2010. The sample was part of the population, who met criteria: (1) Adult type 2 diabetes mellitus patients (>18 years) with HbA1c value in the last 3 months 7% or fasting sugar level >130 mg/dL which indicates that therapy management goals have not been achieved; (2) The patient had no cardiovascular complications and other severe complications such as renal failure, gestational diabetes; and (3) Patients did not experience any change in therapy during the study period. For simple experimental research, which uses a test group and a control group, the number of sample members is between 10-20 each.

In this study, a non-probability sampling technique was used, namely purposive sampling because the sample taken was based on certain considerations, namely from Master Member Card data. The data taken included names, ages, addresses and telephone numbers of diabetic patients. The patient was then interviewed by telephone regarding the last HbA1C value and activity in the past week. Patients who meet the criteria, were asked to be willing to be the subject of research on Diabetes Education services. Subjects were then divided into two groups, namely the test group and the control group at random.

2.5 Data Collection Techniques and Data Analysis Techniques

Data collection was done by using primary sources through questionnaires. Questionnaire was a data collection technique that was done by giving a set of questions, or a written statement to the subject to be answered. Questionnaires were administered before and after the intervention. Data analysis used paired t-test by comparing the mean price between before and after treatment/intervention, and independent t-test to assess the effect of the intervention on the variables measured by looking at the significance of the change value (delta). Quantitative research, using measurements of the level of knowledge, self-care activities, and HbA1c values of patients before and after the intervention were compared with the control group. To find out before and after the intervention, paired t-test statistics were used. The test statistic used to see the effect of the given intervention using an independent t-test.

3. RESULTS

The number of samples in this study were 26 people, who were diabetic patients whose data were recorded in the master member card for chronic diseases at the Century Pharmacy, during the period January 2010-June 2010 who met the research criteria. The sample was then divided into the test and control groups randomly.

3.1 Characteristics of Research Patients

The number of patients with diabetes mellitus who met the research criteria, based on age and gender groupings can be seen in Table 1.

Table 1: Characteristics of Respondens

Characteristics of Respondens	Frequency (n: 26)	Percentage (%)	Average

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Gender	**Male**	10	38.46	
	Female	16	61.54	
Age (years)	**20-44**	7	26.92	52.04-9.03
	45-64	16	65.39	(43.01-61.07)
	≥65	2	7.69	
Length of diabetes (years)	**<1**	7	26.92	3.45-2.43
	1-3	9	34.62	(1.02-5.90)
	>3	10	38.46	

3.2 Knowledge Level

Table 2 described the classification of patients based on their level of knowledge before diabetes education in the test and control groups. In this study, it is necessary to test for normality to determine whether a variable was normal or not. The data was considered to be representative of the population. Normality test with Kolmogorov-Smirnov showed Pvalue=0.988 with probability (sig.) 0.283. Because the probability was >0.05, it can be concluded that the data was normally distributed. Based on the results of the independent t-test statistical test, with Pvalue=0.000 (<0.05), this indicated that diabetes education services provide significant increase in knowledge level of diabetic patients. There was a significant increase in knowledge level after treatment, while in the control group there was no significant increase in the level of knowledge after treatment.

Table 2: Changes in the Knowledge Level of Before and After Intervention

Score (%)	Before Intervention				After Intervention			
	Test Group		Control Group		Test Group		Control Group	
	Frequency (n:13)	Perentage (%)	Frequency (n:13)	Perentage (%)	Frequency (n:13)	Perentage (%)	Frequency (n:13)	Perentage (%)
≤59	6	23.08	3	11.54	0	0	4	15.38
60-74	4	15.38	8	30.77	1	3.85	6	23.08
>75	3	11.	2	7.69	12	46.15	3	11.54

3.3 Self-Care Activity Level

Table 3 described the classification of patients based on the respondents' self-care activity levels from before diabetes education in the test and control groups. Normality test with Kolmogorov-Smirnov showed Pvalue=0.566 with probability (sig.) 0.906. Because the probability was >0.05, it can be concluded that the data was normally distributed. Based on the results of the independent t-test statistical test, with Pvalue=0.000 (<0.05), this indicated that diabetes education services provide significant increase in self-care activity of diabetic patients. There was a significant increase in self-care activity after treatment, while in the control group there was no significant increase in self-care activity after treatment.

Table 3: Changes in the Knowledge Level of Before and After Intervention

Self-Care Activity Level	Before Intervention				After Intervention			
	Test Group		Control Group		Test Group		Control Group	
	Frequency (n:13)	Perentage (%)	Frequency (n:13)	Perentage (%)	Frequency (n:13)	Perentage (%)	Frequency (n:13)	Perentage (%)
0-10	5	19.23	5	19.23	0	0	3	11.54
11-25	7	26.92	8	30.77	10	38.46	10	38.46
26-35	1	3.85	0	0	3	11.54	0	0

3.4 HbA1c Level

HbA1c levels vary between individuals. Broadly speaking, they are grouped into 3, namely: bad (>8%), moderate 96.5-8%), and good (<6.5%). None of the respondents had good HbA1c levels, and most were poor (Table 4). Normality test with Kolmogorov-Smirnov showed Pvalue=1.087 with probability (sig.)

0.188. Because the probability was >0.05, it can be concluded that the data was normally distributed. Based on the results of the independent t-test statistical test, with Pvalue=0.000 (<0.05), this indicated that diabetes education services provide significant improve in HbA1c levels of diabetic patients. There was a significant decrease in HbA1c levels after treatment, while in the control group there was no significant decrease in HbA1c levels after treatment.

Table 4: Changes in the HbA1c Level of Before and After Intervention

HbA1c		Before Intervention				After Intervention			
		Test Group		Control Group		Test Group		Control Group	
Classification	(%)	Frequency (n:13)	Perentage (%)	Frequency (n:13)	Perentage (%)	Frequency (n:13)	Perentage (%)	Frequency (n:13)	Perentage (%)
Bad	>8	8	30.77	11	42.31	6	23.08	10	38.46
Moderate	6.5-8	5	19.23	2	7.69	7	26.92	3	11.54
Good	<6.5	0	0	0	0	0	0	0	0

4. DISCUSSION

The research subjects consisted of 38.46% men and 61.54% women. The mean age of the subjects was 52.04±9.03 (43–61 years). The mean of being diagnosed with diabetes since 3.45±2.43 (1.02–5.90 years). Based on the etiology, 100% of the subjects were patients with Diabetes Mellitus (DM) type 2. Diabetes Education was a program aimed at diabetic patients which aims to increase their knowledge and ability to effectively manage their diabetes, as well as to change the patient's behavior (behavior change). Diabetes education allows patients to participate more actively in the care and prevention of complications. Diabetic patients need opportunities to acquire knowledge and skills that enable and empower them to perform self-care effectively [13], [22], [23]. In managing diabetes with this educational service, researchers improve the patient's ability to self-care by providing health education for individuals in managing diabetes. This educational service uses guidelines, counseling, and behavioral interventions to increase knowledge about diabetes, and improve individual skills in managing diabetes, thereby influencing the improvement of healthy behavior in diabetic patients [2], [22], [24], [25]. These healthy behaviors consist of independent monitoring of blood sugar levels, meal planning (diet), regular exercise, foot care, regular drug consumption, and avoiding smoking. Outcome was measured by the presence or absence of an increase in the level of knowledge and self-care activities, as well as a significant decrease in HbA1c levels [26], [27].

The study was conducted for two intensive months with a frequency of visits twice a week for two weeks. Each meeting is approximately 60-90 minutes. After providing the intervention in the form of educational services, it turned out that there were significant changes in knowledge, self-care activities, and HbA1c values in the test group. This showed that diabetes education can have a positive influence on people with diabetes. The level of knowledge was measured using the Diabetes Knowledge Test questionnaire which contains a number of questions related to diabetes and self-care activities. The average score in the test group experienced a significant increase, from the initial value of 59.92% to 86.77%. The significance of the increase in the level of knowledge has been tested and shows significant results, which means that diabetes education services provide a significant increase in the level of knowledge of diabetic patients. While in the control group, there was no significant increase in the level of knowledge after treatment. An increase in the average self-care activity also occurred in the test group and diabetes education provided a significant increase in self-care activities for diabetic patients. Self-care activities that were measured include a healthy diet, exercise, self-measurement of sugar, foot care, and drug therapy. Although there was a significant increase in overall activity, but if observed individually, there were patients who did not experience an improvement in eating patterns [13], [28]. Evidenced by the absence of an increase in healthy eating patterns. This can happen because of the many factors that influence a person's behavior. In addition,

some patients do not adhere to therapy, and non-adherence in taking these drugs can be a major cause of therapy failure [29]. And this was seen in some patients before receiving intervention. Diabetes education provides understanding to patients about the importance of controlling blood sugar levels, as well as discipline in taking drugs so that complications do not occur. However, the lifestyle changes required of diabetic patients require adequate self- management, as well as social-environmental factors, including health care and community support, which are actually very important [11], [12], [22], [30]. The social support in diabetic patients plays a very important role. Based on research, support from the media is the most influential thing, followed by support from a team of health workers, personal support, family and relatives, and the community. Therefore, it would be better if in an educational service, many parties were involved in it [13], [31].

In this study, the average age of the patients was 52 years, where at that age many obstacles were faced in carrying out self-care activities [32]. Statements from some patients who said that it was very difficult to implement a healthy diet every day because they only eat what is provided. It was the family or nurse who provides food for the patient, and therefore the people closest to the patient must understand the importance of a healthy diet for the patient. Families may be better off if they were included in the educational process [33- 35]. Apart from eating patterns, other obstacles they face were related to sports. Elderly patients will find it difficult to increased sports activities due to their limitations in movement, for example due to osteoarthritis [36], [37]. Limited vision, tremors in the hands, stroke or other physical limitations also affect patients in controlling blood sugar levels independently at home [38]. Some patients had to rely on someone else to measure blood sugar levels at home.

HbA1c value was strongly influenced by patient compliance in carrying out self-care activities. Before treatment, the HbA1c value of 30.77% of patients was in the bad category and 19.23% of the patients were in the moderate category. After the intervention, particularly related to diet, exercise and adherence to medication, there was an increase, namely 23.08% of patients in the poor category and 26.92% of patients in the moderate category. The decreased in HbA1c indicates success in regulating blood sugar which is actually inseparable from the effect of self-care activities. It turned out that the increase in self-care activity that occurred in the test group caused a significant decrease in the average HbA1c level [39]. The educational process provides encouragement to patients to always carry out a healthy lifestyle and interpret the importance of self-care activities, and this is very much needed by patients to be able to run it [40], [41]. So it can be concluded that patients will want to live a healthy lifestyle if they know and have the desire to run it. The pre- test measurement for the HbA1c level was 9.168% to 8.208% during the post test. However, the correlation between increased knowledge, self-care activities and decreased HbA1c levels should be investigated further. In conducting Diabetes Education, there were obstacles felt by researchers, one of which is the subjectivity factor of research subjects in measuring using questionnaires. However, this can be overcome by measuring clinical outcomes such as HbA1c. In addition, constraints in time management complicate the research. Elderly patients require longer time in the educational process, and require repetition of material. In research on the management of a chronic disease with pharmaceutical intervention in the form of pharmaceutical care, namely the Diabetes Education service, it will provide maximum results if it is carried out for more than 2 months, especially to see effectiveness of educational services on HbA1c levels. Although there had been decrease, the post-test HbA1c value still has an average value of 8.208%. The magnitude of the decrease in HbA1c after the post-test had an average value of 0.992. In the future, research can be carried out to explore things that affect/impede patients in carrying out self-care activities. In addition, the family should be involved in the educational process, because the role of the people around the patient also affects the patient's compliance in carrying out self-care activities.

5. CONCLUSION

Diabetes Education services had good influence on the level of knowledge of diabetic patients. This is indicated by the increasing level of patient knowledge significantly after the intervention. Diabetes Education services can also increase self-care activities that included a healthy diet, regular exercise, self-measurement of blood sugar, foot care and adherence to therapy. In addition, the Diabetes Education service has a positive effect on the patient's HbA1c level, namely a decrease in the HbA1c value which indicates that the patient's glycemic control is getting better.

6. CONFLICT OF INTEREST

The authors have no conflicts of interest regarding this investigation.

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