

RESEARCH ARTICLE

The effect of Self-Care on Clinical Outcome of Outpatient Diabetes Mellitus Type 2 in Regional General Hospital West Nusa Tenggara Province

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ABSTRACT:

Type 2 Diabetes Mellitus is a disease characterized by elevated blood glucose levels and cannot be cured, so it needs self-care. Diabetes self-care was an important things in the management of type 2 DM, self-care is carried out by patients with DM in their lifetime. There are several factors that effect self-care including diet, physical activity, medicinal used, blood sugar control and foot care. This study aimed to determine the influence of self-care to blood sugar levels of type 2 diabetes mellitus in Regional General Hospital West Nusa Tenggara Province. This research used analytical observation method with 34 respondents using a questionnaire. The Summary Diabetes Self-Care Activity (SDSCA) and the data was analyzed using linear regression. The research showed that dietary factors have a significant effect on fasting blood glucose level (FBG) with a significance value $p(0.012)$. In addition, there are positive correlation between the level of self-care in type 2 Diabetes Mellitus patient to HbA1C levels ($r = 0.254$, $p = 0.023$). The conclusion of this research was the level of self-care in type 2 Diabetes Mellitus patient had a positive effect on the patient's clinic outcome including FBG, blood glucose 2 hour post prandial, random blood glucose, and HbA1c.

KEYWORDS: Diabetes self-care, Type 2 diabetes, Blood sugar levels, SDSCA questionnaire.

INTRODUCTION:

Diabetes has been declared as one of the largest global health emergencies of the 21st century.¹ Statistics show that diabetes is ranked amongst the top 10 major causes of death globally approximately 80% of all premature non-communicable disease (NCD) deaths are attributable to diabetes.² Diabetes mellitus (DM) is a chronic progressive metabolic disorder characterized by hyperglycemia mainly due to absolute (Type 1 DM) or relative (Type 2 DM) deficiency of insulin hormone. DM virtually affects every system of the body mainly due to metabolic disturbances caused by hyperglycemia, especially if diabetes control over a period of time proves to be suboptimal.³

Until recently it was believed to be a disease occurring mainly in developed countries, but recent findings reveal a rise in number of new cases of type 2 DM with an earlier onset and associated complications in developing countries.⁴ Diabetes is associated with complications such as cardiovascular diseases, nephropathy, retinopathy and neuropathy, which can lead to chronic morbidities and mortality.^{5,6} Serious complications are caused when diabetes is left untreated.⁷

Diabetes, one of the four major non-communicable diseases, is defined by the World Health Organization (WHO) as a public health concern with increasing incidence and increasing numbers of patients in the past few decades. According to the global report on diabetes from the WHO, 1,500,000 individuals died from diabetes in 2012, and an additional 2,200,000 people died due to heightened risks of cardiovascular and other diseases from dysglycemia.⁸ Diabetes in Indonesia is considered a major health problem and has been a concern since the early 1980s With more than 10 million people living with diabetes, Indonesia has a prevalence

rate of 6.2%⁹ and diabetes is one major cause of death.¹⁰ Indonesia was rated as one of the top ten countries globally with a high number of individuals living with diabetes in 2013.¹¹ It is predicted that the same pattern will continue unless interventions to prevent and manage diabetes are implemented.¹²

Although the development of type 2 diabetes is mostly accounted for by inappropriate life habits, including hypertension, obesity, and hypercholesterolemia, most patients with diabetes do not undertake self-care behaviors, such as dietary changes, exercise, self-monitoring of blood glucose (SMBG), and foot care. Moreover, many patients fail to recognize the importance of continued management and the fact that active, continued self-care behaviors can aid in the prevention of diabetic complications.¹³ The diagnosis of type 2 diabetes directly or indirectly affects the patient's quality of life, and there are reports that patients found to have a negative impact on quality of life have higher HbA1c than those who do not within five years of diagnosis.¹⁴ Improvements in metabolic control have a significant effect on the Quality of Life among Adult T2D patients.¹⁵ The other factors that contribute for T2DM risks are living alone, work burn out, poor socioeconomic status, high strain and active job. Pathophysiological mechanism underlying the above observations remain unclear warranting further research in this area. Large scale studies should explore the psychological and behaviour mechanisms associated between work stress and T2DM.¹⁶

For chronic illnesses including diabetes mellitus (DM), healthcare providers continue to struggle with the forever evolving needs of their patients. Keeping the patients connected to a healthcare facility through regular follow ups is crucial in instilling a sense of self-reliance in them and also in preventing long-term complications.¹⁷ However, the management of diseases with multiorgan involvement such as DM is not limited to healthcare settings only. The holistic approach of DM management spans across dietary regulations, physical activity, medication compliance, and self-management.¹⁸ Psychosocial problems complicate medical therapy.¹⁹

According to American Diabetes Association (ADA), only one half of people with diabetes (PWD) are maintaining their glycated hemoglobin (HbA1c) at the recommended levels of <7%.²⁰ There are some demographic factors which impact the levels of HbA1c and cannot be altered such as gender, age, social, and educational status. However, there are also some modifiable psychosocial factors such as self-care activities and self-efficacy which in turn comes from disease-related education.²¹ Self-care activities are the behaviors adopted in order to enhance one's health.^{21,22}

In management of DM, role of self-care has been pivotal. It is an extremely essential component of holistic approach towards management of diabetes and can be achieved with a combination of awareness, knowledge, and internal motivation towards practices.^{23,24}

According to American Association of Diabetes Educators, self-care activities are assessed by seven major parameters including healthy diet, physical activity, regular blood sugar monitoring, medication adherence, effective approach to problem-solving, strong coping skills, and risk-reduction behaviors.^{25,26} Literature has shown these seven self-care behaviors and activities to enhance glycemic control, reduce diabetes-related complications, and contribute to enhancing overall quality of life. Exercise, blood sugar monitoring, and foot care are also recommended in all PWD as essential self-care habits to improve clinical and quality of life outcomes.^{27,28} Research that has been conducted by Bhardwaj, *et al* (2018) states that quality of life of type 2 diabetes mellitus clients significant association with gender, marital status, occupation and family history of diabetes mellitus with quality of life ($p < 0.05$).²⁹ The other research that has been conducted by Thressia, *et al* (2014) states that health education for the modification of life style is the need of the hour, and therefore sleep may be an important modifiable factor for the clinical management of patients with type 2 diabetes.³⁰

In this research, measurement of DM patient self-care using the SDSCA (The Summary Diabetes Self-Care Activity) questionnaire. Activities included in diabetes self-care include dietary regulation, physical exercise, blood sugar monitoring, medication use and foot care. Diabetes self-care has an important role in improving the quality of health and well-being of DM patients, especially in West Nusa Tenggara. So to find out self-care in patients with type 2 DM, it is necessary to conduct research on the level of self-care for patients with type 2 DM outpatients in General Hospital of West Nusa Tenggara Province. In light of the existing literature, an observational study was conducted to evaluate the impact of diabetes self-care activities on glycemic control in PWD.

MATERIALS AND METHODS:

A cross-sectional study was carried out in West Nusa Tenggara Hospital during January-April 2018 in T2DM outpatients. The inclusion criteria were T2DM patients with age 50-74 years received oral antidiabetics at least 6 months with ICD code X E.11 before self-care measurements and were willing to sign the informed consent form. Exclusion criteria are deaf patient, illiterate and pregnant patient. Subjects who met the

inclusion criteria were 34 T2DM patients. This research has been approved by the ethics committee of General Hospital of West Nusa Tenggara Province, Indonesia number 070.2/13/KEP/2020.

Self-care was measured by using The Summary Diabetes Self-Care Activity (SDSCA). Validation the questionnaire was carried out via conducting a pilot study by Jalaludin et al, 2016. The pilot study was conducted with 117 patients. The reliability was analysed using Cronbach's alpha and validity was assessed using exploratory factor analysis. The domain which includes the SDSCA were domains of general diet, exercise, blood glucose testing, medication, and foot care.³¹

Data collection was done by an interview with SDSCA and medical records or patient status which include name, age, gender, diagnosis, treatment and laboratory data. Data were analyzed descriptively to describe patients' characteristics. The chi square test was used to analyze the effect of self-care on clinical outcome of T2DM patients.

RESULTS AND DISCUSSION:

Subject characteristic:

T2DM patients who met the inclusion and exclusion criteria in this study were 34 patients. Table 1 shows list the subject characteristics.

Table 1. Subject characteristic

Characteristics	N	Percentage (%)
Gender	Men	16 47.1
	Women	18 52.9
Age	50 years	7 20.5
	>50 years	27 79.5
Long Suffering of DM	6 months	6 17.6
	≥6 months	28 82.4

Based on table 1, it shows that more people with T2DM are women with a percentage of 52.9% compared to men with a percentage of 47.1%. Women have a tendency to be obese compared to men. The amount of fat in adult men on average ranges from 15-20% of total body weight, and higher in female than in men. So that the risk factors for developing T2DM in women are 3-7 times higher than in men, that is 2-3 times.³² The more fat tissue in the body, the more resistant the body to insulin. Fat can block insulin's action so that glucose cannot be transported into cells and accumulate in blood vessels, resulting an increase in blood glucose levels.³³

Women also have a tendency to experience DM, especially after menopause. This is related to the hormones estrogen and progesterone which affect the body's cells to respond to insulin. These two hormones have an antagonistic effect on blood sugar levels,

namely the estrogen receptor on pancreatic β cells which causes the release of insulin which is the most important hormone in blood glucose homeostasis and the hormone progesterone which has anti-insulin properties and can make cells less sensitive to insulin which causes insulin resistance in the body.³⁴ Sindhu and Jaya Kumar, 2018 give evidence that educational intervention would significantly decrease the BMI in patients with type 2 diabetes mellitus and suggest the need for patient empowerment in the self-management. The study recommends training nurses in diabetes education so that they can actively be involved in educating the patients with diabetes mellitus.³⁵

Table 1 shows that the average age of respondents is over 50 years with a percentage of 79.4%, while the age of respondents under 50 is 20.5%. The results of this study are in line with Chentil, *et.al* (2015) who explained that out of 10 T2DM patients who were in diabetes care centers in the United States, the average age was between 53 years and 60 years.³⁶ This was also conveyed by Whittmore, *et al* (2005), who explained that 53 women who suffered from T2DM, their average age was 57.6 years. In contrast to some of the results of these studies, James (2003) found that the average age of T2DM patients was 54 years, which means the same as the results of studies that have been conducted.³⁷

As age increases, the prevalence of diabetes and impaired glucose tolerance increases. This occurs because the aging process that takes place after the age of 30 years results in physiological and biochemical changes in the body starting from the level of cells, tissues and organs that can affect homeostasis. One of the organs in the body that changes in function due to the aging process is the pancreatic beta cells which produce the hormone insulin.³⁷ If there is a disruption in the secretion of this hormone or inadequate use of glucose at the cellular level, it will have an impact on increasing blood glucose levels. The World Health Organization (WHO) states that after the age of 30, fasting blood glucose levels will increase by 1-2 mg/dl/year and blood sugar 2 hours after eating will increase by 6-13mg/dl. The age group of 36-45 years has 1.30 times risk of having high blood sugar levels, the age group of 46-45 years has 1.52 times risk of having high blood sugar levels compared to <35 years old.³⁸

Based on table 1, it shows that more respondents who suffered from diabetes for more than 6 months with a percentage of 82.3%, while respondents who were less than 6 months old were 17.6%. This was also done by Safitri (2016) who stated that as many as 42.8% of respondents had diabetes in the <5 years range. Different things were found in research conducted by

Pratama that as many as 32.6% of respondents suffered from diabetes in the 5-10 year range (Safitri, 2016).³⁹

Effect of Self Care on Blood Glucose Levels:

Self-care consists of several domains including diet, physical activity, drug use, blood sugar test, and foot care. The effect of each of these domains is associated with fasting blood sugar levels (FBS) where the examination must be fasting for at least 10-12 hours first, then the examination is carried out 2 hours after eating (2hPG) where the examination is carried out 2 hours after eating, the last is blood sugar when (FBS), which means an examination that can be done while fasting or not fasting. The data analysis used is linear regression to determine the effect of self-care on blood glucose levels.

Dietary Habit:

Based on table 2, it shows that diet has a significant effect on FBG and 2hPPG with a p value <0.05. Meanwhile, the blood glucose level at time was not significantly influenced by diet with p value > 0.05. The correlation value is based on table 2 dietary pattern to FBG of (0.425), 2hPPG of (0.240) and the RBG of (0.376) shows that the better diet of T2DM patients, the blood glucose levels of T2DM patients can be well controlled. Diet regulation is to lose weight, lower blood glucose levels, and increase insulin receptor sensitivity.⁴⁰ Diet regulation is one of the main components in the management of DM. Narrative Review Article by Dhandevi, 2015 have identified a diet that shows that consuming vegetables, fruit, fish and whole grains has a lower risk of developing T2DM when compared to the group that usually consumes foods such as high-fat meat.⁴¹ The results of this study show that diet is the main factor that affects the increase in blood glucose levels in T2DM patients, especially after eating.

Physical Activity:

Based on table 2, there is no significant effect between physical activity and fasting blood glucose levels, blood glucose levels 2 hours after eating and blood sugar levels at any time because of the significance value (p > 0.05). Physical activity is a major component of management in T2DM patient, exercise greatly contributes to controlling blood sugar levels and improving cardiovascular function (Lim & Stewart, 2004). Physical exercise needs to be done at least 150

minutes each week such as jogging or walking is very useful to reduce the risk of increasing blood glucose levels.⁴² Exercise is part of a planned and structured physical activity with direct movements to improve physical fitness, during exercise the muscles become more active and the permeability of membranes increases, also an increase in blood flow as a result of which more capillary membranes are opened and more active insulin receptors and there is a shift by the muscles that come from fatty acids to the use of glucose and muscle glycogen.⁴³ Research that has been conducted by Veena and Sangeetha, (2020) indicate that stress is not exacerbated by experience and that occupational stress is associated with increase in glucose levels both fasting and post-prandial. Moderate correlation exists between cortisol levels and blood glucose levels. In this study out of 250 employees, around 6.8% of the employees have found to have perceived stress and 64.8% has moderate stress, out of which 18% of the employees showed high cortisol secretion level.⁴⁴

Drug Use:

Based on table 2, it shows that there is a significant effect between drug use and random blood glucose levels with significance (p <0.05) while fasting blood sugar levels and blood sugar levels 2 hours after eating indicate that there is no significant effect because of the significance value (p > 0.05). The correlation value based on table 2, drug use on FBS is (0.240), 2hPG is (0.194), and RBG is (0.347) which shows that the more routine of drug use in DM patients, the more controlled blood sugar levels will be. Research that has been conducted by Arifin Z (2011) states that there is a significant relationship where the average fasting blood sugar level of respondents in drug use has a very high effect and from the results of the research data that has been carried out there is no difference with the literature.⁴⁵ Based on the type of drug use, most of the drugs used in the sulfonylurea and iguanid groups namely glicemipride and metformin. The sulfonylurea class of drugs has the effect of increasing insulin secretion by the beta cells of the pancreatic gland while the iguanid drugs play a role in lowering blood glucose by increasing glucose transport into muscle cells that are stimulated by insulin. Metformin can increase glucose by 10-40%. These drugs have mutually supporting effects.⁵

Table 2: Linear regression analysis and correlation of the effect of self-care on blood glucose levels

S. No	Domain	P-value			Correlation		
		FBG	RBG	2hPPG	FBG	RBG	2hPPG
1.	Dietary habit	0,012*	0,172	0,028*	0,425	0,376	0,240
2.	Physical activity	0,519	0,376	0,273	0,115	0,193	0,157
3.	Drug use	0,171	0,045*	0,272	0,240	0,347	0,194
4.	Blood sugar test	0,148	0,614	0,844	0,253	0,090	0,035
5.	Foot care	0,948	0,990	0,178	0,012	0,002	0,237

Note: * P < 0,05 means that there is a significant effect

Blood Sugar Test:

Based on table 2, it shows that there is no significant effect between blood sugar test at time, fasting blood sugar levels and blood sugar levels 2 hours after fasting with a significance value ($p > 0.05$). The component of controlling blood sugar levels in self-care patients for DM respondents is checking blood sugar regularly in accordance with the advice of health workers. In addition, respondents must also have the awareness that checking blood sugar levels regularly is something that is important for people with diabetes. DM sufferers carry out instructions from health workers by checking blood sugar levels at least once a month.⁵ Controlling sugar levels greatly affects blood sugar levels where the patient is in a condition that is thought to cause hyperglycemia, hypoglycemia, and when the medication dose is changed so that the patient can be directly involved in managing the disease.⁵

Foot Care:

Based on table 2, it shows that there is no significant effect between self-care and foot care with fasting blood sugar levels, blood sugar levels 2 hours after eating and blood sugar levels at any time with a significance value ($p > 0.05$). The self-care behavior of DM sufferers is very important and very influential where foot care consists of checking the feet, checking the inside of the shoes, drying between the fingers after washing, using footwear when leaving the house.⁴⁶ An individual lacking in foot care will be weak against his commitment to goals, resulting in nursing failure. DM sufferers are expected to be able to see signs of problems with their feet, including being able to see and recognize the condition of the soles or instep, signs of dryness, wounds or cracks that need to be watched out for and patients are expected to get proper treatment by health workers.⁴⁷

Effect of Self Care on HbA1c:

Hemoglobin A1C (HbA1c) is one of the standard tools for measurement of self-care quality among diabetic patients. Its natural and optimum level is 5.6%-7% in diabetic patients. However, it rises up to 7% in cases where health measures are ignored by the diabetic patient.⁴⁸ The reduction or control of HbA1c is the therapeutic goal of the treatment of T2DM. The decrease in HbA1c is influenced by various factors, including the accuracy in selecting antidiabetic drugs according to the patient's condition, lifestyle modifications and patient adherence factors in treatment. The pearson correlation test was conducted to determine the relationship between the level of self-care and the HbA1c levels of T2DM patients.

Table 3: Correlation test between self-care and HbA1c

Group	Correlation coefficient	P Value
Self-care	0,254	0,023*
HbA _{1c}		

* $p < 0,05$, p -value of Pearson correlation

The results of the analysis showed that there was a positive correlation between the level of patient self-care and the HbA1c level ($r=0.254$, $p=0.023$). The results of this study are in line with previous studies which stated that the higher the level of self-care for T2DM patients, the more controlled the HbA1c levels of T2DM patients. Low self-efficacy has an impact on the successful self-care of people with T2DM. Self-efficacy, compliance, and social support, both individually and collectively, have a significant influence on the patient's glycemic profile (HbA1c). Increasing the level of self-efficacy in self-management will improve the patient's self-care behaviour and reduce their HbA1c level.⁴⁹

A study by Fallahi, *et al* (2018) shows that self-efficacy and self-care influence become essential contributors in developing self-management abilities. Specifically, this is demonstrated by more patients trusting and believing that they can carry out a particular regimen, thus bettering their ability to keep their blood sugar within normal limits.⁵⁰ A study conducted by Al-Ozairi, *et al* (2019) showed that spirituality affects people with diabetes, especially when it comes to reducing their level of depression and increasing the ability to control their blood sugar. Good spirituality in a person will also have an impact on their emotional control and emotional intelligence.⁵¹ A study conducted by Saffari, *et al* (2013) showed that someone with reasonable emotional control has a lower HbA1c level.⁵² Research that has been conducted by Sreedevi (2011) states that the structured teaching program on self-care management was effective among patients with type 2 diabetes mellitus.⁵³ Structured education program can bring about significant change in patients self-care behavior to maintain an optimal level of BMI and HbA1c and helps in the prevention of complications due to diabetes. STP (Structured Teaching Programme) on management of type 2 diabetes mellitus is effective in improving the knowledge of patients with type 2 diabetes mellitus.⁵⁴

CONCLUSION:

Based on the research results the self-care activities carried out by T2DM patients have a positive effect on controlling the therapeutic outcome of T2DM patients which includes RBG, 2hPG, FBS, and HbA1c. The better patient performs self-care, the more controlled the patient's T2DM outcome therapy.

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CONFLICTS OF INTEREST:

The author(s) declare(s) that there are no conflicts of interest regarding the publication of this article.

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