



# Self-Management Counseling to Reduce the Risk of Diabetic Foot Ulcers in Type 2 Diabetes Patients

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**Abstract.** Various complications can arise as a result of type 2 diabetes mellitus. One of the main complications of type 2 diabetes is diabetic foot ulcers. To improve compliance, this study used Self-Management Counseling (SMC). This study was conducted from August to November 2024 and lasted for 16 weeks. There were forty respondents selected who met the criteria: they had no wounds and had had diabetes for two years. SMC intervention ( $b= 0.72$ ; 95% CI= 0.28 to 1.15;  $p= 0.001$ ) and education ( $b= 0.39$ ; 95% CI= 0.08 to 0.72;  $p= 0.015$ ) were significantly able to improve dietary behavior, increase education compliance (Mean= 0.46; 95% CI= 0.18 to 0.74;  $p= 0.001$ ), exercise compliance (Mean= 1.13; 95% CI= 0.72 to 1.54;  $p < 0.001$ ), and medication compliance (Mean= 1.18; 95% CI= 0.78 to 1.58;  $p < 0.001$ ). SMC affects ABI, HbA1c, and sensitivity scores so that it can reduce the risk of diabetic foot ulcers. Therefore, it is recommended to accompany type 2 diabetes sufferers to remain compliant with the 4 pillars of diabetes management.

**Keywords:** Compliance, Diabetic foot ulcers, Diabetes Mellitus, Self-Management Counseling

## INTRODUCTION

Type 2 diabetes mellitus (DM) can cause various complications that are dangerous to the health of sufferers. The main complication of type 2 diabetes is diabetic foot ulcers, which result from peripheral neuropathy and secondary ischemia [1] [2]. Peripheral neuropathy can be caused by repeated damage to sensory nerve fibers. In addition, the deposition of glucose metabolism products, such as advanced glycosylation end products, in the blood vessels of the lower extremities can cause skin surface wounds and ulcers [2]. Because poor foot care management can lead to wounds, infections, or decreased physiological function of the feet, many complications can arise [3].

To prevent foot ulceration, people with diabetes who have risk factors should be protected [4]. People with diabetes should adhere to their diabetes treatment program, which includes medication, diet, and exercise, to reduce the risk of diabetic foot ulcers. This means they should change how they behave, take their medications regularly, change their lifestyle, and change their diet as directed by their doctor. However, medication compliance in patients with diabetes and other chronic diseases is not ideal [5].

Conducting self-management counseling (SMC) is one way to increase compliance to reduce the risk of foot ulcers. This is because long-term diseases take a long time to heal, so to prevent diabetic foot ulcers, diabetics can be counseled [6]. Counseling for type 2 DM patients has been widely discussed in research [7] [8] [9] [10]. The novelty of this study is conducting SMC with a four-pillar approach to diabetes management, namely nutrition/nutrition, physical activity, treatment, and education to effectively prevent diabetic foot ulcers and analyzed by path.

This study aimed to examine the causal relationship between variables and identify direct and indirect influences on the risk of diabetic foot ulcers in patients with type 2 DM. The detection of diabetic foot ulcers in type 2 DM was carried out by examining the Ankle-Brachial Index (ABI), foot sensitivity, and HbA1C.

## **METHODS**

### **1. Study Design**

This quasi-experimental study, conducted from August to November 2024, was conducted in a single cohort in Surakarta, Indonesia. It investigated how SMC affects the likelihood of diabetic foot ulcers in patients with diabetes mellitus.

### **2. Samples/Participants**

This study investigated 40 individuals with type 2 diabetes. A simple sampling method was used to draw samples from a predetermined population. The study sample consisted of individuals who met the inclusion and exclusion criteria for type 2 diabetes. The exclusion criteria were patients with type 2 diabetes who had been registered at the Puskesmas for at least two years, did not have diabetic foot ulcers, and were willing to answer questions. Patients with type 2 diabetes who had complications and had difficulty communicating were not accepted.

### **3. Intervention**

DM patients received Self-Management Counseling (SMC) intervention from health professionals trained as counselors. The counseling process lasted 16 weeks, and meetings were held nine times. Counseling included nutrition, diet, exercise, medication, and education. According to the patient's condition, instructions on self-care to reduce the risk of diabetic foot ulcers were needed.

### **4. Data Collection**

Eight trained nurses collected data through physical examination, compliance check, and blood test. The four pillars of diabetes management are nutrition and diet, physical activity, medication, and education. Physical examination included blood tests and HbA1C tests, as well as anthropometry, ABI, and foot sensitivity.

### **5. Data Analysis**

Data analysis was conducted using path analysis to describe univariate and bivariate data, evaluate causal relationships between variables, and find direct and indirect effects.

### **6. Ethical Considerations**

The research ethics committee of Aisyiyah Surakarta University issued an ethical feasibility letter numbered 198/VII/AUEC/2024 on July 4, 2024, which indicates that this research is ethically feasible.

## RESULTS AND DISCUSSION

Tabel 1. Characteristics of DM sufferers (n = 40)

Variabel		Frequency	Percentage
Gender	Female	24	60
	Male	16	40
Job	Working	17	42.5
	Not working	23	57.5
Level of education	Higher education	5	12.5
	Secondary education	20	50
	Primary education	15	37.5
Smoking history	Do not smoke	33	82.5
	Smoke	7	17.5
Age	≤ 60 years	17	42.5
	>60 years	23	57.5
Been sick for a long time	< 5 years	20	50
	≥ 5 years	20	50

The results of the analysis in Table 1 show that the majority of female respondents (60 percent) are unemployed (57.5%), 50% have secondary education, and 82.5% do not smoke. The majority of respondents over 60 years old (57.5%) have been sick for 5 years.

### Structural model test and result

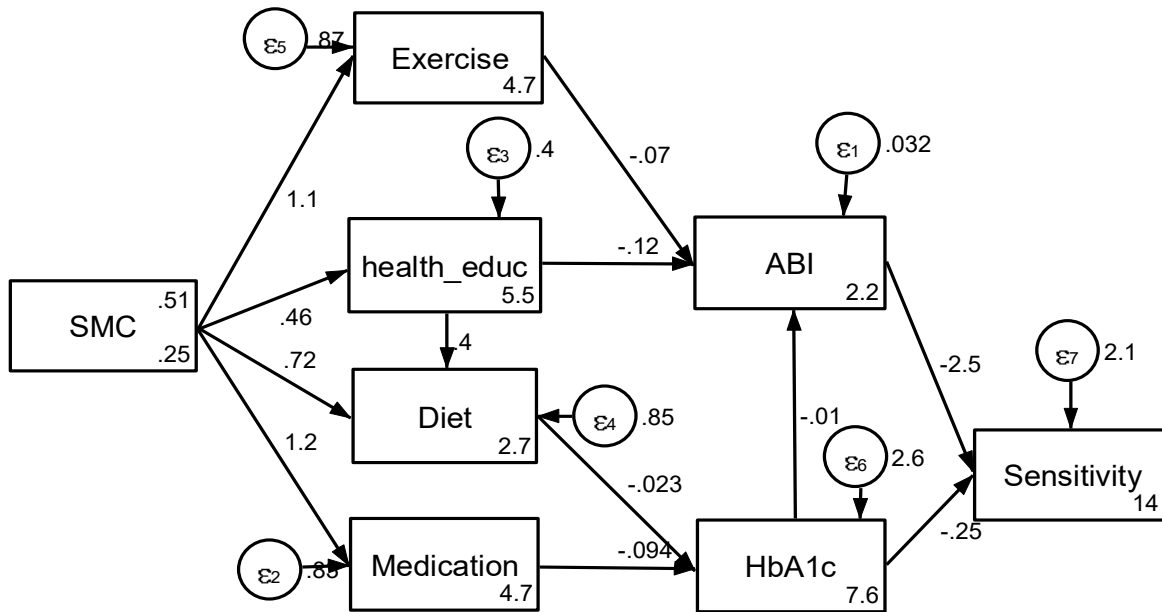


Figure 1. Path analysis model of the mechanism of the influence of SMC on ABI scores, HbA1c, and foot sensitivity

Table 2. Results of the path analysis of the mechanism of the influence of SMC

Dependent variable	Independent variable	b	95% CI		p
			Lower limit	Upper limit	
Sensitivity	← ABI	-2.53	-3.99	-1.07	0.001
	← HbA1c	-0.25	-0.45	-0.05	0.013

ABI	←	HbA1c	-0.01	-0.03	0.01	0.516
	←	Education	-0.12	-0.18	-0.06	<0.001
	←	Exercise	-0.06	-0.10	-0.03	0.001
HbA1c	←	Diet	-0.02	-0.35	0.31	0.892
	←	Adhere to treatment	-0.09	-0.42	0.23	0.572
Diet	←	SMC Intervention	0.72	0.28	1.15	0.001
	←	Education	0.39	0.08	0.72	0.015
Education	←	SMC Intervention	0.46	0.18	0.74	0.001
	←	SMC Intervention	1.13	0.72	1.54	<0.001
Exercise	←	SMC Intervention	1.13	0.72	1.54	<0.001
	←	SMC Intervention	1.18	0.78	1.58	<0.001

Table 3 shows the results of the path analysis of the influence of SMC on ABI, HbA1c, and sensitivity scores. HbA1c ( $b = -0.25$ ; 95% CI= -0.45 to -0.05;  $p = 0.013$ ) and ABI ( $b = -2.53$ ; 95%CI= -3.99 to -1.07;  $p = 0.001$ ) significantly decreased sensitivity. Education significantly decreased ABI ( $b = -0.12$ ; 95% CI= -0.18 to -0.06;  $p < 0.001$ ), but HbA1 had no significant relationship to ABI ( $p = 0.516$ ).

Diet ( $b = -0.02$ ; 95% CI= -0.35 to 0.31;  $p = 0.892$ ) and medication adherence ( $b = -0.09$ ; 95% CI= -0.42 to 0.23;  $p = 0.572$ ) were able to reduce HbA1c, but the value was not significant. SMC intervention ( $b = 0.72$ ; 95% CI= 0.28 to 1.15;  $p = 0.001$ ) and education ( $b = 0.39$ ; 95% CI= 0.08 to 0.72;  $p = 0.015$ ) significantly improved dietary behavior. SMC intervention significantly increased education (Mean= 0.46; 95% CI= 0.18 to 0.74;  $p = 0.001$ ), exercise (Mean= 1.13; 95% CI= 0.72 to 1.54;  $p < 0.001$ ), and medication adherence (Mean= 1.18; 95% CI= 0.78 to 1.58;  $p < 0.001$ ).

To prevent complications that may arise and develop, the primary goal of diabetes therapy is to achieve metabolic control. To achieve this goal, an approach that includes diet, physical activity, and additional treatment or medication must be carried out [11]. People with DM must change their lifestyle by exercising regularly, managing their weight, and adhering to a healthy diet [12]. While several studies have shown a relationship between healthy eating patterns and physical activity and decreased morbidity and mortality, most have not demonstrated supportive behaviors [13].

Counseling is needed to help people with diabetes change their lifestyle [13] [14] [15]. Counseling can increase knowledge about diet, medication, activity, and stress and help them manage their lifestyle better [16]. Exercise can affect blood sugar regulation and control [17]. Regular physical activity can also reduce weight, control blood cholesterol and blood pressure, and help body cells absorb glucose, decreasing blood glucose levels [12]. Weight loss can cause reduced glycated hemoglobin (HbA1c) and blood pressure [18]. Changes in blood pressure can affect ABI values. Patients with high ABI values are at greater risk of developing foot ulcers and neuropathy compared to people with diabetes with normal ABI values [19].

Exercise can also help the function of myelin and axon nerves, improve nerve conduction, increase nerve sensitivity, and improve peripheral sensory neuropathy [3]. In addition, exercise can increase vasodilation and tissue blood flow [20]. By reducing peripheral sensory neuropathy, sensitivity in the feet will increase, which means the risk of diabetic foot ulcers is diminished. Walking, cycling, swimming, and gymnastics are examples of aerobic exercise recommended for people with diabetes for 40 to 60 minutes daily [18].

Lifestyle and dietary changes can help people with diabetes [21]. Dietary adherence is the first step in diabetes management. However, the most challenging part of diabetes management is changing eating habits and adhering to dietary recommendations [21][22]. Therefore, people with diabetes need to be

educated [15] [22] and given dietary guidance so that they can create an appropriate and sustainable meal plan that meets their individual needs [22].

Dietary compliance is crucial for patients with diabetes mellitus (DM) to maintain stable blood glucose [23]. Therefore, dietary counseling programs seem very important to prevent and reduce complications of type II diabetes [24]. Diabetics should reduce their consumption of sugar and fat and consume foods rich in fiber [25]. Patients who received medical nutrition therapy for type 2 DM showed a significant increase in HbA1c scores. In addition, DM patients should also be compliant with treatment for better glycemic control [26].

## CONCLUSIONS

SMC intervention can improve dietary behavior, education, exercise, and medication compliance. SMC also affects ABI, HbA1c, and sensitivity scores, thus reducing the risk of diabetic foot ulcers. Therefore, health workers need to provide counseling to DM patients.

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