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Interventions For Prevent Type 2 Diabetes Melitus Complications : a Review

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ABSTRACT

Type 2 diabetes is a major cause of illness and death. Long suffering from diabetes is often associated with complications such as neuropathy. Complications usually begin to arise after the client has suffered from DM for more than 10 years. Lifestyle modification is a fundamental management approach that can prevent or delay the development of prediabetes into diabetes, as well as reduce the risk of microvascular and macrovascular diseases. The purpose of this study was to review the effectiveness of some interventions on minimizing progression to diabetes in high-risk patients or progression to clinical outcomes (such as cardiovascular disease and death) in patients with type 2 diabetes. Data Sources in tihis study was from research on lifestyle interventions in type 2 diabetes mellitus published between 2007-2022 in online article databases PubMed, Proquest, Geogle Schoolar, Sci Hub and Sciencedirect. The data collection technique was by entering keywords into the database, the keywords used were: interventions AND Type 2 Diabetes Melitus; Lifestyle Diabetes Melitus AND Prevent Complications, Interventions AND Modification Lifestyle. Several interventions were found to prevent complications in patients with type 2 diabetes mellitus, starting from self-empowerment interventions, family empowerment, health belief models, cultural approaches, and others. Comprehensive lifestyle interventions effectively decrease the incidence of type 2 diabetes in high-risk patients and its complications. In patients who already have type 2 diabetes, there is no evidence of reduced all-cause mortality and insufficient evidence to suggest benefit on cardiovascular and microvascular outcomes.

Keywords: complications of type 2 diabetes melitus; lifestyle intervention

INTRODUCTION

Diabetes mellitus (DM) is a group of metabolic disorders characterized by high blood glucose levels. A person with diabetes has an increased risk of experiencing a number of serious life-threatening health problems that requiring high medical care costs, decreased quality of life and increased mortality (1).

According to the Cho et al., (2018) the prevalence of DM in the world reaches 424.9 million people and is estimated to reach 628.6 million in 2045. Indonesia is the country with the sixth most DM sufferers in the world with the number of DM sufferers reaching 10.3 million inhabitants. It is estimated that this number will continue to increase until it reaches 16.7 million people in 2045. The incidence of diabetes mellitus sufferers in 2015 worldwide reaches 415 million, and it is estimated that by 2040 the number of people with diabetes mellitus will be 642 million people (2).

Based on data from the International Diabetes Federation (2021), the countries with the highest number of adults with diabetes aged 20-79 years in 2021 are China with 140.9 million people, India with 74.2 million people, Pakistan with 33 million people, the United States as many as 32.2 million people, and Indonesia as many as 19.5 million people. They are expected to remain so by 2045. Countries that have the highest number of people with diabetes do not necessarily have the highest prevalence. The highest comparative diabetes prevalence rates in 2021 were reported in Pakistan (30.8%), French Polynesia (25.2%) and Kuwait (24.9%). The country is also predicted to have the highest overall comparative diabetes prevalence by 2045, with rates in Pakistan at 33.6%, Kuwait at 29.8% and French Polynesia at 28.2% (3).

Diabetes mellitus can cause various complications, namely hypoglycemia, hyperglycemia, macrovascular disease of large blood vessels, coronary heart disease, microvascular disease of small blood vessels, retinopathy and nephropathy, sensory neuropathy or an effect on excremity. Other complications are also frequent pathological changes in the lower limbs called diabetic feet. In this condition, the condition of the diabetic foot that occurs is structural changes, skin protrusions, skin and nail changes, injuries to the feet, infections, abnormalities in blood vessels, and neuropathic innervation disorders that can cause diabetes patients to experience decreased sensitivity, and loss of sensation is one of the main reason risk factor for diabetic ulcers (4).

Diabetes mellitus clients who have long been diagnosed with diabetes have a higher risk of developing diabetic ulcers. Blood sugar levels that are not controlled from time to time can lead to hyperglycemia, which can lead to complications associated with diabetic neuropathy in which diabetes mellitus patients will lose their sense of taste and are not aware of the appearance of injury (5).

Lifestyle modification is a fundamental management approach that can prevent or delay the development of prediabetes into diabetes, as well as reduce the risk of microvascular and macrovascular diseases. Lifestyle interventions improve all factors of diabetes and components of the metabolic syndrome, obesity, hypertension, dyslipidemia, and hyperglycemia. Lifestyle changes in real life are very difficult to do without the help and supervision of professional health practitioners (6).

The objective of this review was to assess the effectiveness of comprehensive lifestyle interventions in the prevention of diabetes in adults who have been identified as having increased risk for type 2 diabetes (for example, those with the metabolic syndrome or prediabetes) and the prevention of diabetic complications (such as microvascular and macrovascular outcomes) in adults diagnosed with type 2 diabetes.

METHOD

Data Sources and Searches

Literature sources come from online searches of journal databases through free articles in pdf format about research on lifestyle interventions in type 2 diabetes mellitus published between 2007-2022 in online article databases PubMed, Proquest, Geogle Schoolar, Sci-Hub and Sciencedirect.

The data collection technique was by entering keywords into the database, the keywords used were: interventions AND Type 2 Diabetes Melitus; Lifestyle Diabetes Melitus AND Prevent Complications, Interventions AND Modification Lifestyle.

Study Selection

The inclusion and exclusion criteria set out in this literature review include the following:

a. Inclusion Criteria
   Research using both quantitative and qualitative data, research subjects are people with type 2 diabetes mellitus, research published by publishers who already have a digital object identifier (DOI) or already have an ISSN., Years of publication between 2007-2022, The language used is English and Indonesian
b. Exclusion Criteria
   Lifestyle Interventions research whose subjects are not people with type 2 diabetes mellitus, Years of publication outside 2007-2022, Languages used other than English and Indonesian.

Data Extraction

Data extraction can be done if all data that meets the requirements have been classified for all existing data. After the screening process is carried out, the results of this data extraction can be known with certainty from the initial amount of data owned, which still meets the requirements for further analysis. The data extraction process carried out is as follows:

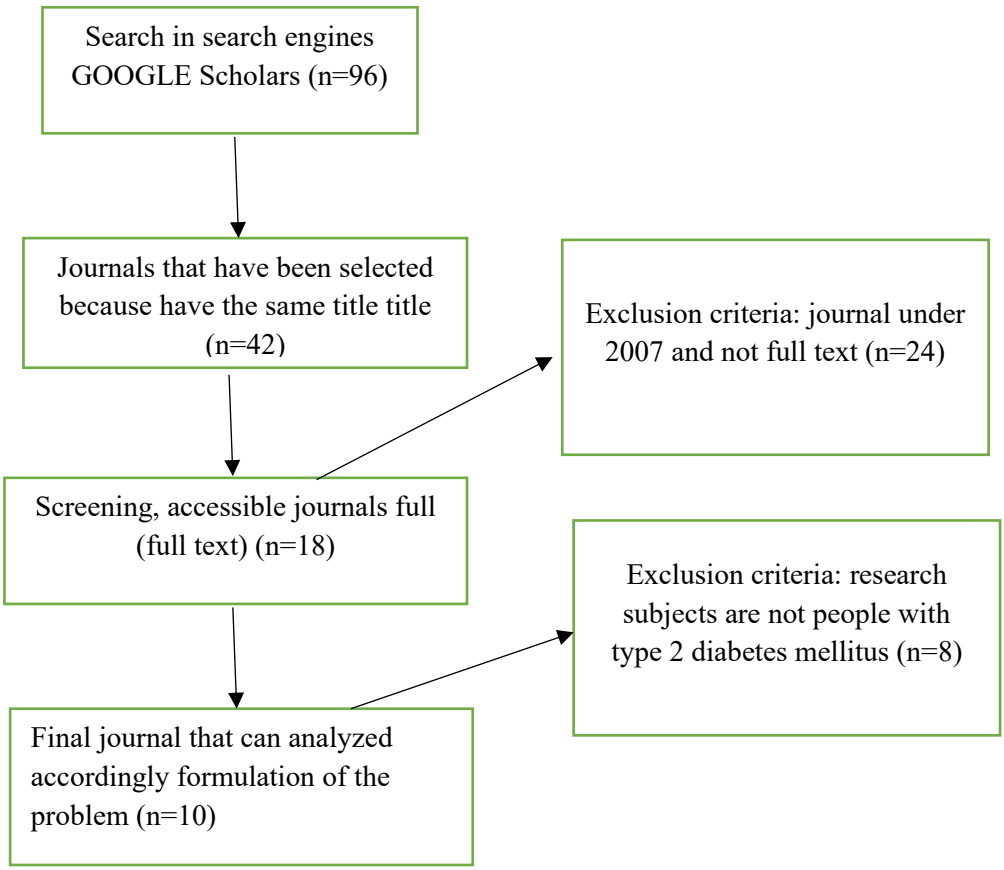

Figure 1. Summary of evidence search and selection.

RESULTS

Lifestyle of Diabetes Mellitus

Lifestyle describes the "Whole person" who interacts with his environment. Lifestyle is a person's pattern of life which is expressed in his activities, interests and opinions in spending his money and allocating his time. Lifestyle is formed through social interaction. Lifestyle is the way a person lives his life which includes activities, interests, attitudes, consumption and expectations (7).

Lifestyle can describe a person's behavior. Adopting a healthy lifestyle is the key to success in achieving the goal of preventing diabetes mellitus. The application of a healthy lifestyle is certain to fail even after being given diabetes mellitus medication. Recurrence of suffering from diabetes mellitus again can occur if a person with diabetes mellitus fails to carry out a healthy lifestyle in everyday life (8,9).

Many people with diabetes mellitus still live an unhealthy lifestyle. The reason is due to diet and physical activity. The diet referred to is that many DM sufferers eat irregularly and consume less fruits and vegetables. As well as not doing regular physical activity or not exercising (10).

Lifestyle management is a fundamental aspect of diabetes care and includes diabetes self-management education (DSME), diabetes self-management support (DSMS), nutritional

therapy, physical activity, smoking cessation counselling, and psychosocial care. Patients and care providers must focus together on how to optimize lifestyle from the initial comprehensive medical evaluation, during all subsequent evaluations and follow-ups, and during the assessment of complications and the management of comorbid conditions to improve diabetes care (11,12).

Factors Affecting Lifestyle Diabetes Mellitus

Lifestyle can be influenced by several factors such as social factors. Social factors that influence food consumption are income levels, food expenditure, education and knowledge. The concept of a healthy lifestyle includes three main aspects of health, namely physical, mental and social. The main components that form the core of this healthy lifestyle concept are: (a) increasing knowledge and habit of washing hands; (b) increase in knowledge and eating patterns (c) increase in knowledge and attitudes about anti-smoking; (d) increasing knowledge and exercise habits; (e) increasing knowledge and handling stress (10,13).

There are two factors that influence the lifestyle of type 2 DM, namely intrinsic factors and extrinsic factors which can be facilitators or obstacles in implementing lifestyle changes. Among the barriers participants faced were established eating habits, lack of self-efficacy, lack of motivation, lack of social support, inadequate knowledge, low socioeconomic status, poor food culture and time management. While the resulting facilitating factors are strong self-efficacy, high motivation, good habits, and sufficient knowledge. In general, patients with diabetes observe more barriers than facilitators to implementing healthy lifestyle changes (14).

Lifestyle Interventions Of Diabetes Melitus

Although current treatment of prediabetes includes pharmacological and lifestyle modification approaches, lifestyle interventions are a cornerstone of treatment for this condition. Insulin resistance is part of the underlying pathology associated with metabolic syndrome, and patients identified with insulin resistance may have hypertension, dyslipidemia, visceral obesity, and vascular disease. Obesity, a sedentary lifestyle, and a high-calorie, high-fat diet correlate with the development of insulin resistance. Lifestyle changes and therapeutic dietary interventions have been shown to prevent or delay the development of diabetes. In the Diabetes Prevention Program (DPP), a relative reduction of 58% in progression to diabetes was observed in the lifestyle group versus a relative reduction of 31%. in development for the metformin group after 2.8 years. Current recommended lifestyle changes include reducing energy intake and increasing physical activity. Both are inversely related to the degree of insulin resistance. Lifestyle

changes can prevent the development of diabetes (15).

Education is carried out to increase efforts to promote healthy living in the prevention and management of DM holistically. DM education is education and training regarding knowledge and skills for DM patients to support behavior change, increase patient understanding of the disease, so as to achieve optimal health, adjust psychological conditions and improve quality of life (Amiruddin, 2023). Education based on the theory of planned behavior, by holding face-to-face meetings and following up on samples after educational interventions, can promote a healthy lifestyle for pre-diabetic women. Therefore, designing and implementing similar interventions in all pre-diabetic individuals seems necessary (16).

There is research that provides a socioecological approach to understanding health promotion for patients with chronic diseases in health safety net systems, using a variety of methods. Future digital health research must focus on the life experiences of marginalized patients to design and effectively implement informatics solutions for this audience (Nguyen et al., 2022). Creating awareness of diabetes risk in at-risk groups and increasing counseling of at-risk groups by doctors/healthcare providers can be key to preventing diabetes (17).

Several barriers at the individual level, community level, and health system level were identified. The main barriers include lack of knowledge, lack of social support, and self-management support. The interventions identified in this review demonstrate that among inner-city African Americans with T2DM, focus is placed at the health system level, with a very limited focus on addressing individual and community level barriers. The final synthesis includes the development of a new integrated model that describes the barriers to care at multiple levels (18).

A variety of methods can be used to guide quality improvement initiatives at the individual practice or system level. The Institute for Healthcare Improvement suggests the Model for Improvement as a framework to guide improvement work (19). The following are several models of intervention in modification in improving diabetes mellitus self-care, including:

Model I-Prevent Diabetes

The framework is developed according to the theory of behavior change and user needs. Various focus group discussions (FGD) were conducted to ascertain needs. The framework is developed according to the theory of behavior change and user needs. Various focus group discussions (FGD) were conducted to ascertain this need (20).

Self Empowerment Model

Empowerment of people with diabetes requires the active participation of patients, families and communities. The health team accompanies the patient

towards changing healthy behavior. The education provided can include self-management of DM such as consuming healthy food, taking diabetes medication regularly and at certain times carrying out regular activities, carrying out independent blood glucose control and utilizing information, and performing regular foot care. Patients must also cooperate with lifestyle changes to prevent long-term complications (21).

The results of other studies show that the factors of knowledge about diabetes, education, age, social support, employment status and A1c levels are significant predictors of the empowerment of individuals with type 2 diabetes mellitus in Turkey. In this study, it is hoped that individuals with type 2 diabetes mellitus will improve literacy related to diabetes, especially in groups with lower education and older ages (22).

Family Empowerment Model

Family involvement in improving self-care for diabetes mellitus patients is very important. We found two studies of high quality and with substantial family involvement that reported an increase in A1c. Due to the heterogeneity of study designs, interventions, and levels of family involvement, it is difficult to assess how family involvement in diabetes interventions can affect the health outcomes of patients and family members. Our family-oriented program improves patient self-efficacy and self-management, which in turn can lower HbA1c levels (23).

Future research should clearly delineate the role of the family in interventions, provide details on family-based interventions, assess the quality and extent of family participation, and compare patient outcomes with and without family involvement (24).

In another study, the results of adjusted analysis showed that supportive family behavior was related to adherence to different self-care behaviors (β=0.20-0.50, p<.05), whereas obstructive family behavior was associated with less adherence to self-care behaviors (β = 0.28- 0.39, p<.01), worse HbA1C (β=0.18, p<.05). Supportive behavior protected from the detrimental effects of obstructive behavior on HbA1C (interaction =−0.22, p<.001). Non-Whites reported more supportive and obstructive behaviors than whites, but race did not influence the relationship between family behavior and self-care or HbA1C (25).

Environmental Modification Model

Providing diabetes education only to individuals with type 2 diabetes may limit its impact on patients, as families can play a large role in disease management. Family-based approaches to chronic disease management emphasize the context in which the disease occurs, including the physical environment of the family, as well as the educational, relational, and personal needs of patients and family members. Including family members in educational

interventions can provide support to patients with diabetes, help to develop healthy family behaviors, and promote diabetes self-management (24).

Lifestyle Modifications Model

A comprehensive lifestyle intervention that includes exercise, dietary changes, and at least 1 other component is effective in reducing the incidence of type 2 diabetes in high-risk patients, and benefits extend beyond the active intervention phase. In patients already diagnosed with type 2 diabetes, evidence of benefit from comprehensive patient-oriented lifestyle interventions is less clear. There is no evidence of benefit across all causes of death and insufficient evidence to suggest a benefit on cardiovascular and microvascular outcomes. Improvement was seen for some secondary outcomes, but it generally did not persist beyond the intervention phase, and its clinical significance is unclear (26).

Diabetes self-care behavior is influenced by economic control status, education level, perception of disease, and family support. Therefore, it is recommended for nurses to apply a health promotion model approach to improve self-care behavior in patients with type 2 diabetes control (27).

Table 1. Diabetes Mellitus Lifestyle Modification Intervention

Author, country, year	objective	Metode	Result
Abdulrehman et al, 2016 (28) Costal Kenya	to describe diabetes self-management among the Swahili of coastal Kenya, and explore factors that affect diabetes self-management within the context of Swahili culture	Etnonursing	Diabetes self-management was insufficiently practiced, and participants had limited understanding of diabetes. Economic factors such as poverty and the high cost of biomedical care appear to have more influence in self-management behavior than socio-cultural and educational factors do. Economic and socio-cultural influences on diabetes self-management should not be underestimated, especially in a limited resource environment like coastal Kenya, where biomedical care is not accessible or affordable to all.
Surucu & Besen, 2017 (22) Turki	to examine predictors of “empowerment” in individuals with type 2 diabetes from Turkey	Korelasi cross sectional Sample : 220 responden	It is important for nurses to assess sources of social support and integrate the results of this assessment to ensure the empowerment of the patient during diabetes education. For the empowerment of diabetic individuals, attempts should be made to increase the diabetes literacy levels of diabetic individuals who have low level of education and who are in the older age group, and patients who can get employed could be directed to work life
Magny-normilus et al, 2019 (29)	to explore and describe the lived experience of adult Haitian immigrants	Kualitatif Sample : 16 partisipan	Four themes emerged: self-reliance, spirituality, nostalgia for home, and a desire for positive patient-provider relationships. Cultural influences and health beliefs may

Haiti	managing T2D living in the United States		affect individual self-management of T2D in this population.
(27)Putra et al, 2019 (27) Bali, Indonesia	to examine a health promotion model in patients with type 2 diabetes mellitus	Cross sectional Sample : 177 responden	Diabetes self-care behavior is influenced by socioeconomic status, level of education, perception of the illness, and family support. Therefore, it is suggested for nurses to apply the health promotion model approach to increase self-care behavior of patients with type 2 diabetes mellitus.
Lindsay Satterwhite Mayberry, MS & Chandra Y. Osborn, PhD, 2015 (25)	assessed the relationships between supportive and obstructive family behaviors and patients' diabetes self-care activities and HbA1C, and potential interaction effects and differences by demographiccharacteristic.	Cross sectional Sample : 192 responden	Involving family members in patients' diabetes management may impede patients' self-care and compromise their glycemic control unless family members are taught to avoid obstructive behaviors.
Whicit et al, 2016 (23) Thailand	evaluated a theoretically-derived family-oriented intervention aimed to improve self-efficacy, self-management, glycemic control and quality of life in individuals living with Type 2 diabetes in Thailand.	single-blinded randomized controlled trial sample : 140 responden	evaluated a theoretically-derived family-oriented intervention aimed to improve self-efficacy, self-management, glycemic control and quality of life in individuals living with Type 2 diabetes in Thailand.
Wallin & Lo, 2007 (30) Swedia	To describe how diabetic immigrants from Somalia experience everyday life in Sweden and how they manage diabetes-related problems, with inclusion of a gender perspective	Kualitatif Sample : 19 partisipan	Four themes emerged: experience of distress in everyday life; everyday life continues as before; comprehensibility gives a feeling of control; and being compliant. A major finding was the variation in how the participants managed the fasting month of Ramadan. Several participants fasted and did not see the diabetes as an obstacle, others did see it as an obstacle or indicated that fasting was not compulsory for a sick person
Okosun & Lyn, 2015 (17) Amerika Serikat	to examine whether persons who are aware of their prediabetes were more likely than persons with normal glycemia to report lifestyle changes (weight control, physical activity and fat/calories intake), and to determine the interactive effect of persons aware of their prediabetes and persons reporting doctor/health care provider's (DHCP) advice on overall lifestyle change.	Cross sectional Sample : 9966 responden	There was no significant interaction between persons aware of their prediabetes and persons that reported DHCP advice with reported overall lifestyle change. Creating diabetes risk awareness in at-risk groups and increased counseling of at-risk groups by doctors/health care providers may be the keys to prevent diabetes.

Subramaniam et al, 2021 (20) Malaysia	propose a framework to aid in the development of self-care systems to prevent T2D, which integrates behavioral change theories and techniques and offers features, such as goal setting, activity planning, and health monitoring	Mix Metode, Quantitative and qualitative study Sample : 50 responden	Users viewed i-Prevent Diabetes positively and experienced a positive change in their attitude toward their health. Diabetes prevention systems, such as i-Prevent Diabetes, have the potential to increase self-care behaviors among individuals with prediabetes, enabling them to manage their lifestyle and nutrition more effectively to avert a variety of potentially fatal conditions.
Mohammadnia Motlagh et al, 2022 (16)	to determine the effect of theory-based education on promoting a healthy lifestyle and fasting blood sugar (FBS) in pre-diabetic women	RCT Sample : 71 woman with prediabetik	Education based on the theory of planned behavior, by holding face-to-face meetings along with following up the samples after the educational intervention, can promote healthy lifestyle of pre-diabetic women. Therefore, designing and implementing similar interventions on all pre-diabetic individuals seem necessary.

CONCLUSION

Comprehensive lifestyle interventions effectively decrease the incidence of type 2 diabetes in high-risk patients and its complications. In patients who already have type 2 diabetes, there is no evidence of reduced all-cause mortality and insufficient evidence to suggest benefit on cardiovascular and microvascular outcomes.

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