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## Effectiveness of Physical Activity Interventions in Type 2 Diabetes Mellitus Patients: A Literature Review

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### Artikel info

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**Article history:**

Received: 05th June, 2021  
Revised: 10th July, 2021  
Accepted: 19th August, 2021

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**DOI:**

<http://doi.org.10.35654/ijnhs.v4i4.506>

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**Abstract.** Diabetes Mellitus (DM) is a chronic disease associated with insulin deficiency and the inability of the pancreas to produce enough insulin. WHO predicts that the number of people with type II diabetes mellitus in Indonesia will increase to 12 million in 2030. The study aimed to describe Physical Activity Interventions in type 2 diabetes mellitus patients. Using the online journal database that provides free articles and journals from 2010 -2020 in PDF form such as: *Scinapse*, *Pubmed*, *ProQuest*, *MDPI* and *Google Scholar* using the keywords "Physical Activity", "Effectiveness of Physical Activity". Physical activity intervention can improve the condition of patient with Diabetes mellitus if routinely done. Intake of physical activity intervention can control HbA1c levels and blood sugar, body weight and other glycemic control. Physical activity intervention is able to improve the condition of Diabetes Mellitus patients.

**Keywords:** Physical Activity, Diabetes Mellitus



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### INTRODUCTION

Diabetes mellitus (DM) is a chronic metabolic disease, which is emerging as a major public health problem. The worldwide prevalence of diabetes in adults is estimated at 4.0% in 1995 and is projected to reach 5.4% in 2025. The number of adults with diabetes in Indonesia is projected to increase from 6.9 million in 2010 to 12 million in 2030 (1). DM is an established risk factor for several causes of death, including ischemic heart disease, stroke, kidney disease, infectious diseases, and some cancers (2).

According to the latest estimates, 18.8 million people in the US have been diagnosed with diabetes, and an additional 7 million are believed to live with undiagnosed diabetes. At the same time, an estimated 79 million adults have prediabetes, a condition in which blood sugar levels are higher than normal, but not high enough to be diagnosed as diabetes, and raises a person's risk of type 2 diabetes, heart disease, and stroke. Thus, more than 100 million Americans are at risk of developing diabetes complications (3). In 2014, Approximately 382 million people worldwide, or 8.3% of adults aged 20-79 years, are estimated to have diabetes. (4).

According to the International Diabetes Federation (IDF), > 382 million people worldwide have diabetes in 2012 and this number is projected to reach 592 million by 2035 (5). During 2015, 415 million adults had type 2 diabetes mellitus (T2DM), which is predicted to increase to 642 million by 2040 (6).

The increased number of diabetes mellitus patients is triggered by unhealthy lifestyles such as lack of physical activity, obesity, consuming unhealthy food, and smoking behavior. The age of the patient was more of diminishing or getting younger. One in five people with diabetes is still under 40 years old, which is between 20 to 39 years, as many as 1.671.000 people. While those aged 40 to 59 years as many as 4.651.000 people and the rest were aged 60 to 79 years. Diabetes is a severe threat to humans, and it remains the seventh leading cause of death in the world (7).

Diet and physical activity are important risk factors that can be modified which affect the onset, severity, and management of DM (8). Physical activity (PA) is considered a pillar of diabetes mellitus management to prevent complications, despite the conclusive evidence is lacking (Diewertje et.al, 2012).

Physical activity can be promoted in primary care in various ways, including the delivery of both written and unwritten information, and referral to an exercise program. In the UK, it has been demonstrated in a health referral scheme during the last two decades, but there are concerns that this may not result in a sustained change in physical activity beyond the ordinary program duration of 12 weeks (10).

A good result of physical activity should qualify that is held at least 3 to 4 times a week and within a period of a minimum of 30 minutes. Physical activity does not have to be a strenuous activity, just walking in the morning while enjoying the scenery for 30 minutes is included in the criteria of a good physical activity (11).

Handling steps to minimize complications of type II DM can be done in various ways. One of them is management. The four main pillars of management are counseling, meal planning, physical exercise, and pharmacological interventions. Physical activity is a decent intervention to increase insulin action on glucose homeostasis in healthy individuals and who have insulin resistance, such as type II diabetes mellitus patients (12).

We conducted a literature review to find out whether physical activity interventions in DM patients were more effective than other interventions.

## **OBJECTIVE**

The study aimed to describe Physical Activity Interventions in type 2 diabetes mellitus patients.

## **METHOD**

Online journal database that provides free articles and journals both national and international in PDF form such as *Scinapse*, *Pubmed*, *ProQuest*, *MDPI*, *Ebsco*, *Elsevier*, *Academia.edu*, and *Google Scholar* as well as other reference sources in the form of text books from the library, National health reports, theses and dissertations as well as abstracts from research results that are included in the proceedings. The data used from this collected

literature are the last 10 years from 2010-2020. Based on the following keyword set: “Physical Activity”, “Effectiveness of Physical Activity”, “Physical Activity Intervention”.

Table 1. List of criteria in the review of the literature articles

No	Inclusion	Exclusion
1	The literature taken is the literature that discusses Physical Activity in Diabetes Mellitus patients	Abstract only
2	Physical Activity Interventions provide results or impact on people with Diabetes Mellitus	Incomplete text
3	Population studied is clear	Double publication
4	Full Text	Population studied is unclear
5	Journal published in the last 10 years (2010-2020)	
6	Articles in English and Bahasa	
7	Open access	

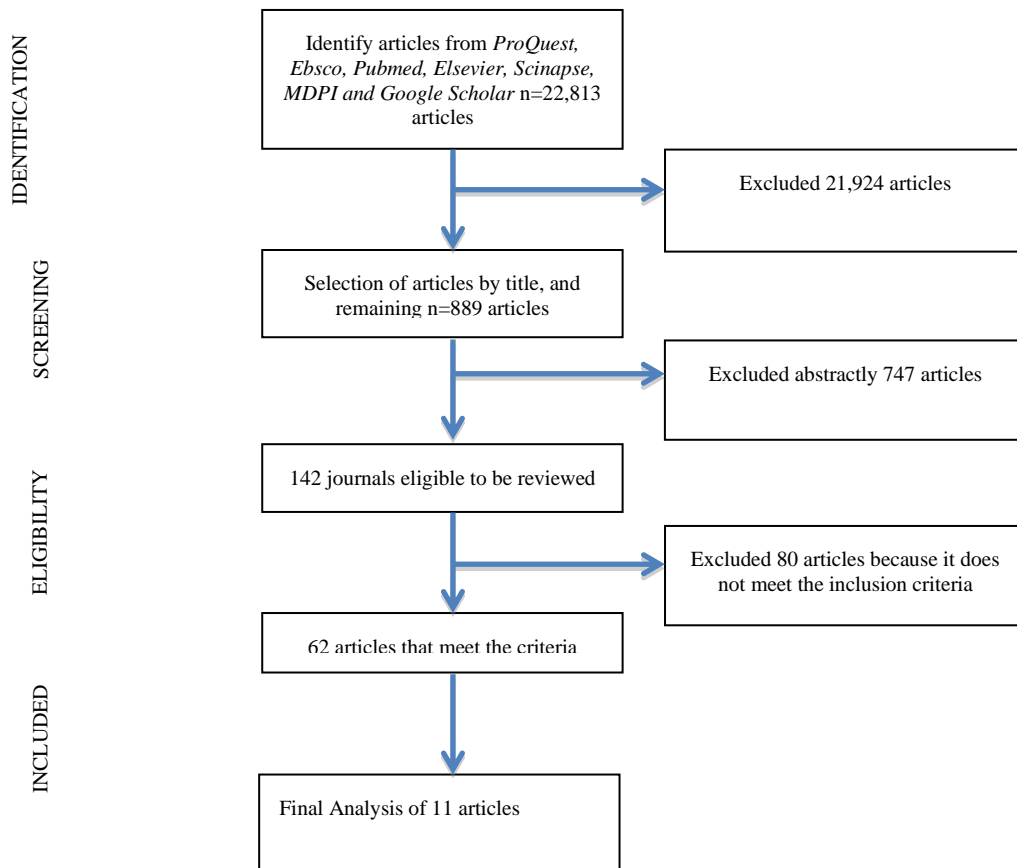


Figure 1. Systematic review process

Writing a literature review follows the writing guidelines of Preferred Reporting Items for Systematic Reviews (PRISMA). The stages in the review consist of identifying articles from the article source database (Identification), After that, the articles were filtered according to the inclusion criteria and exclusion criteria (screening), after that, all articles that match the inclusion (eligibility) and exclusions criteria were then assigned to suitable articles according

to the design of the Physical Activity Effectiveness research plan (included). The total articles obtained from *Scinapse*, *Pubmed* and *Google Scholar* are 22,813 articles.

## RESULT

Based on the review results of several articles related to physical activity interventions, it can be explained that the research conducted by Desveaux *et al.* with the research design used was prospective, cross-sectional, repeated measures, and the study subjects of Diabetes Mellitus patients aged over 40 years. This journal determines whether adults with diabetes and Transtibial Amputation (TTA) meet the recommended guidelines to the intensity of physical activity and the number of daily steps. The results obtained regarding physical activity are the physical activity levels for adults with diabetes and TTA remained stable after discharge from prosthetic rehabilitation but far below the recommended guidelines of 6,500 steps per day and 150 minutes of moderate to high physical activity per week (13).

Research conducted by Anjana *et al* to assess the pattern of physical activity in Diabetes Mellitus patients across India using a cross-sectional study method, result that that the majority of people in India are not active in physical activity, which is less than 10%. Thus, it is necessary to do physical activity to prevent the epidemic of diabetes and obesity in India (14).

According to Mynarski *et al.*, (2012), researching by doing physical activity to analyze glycemic control (HbA1c) and body mass index (BMI), in patients with type 2 diabetes mellitus in a randomized and controlled design. This study found that the IPAQ could serve as a potential tool for physical activity assessment without further requirements for more sophisticated methods. The results showed that habitual physical activity has no impact on glycemic control and BMI in type 2 diabetes patients. However, further studies of larger populations are necessary to explore this issue.

Other results from the articles reviewed regarding physical activity were carried out by Spartano *et al.* to determine the cross-sectional relationship of physical activity with circulating concentrations of IGF-1, VEGF, and BDNF in individuals with and without diabetes, with a prospective cohort study design. Results showed that physical activity was associated with higher circulating IGF-1 and BDNF in participants with Diabetes Mellitus. These results, distinguishing interaction based on age and diabetes status, may also help explain some inconsistent results in studies related to physical activity with growth and neurotrophic factors (16).

Research result by Joseph *et al.* assessed the relationship between physical activity, sedentary behavior, and the incidence of diabetes in the Multi-Ethnic Study of Atherosclerosis using an observational study design. This study found results that confirm the importance of physical activity and sedentary behavior on the risk of diabetes in a multiethnic population and show the potential variation across racial/ethnic groups (17).

The next review journal related to research conducted by Hjerkind, Stenehjem dan Nilsen to determine whether physical activity can compensate for the adverse effects of adiposity at risk of diabetes. The design used is the data from the prospective population-based HUNT study. The results of this study show that overweight and obesity are associated with increased risk of diabetes, especially among those who also reported being physically inactive. High levels of physical activity are associated with a lower risk of diabetes in all body mass index categories but there is no clear evidence that being physically active can fully offset the adverse effects of adiposity on diabetes risk (18).

Journal review results by Sanabria-Martínez *et al* were performed on pregnant women, This journal assessed the effectiveness of exercise intervention during pregnancy to prevent gestational diabetes mellitus and excessive maternal weight gain by using a meta-analysis of randomized controlled design, and it was found that a structured moderate physical exercise

program during pregnancy reduced the risk of gestational diabetes mellitus and reduced maternal weight gain, and it seems safe for mother and baby. However, further studies are necessary to establish recommendations (19).

According to research Van Rooijen, Viviers dan Becker, the aim of the study is to determine the effectiveness of educational intervention programs as walking and daily diet with the study design randomized controlled trial and found the results that the physical activity intervention HbA1c results can be increased for four months. Required more frequent contact with patients (20).

## DISCUSSION

This study examines physical activity in adults with diabetes with lower extremity amputations. Despite improved functional mobility (Test L) for six months, physical activity remains well below 6500 steps per day, and 150 minutes per week of moderate to high physical activity are recommended for individuals with diabetes. The level of physical activity showed a good to excellent with functional exercise capacity and a good relationship with mobility and balance confidence (13).

Daily physical activity was defined as body movement continuously through the contraction of skeletal muscle resulting in increased energy expenditure in daily life (21).

Physical activity (PA) is one of the excellent treatment options for people with prediabetes or diabetes. However, some of the increased risks occur with increased physical activity, and certain precautions are necessary to reduce this risk, especially if these people are not used to exercising. We performed a standard search for all additional events associated with increased physical activity in people with prediabetes or diabetes (type 1 or type 2), and provide evidence-based guidelines on screening physical activity in these high-risk individuals (22).

Exercising under hypobaric conditions poses several unique challenges for diabetics and has the potential to lead to dangerous situations such as unanticipated hypoglycemia and hyperglycemia. (23).

In a study conducted by *Desveaux et al* physical activity was assessed using the Godin Leisure-Time Physical Activity Questionnaire (GLTEQ) (11). Participants were asked to report the frequency and duration of light-intensity (easy walking, yoga, golf), moderate-intensity (brisk walking, cycling, tennis), and high-intensity (aerobics, jogging, lap swimming) leisure-time physical activities carried out in a typical week. The number of minutes is calculated by multiplying the frequency of weekly physical activity with the duration in minutes (13).

Most patients with type 2 diabetes mellitus are sedentary despite the clear benefits of regular physical activity, including better glucose control and improved quality of life (24). Another study aimed at evaluating the cost-effectiveness of healthy eating and physical activity intervention compared to usual care among pregnant women at increased risk of GDM from a social perspective. (25).

Lifestyle interventions remain the cornerstone of the management of type 2 diabetes mellitus (T2DM). However, adherence to physical activity (PA) and its impact on cardiorespiratory fitness in this population has been poorly described (26). Physical activity can have a significant effect on glucose metabolism in individuals with and without type 1 diabetes mellitus (T1DM) (27). In people who are at high risk of diabetes, interventions aimed at promoting healthy behavior change that can prevent or delay the development of diabetes and retinopathy and can lead to sustainable health benefits (28). The frequency and intensity of physical activity in the absence of a supportive environment that will allow the achievement of daily MVPA recommendations is not optimal (29).

Physical activity exercise is recommended as an adjunct therapy to diet in the management of type 2 diabetes mellitus (non-insulin-dependent). The latest review shows the potential of exercise to improve insulin sensitivity, glucose tolerance, and long-term glycemic control as measured by HbA1c in diabetes patients. In addition, data are showing that regular physical activity leads to beneficial changes in serum lipid profiles. However, the benefits in clinical trials are simple from a clinical viewpoint.

## CONCLUSION

Physical Activity Interventions can improve the condition of DM patients if done regularly and according to recommendations such as improving glycemic control, lose weight, and prevent further complications. Further research is necessary to assess the effectiveness of physical activity.

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