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The Role of Physical Activity in Improving Quality of Life and Glycemic Control in Type 2 Diabetes Mellitus Patients: A Systematic Literature Review

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ABSTRACT

Type 2 diabetes mellitus (T2DM) is a chronic disease that poses a global health burden with a significant increase in cases and complications. Physical activity plays an important role in improving glycemic control and quality of life in T2DM patients. This study aims to analyze the role of physical activity on quality of life and glycemic control through a Systematic Literature Review (SLR) guided by PRISMA. Articles were searched through the PubMed and ScienceDirect databases using the keywords "Diabetes Mellitus Type 2," "Physical Activity," and "Quality of Life." Of the 178 articles found, 11 met the inclusion criteria (English language, published between 2020 and 2025, full text, and studies on DMT2 patients). Most studies used a Randomized Controlled Trial (RCT) design.

The synthesis results show that aerobic physical activity, resistance training, or a combination of both consistently improves the quality of life and physical function of patients with DMT2. Structured home-based exercise for 12 weeks and community-based and online programs showed significant improvements in physical, psychological, and social domains. In addition, seven of the eleven studies reported a decrease in blood glucose or HbA1c levels after intervention. Programs with supervision, whether in-person or online, provided better compliance and glycemic outcomes.

Conclusion, regular physical activity, especially a supervised combination of aerobic and resistance training, effectively improves the quality of life and metabolic control of patients with type 2 diabetes and has the potential to be integrated into primary and community health services.

Keywords: Physical Activity, Quality of Life Type 2 Diabetes Mellitus

INTRODUCTION

Type 2 diabetes mellitus is a non-communicable disease that ranks eighth in terms of global disease burden, and is estimated to rise to second place by 2050. The number of diabetes cases globally will increase from 589 million in 2024 to 853 million in 2050. The prevalence of diabetes in Indonesia is 11.3%, or 20 million out of 185 million adults (IDF, 2021). The impact of diabetes mellitus, in addition to causing high glucose levels, also causes a decline in physical function, reduces quality of life, and increases the risk of chronic complications that contribute to an increase in global morbidity and mortality rates (Khan et al., 2020).

DMT2 management strategies include lifestyle changes such as diet control, exercise, and weight loss, which should begin before and concurrently with pharmacological therapy (MacDonald et al., 2021). Diabetes prevention and control guidelines emphasize that patient self-management is crucial for controlling disease progression. However, adherence to self-management guidelines among patients remains suboptimal. Research shows that the level of adherence to dietary guidelines among patients with type 2 diabetes mellitus is 57.27%, blood glucose monitoring is 48.13%, and exercise is 49.79% (Liu et al., 2025). Lifestyle interventions involving dietary management and physical activity are very important, as physical activity not only improves blood glucose control but also affects quality of life (Abonie et al., 2023). Quality of life encompasses physical and mental symptoms, functional status in the form of physical function, psychological function, and social function, and general health perception. Overall quality of life encompasses overall well-being and life satisfaction (Langendoen-Gort et al., 2022). The World Health Organization (WHO) recommends that patients with chronic diseases engage in at least 150-300 minutes of aerobic physical activity

(World Health Organization (WHO), 2021). Exercise and physical activity in the form of aerobic and endurance training effectively increase insulin sensitivity and improve glycemic control (Al-Mhanna et al., 2024). A study found that a structured 12-week exercise program effectively reduced insulin resistance, improved quality of life, and increased functional capacity (Rietz et al., 2022). A well-planned and supervised exercise program is an important part of primary prevention of type 2 diabetes (Ribeiro et al., 2023). This study aims to analyze the role of physical activity on quality of life and glycemic control through a Systematic Literature Review (SLR) guided by PRISMA.

MATERIALS AND METHODS

This study used a Systematic Literature Review (SLR) approach, guided by the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) guidelines. The PRISMA framework emphasizes clarity and documentation of inclusion and exclusion criteria, search strategies, and screening processes (Page et al., 2021). A flowchart summarizing the research methodology process using PRISMA is presented in Figure 1.

The PRISMA approach uses several stages, namely determining the topic, searching for sources, selecting relevant sources, grouping and analyzing articles. Articles were obtained from the Pubmed and Science Direct databases. The inclusion criteria were articles in English, full-text articles that were available and accessible. The articles used were publications from 2020 to 2025 and were relevant to the research objectives.

The search query used was “Diabetes Mellitus Type 2” AND “Physical Activity” AND “Quality of Life.” Based on this query, 178 articles were found, and 11 articles were included in this study. The articles were selected after applying the following criteria:

Inclusion criteria:

Studies on patients with type 2 diabetes mellitus

- Articles in English
- Articles published between 2020 and 2025

Exclusion criteria

- Studies not in English
- Studies published without full text
- Published in non-open access journals

Articles included in the study were selected using the Critical Appraisal table.

The review was conducted using the PRISMA guidelines. The flow diagram is illustrated in Figure 1.

RESULTS

The database search identified 178 citations. A total of 35 full-text studies were selected for full assessment to examine their eligibility criteria. After full-text screening, eleven articles were included in this review for data extraction. See the PRISMA flow diagram (Figure 1)

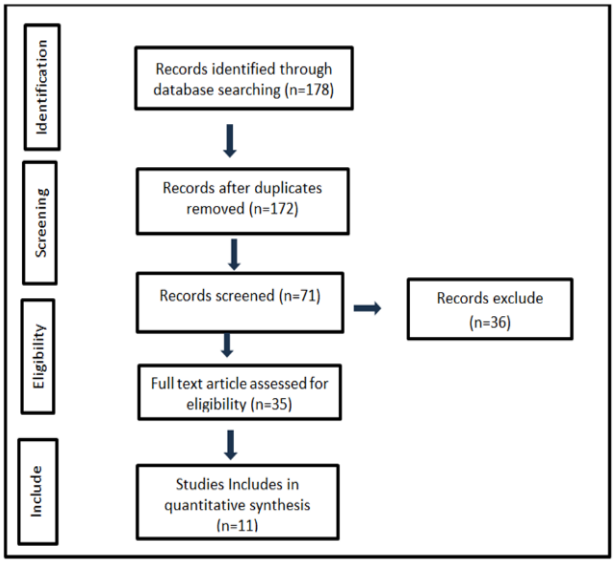


Figure 1. PRISMA flow chart

Based on the results of a systematic literature search, 178 articles were found. Of the 178 articles, 11 articles were included in the final review process. Table 1 shows the data that met the research criteria. The results of the article review aimed to determine the role of physical activity in improving the quality of life of patients with diabetes mellitus.

Table 1. Selected Research Articles

No	Artikel/ Author / Year	Country	Method/ Sampling Methode/ Study Period	Data Set / Key Details
1	Improving Metabolic Syndrome in Ghanaian Adults with Type 2 Diabetes through a Home-Based Physical Activity Program: A Feasibility Randomized Controlled Trial Amin M., Kerr D., Atiase Y., Samir M.M., Driscoll A. (2023)	Ghana	Randomized Controlled Trial (RCT) Purposive sampling June–August 2022 (12-week intervention) 87 participants	- Adults ≥18 years with T2DM and metabolic syndrome - Intervention: 12-week *home-based* physical activity program combining aerobic (walking) and resistance (elastic band) exercise, - Results: Significant improvements in FBG (−2.4%), WC (−5.4%), SBP (−9.8%), and MetS severity (−8.8%) in intervention vs control ($p<0.05$). - Conclusion: The 12-week home-based PA program is *feasible, safe,* and effective in improving metabolic health and QoL among Ghanaian adults with T2DM.
2	The effect of home-based resistance exercise training in people with type 2 diabetes: A randomized controlled trial Al Ozairi E., et al. (2023)	Kuwait	Randomized Controlled Trial (RCT) Consecutive sampling January – June 2021 (12-week intervention) 60 participants	- Adults aged ≥ 40 years with T2DM (HbA1c > 7%, stable medication). - Intervention: 12-week *home-based resistance training* using elastic bands- Results: Significant reductions in HbA1c (−0.8%, $p < 0.05$), fasting glucose, and body fat %; increased muscle strength ($p < 0.01$). Adherence > 85 %. - Conclusion: A structured, home-based resistance-training program over 12 weeks is *feasible, safe,* and *effective* in improving glycaemic control and physical fitness in people with T2DM.
3	Changes of Physical Function and Quality of Life in Patients with Type 2 Diabetes after Exercise Training in a Municipality or a Hospital Setting Molsted, S., Jensen, T. M., Larsen, J. S., Olesen, L. B., Eriksen, S. B. M., Rasmussen, S. S., & Aadahl, M. (2022)	Denmark	Clinical intervention study (12-week exercise training Consecutive sampling Feb 2015 – Dec 2017 72 participants	- Intervention: 12-week supervised exercise training - Results: CST improved in both groups - Conclusion: Both hospital and municipal exercise settings improved physical function equally, but municipality-based training showed greater improvement in QOL.
4	Associations between physical activity patterns and quality of life in persons with type 2 diabetes Abonie, U. S., Ofori-Ampomah, A. K., Makinyi,	Ghana	Cross-sectional quantitative study using questionnaires May – July 2021 121 participants	Primary data collected through self-administered questionnaires and clinical visit assessments. Relationship between Physical Activity and Quality of Life, Spearman's correlation analysis showed a significant negative relationship between physical activity

	V., Addo, R. A., & Kumah, L. (2023)			levels and total D-39 scores (r = – 0.431, p < 0.001). Conclusion: There is a strong and significant relationship between physical activity and quality of life in people with type 2 diabetes in Ghana.
5	Effects of combined resistance training and Tai Chi on oxidative stress, blood glucose and lipid metabolism and quality of life in elderly patients with type 2 diabetes mellitus Chang, S. & Liu, H. (2024)	China	Randomized Controlled Trial (RCT) May – August 2022 94 participants	- Intervention: 24-week exercise program - Groups: Resistance Training (RT), Tai Chi (TC), Combined RT+TC, Control (no exercise). - Results: Combined RT+TC significantly improved oxidative stress markers and partially improved lipid/glucose levels, though no synergistic effect beyond single interventions.
6	Effectiveness of structured exercise program on insulin resistance and quality of life in type 2 diabetes mellitus–A randomized controlled trial Amaravadi et al. (2024)	India	Randomized Controlled Trial (RCT) 146 participants	Primary data were collected from participants with T2DM through laboratory measurements (HOMA-IR, HbA1c, FBS, PPBS) and WHOQOL-BREF quality of life questionnaires before and after the intervention.
7	Impact of a community-based lifestyle intervention with initial sedentary reduction or physical activity increasing goals on self-reported health-related quality of life Mitchell-Miland, C., Harris, J. E., Cross, R., et al. (2025)	United States	Randomized Controlled Trial 82 participants	Intervention: Community-based lifestyle program, approach: sedentary reduction (SR) and physical activity promotion (PA). - Results: Both groups showed significant increases in total physical activity and decreases in sitting time. - Conclusion: Community-based interventions are effective in improving metabolic health in people with T2DM.
8	Effects of Brain Breaks Video Intervention of Decisional Balance among Malaysians with Type 2 Diabetes Mellitus: A Randomized Controlled Trial Hidrus, N. H., Muhammad, N. A., Hassan, M. H., et al. (2021)	Malaysia	Quasi-experimental study (pre-post test design with control group) Purposive sampling 70 participants	- Intervention: Theory-based Brain Breaks Video Physical Activity Program. - Results: There was a significant increase in pros scores and a decrease in cons scores in the intervention group compared to the control group (p < 0.001). - Conclusion: The Brain Breaks Video intervention is effective in increasing motivation for physical activity in patients with type 2 diabetes.

9	Effects of 12-Week Progressive Sandbag Exercise Training on Glycemic Control and Muscle Strength in Patients with Type 2 Diabetes Mellitus Chien, M.-Y., Huang, T.-Y., Chen, H.-C., Wu, Y.-T. (2022)	Taiwan	Randomized Controlled Trial (RCT) 60 participants	- Intervention: Progressive Sandbag Exercise - Results: Significant decrease in HbA1c (−0.6%, $p<0.01$) - Conclusion: Progressive sandbag exercise for 12 weeks is safe, effective, and easy to implement to improve glycemic control and muscle function in patients with T2DM.
10	*The effect of an online-supervised exercise program in older people with diabetes on fasting blood sugar, psychological resilience and quality of life"*: Terkes, N., Yildiz, A., & Ozdincler, A. R. (2023)	Turkey	Randomized Controlled Trial (RCT) with two groups (intervention and control) Convenience sampling	- Intervention: A 6-week online-supervised exercise program.- Control: Independent exercise without online supervision. - Results: Significant decrease in FBS in the intervention group compared to the control group ($p<0.05$); significant increase in resilience and quality of life scores. - Conclusion: The online-supervised exercise program is effective in improving glycaemic control and psychological well-being in older adults with type 2 diabetes.
11	Behavioral interventions to promote physical activity in a multiethnic population at high risk of diabetes: The Walking Away from Type 2 Diabetes randomized controlled trial." Khunti, K., et al. (2021)	United Kingdom	Randomized Controlled Trial (RCT) – *Walking Away from Type 2 Diabetes* Cluster random sampling 808 participants	- Intervention: Group-based education and behavioural program to increase physical activity (walking-based behavioural intervention). - Control: Standard care from general practice. - Results: No significant increase in total physical activity, but a small increase in the subgroup with high compliance. - Conclusion: Community-based behavioural interventions are feasible, but the impact on increasing physical activity requires additional intensive strategies.

The general characteristics of the studies included populations from various countries, namely Ghana, Kuwait, Denmark, China, India, the United States, Malaysia, Taiwan, Turkey, and the United Kingdom. The research methods were mostly randomized controlled trials (RCTs), with eight articles, two quasi-experimental articles, and one cross-sectional article. RCTs are ideal for determining the efficacy of interventions randomly assigned to intervention and control groups. They have high internal validity and can provide unbiased causal effects from exposure to outcomes (Fernainy et al., 2024). The sample size ranged from 60 to 808 respondents. The duration of the intervention varied from 6 weeks to 48 months, with 4 studies lasting 12 weeks.

Based on the synthesis of 11 articles, the table shows the main findings related to physical activity, blood glucose reduction, improved quality of life, and psychosocial influences and social support. Aerobic physical activity such as walking and community-based physical activity reduces blood glucose and HbA1c (Amin et al., 2023), (Mitchell-Miland et al., 2025). Improved physical function and daily activity capacity (Molsted et al., 2022), as well as improved general health perception and quality of life (Terkes et al., 2023b). Resistance training interventions using elastic bands or sandbags affect strength and muscle mass and insulin sensitivity. Increased insulin sensitivity increases insulin resistance (Al Ozairi et al., 2023), (Chien et al., 2022). There is a significant decrease in blood glucose and HbA1c levels (Al Ozairi et al., 2023; Chien et al., 2022).

Physical activity in the form of a combination of aerobic and resistance training, such as walking and elastic bands, or a combination of resistance training and Tai Chi, reduces blood glucose and metabolic parameters more significantly than single exercises (Amin et al., 2023), (Chang & Liu, 2024). Improvements in overall quality of life include physical function, vitality, and health perception (Amin et al., 2023). Most studies show improvements in the quality of life of type 2 DM patients in the following domains: physical function and daily activities, general health perception, vitality and energy, and emotional and social well-being (Molsted et al., 2022), (Terkes et al., 2023a), (Abonie et al., 2023). Psychosocial factors and social support are correlated with physical activity and improved quality of life, influenced by motivation and perceived benefits (Abonie et al., 2023). Social support-based physical interventions increase motivation and exercise adherence (Hidrus et al., 2021). Online supervision programs increase psychological resilience (Terkes et al., 2023b).

DISCUSSION

The synthesis of eleven studies shows that physical activity, whether in the form of aerobic exercise, resistance training, or a combination of aerobic and resistance training, consistently improves the quality of life (QoL) of patients with diabetes. Community-based approaches are conducted either face-to-face or online. Studies by Amaravadi (2024) and Amin (2023) show that 12 weeks of structured home-based exercise resulted in a significant improvement in the quality of life of respondents, as seen in a significant increase in WHOQOL-BREF scores (Amaravadi et al., 2024), (Amin et al., 2023). Improvements in quality of life were seen in the physical, vitality, and daily functioning domains. Chien's (2022) study found that progressive resistance training using sandbag exercises in elderly patients improved quality of life and muscle mass (Chien et al., 2022). These results are in line with Molsted (2022) in Denmark, who reported an increase in physical function and general health perception after a 12-week exercise program (Molsted et al., 2022). Different results were found in Al-Ozairi's (2023) study, which did not find significant changes in quality of life despite an increase in muscle strength and lean body mass. This study indicates that psychosocial factors and social support also play a role in improving quality of life (Al Ozairi et al., 2023).

Community-based approaches, such as those described in Mithell-Miland (2025) and Khunti (2021), show that reducing sedentary time and increasing moderate physical activity significantly improves quality of life, even though the reduction in blood glucose levels is relatively small. A literature review study conducted by Smith (2024) on reduced activity found an improvement in glycemic control in the intervention group compared to the control group (Smith et al., 2024).

Regarding the effects on the glycemic levels of patients who performed physical activity, seven out of eleven studies reported a decrease in blood glucose or HbA1c levels after the intervention. Amaravadi (2024) showed a decrease in HbA1c ≈ 0.55% and HOMA-IR after a 12-week combination of aerobic and resistance training, while Chien (2022) found a decrease in HbA1c along with an increase in muscle mass and strength. Terkes (2023) added a new dimension: a 6-week online-supervised exercise program significantly reduced fasting blood sugar and BMI in elderly individuals with diabetes. Based on these findings, it can be seen that intensity, frequency, and supervision are determining factors for the success of glycemic control, where there was a decrease in blood glucose in the intervention group. (Terkes et al., 2023).

In addition to physical aspects, several studies highlight the role of psychological and behavioral mechanisms in improving QoL. Hidrus (2021) found that a four-month Brain Breaks Video intervention improved decisional balance (increasing the perceived benefits of physical activity and reducing barriers), which is a strong predictor of active behavioral change. Terkes (2023) reported an increase in psychological resilience in the supervised online exercise group, indicating that social engagement, support, and a sense of competence contribute to mental well-being. These findings reinforce the theory that QoL improvement is not only determined by physiological outcomes but also by self-efficacy and social support resulting from active participation in exercise programs.

Interventions can be conducted in person and online or remotely. Terkes (2023) showed that online-supervised exercise produced QoL and glycemic outcomes that were equivalent or better than unsupervised exercise, with high safety and better compliance in the elderly population. These findings complement the results of Khunti (2021), who used an SMS-based mHealth intervention, and Mitchell-Miland (2025), who used a community-based approach (Mitchell-Miland et al., 2025).

Overall, physical activities such as aerobic, resistance, and combined aerobic and resistance exercises have been shown to improve quality of life (QoL) and glycemic control (Chang & Liu, 2024). Home-based resistance training effectively improves muscle strength and physical function, especially in older adults (Al Ozairi et al., 2023). Community-based and digital interventions improve adherence and motivation, with positive effects on QoL despite varying glycemic effects (Mitchell-Miland et al., 2025). One key factor that enhances the physiological and psychological benefits of exercise is supervision, whether in person or online (Terkes et al., 2023).

CONCLUSION

Physical activity has been shown to provide multidimensional benefits for patients with type 2 diabetes. A combination of aerobic and resistance exercise—whether conducted in person or online—improves quality of life, physical function, and several metabolic parameters. Supervised programs, including online-supervised exercise, yield the best results because they promote adherence, motivation, and psychological resilience. Integrating this approach into primary care and community services is expected to improve quality of life and reduce the burden of chronic diabetes complications sustainably.

CONFLICT OF INTEREST (if any)

The authors declare that there is no conflict of interest regarding the publication of this study

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