

Research Trends in Physical Activity to Improve Quality of Life in Type 2 Diabetes Mellitus Patients with Knee Osteoarthritis: Bibliometric Analysis

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Abstract. There are 529 million people living with Diabetes Mellitus worldwide with a global Diabetes Prevalence of 6.1%. In 2050, it is estimated that more than 1.31 billion people are projected to suffer from DM which results in loss of insulin receptor sensitivity, reduced chondrocyte survival and differentiation capacity, thus accelerating the development of knee Osteoarthritis (OA). The combination of chronic pain, limited mobility, and high disease burden leads to a decline in quality of life. The purpose of this study is to analyze the quality of life of people with Type 2 Diabetes Mellitus with knee Osteoarthritis. The selection process focused on articles that have been cited and have been published between 2020 and 2025. Researchers analyzed the articles to determine research progress in the field of quality of life of people with Diabetes Mellitus with knee Osteoarthritis in the last five years. Furthermore, it emphasizes important discoveries in the field of interventions to improve the quality of life of people with DM with knee OA. Furthermore, researchers provide a comprehensive analysis of factors related to the quality of life of people with type 2 DM with knee OA by measuring publications and identifying journals that publish related articles. This study also reveals journals and authors that obtain the highest citations. Future research needs to increase physical activity and strength and muscle training to reduce disease severity and improve the quality of life of DM patients with OA.

Keywords: quality of life, diabetes mellitus, osteoarthritis, knee, physical activity.

1 Introduction

Type 2 Diabetes Mellitus (DM) is a collection of symptoms that arise in a person due to increased blood sugar levels (hyperglycemia) due to insulin deficiency. Hyperglycemia causes oxidative stress, excessive production of pro-inflammatory cytokines and advanced glycated end products (AGEs) in the joints that cause inflammation, increased cytokines, production of matrix metalloproteinases (MMPs) by chondrocytes with increased free fatty acids (FFA), which modulate the development of Osteoarthritis (OA) [1]. DM results in loss of insulin receptor sensitivity, which can reduce chondrocyte survival and differentiation capacity, thereby accelerating the progression of OA [2].

Individuals with diabetes mellitus and knee osteoarthritis are expected to experience more knee pain than individuals without diabetes. The presence of diabetes accelerates the development and progression of knee osteoarthritis. Knee osteoarthritis can limit participation in social and daily activities. Ultimately, the combination of chronic pain, limited mobility, and a high disease burden leads to a reduced quality of life [3].

Knee OA accounts for nearly 80% of OA cases [4]. At least one in six individuals with diabetes suffers from knee OA. Diabetes with knee OA leads to prolonged sitting and decreased physical activity. This lack of physical activity in people with diabetes with knee OA can increase the risk of complications such as cardiovascular disease [5]. There are 529 million people living with diabetes mellitus worldwide. The global prevalence of diabetes is 6.1%. By 2050, it is estimated that more than 1.31 billion people will suffer from diabetes [6]. The prevalence of diabetes mellitus (DM) in Indonesia is estimated to increase from 9.19% in 2020 (18.69 million cases) to 16.09% in 2045 (40.7

million cases). This prevalence has increased by 75.1% over 25 years, with an average increase of 3% per year [7].

This study aims to examine the impact of type 2 diabetes mellitus on the quality of life of individuals who also suffer from knee osteoarthritis, with a focus on non-medical factors. The study aims to identify factors influencing the quality of life of individuals with type 2 diabetes mellitus and knee osteoarthritis, including management of medical conditions, therapy received, and level of physical activity. The study aims to analyze the impact of comorbid knee osteoarthritis on the quality of life of individuals with type 2 diabetes mellitus, including potential complications or interactions between the two conditions. The study aims to identify and evaluate various interventions that have been implemented to improve the quality of life of individuals with type 2 diabetes mellitus and knee osteoarthritis. The study aims to develop evidence-based recommendations for the management of individuals with type 2 diabetes mellitus and knee osteoarthritis to improve quality of life, providing insights applicable to clinical practice.

The novelty of this study is that it targets a population with specific comorbidities, namely type 2 diabetes mellitus and knee osteoarthritis, which are relatively rarely studied together. This bibliometric analysis examines the quality of life in individuals with type 2 diabetes mellitus and knee osteoarthritis. Existing evidence regarding interventions to improve the quality of life of people with DM and knee osteoarthritis is limited. Empirical studies that mention interventions to improve the quality of life of people with DM and knee OA are still very limited. Bibliometric analyses have mostly focused on physical activity for type 2 DM or only for people with knee osteoarthritis, but not on the type 2 DM and osteoarthritis population. This study utilized Scopus-based data, recognized as peer-reviewed data that covers a broader and more global spectrum. Therefore, it is necessary to examine the existing literature on interventions that can be implemented to improve the quality of life of people with DM and knee OA.

2 Methods

The main objective of this study is to analyze the effectiveness of physical activity to improve the quality of life of people with diabetes mellitus and knee osteoarthritis. This study has conducted a systematic literature review of previous research studies. A systematic literature review attempts to find, critically assess, and combine all relevant studies conducted on the topic of type 2 diabetes mellitus with knee osteoarthritis and physical activity to improve the quality of life of people with type 2 diabetes mellitus and knee OA.

2.1 Databases and search strategy

Advanced keywords were developed based on the primary keywords, namely “Diabetes Mellitus,” “Quality of Life,” “Physical activity,” and “Knee Osteoarthritis” for article search. Each keyword was searched for synonyms using Medical Subject Headings (MeSH) from NCBI (<https://ncbi.nlm.nih.gov/mesh>). Based on MeSH, lexical analysis revealed that the keyword “Diabetes Mellitus” is synonymous with “Diabetes mellitus type 2” in the context of this study. Further semantic exploration using co-occurrence analysis of the keyword Quality of life identified related terms such as “Life Quality,” “Health-Related Quality of Life and,” “Health-Related Quality Of Life,” and “HRQOL.” While the term “Knee” remained unique, “Osteoarthritis knee” was found to be semantically related to “Knee Osteoarthritis,” “Knee Osteoarthritis,” “Osteoarthritis of the Knee,” “Osteoarthritis of the Knee.” The keyword “Physical activity” is proven to be a more specific term for a broader category, namely “Exercises, Exercise, Physical Exercises, Physical, Physical Exercise, Physical Exercises, Exercise, Aerobic, Aerobic Exercise, Aerobic Exercises, Exercises, Aerobic, Exercise, Isometric, Exercises, Isometric, Isometric Exercise, Isometric Exercise, Acute Exercise, Acute Exercises, Exercise, Acute, Exercises, Acute, Exercise Training, Exercise Trainings, Training, Exercises, Trainings, Exercises, Physical Activities, Activities, Physical, Activities, Physical, Physical Activities. The article search was carried out as of June 8 2025, by accessing the PubMed and Scopus databases.

The search for relevant publications was conducted on May 3, 2025, based on Scopus data. The search on the Scopus database was based on the search query “quality of life” and “diabetes

Mellitus” filtered from 2020 to 2025, which includes the last five years of research that resulted in 16,647 articles. The search used the search quarry “quality of life” and “diabetes Mellitus” and “knee” with a total of 481 articles. Articles were excluded based on document type: book chapters (1), editorials (4), reviews (52), conference papers (4), letters (2), notes (4) so that the total number of articles was 207 articles. The articles taken were publication stage articles that were confirmed to be final, articles were excluded based on the publication stage: articles in the process of being published (1) so that the total number of articles was 206 articles. The articles taken were articles in English and articles were not included in the analysis because they used Russian (1 article) and Chinese (1 article), so that the total number of articles included in the analysis was 204 articles. After screening, open access articles were selected, and articles were excluded based on all open access types: green (93), gold (95), hybrid (20), and bronze (3), resulting in 136 articles entering the next stage.

A search for relevant publications was conducted on May 3, 2025, based on Scopus database. The search in the Scopus database was based on the search queries "quality of life" and "diabetes mellitus" filtered from 2020 to 2025, covering the last five years of research, resulting in 16,647 articles. The search used the search queries "quality of life" and "diabetes mellitus" and "knee," resulting in 481 articles. Articles were excluded based on document type: book chapter (1), editorial (4), review (52), conference paper (4), letter (2), and note (4), resulting in 207 articles. The articles taken are publication stage articles that are confirmed to be final, articles are excluded based on the publication stage: articles are in the process of being published (1) so that the number of articles is 206 articles. The articles taken are articles in English and articles are not included in the analysis because they use Russian (1 article) and Chinese (1 article) so that the number of articles included in the analysis is 204 articles. After filtering, articles that are open access are taken, articles are excluded based on all types of open access: green (93), gold (95), hybrid (20), bronze (3) so that the number of articles included in the next stage is 136 articles.

2.2 Data collection and screening

The search for relevant publications in the Scopus database data was conducted on May 3, 2025 based on Scopus data with TITLE-ABS-KEY ("quality of life" AND "diabetes mellitus" AND "knee") AND PUBYEAR > 1999 AND PUBYEAR < 2026 AND (LIMIT-TO (DOCTYPE , "ar")) AND (LIMIT-TO (PUBSTAGE , "final")) AND (LIMIT-TO (SRCTYPE , "j")) AND (LIMIT-TO (LANGUAGE , "English")) AND (LIMIT-TO (OA , "all")).

This study uses a bibliometric approach from trending articles. This approach ensures comprehensive and transparent research on this topic. Bibliometrics uses VOSviewer to visualize bibliographic and citation data, and author collaboration. Bibliometric and systematic literature reviews with "Quality of life" and "Diabetes Mellitus" and "knee" as the main keywords with the Boolean operator "and". A search on the Scopus database was conducted based on the search query "quality of life" and "diabetes Mellitus" filtered from 2020 to 2025, covering five years of research. The search used the search queries "quality of life" and "diabetes Mellitus" and "knee". Articles were excluded based on document type: The articles retrieved were publication-stage articles that were confirmed to be final. The articles retrieved were Submit article entries in English. After screening, open access articles are selected, resulting in a number of articles that will be included in the next stage of further analysis.

2.3 The research questions in this bibliometric analysis are:

What are the trends in scientific publications on the topic of physical activity to improve the quality of life of people with type 2 diabetes mellitus and knee osteoarthritis by year, author, and region? What is the distribution of authors and review themes based on the distribution of scientific publication clusters and topics on physical activity to improve the quality of life of people with type 2 diabetes mellitus and knee osteoarthritis in the last five years (2020-2025)?

What are the trends in scientific publication topics regarding the effectiveness of physical activity to improve the quality of life of people with type 2 diabetes mellitus and knee osteoarthritis in the last five years (2020-2025)? This study includes the following variables: title, author, year, location,

population, intervention, comparison, outcomes, study design, results, limitations, and knowledge gaps for novelty and suggestions for further research.

3 Results And Discussion

3.1 Study characteristics

The search for relevant publications was conducted on May 3, 2025, based on Scopus data. The search on the Scopus database was based on the search query “quality of life” and “diabetes Mellitus” filtered from 2020 to 2025, which includes the last five years of research that resulted in 16,647 articles. The search used the search quarry “quality of life” and “diabetes Mellitus” and “knee” with a total of 481 articles. Articles were excluded based on document type: book chapters (1), editorials (4), reviews (52), conference papers (4), letters (2), notes (4) so that the total number of articles was 207 articles. The articles taken were publication stage articles that were confirmed to be final, articles were excluded based on the publication stage: articles in the process of being published (1) so that the total number of articles was 206 articles. The articles taken were articles in English and articles were not included in the analysis because they used Russian (1 article) and Chinese (1 article), so that the total number of articles included in the analysis was 204 articles. After screening, open access articles were selected, and articles were excluded based on all open access types: green (93), gold (95), hybrid (20), and bronze (3), resulting in 136 articles entering the next stage. In this article, the author uses three research questions (RQs):

RQ 1: What are the trends in scientific publications on the topic of physical activity to improve the quality of life for patients with diabetes mellitus and knee osteoarthritis based on year, author, and region?

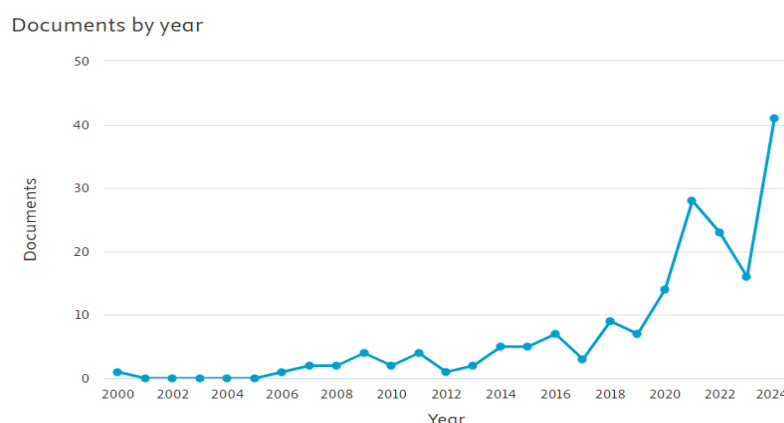


Fig. 1. Trends in Quality of Life Articles in Diabetes Mellitus Patients with Knee Osteoarthritis in Scopus-Indexed Journals.

Based on data from 136 articles discussing the quality of life in DM patients with knee OA in 2020, 14 articles were published in Scopus-indexed journals and increased in 2021 to 28 articles. In 2022, the number of Scopus-indexed publications increased again to 23 articles. In 2023, there was a decrease in the number of articles and 16 articles were obtained. The research trend on the quality of life of type 2 Diabetes Mellitus patients experienced the highest increase in 2024, this proves that the theme of quality of life is trending and attracts the attention of researchers as evidenced by the 41 articles published that year.

One of the studies on the quality of life of DM patients with knee OA conducted in 2024 was a study conducted by S. R. Seow et al on the Combination of Knee Osteoarthritis and Diabetes is Associated with Decreased Muscle Strength, Lack of Physical Activity, and Worse Quality of Life, the findings of the study revealed unique physical and psychosocial characteristics of the diabetic knee osteoarthritis subgroup in the form of reduced muscle strength and physical inactivity. The

study recommended that in the future should investigate whether management of metabolic factors, and increased physical activity and strength training, can reduce knee osteoarthritis symptoms and disease severity [3].

RQ2 : How is the distribution of authors and study themes based on cluster distribution, scientific publication topics Physical activity to improve the quality of life of type 2 Diabetes Mellitus sufferers with knee osteoarthritis in the last five years, namely 2020-2025?

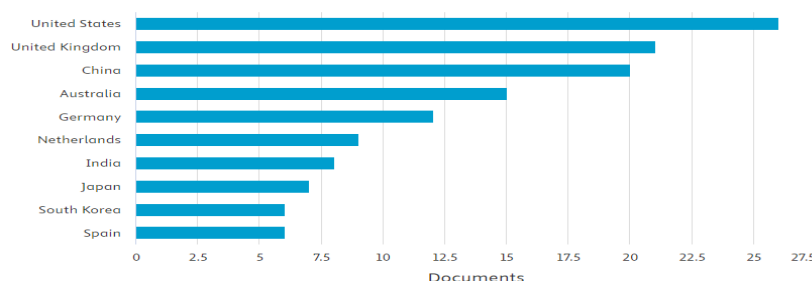


Fig. 2. Comparison of the Number of Documents on Quality of Life in Patients with Diabetes Mellitus and Knee Osteoarthritis by Country.

The country with the most publications on the quality of life of people with diabetes mellitus (DM) and knee OA is the United States (26 papers). One study conducted in America on the quality of life of people with DM and knee OA was conducted by S. Aree-Ue, I. et al., regarding a comprehensive health education program plus monitoring support for older adults with knee osteoarthritis, accompanied by overweight and type 2 diabetes. Results showed that most patients in both groups showed overall improvement: reduced pain, improved physical ability, reduced symptoms of depression and fatigue, and improved quality of life and sleep.

The interaction effect (group and time) showed statistically significant differences between the intervention and control groups in pain, knee range of motion, and fatigue at each follow-up time. A comprehensive health education program plus monitoring support from village health volunteers improved outcomes in this population. Integrated health education resources and support for older adults with knee osteoarthritis and type 2 diabetes represent an effective non-surgical treatment that highlights the role of professional nurses and non-professional village health volunteers. Nurses should consider implementing health education programs plus monitoring support to reduce the impact of chronic disease and improve patients' quality of life [8].

The second country with the most articles published on the quality of life of DM and OA sufferers was the United Kingdom with 21 documents, China with 20 documents, Australia with 15 documents and Germany with 12 documents.

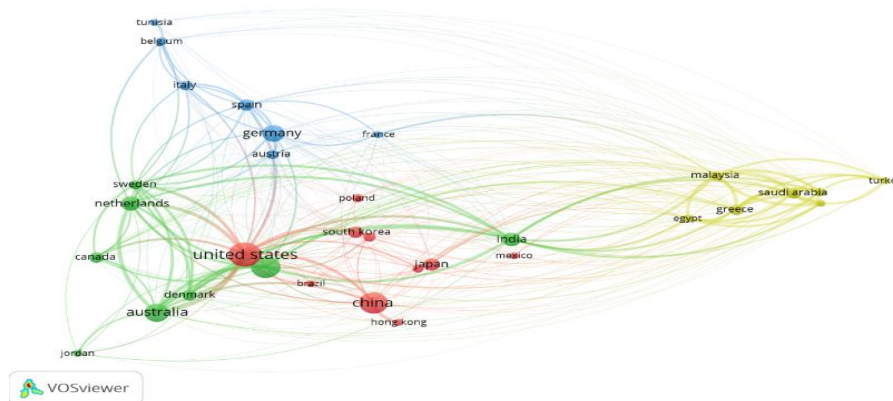


Fig. 3. Network Visualization of Quality of Life in Diabetes Mellitus Patients with Knee Osteoarthritis Across Countries.

There are four research network clusters on the quality of life of people with DM and knee OA. Cluster 1 is research conducted in seven countries: Australia, China, Japan, Singapore, South Korea, the United Kingdom, and the United States. Cluster 2 consists of five countries: Austria, Germany, Italy, Spain, and Sweden. Cluster 3 consists of four items: Greece, India, Malaysia, and Saudi Arabia. Cluster 4 consists of two countries: Denmark and the Netherlands, and cluster 5 consists of one country: Canada.

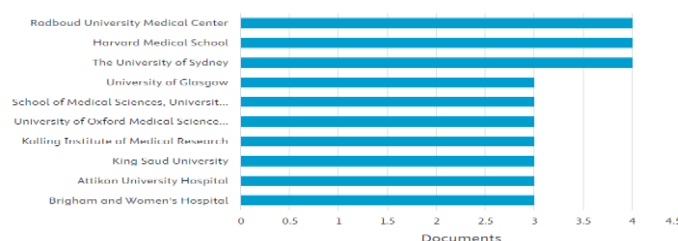


Fig. 4. Research Affiliation: Quality of Life in Diabetes Mellitus Patients with Knee Osteoarthritis.

The dominant campus conducting research on Quality of Life is Radboud University Medical Center with 4 articles, and Harvard Medical School with 4 articles. One of the studies conducted by Harvard Medical School is a study on the exploration of antidiabetic drug targets as potential disease-modifying agents in osteoarthritis conducted by Kai Fu in 2024 which showed a potential therapeutic role for antidiabetic drugs in treating osteoarthritis [9].

The universities that also wrote about the quality of life of DM patients with knee osteoarthritis were The University of Sydney with 4 articles, the University of Glasgow with 3 articles and the School of Medical Science, University Sains Malaysia with 3 documents.

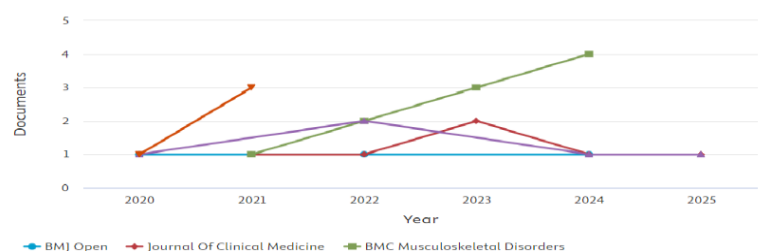


Fig. 5. Quality of Life Documentation for Diabetes Mellitus Patients with Knee Osteoarthritis Based on Top 10 Journal Sources.

One of the studies published by University Sains Malaysia is the combined effects of aerobic and resistance training on glycemic control, blood pressure, inflammation, cardiorespiratory fitness, and quality of life in patients with type 2 diabetes and overweight/obesity: a systematic review and meta-analysis conducted by AL-Mhanna SB, Batrakoulis A in 2024. The study findings highlight the importance of exercise interventions such as CART (combined aerobic and resistance training) as an important element in a comprehensive diabetes management strategy, ultimately improving overall health outcomes in individuals with T2DM and overweight/obesity. No difference was found in resting heart rate between CART and ST (standard treatment). These results show clear evidence considering the positive role of CART in inducing beneficial changes in various indicators related to cardiometabolic and mental health in patients with T2DM and overweight/obesity simultaneously. More studies with robust methodological designs are needed to examine the dose-response relationship, configuration of training parameters, and the mechanisms behind these positive adaptations [9].

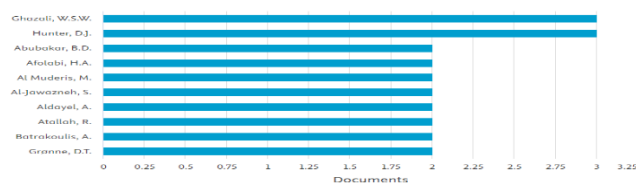


Fig. 6. Quality of Life Assessment of Diabetes Mellitus Patients with Knee Osteoarthritis.

The researcher who published the most articles on the quality of life of DM patients with knee OA is Sameer Badri Al-Mhanna who studied the Quality of Life of DM patients with knee OA with Home circuit training improves blood lipid profiles, liver function, musculoskeletal fitness, and health-related quality of life in overweight/obese elderly patients with knee osteoarthritis and type 2 diabetes. The results of the study showed that HBCT (home-based circuit training) significantly reduced total cholesterol (TC), triglycerides (TG), low-density lipoprotein cholesterol (LDLC), aminotransferase, alanine aminotransferase, FBG, and knee pain. Furthermore, HBCT caused significant improvements in high-density lipoprotein (HDL-C), lower body muscle strength, endurance, function, mobility, and HRQoL in overweight/obese older adults with T2DM and KOA. Badri Al-Mhanna's findings offer valuable insights for clinicians and practitioners seeking evidence-based exercise interventions tailored to patients managing substantial metabolic and musculoskeletal health challenges in clinical practice.

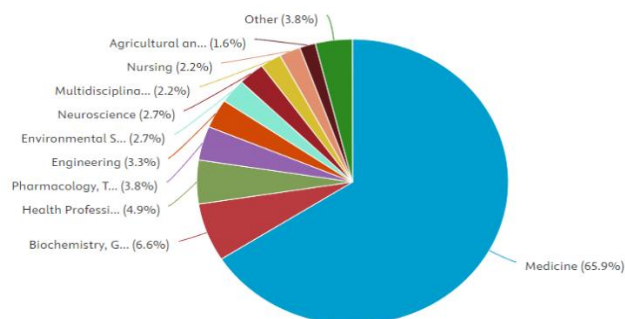


Fig. 7. Quality of Life Document for Diabetes Mellitus Patients with Knee Osteoarthritis Based on Scientific Evidence

Based on subject matter, most research on quality of life comes from the fields of medicine, biochemistry, public health, and pharmacy.

RQ 3. What is the trend in scientific publication topics on the effectiveness of physical activity in improving quality of life in people with diabetes mellitus and knee osteoarthritis over the past five years, 2020-2025? Using Vosviewer, the following descriptive results are presented:

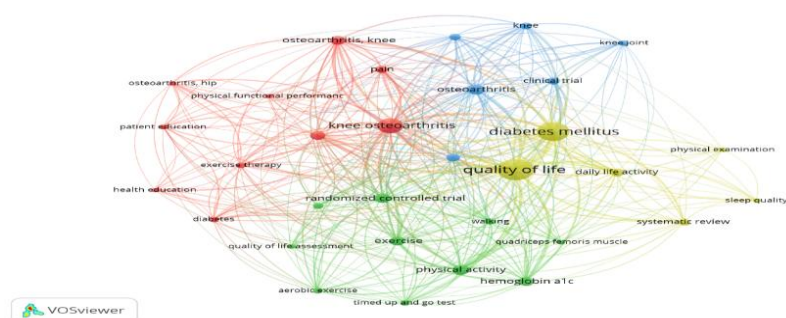


Fig. 8. Bibliometric Analysis Framework: Emergence and Representation of Key Terms

The keywords Quality of life had an occurrence of 113, Diabetes Mellitus had an occurrence of 94, knee osteoarthritis had an occurrence of 58, osteoarthritis had an occurrence of 28, physical activity had an occurrence of 27, RCT had an occurrence of 23, exercise had an occurrence of 22, knee osteoarthritis had an occurrence of 22, knee pain had an occurrence of 21 and daily life activity had an occurrence of 17. The following are ten keywords related to Quality of Life.

Table 1. Total Link Strength Based on Ten Keywords

Rank	Keywords	Total Link Strength
1	quality of life	466
2	diabetes Mellitus	356
3	knee osteoarthritis	301
4	osteoarthritis	173
5	physical activity	155
6	a randomized controlled trial (RCT)	142
7	sport	163
8	osteoarthritis of the knee	155
9	knee pain	136
10	daily activities	102

Source: VosViewer software

Based on the Bibliometric Analysis in Figure 7 and the total link strength, it can be concluded that research on physical activity in people with Diabetes Mellitus is still rarely conducted.

3.2 Discussion

DM can result in decreased muscle mass and strength, particularly in the lower limbs, which can weaken muscles and make functional tasks requiring leg strength difficult. DM can also cause neuropathy, or nerve damage, which impairs motor or sensory function in the lower limbs. Differences in physical performance between people with OA and DM and those with OA alone can have significant clinical implications. These differences can make it difficult for people with OA and DM to maintain their independence and quality of life [10].

Diabetes mellitus negatively impacts knee function, quality of life, and muscle strength in patients with knee osteoarthritis. Patients with knee osteoarthritis and diabetes have poorer knee function, range of motion, radiographic severity, and quality of life compared with patients with knee osteoarthritis without diabetes [3].

Patients with pain sensitivity have a poorer quality of life compared to those without. Longer duration of diabetes and higher HbA1c levels are associated with poorer knee function, quality of life, and range of motion limitations in patients with knee osteoarthritis. Patients with knee osteoarthritis and diabetes are more likely to have more severe radiographic osteoarthritis (Kellgren-Lawrence grade 3-4) compared to patients with knee osteoarthritis without diabetes [11].

A study conducted by Su et al. on Different intensities of aerobic exercise for patients with type 2 diabetes mellitus and knee osteoarthritis: a randomized controlled trial showed that the mean HbA1c levels adjusted (gender, baseline BMI, and baseline outcome measures) at 6-month follow-up decreased significantly in the high-intensity exercise group compared to the other groups (high-intensity group vs. control group). The mean KOOS scale for pain and quality of life were statistically significantly different between the control group and the moderate or high-intensity group [12]. A study conducted by Shi Rui SEOW in Malaysia found significant differences in: the 6-meter walk test, the timed get-up-and-walk test, and the 5-fold sit-stand test, quality of life, and physical activity. Knee osteoarthritis and diabetes mellitus were independently associated with reduced handgrip strength, the 5-fold sit-stand test, quality of life, and physical inactivity. These findings reveal unique physical and psychosocial characteristics of the diabetic knee osteoarthritis subgroup, including reduced muscle strength and physical inactivity. Future research should investigate whether managing metabolic factors, increasing physical activity and strength training, can reduce knee osteoarthritis symptoms and disease severity [3].

4 Conclusion

These findings underscore the need to improve the quality of life of people with DM and OA through physical activity. Future research should aim to increase physical activity in people with DM and knee OA to improve their quality of life.

4.1 Conflict of Interest

All authors declare no conflict of interest.

4.2 Acknowledgment

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