

Influencing Factors of Exercise Behavior in Patients with Type 2 diabetes: A Systematic Review of Qualitative Studies

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Background: Exercise is a critical component of diabetes health management. Long-term regular exercise can improve blood glucose levels and prevent or control diabetes-related complications. When facing exercise decision-making, patients are often full of confusion and hesitation, and may refuse to participate, thus affecting the effect of blood glucose control.

Purpose: The objective of this review was to systematically evaluate and integrate qualitative research on factors influencing exercise behaviour and exercise experience in diabetes patients to provide references for formulating management strategies to improve patients' exercise compliance.

Patients and Methods: PubMed, Web of Science, Embase, PsycINFO, CINAHL, Scopus, CNKI, VIP, Wanfang and SinoMed were searched for qualitative studies or mixed methods studies concerning qualitative research on exercise influencing factors or experience in diabetes patients from the establishment of the database to March 2025. The quality evaluation of the included studies was critically conducted using an established tool after study selection. And then extract and analyse the data, using a systematic review and thematic synthesis approach to analyse the data.

Results: A total of 32 studies were included, using thematic analysis, 11 interrelated themes were identified. Among them, exercise stimulates positive emotions and makes exercise a habit; perceiving the benefits of exercise; external support system; correct understanding of exercise; suitable exercise mode serves as promoting factors, obstacle factors including limitations due to personal conditions or concerns about adverse events caused by exercise; lack of knowledge related to exercises or misconceptions about it; being restricted by external conditions; incomplete support system; personal emotions and psychosocial factors; cultural restrictions and other reasons.

Conclusion: The influencing factors of exercise behavior are complex and have a profound impact on patients' exercise compliance. Medical staff should clarify the four core dimensions that affect patients' exercise behavior, enhance patients' exercise-related knowledge through health education and other methods, encourage patients to choose exercise methods that are suitable for themselves, and encourage family members or peers to participate with patients, and promote patients' active participation in exercise by exerting their autonomy, thereby achieving more ideal health outcomes.

Keywords: diabetes mellitus, exercise, qualitative research, systematic review

Introduction

Diabetes is one of the fastest growing global medical emergencies in the 21st century. Type 2 diabetes (T2D) accounts for more than 90% of all diabetic patients.¹ Diabetes raises the risk of microvascular compliance as well as macrovascular compliance.² Diabetes and the associated compliance also reduce people's quality of life.³ As a result, T2D, a disease with a high incidence rate, poses a serious threat to people's physiology and psychology, as well as a significant societal burden.

Physical activity increases insulin sensitivity by enhancing free fatty acid oxidation, skeletal muscle mitochondrial function, and serum adiponectin levels.^{4,5} Exercise also helps the body produce irisin, which can work on the

muscles, liver, and adipose tissue of the human body, so improving blood glucose control.⁶ However, since many patients are affected by multiple factors, the exercise participation rate among T2D patients is still at a low level. They demonstrate a poor willingness to engage in the initial test as well as difficulty adhering to regular exercise over time. Related research found that more than 96% of patients with T2D had fewer than 2 times of physical activity per week.⁷ Only 23.8% of persons with diabetes met aerobic, 10.9% met muscle-strengthening, and 6.2% met both physical activity guidelines.⁸ Consequently, the proportion of long-term exercise adherence still needs to be improved.

Although there have been many qualitative research on the experience of exercise decision-making. For example, Crews et al⁹ summarized the many factors that affect patients' exercise behavior, but most of them were cross-sectional studies. Maudet-Coulomb et al¹⁰ clarified the positive effects of various exercise interventions on patients' physical activity levels, physiological indicators, self-efficacy, and other psychological aspects. Whereas quantitative studies focus on correlations, qualitative research is crucial for designing patient-centered interventions as it uncovers lived experiences and complex decision-making processes. Meanwhile, there has been no systematic review on the factors that promote or hinder patients' exercise in everyday life. In order to systematically explain the experience and cognition of T2D patients' exercise decision-making, thoroughly analyze the reasons why patients refuse to exercise or find it difficult to maintain exercise, and summarize the experiences of successful persisters, this study employs a systematic review and thematic synthesis method to integrate and analyze pertinent qualitative interview. This study can provide valuable references for the development of targeted exercise intervention strategies in clinical practice.

Materials and Methods

Search Strategy (Figure 1)

Figure 1 presents the article selection. The research strategy incorporated three concepts of interest: (1) Type 2 Diabetes Mellitus; (2) exercise or physical activity; (3) qualitative studies. Boolean terms (AND/OR) were used to combine medical subject headings (MeSH) terms and other keywords. Firstly, identified MeSH terms, and then researched papers across different databases, the electronic research strategy was (qualitative research OR qualitative* OR experience OR feelings OR interview OR phenomeno* OR ethnographic research OR grounded theory) AND (exercise OR training OR physical activity OR exercis*) AND (diabetes mellitus OR diabetes). The search method was adapted to fit each database. The search strategy had no year limit, but it was confined to studies published in English or Chinese. All references were imported into EndNote 21 to check for duplication and relevancy.

Inclusion and Exclusion Criteria

Studies were included if they:

- (1) Studies involved participants with T2D over the age of 18;
- (2) Outcomes were the views, perceptions, experiences, and barriers or contributing factors to exercise;
- (3) Qualitative studies or mixed methods studies which reported qualitative results.

Studies were excluded if:

- (1) Participants with pre-diabetes, high risk of diabetes or gestational diabetes;
- (2) Participants had severe chronic diseases;
- (3) The full text was not available;
- (4) Non-English or Chinese papers.

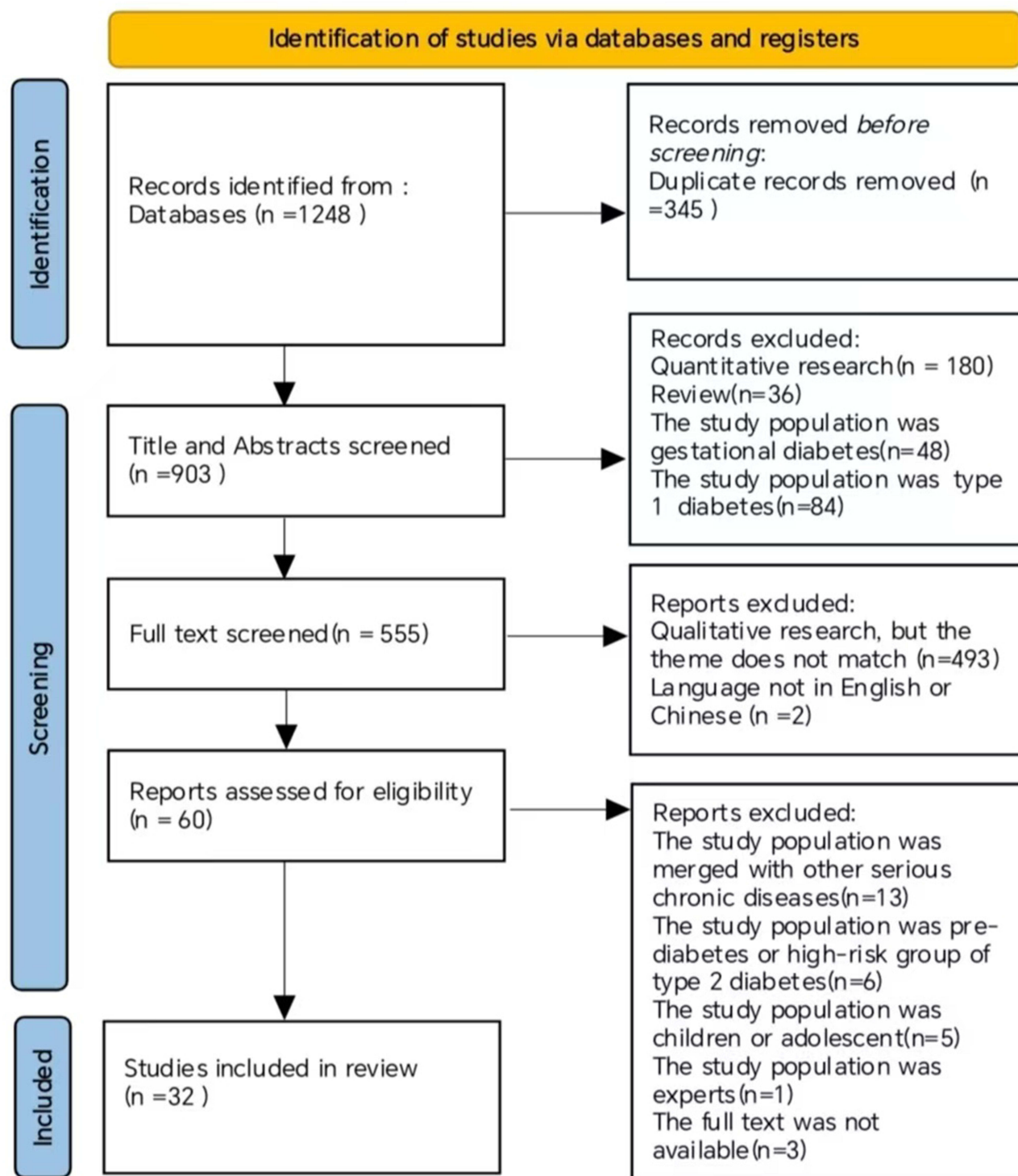


Figure 1 Preferred Reporting Items for Systematic Reviews and Meta-Analysis flow diagram.

Quality Assessment (Table 1)

The JBI Critical Appraisal Checklist for Qualitative Research (JBI-QARI)⁴³ was used to assess the quality of included studies.^{11–42} The JBI-QARI includes ten criteria: philosophical perspective, methodology, data collection, representation and analysis of data, interpretation of results, researcher reflexivity, ethical approval, and data analysis. Each criterion offers response options of “yes”, “no”, “unclear”, or “not applicable.” Quality assessment was conducted separately by

Table 1 Quality Appraisal of Studies Using JBI-QARI Instrument

Study Reference	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
Zhao et al ¹¹	U	Y	Y	Y	Y	Y	Y	Y	Y	Y
Advika et al ¹²	Y	Y	Y	Y	Y	N	Y	Y	N	Y
Amin et al ¹³	U	Y	Y	Y	Y	N	Y	Y	N	Y
Booth et al ¹⁴	U	U	Y	Y	Y	N	Y	Y	N	Y
Ranasinghe et al ¹⁵	U	U	Y	Y	Y	N	Y	Y	Y	Y
Matpady et al ¹⁶	U	NA	Y	Y	Y	N	Y	Y	Y	Y
Mier et al ¹⁷	U	U	Y	Y	Y	Y	Y	Y	N	Y
Momani et al ¹⁸	Y	Y	Y	Y	Y	N	Y	Y	Y	Y
Mphwanthe et al ¹⁹	U	U	Y	Y	Y	N	Y	Y	Y	Y
Cartagena et al ²⁰	Y	N	Y	Y	Y	N	Y	Y	Y	Y
Tariq et al ²¹	U	U	Y	Y	Y	Y	Y	Y	Y	Y
Tripathi et al ²²	U	Y	Y	Y	Y	N	Y	Y	Y	Y
Bosch et al ²³	U	Y	Y	Y	Y	N	Y	Y	N	Y
He et al ²⁴	U	U	Y	Y	Y	N	Y	Y	Y	Y
Medagama et al ²⁵	U	U	Y	Y	Y	Y	Y	N	Y	Y
Medagama et al ²⁶	U	NA	Y	Y	Y	N	Y	N	Y	Y
Hansen et al ²⁷	U	Y	Y	Y	Y	N	Y	Y	Y	Y
Zhou et al ²⁸	U	N	Y	Y	Y	N	Y	Y	Y	Y
Walker et al ²⁹	U	U	Y	Y	Y	N	Y	Y	Y	Y
Miller et al ³⁰	U	U	Y	Y	Y	N	Y	Y	N	Y
Arovah et al ³¹	U	U	Y	Y	Y	N	Y	Y	Y	Y
Ferrand et al ³²	U	U	Y	Y	Y	N	Y	Y	Y	Y
Lawton et al ³³	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Arsh et al ³⁴	U	U	Y	Y	Y	Y	Y	Y	Y	Y
Dai et al ³⁵	U	Y	Y	Y	Y	N	Y	Y	Y	Y
Jin et al ³⁶	U	Y	Y	Y	Y	N	Y	Y	N	Y
Huang et al ³⁷	U	Y	Y	Y	Y	N	Y	Y	N	Y
Yan et al ³⁸	U	Y	Y	Y	Y	N	Y	Y	N	Y
Zhang et al ³⁹	U	Y	Y	Y	Y	N	Y	Y	N	Y
Fan et al ⁴⁰	U	Y	Y	Y	Y	N	Y	Y	N	Y
Huang et al ⁴¹	U	Y	Y	Y	Y	N	Y	Y	N	Y
Guo et al ⁴²	U	Y	Y	Y	Y	N	Y	Y	N	Y

Abbreviations: Y, yes; N, no; U, unclear; NA, not applicable; Q, question number on JBI-QARI instrument.

Zhu Han and Li Wang, and inconsistencies were discussed and resolved between Zhu Han and Li Wang. Studies were reviewed based on the results of the quality assessment, but no studies were omitted due to their quality.

Data Extraction and Synthesis (Table 2)

The first author extracted data of the included studies, while the second author reviewed the results. The extracted data contained precise information about the author, year of publication, country of study, study methodology, data collection methods, sample size, phenomena relevant to the review questions, and results. The data were synthesized using the thematic synthesis approach, bringing together common data from studies that offered information on patients'

Table 2 Specific Information of the Included Studies

Author	Year	Country	Methodology	Data Collection	Study Population	Phenomenon of Interest	Key Findings
Zhao et al ¹¹	2025	England	Describe qualitative study	Semi-structured interviews	23 T2D Participants	Barriers and Facilitators to Physical Activity	19 themes
Advika et al ¹²	2017	India	Grounded theory	Semi-structured interviews	13 T2D Participants	Facilitators and barriers of Exercise in patients with Type 2 diabetes	8 themes
Amin et al ¹³	2023	Ghanaian	Describe qualitative study	Semi-structured interviews	13 T2D Participants	Understanding Physical Activity Behavior	2 themes
Booth et al ¹⁴	2013	England	Describe qualitative study	Semi-structured interviews	16 T2D Participants and 7 health professionals	Diet and physical activity in the self-management	6 themes
Ranasinghe et al ¹⁴	2015	Sri Lankan	Phenomenology	Focus Group Discussions	50 T2D Participants	Knowledge and perceptions about diet and physical activity	12 themes
Matpady et al ¹⁶	2024	India	Mixed-Method Study	Cross-sectional survey and an in-depth interview	35 T2D Participants	Barriers and Enablers for Physical Activity Engagement	6 themes
Mier et al ¹⁷	2007	Mexico	Not specified	Focus Group Discussions	29 T2D Participants	Perspectives on Definitions, Motivators, and Programs of Physical Activity	3 themes
Momani et al ¹⁸	2025	Jordan	Grounded theory	Semi-structured and audio-recorded interviews	11 T2D Participants	Physical activity among adults with type 2 diabetes mellitus	2 themes
Mphwanthe et al ¹⁹	2021	Malawi	Describe qualitative study	Focus Group Discussions	39 T2D Participants	Perceived barriers and facilitators to diet and physical activity	5 themes

(Continued)

Table 2 (Continued).

Author	Year	Country	Methodology	Data Collection	Study Population	Phenomenon of Interest	Key Findings
Cartagena et al ²⁰	2022	Spain	Describe qualitative study	Semi-structured interviews	10 T2D Participants	Successful Practices in Performing and Maintaining Physical Activity	2 themes
Tariq et al ²¹	2022	Pakistan	Phenomenology	Semi-structured interviews	30 T2D and 17 family members	Experiences of living with type 2 diabetes	3 themes
Tripathi et al ²²	2023	India	Describe qualitative study	Focus group discussions	12 T2D and 15 healthcare providers	Barriers and facilitators in dietary and physical activity management of type 2 diabetes	3 themes
Bosch et al ²³	2021	America	Phenomenology	Voice-recorded focus group discussions	14 T2D Participants	Perceptions of Physical Activity	8 themes
He et al ²⁴	2013	China	Describe qualitative study	In-depth semi-structured interviews	17 T2D Participants	Factors influencing exercises	6 themes
Medagama et al ²⁵	2018	Sri Lanka	Describe qualitative study	Semi-structured questions utilising in-depth interviews	11 T2D Participants	Lack of infrastructure, social and cultural factors limit physical activity among patients with type 2 diabetes	3 themes
Medagama et al ²⁶	2018	Sri Lankan	Mixed-Method Study	Cross-sectional research method and in-depth interviews	45 T2D Participants	Comorbidities and Ethnocultural Factors Limit the Physical Activity	2 themes
Hansen et al ²⁷	2025	England	Phenomenology	Semi-structured interviews	18 T2D Participants	Experiences of successful physical activity maintenance among adults with type 2 diabetes	7 themes
Zhou et al ²⁸	2025	China	Phenomenology	Semi-structured face-to-face in-depth interviews	16 T2D participants combined with frailty	Influencing factors of exercise behavior	3 themes
Walker et al ²⁹	2018	Denmark	Describe qualitative study	Semi-structured individual qualitative interviews	5 T2D participants	Motivational factors for initiating, implementing, and maintaining physical activity behavior following a rehabilitation program	2 themes

(Continued)

Table 2 (Continued).

Author	Year	Country	Methodology	Data Collection	Study Population	Phenomenon of Interest	Key Findings
Miller et al ³⁰	2010	America	Grounded theory	Moderator-led focus groups	31 T2D participants	Perceptions of physical activity and motivational interviewing	14 themes
Arovah et al ³¹	2019	Indonesia	Describe qualitative study	Focus groups	28 T2D participants	Physical Activity Programming for Type 2 Diabetes Patients' Need	4 themes
Ferrand et al ³²	2008	French	Not specified	Interviews	23 T2D participants	Motives for regular physical activity	2 themes
Lawton et al ³³	2006	Pakistan	Grounded theory	Respondents interviews	23 Pakistani and 59 Indian T2D participants	Barriers to physical activity	4 themes
Arsh et al ³⁴	2023	Pakistan	Describe qualitative study	Semi-structured individual interviews	23 patients diagnosed with depression and T2DM, and their carers, and healthcare staff	Barriers & facilitators to physical activity	5 themes
Dai et al ³⁵	2024	China	Phenomenology	Semi-structured interviews	13 T2D participants	Exercise decision-making experience	3 themes
Jin et al ³⁶	2021	China	Phenomenology	Semi-structured interviews	14 overweight T2D participants	Exercise management experience	5 themes
Huang et al ⁴¹	2020	China	Describe qualitative study	Semi-structured interviews	17 T2D participants	Factors influencing exercise behavior	2 themes
Yan et al ³⁸	2020	China	Phenomenology	Semi-structured interviews	11 T2D participants	Experience high-intensity interval exercise	3 themes
Zhang et al ³⁹	2016	China	Phenomenology	Semi-structured interviews	11 T2D participants	Cognition of Exercise Therapy	2 themes
Fan et al ⁴⁰	2015	China	Phenomenology	Semi-structured interviews	6 T2D participants	The True Experience of Exercise Therapy	4 themes
Huang et al ⁴¹	2015	China	Phenomenology	Semi-structured interviews	6 T2D participants	The True Experience of Exercise Therapy	4 themes
Guo et al ⁴²	2014	China	Phenomenology	Semi-structured interviews	10 T2D participants	The True Feeling and Inner Hope of Exercise Therapy	4 themes

viewpoints on physical activity. As the primary purpose of this research was to discover factors impacting patients' exercise behavior, categories were grouped into overarching themes, which represented the review's consolidated conclusions. The findings were then classified into subthemes line by line, and specific quotes that represent the subthemes were identified. Furthermore, the categories had been repeatedly revised and refined. Critical reflection was engaged during the categorizing process.

Results

Study Description and Data Synthesis results (Table 3)

The included studies were published between 2005 and 2025, involving 14 countries: England (n=4), India (n=3), Ghanaian (n=1), Sri Lankan (n=3), Mexico (n=1), Jordan (n=1), Malawi (n=1), Spain (n=1), Pakistan (n=2), America (n=2), China (n=10), Denmark (n=1), Indonesia (n=1) and French (n=1). In total, there were 682 patients and 39 participants related to patients across all studies, 30 studies used qualitative research methodologies, while 2 studies used a mixed-method approach. Interrelated subthemes were identified and detailed.

Table 3 Data Analyse results of the Included Studies

Themes	Subthemes	Representative Studies
(a) Exercise stimulates positive emotions	Having willpower	[28,31,37]
	Having self-control	[24,37]
	Make exercise a daily habit	[11,27,32]
	Role model effect	[27]
(b) Perceive the benefits of exercise	Good blood sugar control.	[15,20,24,27,31,33,38,40]
	Lose weight	[12,17,29,32,34]
	Release the pressure	[20]
	Promoted sleep	[13]
	Exercise enhances self-efficacy	[32]
(c) External support system	Companion support	[18,20,27,28,34]
	Family support	[17,20,21,28,32,34,36,37]
	Medical staff support	[12,13,19,20,34]
(d) Correct understanding of exercise	Worried about complications of diabetes	[12,20,27,29,31,37]
	Understood the importance and knowledge of sports	[11,15,20,24,31]
	Hope to use exercise to reduce medication or replace drugs	[27,31]
(e) Suitable exercise mode	Make work or household chores a part of exercise	[13,16,19,33,34]
	Choose exercise methods that are suitable for your physical condition	[20,21,24]
	Choose an entertaining form of exercise	[22,27]
(f) Limitations on own conditions or concerns about adverse events caused by exercise	Concerns about potential negative impacts of exercise	[16,28,31,36–38]

(Continued)

Table 3 (Continued).

Themes	Subthemes	Representative Studies
	Limited physical condition	[11,13,15,18,19,22,23,25,26,28,31,33,36]
(g) Lack of knowledge related to sports or misconceptions about sports	Doubts about the effectiveness of exercise	[12,28,31,37,38]
	Insufficient awareness of the benefits of exercise	[16,35]
	Insufficient understanding of the therapeutic effects of exercise	[13]
	Neglecting weight issues	[12,16]
(h) Restricted by external conditions	Insufficient time	[12,13,17,25,26,28,31,35–38,40]
	The external environment such as infrastructure is now going	[11,12,17,21,22,24,25,28,34,35]
	Due to weather conditions	[11,17,18,31,33,39]
	The cost of sports is high	[11,17]
	Worried about the safety of the sports environment	[13]
(i) Incomplete support system	Lack of professional guidance from medical personnel	[12,18,24,30,37,40]
	It is difficult to find useful information from the vast amount of information on the internet	[35]
	Insufficient strengthened supervision after discharge	[38]
	Insufficient social support	[11]
	Lack of peer support	[18,20,24]
(j) Personal emotions and psychosocial factors	Lack of confidence in sports oneself.	[16,31,36]
	Shame of sports.	[13,19,25,26,36]
	Peer influence.	[35]
	Time allocation obstacles	[36]
	Prioritize economic benefits over physical activity.	[34,39]
	Exercise leads to changes in lifestyle habits	[14,38]
(k) Cultural restrictions	The cultural environment is unfamiliar	[33]
	Cultural stigma	[33,34]
	Cultural beliefs lead to misconceptions	[33]
(l) Other reasons	Electronic products distract attention	[22]
	Lack of athletic skills	[11,24]
	Not seeing the positive benefits of exercise	[30]

Theme 1 Exercise Stimulates Positive Emotions or Makes Exercise a Habit

According to research, patients with strong willpower are more likely to maintain exercise routines in the long term,²⁸ and people with good self-control can actively alter their exercise tactics when the external environment is limited:

I am always very busy with my work, and cannot afford enough time for exercises. But I think out a way. I usually get off the bus one stop prior to my destination, and then choose to walk home after work. I think it suits me because it will not take up too much of my time.²⁸

After completing the internalization phase of exercise behavior, patients can make their own decisions to continue exercising without being pushed to do so, and incorporate exercise as a habit into their daily lives, making it an important component of self-identity. One participant explained:

If I skip exercising for a few days, I feel uncomfortable and itchy, I want to exercise, it's become a habit, and even if I'm lazy for a few days, I feel bad if I skip exercising for too long.¹¹

Some patients have successfully reduced the cognitive burden generated by continual decision-making by creating detailed workout regimens in advance.²⁷ The exemplary role helps patients improve their exercising self-efficacy. One participant expressed:

The BBC showed a documentary called Fixing Dad... Here's this guy, a bit older than me, type 2 diabetic ... he changed the way he eats and he exercises more. And his diabetes is put into remission. And I was like. 'Oh? Well! If he can do it, I can do it!' And that is what started my journey.²⁷

Theme 2 Perceive the Benefits of Exercise

To begin, in terms of psychology, many participants reported that physical activity helps reduce blood glucose levels and promotes weight management. For instance, one said:

I believe exercises help modify blood glucose. Sometimes, I measured my blood glucose after walking for half an hour after dinner. Two-hour post-prandial blood glucose level always ranges between 7 and 8 mmol/l. Hyper glucose level does not happen,²⁴

Another explained: "It would really be motivating. You want to get into a loop where you eat right because you are exercising and you are exercising because you are losing weight".²⁹ It has also improved sleep quality.¹³ Secondly, exercise significantly improves patients' mental health. Patients experience less anxiety and depression after exercising, as well as increased inner satisfaction and enjoyment of the activity. One patient explained:

Well-being. That's it, sometimes you're in a bad mood for whatever or sometimes without any reason, and when you go out walking and when you get home, it's gone.²⁰

Furthermore, exercise helps boost the immune system and improve overall health. Improving patients' health status effectively boosts their self-efficacy, resulting in a positive feedback loop.³²

Theme 3 External Support System

Mutual encouragement, support, and monitoring among peers effectively increase passion for exercising:

When for some reason I miss my walking routine, let's say for 1 or 2 days, many people will ask me: 'where have you been?', in a way that makes me happy because it means that many people care for me.³¹

Participants said that this form of encouragement, together with other physiological and psychological benefits, prompted them to continue exercising. Good family support also provides essential guarantees for patients to continue exercising:

For the past few days, my son has accompanied me for a walk. He offers to go for a walk, and we walk for about 30 minutes. Usually, he is busy at night, so we can't go for a walk then. However, when he has time, he asks me to go for a walk with him, which I do.²¹

Professional advice and favorable incentives from medical professionals have a substantial impact on patients' exercise compliance. One participant said: "When you say, physical activity is told (advised/prescribe) by the doctor, it means a lot, whenever a doctor says anything, I do what he suggests, you can say (ask) why (I follow the doctors' advice) but because he knows everything about me (my disease condition) ... even if he told me to run for a while, I cannot ignore that".²⁹ Another said: "The nurses told me more about it (exercise) than the doctor did. The nurses are much closer to patients than doctors are and we tend to listen to them more". As a result, it is worth emphasizing that nursing staff and patients interact frequently, therefore the advice given by nurses to patients has a significant impact. This frequent contact not only improves the effectiveness of health recommendations, but it also fosters a stronger trust relationship.

Theme 4 Correct Understanding of Exercise

Many patients are concerned about the long-term risks of diabetes, therefore they prioritize the health benefits of exercise. One participant expressed:

I was terrified of getting my foot chopped off. I thought: 'Oof, this is really really serious what can happen there!' Chronic, progressive disease that leads to heart attack, stroke, amputations, and blindness! Once I read that, that was it, and I thought: 'I need to do something about this!'²⁷

Some patients aim to cut their medication dosage or even replace it entirely with diet and exercise. For instance, one participant shared:

The first thing the diabetic nurse said was: 'right, I will put you on metformin'. I said, 'OK', but I then said, 'No!'. And I [have] successfully since managed [to control my diabetes] with just diet and exercise. [...] Going on medication is like giving into it. It's an ongoing battle with my diabetic nurse around medication.²⁷

Furthermore, patients can clarify relevant exercise knowledge with support from medical staff or self-learning online.^{20,24}

Theme 5 Suitable Exercise Mode

Patients include household tasks or professional activities into their daily exercise routines. One say:

I briskly walk as part of my exercise. I also go to Lilongwe river to wash my clothes either two or three times a week and I wash for over 40 minutes. I even wash my wife's clothes which I also consider as part of my exercise and it's really helping me,

Another stated: "I do farm a lot and my work involves carrying heavy metals, because I am a welder. So, I do physical activity through work".¹⁹ Some patients choose exercise regimens that are appropriate for their physical abilities and health situation. For example, because of the patient's advanced age or bronchitis, walking was chosen as a type of exercise.^{20,24} Patients' ability to continue for an extended period of time is also influenced by their workout style. When patients engage in recreational exercise, the enjoyment and happiness they get serve as a motivator for further participation. One participant shared: "The joy, the actual psychological aspect of the biking – being out in the air is genuinely motivating. I just love being out in the air".²⁷

Theme 6 Adverse Events Caused by Personal Health Limitations or Concerns About Exercise

Diabetes causes decline of body function, which restricted the physical activity.¹⁵ The patient's ability to complete certain movements is limited due to other illnesses such as vision problems, gout, breathing problems, chest pain, resulting in the inability to complete certain forms of exercise. One participant explained:

I can't exercise like the strong guys [healthy people]. At my age, my hypertension doesn't allow me to exercise. My heart beats too fast... my knee [arthritis] doesn't allow me. [hurts when I exercise].¹³

Another explained: "I have gout and my weight is very high, it's difficult for me to walk even 50 steps. I somehow manage to do my routine".²² Due to prior experiences, patients frequently worry that their initial conditions (such hypoglycemia, or unforeseen circumstances like exercise-related injuries) may worsen as a result of exercise. They

actively lower their activity intensity or avoid exercise as a result of this worry.¹⁶ For instance, one participant said: “I dare not go out for exercise now. I fell last month and have been walking slowly and carefully lately”.²⁸

Theme 7 Lack of Knowledge Related to Sports or Misconceptions About Sports

Some patients feel that exercise cannot or only temporarily improves blood glucose levels, and that it may raise physical stress and the risk of unpleasant events such as perspiration, elevated heart rate, and dyspnea after exercise.³³ One said: “Exercise is beneficial for physical health, but medication is important. People at this age still need to rely on medication to control themselves.” Another stated:

After exercising, it seems that there hasn't been any improvement in the body, and I feel like it's mostly the medication and diet control that works, and exercise doesn't change those symptoms (blood glucose, fatigue),²⁸ or even if wanting to continue exercising, a lack of professional advice leads to a misunderstanding of the optimum exercise time and intensity.¹³ They are also unable to forecast the precise advantages of exercise, raising concerns about their own decision-making procedures:

I am advised to do exercise, and I walk for 15 to 30 minutes a day, I do not know whether it is sufficient to control diabetes or not.¹⁶ Some patients have a limited grasp of obesity issues, and some patients with a familial history of obesity see obesity as a typical occurrence, lacking the motivation to control their weight through exercise. For example, one participant explained: “Everyone in my family is well built as I am. It is not like I gained weight in the middle I have always been on the heavier side from when I was young”.¹²

Theme 8 Restricted by External Conditions

A large number of studies found that due to the increased pressure of social roles and the significant burden of work and family responsibilities, patients' disposable time is significantly reduced, making it difficult to ensure regular exercise arrangements, resulting in insufficient exercise time for themselves. Exercise is also limited by the patient's living conditions and infrastructure. If the patient's living environment lacks handy exercise facilities or walking trails, their willingness to exercise will decline. Some participants noted that the expense of fitness equipment or facilities is a deterrent to exercising. One participant said:

Currently, playing table tennis is very costly. It's very expensive. A bucket of balls costs over 70 yuan for 12 balls, and it's gone after playing three times. Each time, the venue fee is 50 yuan. Just thinking about it, it's already very expensive.¹¹

At the same time, weather conditions might make it difficult for patients to exercise, with extreme weather conditions such as high heat, severe cold, and pollution directly impeding outdoor activities.^{11,33} Furthermore, some patients are concerned about their personal safety during evening exercise and in distant regions, which reduces their motivation to exercise. One participant expressed: “It is not safe to exercise outside [especially] at dawn. The recent [serial] killings of women makes me fear going out early in the morning to exercise”.¹³

Theme 9 Incomplete Support System

Due to their busy daily schedules, medical staff have neglected to provide exercise guidance to patients; or, if they have provided relevant guidance to patients, it is too abstract, leaving patients with some doubts about the specific implementation process; in some cases, medical staff only inform patients of the importance of exercise, lacking effective communication with patients and personalized guidance.^{14,18,30} When confronted with a plethora of online information, patients struggle to identify the best workout method for themselves.³⁵ Due to a lack of professional supervision, some patients struggle to continue regular exercise for an extended period of time after discharge, resulting in a steady decrease in compliance.³⁸ Some patients have difficulties sticking to their fitness regimen due to a lack of peer or group motivation. One participant expressed: “I am not doing exercise every day because no one is walking with me, I like walking with others”.¹⁸

Theme 10 Personal Emotional Factors

Some patients are concerned about physical exercise due to age or a lack of trust in their athletic ability, therefore they intentionally avoid sports activities,^{16,31} Chronic illness can reduce patients' quality of life by generating negative

feelings such as despair and anger, losing tolerance with therapy (including exercise), and, ultimately, decreasing patients' exercise compliance.⁴⁰ Patients' decision-making behavior is frequently influenced by their peers, and if people around them stop exercising, the patient's inclination to continue exercising decreases.³⁵ The patient's sense of guilt due to their incapacity to learn might also become a barrier to their movement.^{19,26} Furthermore, some patients value economic rewards (such as the sense of accomplishment that comes from earning money) over health management and consciously choose to discontinue exercise.³⁴

Theme 11 Cultural Restrictions

Cultural elements that impede patient movement can be divided into two categories: individual cognitive level and society cultural level. For example, when patients migrate to foreign cultural contexts and have inadequate English proficiency, they frequently avoid outdoor activities out of fear of being unable to successfully seek aid in the event of an unforeseen crisis. A typical case demonstrates that a patient experienced limb spasms when walking exercise on the advice of a doctor, but owing to language issues, they were unable to access timely care, leading to a chronic phobia of going out alone.³³ Furthermore, some patients' disease attribution influences their athletic motivation, such as attributing diabetes to God's will rather than their own behavior, so diminishing the initiative for lifestyle change.³³ At the social cultural level, including the phenomenon of sports stigmatization: certain forms of exercise (such as cycling and walking) are labeled as 'symbols of poverty',³⁴ or running on the road is considered unconventional behavior,²¹ leading to psychological resistance; gender cultural constraints: traditional culture prohibits physical exposure between the opposite sex, and the lack of supporting facilities (such as same-sex coaches and single-sex sports venues) further hinders the development of fitness, swimming, and other activities.³³

Theme 12 Other Reasons

Excessive use of electronic gadgets, such as mobile phones, televisions, and laptops, can lead to a sedentary lifestyle: "I come back from the office and lie down; I watch my social media profile etc. without noticing when it's time for dinner. Then I skip my evening walk",²² some patients, despite their want to exercise, face challenges in real implementation due to a lack of exercise abilities, making it difficult for them to sustain regular exercise habits. One participant shared: "I once tried to play table tennis. But when I went to the venue, no one was willing to play with me because I am just a beginner".²² When exercise time conflicts with personal preference periods (such as the "afternoon exercise routine"), patients' inclination to exercise decreases significantly;³⁶ alternatively, after abandoning their old habits, patients frequently struggle to adapt to the new exercise routine owing to laziness.¹⁴ Furthermore, patients' exercise compliance and motivation may suffer as a result of a misunderstanding of the benefits of exercise. One participant stated: "I played basketball every day. And when I do that I never lose weight. So it's all a turn off to me".¹⁶

Discussion

This study revealed four core dimensions that affect exercise behavior of diabetes patients through systematic review and thematic synthesis. The first aspect to consider is knowledge and cognitive factors: It is manifested in the patient's mastery of sports and diabetes management knowledge, as well as the positive feedback formed through practice, such as the perceived improvement of exercise on blood sugar control. Another key point is structural barriers and social support systems: involve objective constraints such as economic costs, time arrangements, environmental accessibility, and subjective support resources such as family support, peer encouragement, and guidance from medical personnel. Notably, in terms of selecting exercise methods, choosing exercise methods that are suitable for one's own health condition or have fun can significantly increase the likelihood of long-term persistence. The final consideration is personal motivational factors: including intrinsic driving forces such as strong autonomy and the habit of exercising, as well as hindering factors such as emotional disorders such as exercise shame; The modern lifestyle challenge of excessive use of electronic devices squeezing out exercise time; Shortcomings in individual abilities.

Patients with exercise knowledge often have higher exercise compliance. Under the theoretical framework of the health belief model, patients' health behavior decisions can be influenced by two key cognitive factors: the perception of the benefits of adopting healthy behaviors, and the judgment of potential serious consequences of diseases such as death,

disability, and long-term health problems.⁴⁴ These cognitive factors not only encourage patients to actively adopt healthy behaviors or seek treatment, but also have an impact on their long-term treatment compliance. Multiple studies have provided empirical support for this: Zhu et al⁴⁵ found that there is a significant correlation between patients' mastery of exercise knowledge and exercise compliance. Patients who have sufficient mastery of exercise knowledge are better able to follow exercise advice and improve their exercise compliance; Mwimo et al⁴⁶ further confirmed that the level of belief and knowledge of T2D patients can effectively predict their practice of physical activity. As mentioned, when patients observe that their blood glucose levels are effectively controlled after exercise and their weight gradually decreases, these positive changes significantly enhance their motivation to continue exercising; at the same time, when patients are fully aware of the severity of complications of diabetes (such as diabetes foot), exercise is regarded as an important intervention to reduce such risks. On the contrary, some patients who lack exercise knowledge believe that the increased heart rate and shortness of breath caused by exercise will increase the burden on the body and avoid exercise. Therefore, medical staff should popularize patients' exercise knowledge such as the positive effects of exercise and specific exercise intensity and correct patients' misconceptions about exercise through various forms such as health education lectures, distribution of promotional brochures, and online science popularization. Besides, actively guiding patients to pay attention to the short-term and long-term benefits of exercise, and providing targeted health guidance through evaluating their understanding of the severity of the disease, is essential for long-term changes in exercise behavior.

For external objective conditions and support systems, social support theory suggests that informal or formal support systems from family members, peers, or healthcare professionals can serve as external motivators that can be leveraged through emotional support or professional guidance. This can enhance an individual's ability to cope with various environmental challenges.⁴⁷ And professional guidance from healthcare professionals can help patients have a more accurate understanding of the disease, making them more willing to follow exercise plans and having a positive impact on their physical and mental health. Further research reveals that perceived social support is an important predictor of physical activity levels,⁴⁸ however, time constraints and health status limitations constitute the main obstacles to achieving compliance.⁴⁹ At the practical level, the following adaptive strategies can be adopted to cope with environmental barriers: in the face of extreme weather conditions, it is recommended to adjust the exercise period to a climate suitable morning or evening, or switch to indoor exercise, such as using treadmills and other fitness equipment; time limited patients can use their fragmented time for exercise, such as using stairs instead of elevators or walking instead of transportation. These small activities do not take up a lot of time and can increase physical activity. Even without professional equipment, patients can creatively utilize household items for strength training. It is particularly noteworthy that medical personnel should focus on building a social support network, encouraging patients to establish exercise partnerships with their families and peers, and include peer mentorship components in exercise programs. This sociable exercise not only provides supervision and support, but also enhances the enjoyment and sustainability of exercise. This comprehensive support strategy promotes the formation and maintenance of healthy behaviors from three levels: cognitive, emotional, and behavioral.

In terms of the choice of exercise mode, some patients are afraid of exercise because they have limited physical function due to diabetes or other chronic diseases, or because they are worried that exercise may aggravate the primary disease, induce hypoglycemia, fall and other adverse events. Conversely, there are also patients who actively seek suitable forms of exercise despite facing physical limitations, such as converting daily work or household activities into exercise opportunities. The level of interest of patients in rehabilitation activities is closely related to their treatment participation and long-term compliance, some patients tend to choose sports projects with strong interest, and maintain their long-term participation enthusiasm through the pleasant experience during the exercise process. According to the theory of behavioral motivation, when patients develop an intrinsic interest in a rehabilitation activity, their likelihood of actively participating significantly increases.⁵⁰ Kanai et al⁵¹ found through a large sample study that through three years of continuous incentive measures, patients' exercise participation and long-term persistence have been significantly improved. These research results indicate that stimulating patients' interest in activities is an important strategy for increasing their participation and long-term persistence. Therefore, it is recommended that patients choose appropriate forms of exercise based on their own health status, and medical staff need training to develop personalized exercise prescriptions and provide targeted health guidance for patients based on individual physical and cultural differences.

Research has shown that aerobic exercise can promote the secretion of more cortisol, endorphins, and dopamine in the human body, the changes in bodily function caused by these substances after exercise are not only effective in reducing stress reactions, but also closely related to the pleasurable experience brought by exercise.⁵² In the field of health behavior research, willpower and habits are two key elements for long-term adherence to healthy behavior. Willpower is not only the initial driving force for people to start a healthy behavior, but also helps individuals resist various temptations and cope with setbacks in the process of maintaining healthy behavior; habit, on the other hand, is a relatively fixed and automated behavioral pattern, and its persistence contributes to the long-term maintenance of healthy behavior, as healthy behaviors gradually become habits, people no longer need to rely on strong willpower to drive their execution.⁵³ As mentioned earlier, patients with strong willpower are often able to persist in healthy behaviors for a long time. Some patients integrate exercise into their daily lives, making it a habit, and once they stop exercising, they will feel uncomfortable. However, there are also some patients who find it difficult to change their existing lifestyle habits, making it difficult to integrate exercise into their daily lives. Therefore, when habits are formed, people's dependence on willpower when performing healthy behaviors will significantly decrease. Social cognitive theory suggests that when observers see role models succeed, they can predict that they will also achieve similar success after performing the same behavior, thereby enhancing their motivation to imitate and promoting individual behavior change and growth.⁵⁴ In summary, medical personnel should actively help patients develop exercise habits and introduce them to successful cases around them to enhance patients' self efficacy in persisting in exercise. Patients themselves should also balance the relationship between earning money and exercising, consciously resist the temptation of addiction to electronic products, and strive to develop exercise habits.

Limitations

This study also has certain limitations due to pragmatic reasons, as only articles in English and Chinese were included and literature in other languages was not included, which may affect the comprehensiveness of the analysis results. Meanwhile, the literature that meets the inclusion criteria does not involve ethnographic research. Subsequent research can expand multilingual literature retrieval to explore the key factors affecting patient exercise compliance in depth, thereby provide more comprehensive evidence-based support for optimizing clinical intervention strategies.

Conclusion

This review clarified many promoting and hindering factors that affect physical activity of T2D patients in daily life. Understanding the reasons why patients refuse or find it difficult to maintain exercise, as well as their successful experiences in maintaining exercise, can assist nurses to identify patients' individual nursing needs and adopt relevant promotion plans. The patients' opinions and experiences of the current literature can be classified into personal factors, external factors. Personal factors include the patient's level of knowledge, perception of benefits, physical condition, choice of exercise style, cultural factors; external factors include objective conditions, support systems, and other factors should also be considered. In future nursing, attention should be paid to the objective conditions and inner experiences of patients, identifying factors that affect exercise compliance from multiple perspectives, and then developing targeted exercise promotion plans from multiple dimensions, evaluating the effectiveness of the plans, and making timely modifications to further enhance compliance.

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