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Prevalence of Erectile Dysfunction and Quality of Life among Male with Diabetes Mellitus: A systematic review

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Abstract
This systematic review examines the prevalence of Erectile Dysfunction (ED) and its impact on Quality of Life (QoL) among males with diabetes mellitus. Following PRISMA guidelines, literature from 2018 to 2024 was analyzed, with 11 relevant studies selected from 172 screened articles. The quality of each study was appraised using the Joanna Briggs Institute checklist, yielding a combined sample size of 3,928 diabetes males. Findings show an ED prevalence range of 28.1% to 94.7%, with ED contributing to lower self-esteem, relationship difficulties, and psychological distress, significantly impacting QoL. The study highlights the need for targeted interventions to improve the QoL of diabetes males in Malaysia.

Keywords: Prevalence; Quality of Life; Erectile Dysfunction; Male with diabetes

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1.0 Introduction
Diabetes mellitus is a critical global health issue, affecting 463 million people worldwide in 2019 and projected to rise to 578 million by 2030 (Organization Diabetes, 2023). In Malaysia, diabetes prevalence increased from 11.2% in 2011 to 18.3% in 2019, and by 2025, it is expected to impact 7 million adults (Akhtar et al., 2022). Among various health complications, diabetes significantly raises the risk of erectile dysfunction (ED), a condition impacting diabetes males' quality of life (QoL) (Gebeyehu et al., 2023; Kang et al., 2022).

Erectile dysfunction (ED) in diabetes males is defined by a persistent inability to achieve or maintain an erection, often due to nerve and blood vessel damage, hormonal imbalances, and psychological factors (Barnard-Kelly et al., 2019; Yafi et al., 2016). Studies show that diabetes males experience ED at higher rates and younger ages than non-diabetics (Walle et al., 2018). In Malaysia, ED prevalence in diabetes males increased from 8.3% in 2013 to 14.5% in 2019, indicating a rising health burden (Arunah Chandran, Mohd Nazri Abdullah, 2019).

This review systematically examines the prevalence of ED and its impact on QoL among diabetes males to establish a foundation for targeted interventions.

2.0 Literature Review:

The ED is a common complication among males with diabetes, with prevalence rates ranging from moderate to very high, depending on geographical and methodological factors. The impacts of ED are not only on physical health but also on various dimensions of quality of life (QoL), including mental, emotional, and social well-being (Schweyer, 2017). Males with diabetes who experience ED frequently report reduced relationship satisfaction, diminished self-esteem, and increased psychological distress, which negatively affect their mental health and social interactions (Anwar et al., 2017; Przydacz et al., 2023)

Physiologically, ED in diabetic males is often linked to complications such as hypogonadism, characterized by low testosterone levels, which further exacerbates sexual dysfunction (Barnard-Kelly et al., 2019). Psychological factors like stress and anxiety are also significant contributors commonly experienced by the diabetic population with ED, adding complexity to QoL management (Mushtaq et al., 2018; Barnard-Kelly et al., 2019).

Despite extensive research on ED and diabetes, a significant gap exists in studies specifically addressing the comprehensive impact of ED on QoL among males with diabetes. While much of the literature focuses on risk factors or the clinical aspects of ED, the broader QoL implications—encompassing psychosocial, emotional well-being, and social interactions—remain underexplored. Existing studies often overlook how ED affects daily life and interpersonal relationships, particularly within diverse cultural contexts. This systematic review aims to address this gap by integrating previous findings on ED prevalence and its impact on the QoL of males with diabetes. By providing a clearer understanding of ED's impact on QoL, this review seeks to inform further in-depth research and contribute to the development of more effective, targeted interventions that support the well-being of diabetic males affected by ED.

3.0 Materials and Methods

3.1 Source
This systematic literature review adhered to the methodological framework established by the "Preferred Reporting Items for Systematic Reviews and Meta-Analysis" (PRISMA) group (Liberati et al., 2009). The systematic selection of relevant articles followed the prescribed stages of identification, screening, eligibility assessment, and inclusion, as outlined in the PRISMA guidelines (Haddaway et al., 2022). This rigorous approach ensures transparency, replicability, and comprehensiveness in the review process, aligning with the best practices endorsed by the PRISMA group for systematic reviews and meta-analyses.

3.2 Formulation of the Research Question
The research question for this study is formulated based on the PICO guidelines, emphasizing four key concepts: Population or Problem (P), Intervention or Exposure (I), Comparison (C), and Outcome Measures (O) (Stern et al., 2014). The study's population includes male individuals with diabetes (Type 1 and Type 2), while the intervention involves patients with diabetes, either with or without ED. There is no specific comparison aspect in this context. Outcome measures focus on the Prevalence of ED and the impact of ED on QoL. Therefore, the main research question of this study is: "What is the prevalence of ED among males (Type 1 and Type 2) and how does ED impact the QoL of the male with diabetes?"

3.3 Information Sources
The systematic exploration for pertinent literature in this research, probing the correlation between diabetes and male sexual health, was meticulously conducted through the scrutiny of seven distinguished electronic databases: Scopus, Science Direct, Web of Science, Google Scholar, PubMed, SAGE and ResearchGate.

3.4 Search Strategy
The research, conducted between January 2018 and 2024, focused on recent English language publications. Utilizing strategic keywords such as "T1DM or T2DM" "Erectile Function International Index of Erectile Function (IIEF) Questionnaire," "male sexual health," "erectile dysfunction," and "sexual well-being in diabetes," the search aimed at pinpointing and extracting highly relevant scholarly contributions. Inclusion criteria specified publication from 2018 onwards, the use of English, and the adoption of a cross-sectional quantitative study design.

3.5 Selection Process
A search of English-language articles from 2018 to 2024 yielded 172 articles, with 33 duplicates removed. The databases searched included Scopus (26 articles), ScienceDirect (30), Web of Science (20), Google Scholar (50), PubMed (13), SAGE (4), and ResearchGate (29). All articles were managed in Mendeley, which automatically excluded duplicates; the remaining duplicates were manually removed. Two reviewers (JY and SY) screened the titles and abstracts of 139 articles, excluding 77 for not meeting the inclusion criteria. The full texts of 62 articles were further reviewed, leading to the exclusion of 51 for insufficient relevance. Ultimately, 11 articles met the criteria and were included in this review. A second review by JY and SKAS assessed article quality, with the PRISMA 2009 Flow Chart used to illustrate the selection process (Figure 1).
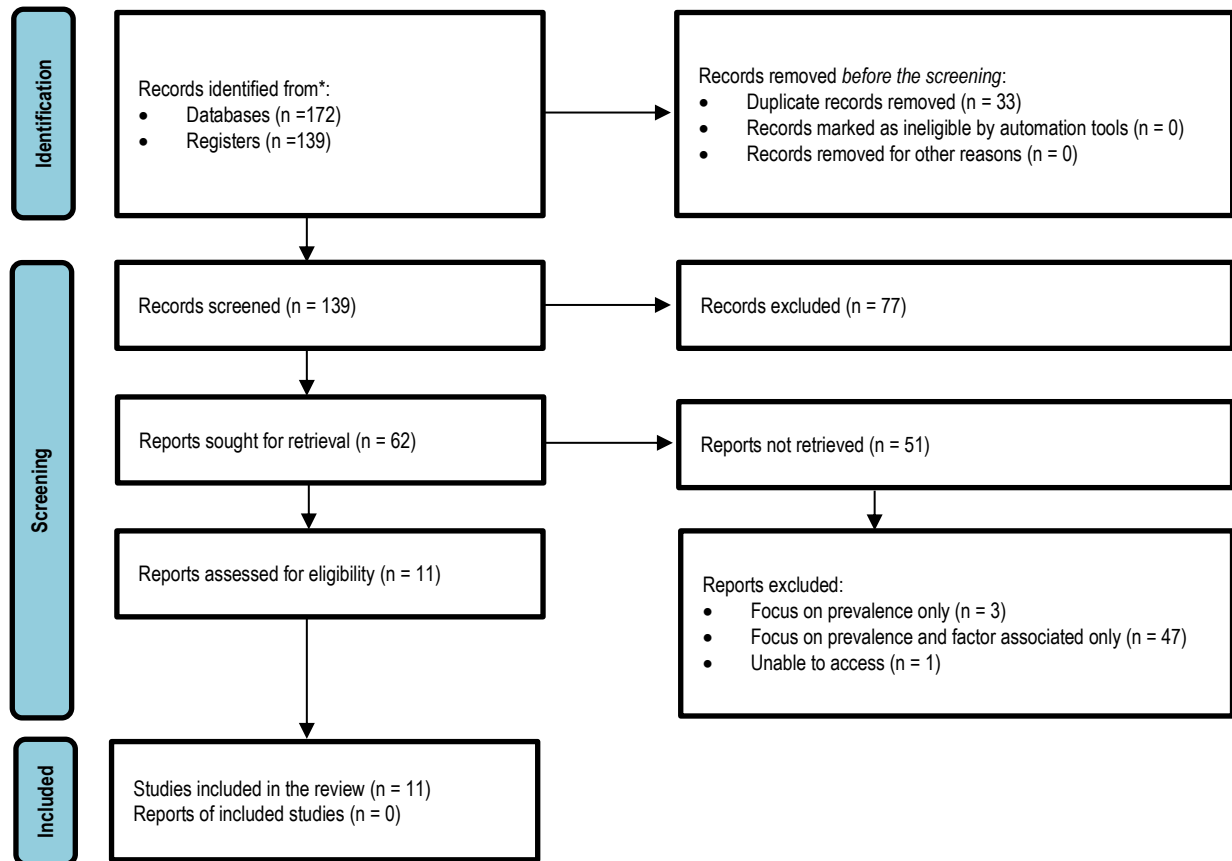
Figure 1: PRISMA 2009 Flow Diagram. Flow chart to summaries the selection of patent articles for the review adopted from Haddaway et al. (2022)

3.6 Quality Appraisal

The criteria for article selection in this study are as follows: published in English (Inclusion Criteria 1), discussing the prevalence using IIEF-5 tool and QoL related to ED (Inclusion Criteria 2), focusing on the male with diabetes population which is Type 1 diabetes mellitus and Type 2 diabetes mellitus (Inclusion Criteria 3), and must be a cross-sectional quantitative study (Inclusion Criteria 4). This study selectively chose articles written in English for publication purposes, while other inclusion criteria were incorporated to address the research question regarding the pattern of ED among male individuals with diabetes. A total of 11 articles that met all inclusion criteria were critically evaluated using the "Joanna Briggs Institute (JBI) Critical Appraisal Checklist" for cross-sectional studies. This assessment aimed to evaluate the methodological quality of each study and determine how well they addressed potential biases in their design, implementation, and analysis (Moola et al., 2015). The scoring results for critical appraisal were derived from the percentage: >75% = Good, 50–75% = Fair, and <50% = Poor (Monnaatsie et al., 2021). Table 3 provides a summary of the JBI cross-sectional studies appraisal. The selected articles for this study were critically appraised to obtain relevant outcomes, as summarized in Table 3.

Table 3 Quality Appraisal

Author (year)	Inclusion criteria	Study subject and setting	Validity and reliability of the study	Risk of bias	Identify confounding factors	Strategies to deal with confounder	Outcome measure	Statistical analysis
Hylmarova et al. (2020)	Yes	Unclear	No	No	No	No	Yes	Yes
Torkamani et al. (2021)	Unclear	Yes	Yes	Yes	No	No	Yes	Yes
Silva et al. (2022)	Yes	Yes	No	No	No	No	Yes	Yes
Fang et al. (2023)	Yes	Yes	No	No	No	No	Yes	Yes
Ugwumba et al. (2018)	Yes	Yes	No	No	No	No	Yes	Yes
Defeudis et al. (2023)	Yes	Yes	No	No	No	No	Yes	Yes
Mushtaq et al. (2018)	Yes	Yes	No	No	No	No	Yes	Yes
Barnard-Kelly et al. (2019)	Yes	Yes	No	No	No	No	Yes	Yes
Thongtang et al. (2020)	Yes	Yes	No	No	No	No	Yes	Yes

Author (year)	Inclusion criteria	Study subject and setting	Validity and reliability of the study	Risk of bias	Identify confounding factors	Strategies to deal with confounder	Outcome measure	Statistical analysis
Jombo et al. (2020)	Yes	Yes	Yes	No	Yes	Unclear	Yes	Yes
Bekele et al. (2022)	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes

4.0 Results

4.1 Overall findings
The 11 selected articles, published between 2018 and 2023 with a total sample of 3,928 participants across multiple countries (e.g., Czech Republic, Iran, Sri Lanka, China, Nigeria, Italy, Pakistan, United Kingdom, Thailand, Ethiopia), provide insights into the prevalence of ED and its impact on QoL in males with diabetes.

4.2 Prevalence of Erectile Dysfunction in Males with Diabetes
The prevalence of ED among males with diabetes varied significantly, ranging from 28.1% to 94.7%. The highest prevalence, 94.7%, was reported in Nigerian males with Type 2 diabetes (Ugwumba et al., 2018), while the lowest prevalence of 28.1% was observed among Thai males (Thongtang et al., 2020). This variability illustrates the diverse burden of ED across diabetes populations, with Type 2 diabetes generally exhibiting higher rates.

4.3 Quality of Life of Males with Diabetes
Findings on the QoL in males with diabetes depict a complex landscape. Past studies highlight the occurrence of retrograde ejaculation and hormonal changes, such as elevated sex hormone binding globulin (SHBG) levels, with correlations to daily insulin dose and a negative correlation between prostate-specific antigen (PSA) and glycated hemoglobin (HbA1c) (Hylmarova et al., 2020). Torkamani et al. (2021) despite lacking prevalence figures, found a relationship between diabetes and overall sexual function and SQOL-M, especially in certain subgroups. Silva et al. (2022) report a high prevalence of ED with significant psychological pressure, emphasizing the low propensity for seeking treatment. Fang et al. (2023) identify the relationship between ED and socio-economic status, with higher income associated with better erectile function Ugwumba et al. (2018) establish predictors such as poor glycemic control, longer diabetes duration, and overweight/obesity. Defenders et al. (2023) outline the connection between treatment adherence and a positive lifestyle, also identifying associations between health literacy and ED. Mushtaq et al. (2018) report a substantial frequency of ED and its association with hypogonadism. Barnard-Kelly et al. (2019) emphasize significant psychosocial impacts on self-esteem, relationships, attractiveness, and loneliness. Thongtang et al. (2020) illustrate the impact of ED on various QoL domains. Jombo et al. (2020) find a significant association between ED and depression. Barnard-Kelly et al. (2019) report a high prevalence of ED with significant factors affecting sexual satisfaction and penetration difficulties.

Table 4: Results of the prevalence of ED, Factor Associated with ED, and the QoL among male diabetes

Author (year) Country	Study Objective	Sample size	Prevalence	Quality of Life
Hylmarova et al. (2020) Czech Republic	Influence of T1DM on sexual function and hormones	57	28.1% experienced ED (IIEF-5 ≤21)	T1DM lowers males' QoL with high rates of ED, reduced sexual satisfaction, and retrograde ejaculation.
Torkamani et al. (2021) Iran	Sexual function comparison in T2DM males	276	NA	No statistically significant differences in sexual function, including various aspects, between diabetic and non-diabetic infertile male diabetes.
Silva et al. (2022) Sri Lanka	Prevalence and impact of ED in diabetes clinic.	212	79.2% experienced ED.	QoL and Treatment Seeking: Despite 60.5% experiencing psychological and/or relationship effects due to ED, 85.6% did not disclose it to a health provider.
Fang et al. (2023) China	ED and socioeconomic status	1739	NA	Quality of sexual life: Participants with higher family income to poverty (PIR) were more likely to report good erectile function than those with lower PIR (p-value=0.005).
Ugwumba et al. (2018) Nigeria	ED prevalence and predictors in T2DM males	325	94.7% of the participants had ED	Predicts poor QoL in males with T2DM, affecting their well-being and often accompanied by low treatment-seeking behaviour.
Defeudis et al. (2023) Italy	Health Literacy and ED in T2DM	167	86.5% of the participants had ED	Males with T2DM and ED, lower health literacy and higher BMI worsen QoL

Author (year) Country	Study Objective	Sample size	Prevalence	Quality of Life
Mushtaq et al. (2018) Pakistan	Hypogonadism and ED in T2DM	160	The overall frequency of ED was reported as 62.5%	Quality of sexual life: 40% of patients with ED suffered from some form of hypogonadism with subnormal testosterone levels. The difference in testosterone levels between patients with and without ED was statistically significant (p-value= 0.0001).
Barnard-Kelly et al. (2019) United Kingdom	Psychosocial impact of diabetes-related ED.	100	66% of the participants had ED	Diabetes and associated sexual health issues have a considerable negative psychosocial impact. Specific aspects affecting QoL include self-esteem, relationships, attractiveness, and feelings of loneliness.
Thongtang et al. (2020) Thailand	ED predictors in T2DM	582	71.5% of the participants had ED.	Overall QoL was moderate (mean = 95.42 ± 11.39). Domain scores: Psychological and Environmental were good (23.84 ± 3.42, 31.4 ± 3.98), while Social Relationships and Physical were moderate (10.77 ± 1.93, 24.9 ± 3.13).
Jombo et al. (2020) Nigeria	Diabetes with ED and QoL impacts	103	50.2% experienced ED.	ED was found to be significantly associated with psychological (depression) impact (p-value = 0.002).
Bekele et al. (2022) Ethiopia	ED magnitude and QoL in T2DM	307	82.1% experienced ED.	Quality of sexual life: About half of the participants (48.2%) had difficulties with penetration after achieving an erection. Approximately 39.7% of participants reported never being satisfied with sexual intercourse.

5.0 Discussion

5.1 Prevalence of Erectile Dysfunction in Males with Diabetes
The prevalence of ED among diabetes males varies significantly, ranging from 28.1% to 94.7%, depending on various factors such as the type of diabetes, geographic location, and study methodology. This wide range of prevalence highlights the complex relationship between diabetes and ED, where the type of diabetes (Type 1 or Type 2), duration of diabetes, and the age of the individuals can significantly influence the occurrence of ED. Studies using the International Index of Erectile Function (IIEF) Questionnaire have provided consistency in diagnosing ED (Rosen et al., 1997); however, differences in how the questionnaire is administered and interpreted could still contribute to the variability in reported rates.

The high prevalence of 94.7% in males with Type 2 diabetes (Ugwumba et al., 2018) suggests that males with Type 2 diabetes mellitus are at a significantly higher risk for ED, reflecting the severity of vascular and nerve damage that often accompanies long-term hyperglycaemia. This is in line with other studies indicating a higher prevalence of ED in diabetes populations compared to their non-diabetes counterparts (Sondhi et al., 2018). The difference in ED prevalence between regions further underscores the need for region-specific interventions that are sensitive to the unique demographic and healthcare characteristics of each area such as Egypt (Alanazi et al., 2022), Gabon (Ndang Ngou Milama et al., 2022), Italy (Defeudis et al., 2023), and Greece (Katsimardou et al., 2023).

Interestingly, a lower prevalence of 28.1% was observed in Thai males with Type 1 diabetes (Thongtang et al., 2020). This raises questions about the differential effects of diabetes types on erectile function. While Type 2 diabetes is often associated with more severe vascular complications, Type 1 diabetes may involve a different pathophysiological mechanism that affects erectile function less severely, especially in younger populations. Future studies should explore the roles of glycaemic control, disease duration, and age, which may help explain these differences (Almigbal, 2019).

Age remains one of the most significant factors contributing to the development of ED. While older age is a confirmed risk factor for ED due to the natural decline in physiological functions and the increased likelihood of comorbid conditions such as cardiovascular disease (Silva et al., 2022; Ugwumba et al., 2018), younger diabetes males also face the risk of early-onset ED, particularly those with poor glycaemic control. Understanding how age and diabetes interact to influence ED prevalence is crucial for developing effective age-specific management strategies.

5.2 Quality of Life of Males with Diabetes
The ED has a profound impact on the quality of life (QoL) of diabetes males, not only affecting their sexual health but also influencing their psychological well-being, self-esteem, and social interactions. Quality of Life (QoL) is a broad measure that includes physical, mental, and social aspects of health, and studies have shown that diabetes males with ED experience considerable declines in these areas (Schweyer, 2017). The biochemical factors, including elevated levels of sex hormone binding globulin (SHBG), prostate-specific antigen (PSA), and glycated hemoglobin (HbA1c), are often linked to poor erectile function, contributing to a decreased overall QoL (Hylmarova et al., 2020).

Furthermore, many diabetes males with ED also suffer from hypogonadism, characterized by low testosterone levels, which exacerbates sexual dysfunction and further diminishes QoL. Hypogonadism contributes to emotional distress, fatigue, and decreased libido, which negatively affects relationships and overall life satisfaction (Mushtaq et al., 2018). These findings highlight the need for

comprehensive treatment strategies that address not just the physical aspects of ED but also the psychological and hormonal factors involved.

The psychological impact of ED on diabetes males is substantial. Many males report significant depressive symptoms and psychological distress associated with ED, which further contributes to a decline in QoL (Silva et al., 2022; Jombo et al., 2020). The emotional burden of ED can lead to feelings of isolation, anxiety, and low self-esteem, which can interfere with their ability to maintain healthy relationships. In Malaysia, while diabetes research is prevalent, studies specifically addressing the impact of ED on QoL in this population are limited, leaving a gap in understanding the full psychosocial consequences of ED among diabetes males.

Income and socioeconomic status also play significant roles in the severity of ED and its impact on QoL. Higher-income levels are positively associated with better erectile function and overall health outcomes. Males with higher incomes are more likely to have access to advanced healthcare, including treatments for ED, and are less likely to experience the mental health challenges associated with lower socioeconomic status (Alaofè H et al., 2022; Fang et al., 2023). On the other hand, those in lower income groups often face higher rates of depression, which can further worsen sexual function and QoL. These findings emphasize the need for policies that address the socioeconomic determinants of health, ensuring equitable access to healthcare and mental health support for all diabetes males.

Additionally, lifestyle factors such as physical activity, diet, smoking cessation, and moderation of alcohol intake are crucial in managing ED and improving QoL. Studies have shown that regular exercise and a balanced diet can help manage diabetes more effectively, improving both cardiovascular health and erectile function (Barnard-Kelly et al., 2019). Lifestyle interventions aimed at encouraging physical activity and dietary improvements, along with smoking cessation and reduced alcohol intake, can significantly enhance both sexual health and overall well-being in diabetes males.

Socio-demographic factors, including age, education, and body mass index (BMI), also play a role in determining the severity of ED and its impact on QoL. As age increases, so does the prevalence of ED, due to the natural aging process and the higher likelihood of comorbid conditions such as hypertension and obesity (Barnard-Kelly et al., 2019). Educational attainment is also linked to better health outcomes, as individuals with higher levels of education are more likely to have access to healthcare resources and be more proactive in managing their health (Alaofè H et al., 2022). Higher socioeconomic status, often associated with higher educational levels and better access to healthcare, leads to better erectile function and overall health, further emphasizing the importance of addressing these factors in public health interventions (Fang et al., 2023).

6.0 Conclusion and Recommendation

This systematic review provides valuable insights into the prevalence of ED and its impact on QoL among males with diabetes. The findings demonstrate a wide range of ED prevalence indicating the substantial effect of diabetes on sexual health across different populations. The ED's impact on QoL is evident in psychological distress, reduced self-esteem, and strained relationships, highlighting its profound effect on the overall well-being of males with diabetes.

Despite the value of this review, limitations include a focus on English-language literature from 2018 to 2024, which may omit earlier relevant studies and reduce the representation of local Malaysian research. Future research should focus on region-specific studies to provide clearer insights into ED prevalence and QoL impacts within Malaysia. Such research could support the development of targeted, culturally relevant interventions to enhance the QoL of diabetes males affected by ED.

7.0 Paper Contribution to Related Field of Study

This review provides valuable insights into the prevalence of ED and its impact on the QoL among diabetes males, particularly in the Malaysian context. It highlights the psychological and social challenges faced by diabetes males with ED, emphasizing the need for targeted healthcare interventions. The findings suggest the development of culturally relevant interventions and psychosocial support to improve QoL. This study also offers direction for future research and policy development to enhance healthcare strategies in Malaysia.

8.0 Financial support

9.0 Acknowledgement

10.0 Conflict of Interest

The authors declare that they have no competing interests.

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