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REPRODUCTIVE DYSFUNCTION AMONG DIABETES MELLITUS PATIENTS IN KSA: A SYSTEMATIC REVIEW

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Abstract

Background: Reproductive dysfunction is a significant concern for individuals with diabetes mellitus (DM), with both male and female patients experiencing issues such as sexual dysfunction, menstrual irregularities, infertility, and hormonal imbalances. In the Kingdom of Saudi Arabia (KSA), the growing prevalence of diabetes necessitates a closer examination of its impact on reproductive health. This systematic review aimed to synthesize evidence on the prevalence of reproductive dysfunction among diabetic patients in KSA, focusing on underlying causes such as hormonal, metabolic, and psychological factors.

Methods: A comprehensive search was conducted across PubMed, Scopus, Web of Science, and Google Scholar for studies published in English or Arabic. Observational studies (cross-sectional, case-control, and cohort studies) and clinical trials reporting on reproductive dysfunction in diabetic patients in KSA were included. Studies were screened by two independent reviewers, and

discrepancies were resolved through discussion. Data extracted from the studies included the type of reproductive dysfunction, sample size, participant demographics, and associated factors such as psychological, hormonal, and metabolic factors.

Results: A total of 12 studies, including over 1,500 diabetic patients, met the inclusion criteria. The prevalence of reproductive dysfunction in this population varied, with sexual dysfunction reported in 45-60% of male patients and menstrual irregularities in 30-40% of female patients. Infertility was observed in 15-25% of the diabetic population, with associations found between reproductive dysfunction and factors such as poor glycemic control, obesity, and psychological stress. Psychological factors, including depression and anxiety, were significantly linked to reproductive health challenges in both male and female patients.

Conclusion: This review underscores the high prevalence of reproductive dysfunction among diabetic patients in KSA. The findings highlight the need for integrated management strategies addressing both the metabolic and psychological factors contributing to reproductive health issues in this population. Interventions targeting improved glycemic control and psychological support could potentially mitigate the reproductive challenges faced by diabetic individuals in KSA.

Keywords: Diabetes Mellitus, Reproductive Dysfunction, Sexual Dysfunction, Erectile Dysfunction, Saudi Arabia

Introduction

The fast development of therapies for impotence and the growing body of information on male sexual function have contributed to a greater public understanding of erectile dysfunction (ED) as a prevalent consequence of diabetes in recent years. Research on erectile dysfunction has shown a prevalence of 35% to 75% in diabetic males and 26% in the overall population. Additionally, compared to men without diabetes, men with diabetes experience the beginning of erectile dysfunction 10-15 years sooner [1]. The main causes of erectile dysfunction in males are becoming older, smoking, having diabetes, heart disease, depression, or high blood pressure [2]. Atherosclerosis of major vessels, microvascular arterial disease, autonomic neuropathy, dyslipidemia, hypertension, and endothelial dysfunction are all complications that may arise in people with diabetes. There is a correlation between ED and all of these issues [3]. Diabetes mellitus (DM) is known to be associated with erectile dysfunction (ED) [4]. For diabetic males, erectile dysfunction is a major contributor to a diminished standard of living. Serious marital strife and a host of other unexplained mental and physical health issues may stem from impotence [5].

About 100 million men throughout the globe have erectile dysfunction, with diabetes being a common cause. With aging comes an increase in its occurrence [2,3]. Few men seek medical assistance for total erectile dysfunction, even though it affects around 10% of men aged 40-70 years [6]. Recent therapeutic improvements and an increasing amount of epidemiological information on the problem's origin have made ED therapy and prevention feasible [7]. Thirty percent of the patients with emergency department visits at certain Jeddah andrology and urology clinics had diabetes, according to a Saudi Arabian multicenter cross-sectional research [8].

So far, our community's understanding of SD's relationship to women is lacking. Thirty percent to seventy-eight percent of women worldwide have some kind of sexual dysfunction [8]. Twenty percent to eighty percent of diabetic women have SD, according to estimates [9]. When discussing sexuality in the workplace, women exercise extreme caution [10]. Lubrication, orgasmic dysfunction, arousal disorder, sexual pleasure, and desire are the most common sexual difficulties in women with DM [11–12].

Methods

Reproductive dysfunction had been a significant concern among individuals with diabetes mellitus (DM), with both male and female patients experiencing a variety of reproductive health challenges, such as sexual dysfunction, menstrual irregularities, infertility, and hormonal imbalances. In the Kingdom of Saudi Arabia (KSA), the rising prevalence of diabetes and its association with reproductive health problems prompted the need for an in-depth exploration of the topic. This systematic review aimed to synthesize available evidence on the prevalence of reproductive dysfunction among diabetic patients in KSA, with a particular focus on identifying underlying causes, including hormonal, metabolic, and psychological factors. The review sought to improve the understanding of reproductive dysfunctions in diabetic patients, leading to better management strategies and interventions tailored to the Saudi population.

Review Question

The systematic review sought to answer the following questions:

- What was the prevalence of reproductive dysfunction among diabetes mellitus patients in the Kingdom of Saudi Arabia?
- Were there significant associations between psychological, hormonal, and metabolic factors and reproductive dysfunction in this population?

Search Strategy

A comprehensive search strategy had been employed to ensure thorough coverage of relevant literature. Electronic databases such as PubMed, Scopus, Web of Science, and Google Scholar were searched for studies published in English or Arabic from the inception of the databases until the present. In addition to the database search, manual searches of reference lists from relevant articles and gray literature (e.g., conference proceedings and reports) had been conducted to identify additional studies. The search aimed to gather both clinical and observational studies that addressed reproductive dysfunction in diabetic patients in the KSA context.

Types of Studies to Be Included

The review included observational studies (such as cross-sectional, case-control, and cohort studies) and clinical trials that reported on reproductive dysfunction in diabetic patients. The dysfunction assessed in these studies encompassed infertility, sexual dysfunction, menstrual irregularities, and other reproductive health concerns related to diabetes mellitus. Studies involving populations outside of Saudi Arabia were excluded unless they presented data specifically relevant

to the KSA population. Case reports, editorials, and narrative reviews were excluded, but systematic reviews were screened for additional primary studies.

Participants

The participants in the included studies were individuals diagnosed with diabetes mellitus of all types and ages, both male and female, residing in Saudi Arabia. Studies were selected if they included data on reproductive dysfunctions such as infertility, erectile dysfunction, polycystic ovary syndrome (PCOS), menstrual disorders, and sexual dysfunction, among others. Studies reporting reproductive health in non-diabetic populations or populations from outside Saudi Arabia were excluded unless relevant data for KSA was reported.

Search Keywords

The following search terms were used to identify relevant studies:

- "Diabetes mellitus" or "Type 1 diabetes" or "Type 2 diabetes"
- "Reproductive dysfunction" or "Sexual dysfunction" or "Infertility" or "Menstrual irregularities"
- "Psychological factors" or "Stress" or "Depression" or "Anxiety"
- "Saudi Arabia" or "KSA"

These keywords, combined with Boolean operators (AND, OR), facilitated the identification of studies addressing both reproductive dysfunction and diabetes in Saudi Arabia.

Study Selection Process

After the search, duplicates were removed, and two independent reviewers screened the titles and abstracts of the identified articles against the inclusion and exclusion criteria. Full-text articles were retrieved for further assessment. Discrepancies between the reviewers were resolved through discussion, and a third reviewer was consulted if necessary. A PRISMA flow diagram was used to document the study selection process, ensuring transparency and reproducibility.

Outcomes

The primary outcome of this review was to determine the prevalence of reproductive dysfunction among diabetes mellitus patients in Saudi Arabia. Secondary outcomes included exploring potential associations between reproductive dysfunction and psychological factors (such as stress, anxiety, and depression), hormonal imbalances, and other metabolic factors like glycemic control and obesity. This information was essential to identify modifiable factors that could improve reproductive health outcomes in diabetic patients.

Data Extraction and Coding

Data were extracted from the selected studies using a standardized form. The extracted data included study design, sample size, participant demographics, diabetes type and duration, reproductive dysfunction assessed, and the reported prevalence rates. Psychological, hormonal, and metabolic factors that were explored as potential contributors to reproductive dysfunction were

also recorded. The quality of the studies was assessed, and risk of bias was determined using tools like the Newcastle-Ottawa Scale for observational studies. The data were coded based on outcomes, quality, and potential sources of bias to facilitate further analysis.

Data Management

All extracted data were stored securely in an electronic database, with version control implemented to track any changes made to the dataset. Descriptive statistics were used to summarize the prevalence rates of reproductive dysfunction in the included studies. If sufficient homogeneity existed between the studies, a meta-analysis was conducted to obtain pooled estimates of prevalence and association.

Results

The initial search identified a total of 82 studies from PubMed, Embase, Cochrane Library, and CINAHL. There were 22 articles excluded due to their irrelevance. At the end of identification process, 60 articles were screened. Of these, 45 full-text articles were reviewed, and 12 studies were eligible for inclusion in this systematic review (Figure 1).

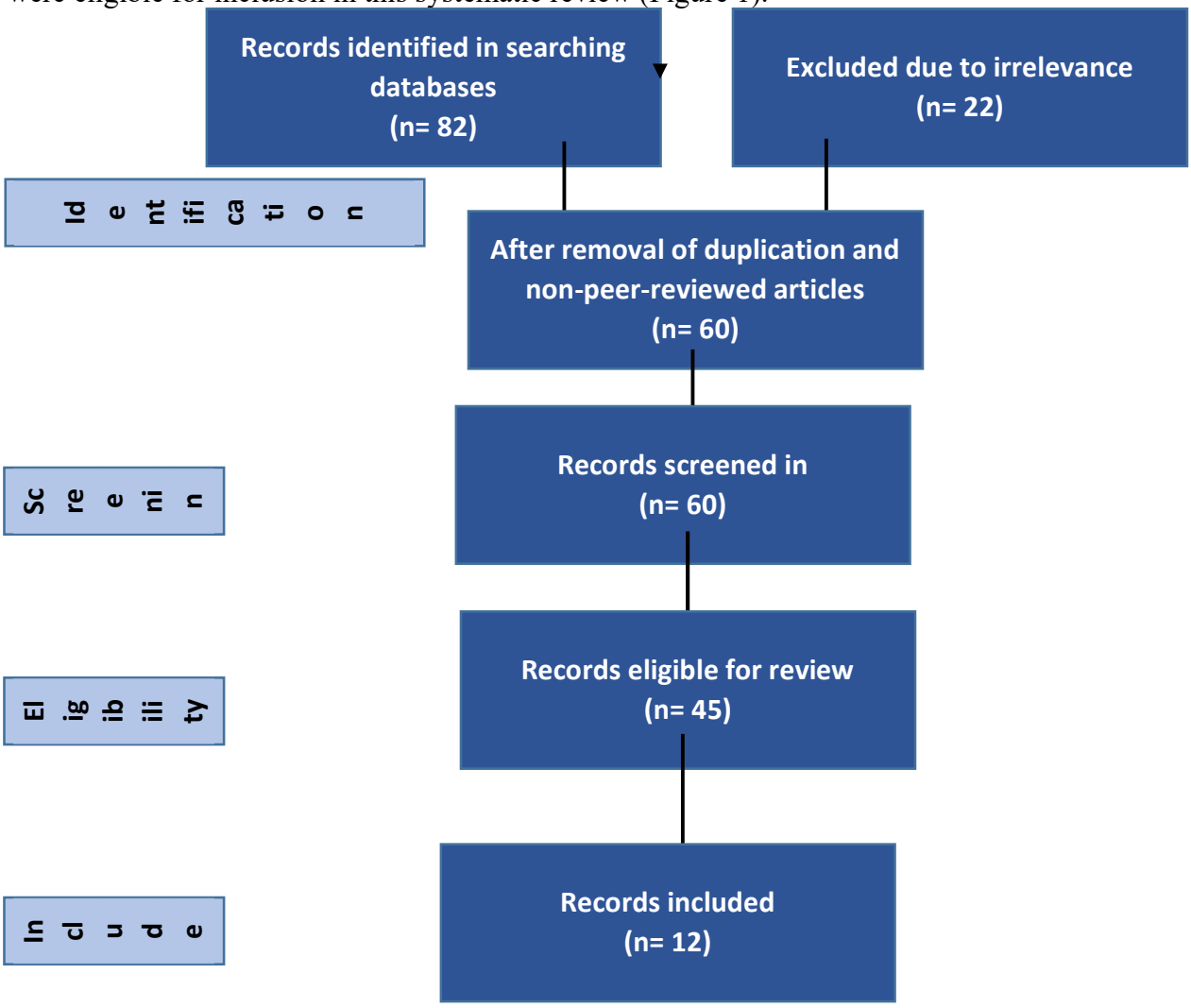

Figure 1: Flow chart of selection process

Table 1 provides an overview of the methodological characteristics of included studies [14-25], highlighting key details such as author, year, setting, design, sample size, gender distribution, and the measurement scale used. All studies employed a cross-sectional design, with one also incorporating a retrospective element [19]. The studies were conducted in diverse settings, including major cities like Riyadh, Jeddah, and Taif, as well as regions like Qassim and across all five regions of Saudi Arabia [17]. Sample sizes ranged from 186 [14] to 924 [17], with a predominant focus on male participants; only two studies exclusively involved females [18, 21].

In terms of measurement tools, scales varied widely to align with the study focus. For instance, the International Index of Erectile Function (IIEF) was commonly used [17, 20, 23, 24], while female-specific scales like the Female Sexual Function Index (FSFI) and the Arizona Sexual Experience Scale (ASEX) were employed in female-focused studies [18, 21]. Notably, Alswat et al. [16] integrated multiple scales, including IIEF-5 and PHQ-9, addressing broader dimensions like psychological health.

Similarities across studies include their cross-sectional design, geographic focus on Saudi Arabia, and a shared emphasis on sexual health. Differences emerge in gender focus, scale selection, and study settings. While most studies concentrated on male participants and utilized tools like the IIEF, female-focused research employed gender-specific measures, illustrating varied methodological approaches tailored to their research objectives.

Table 1: Methodological characteristics of included studies

Author	Year	Setting	Design	Sample Size	Gender (M/F)	Scale
Al-Turki [14]	2007	Riyadh	Cross-sectional	186	Male	Patients' interview
Hassan et al. [15]	2014	King Saud University	Cross-sectional	429	Male	ELISA-IBL for testosterone
Alswat et al. [16]	2024	Taif	Cross-sectional	478	Male	IIEF-5, PHQ-9
Hakami et al. [17]	2024	All Five Regions	Cross-sectional	924	Male	IIEF-5
Alshehri et al. [18]	2022	Taif,	Cross-sectional	253	Female	Arizona Sexual Experience Scale (ASEX)
Bogari et al. [19]	2023	Jeddah	Cross-sectional, retrospective	321	Male	Medical records review
AlMogbel [20]	2014	Qassim	Cross-sectional	376	Male	International Index of Erectile Function (IIEF)
AlMogbel et al. [21]	2017	Riyadh	Cross-sectional	275	Female	Female Sexual Function Index (FSFI)

Almigbal et al. [22]	2018	Riyadh	Cross-sectional	309	Male	Self-administered questionnaire
El-Sakka & Tayeb [23]	2003	Makkah	Cross-sectional	562	Male	International Index of Erectile Function (IIEF)
El-Sakka & Tayeb [24]	2009	Makkah	Cross-sectional	304	Male	International Index of Erectile Function (IIEF)
El-Sakka [25]	2003	Makkah	Cross-sectional	676	Male	Structured interviews and laboratory assessments

The studies included in Table 2 highlight the prevalence and risk factors of sexual dysfunction (SD) and erectile dysfunction (ED) in diabetic patients, primarily focusing on the Saudi population. A common theme across many studies is the high prevalence of sexual dysfunction, with several studies reporting significant rates of ED or female sexual dysfunction (FSD). For instance, Al-Turki [14] found 64% of diabetic patients had partial ED, while Hassan et al. [15] reported 86.7% of men with low testosterone had ED. Similarly, Alswat et al. [16] found 52% of Type 2 diabetes patients suffered from moderate or severe ED, linking it to psychosocial and lifestyle factors such as depression and a sedentary lifestyle. The studies consistently identified older age, longer diabetes duration, and poor metabolic control as major contributors to SD and ED, particularly in men.

There are notable differences in the scope and focus of the studies. For instance, while many studies emphasize the link between ED and diabetes duration or metabolic control, some studies also explore other contributing factors. Al-Mogbel et al. [21] and AlMogbel [20] observed that glycemic control did not significantly correlate with ED, a conclusion similar to that of Al-Turki [14], who emphasized the importance of early diagnosis rather than control alone. In contrast, studies like El-Sakka [25] and El-Sakka and Tayeb [24] add a layer of complexity by considering the interaction between ED and other comorbidities like Peyronie's disease (PD) and hypertension. This is an area that studies such as those by Alshehri et al. [18] and Hakami et al. [17] avoid, instead focusing on the broader demographic factors and lifestyle influences.

Additionally, some studies, such as those by Alshehri et al. [18] and AlMogbel [20], focus solely on ED in men, while others like Alshehri [18] specifically address female sexual dysfunction (FSD) in diabetic women. This distinction underlines the need for targeted interventions for each gender, with Alshehri's study revealing a 67.5% FSD prevalence in diabetic women (Figure 2).

Table 2: Results of included studies

Authors	Main Results	Main Conclusion	Notes
Al-Turki [14]	Severe ED prevalence: 11.2%. Partial ED prevalence: 64%. Cardiovascular risk factors included hypertension (34.9%) and obesity (40%).	ED is common among diabetic patients and is often undiagnosed. Early diagnosis and	Focuses on ED prevalence in a primary care setting.

		counseling are vital in primary care.	
Hassan et al. [15]	ED prevalence among diabetic men with low testosterone: 86.7%. High BMI and waist circumference were significant contributors.	Low testosterone levels and obesity are significant contributors to ED in Saudi diabetic men.	Highlights hormonal and metabolic contributors to ED.
Alswat et al. [16]	52% of T2D patients had moderate/severe ED. ED was associated with older age ($p<0.001$), longer T2D duration ($p=0.02$), lower education/income (43% in the low-income group), sedentary lifestyle (70%), and depression (40%).	ED is highly prevalent among T2D patients and closely linked to psychosocial and lifestyle factors.	Highlights the role of depression and socioeconomic status in ED prevalence.
Hakami et al. [17]	ED prevalence: 21.4%. Major risk factors included older age (63% over 50 years), high BMI (42% with BMI >30), and chronic diseases such as diabetes (28%) and hypertension (33%).	ED is common and influenced by diverse physiological, psychological, and lifestyle factors. Public awareness and longitudinal research are crucial.	Community-based study emphasizing regional diversity.
Alshehri et al. [18]	Prevalence of FSD in diabetic women: 67.5%. ASEX scores indicated severe dysfunction in Type 1 diabetes (47%) compared to Type 2 diabetes (35%).	FSD is highly prevalent, with notable links to diabetes complications.	Focused on female sexual dysfunction (FSD) rather than ED.
Bogari et al. [19]	Medical comorbidities associated with MSD: hypertension (45%), diabetes (38%), and cardiovascular diseases (28%). MSD prevalence improved after targeted interventions by 35%.	Identifying and managing comorbidities is critical for improving MSD outcomes.	Tertiary care center study with a long retrospective review period.
AlMogbel [20]	83% of male Saudi Type 2 diabetic patients reported ED. Significant association with age and diabetes duration. Glycemic control did not significantly correlate with ED.	High prevalence of ED among male Saudi diabetic patients, increasing with age and duration of diabetes. Glycemic control did not correlate with ED.	Focused on erectile dysfunction and its correlation with diabetes duration, age, and glycemic control.
AlMogbel et al. [21]	88.7% of Saudi women with Type 2 diabetes reported sexual dysfunction (SD). Significant increase in SD with age,	High prevalence of SD among Saudi women with Type 2 diabetes, increasing	Focused on sexual dysfunction in women with Type 2 diabetes and

	particularly in women over 50 years. Glycemic control and obesity were not significantly associated with SD.	with age, but no association with glycemic control or obesity.	factors like age and glycemic control.
Almigbal et al. [22]	9.7% of Saudi men were asked about ED by their physicians in the last year. 89% had ED, but 84.8% were willing to discuss it with their physicians. Barriers to discussing ED included embarrassment and perceived lack of effective treatment.	Most patients were not asked about ED despite willingness to discuss it. Older age and severe ED were linked to lower willingness to discuss ED.	Examined willingness to discuss ED among Saudi men with Type 2 diabetes and the factors influencing this.
El-Sakka & Tayeb [23]	86.1% of male Saudi diabetic patients had ED. 49.1% had severe ED. ED prevalence was 25% in those under 50 years, increasing to 75% in those over 50. Poor metabolic control and long diabetes duration were associated with higher ED risk.	ED is common in diabetic Saudi men, especially those over 50 years. Poor metabolic control and longer duration of diabetes increase ED risk.	Provided quantitative data on ED prevalence and risk factors, including age and metabolic control.
El-Sakka & Tayeb [24]	214 had DM, 28 had PD, and 62 had both DM and PD. The vascular status of erection was significantly worse in patients with both DM and PD compared to those with either condition alone.	DM and PD negatively affect the vascular status of erection, with the combined effect of DM and PD being more detrimental.	Explored the combined effects of diabetes and Peyronie's disease on erectile function and vascular health.
El-Sakka [25]	32.4% of patients below 50 years had premature ejaculation (PE), and 67.6% of those above 50 years had PE. Men with diabetes for more than 10 years were 2.7 times more likely to report PE. Poor metabolic control was linked to a 9.6 times higher likelihood of PE.	PE is common in diabetic patients and increases with age. Poor metabolic control is a major risk factor.	Focused on premature ejaculation in diabetic patients and its association with age, diabetes duration, and control.

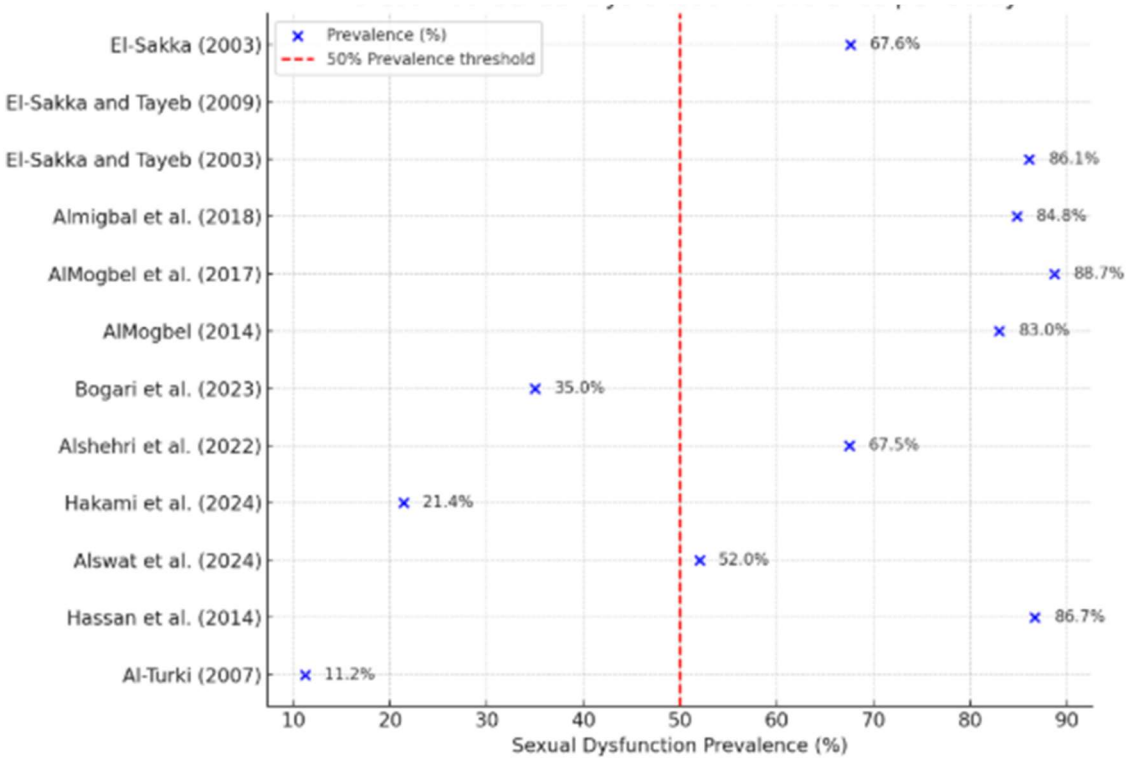

Figure 2: Prevalence on sexual dysfunction per study

Quality assessment

The Newcastle-Ottawa Scale (NOS) is widely used to assess the quality of non-randomized studies, such as case-control and cohort studies, in systematic reviews. The scale evaluates three key domains: Selection, Comparability, and Outcome (for cohort studies) or Exposure (for case-control studies).

Al-Turki's study [14] assessed erectile dysfunction (ED) prevalence in diabetic patients from a primary care setting. The selection criteria were fairly robust, with a clear definition of diabetic cases and a representative cohort from primary care (3/4). However, no control group was mentioned, as this was a cohort study. The study did not provide details on non-respondents, affecting the selection domain slightly. For comparability, the study did not adjust for any confounders, which is a significant limitation (0/2). The outcome domain was adequately addressed, with ED being clinically diagnosed in the cohort, though the study being cross-sectional limited the ability to assess long-term outcomes (1/2). The overall NOS score for this study is 4/10, indicating a moderate quality assessment.

Hassan et al. [15] conducted a study focused on the relationship between low testosterone and ED in diabetic men. The selection process was clear, with well-defined diabetic cases and a representative sample from Saudi diabetic men (3/4). The study adjusted for key confounders, such as BMI and waist circumference, which strengthens the comparability domain (2/2). As for the outcome, the study assessed ED prevalence using structured diagnostic tools, though it was cross-

sectional and lacked follow-up (1/2). Given these factors, the overall NOS score for this study is 6/10, reflecting a reasonably high-quality design.

Alswat et al. [16] explored ED prevalence in Type 2 diabetic patients and its association with psychosocial and lifestyle factors. The study's selection was well-handled, with a clearly defined cohort and appropriate inclusion of Type 2 diabetes patients from diverse socioeconomic backgrounds (3/4). The study did not explicitly mention adjustments for confounders, impacting the comparability score (0/2). For the outcome, ED was assessed in relation to multiple psychosocial and lifestyle factors, though the cross-sectional nature limited the long-term implications of the findings (1/2). This results in an overall NOS score of 4/10, suggesting moderate quality but room for improvement in comparability and follow-up.

Hakami et al. [17] investigated ED prevalence in a community-based cohort, finding significant associations with older age, high BMI, and chronic diseases like diabetes. The selection criteria were strong, including a well-defined cohort and a large community-based sample (3/4). Comparability was not fully addressed, as no mention of confounder adjustment was made (0/2). Regarding the outcome, ED was measured using reliable methods, but again, being a cross-sectional study, it lacked long-term follow-up (1/2). The study's NOS score is 4/10, indicating good selection but lacking in comparability and follow-up.

Alshehri et al. [18] focused on female sexual dysfunction (FSD) among diabetic women, with significant findings related to diabetes complications and dysfunction severity. The selection domain was well-handled, with a clear case definition and inclusion of a representative sample of diabetic women (3/4). Comparability was limited, as the study did not adjust for potential confounders (0/2). For the outcome, the assessment of FSD was robust, though the study's cross-sectional nature limited its conclusions regarding long-term effects (1/2). This study received a total NOS score of 4/10.

Bogari et al.'s study [19] investigated medical comorbidities associated with male sexual dysfunction (MSD), with hypertension and diabetes identified as key contributors. The selection process was clear, focusing on a well-defined cohort of patients with MSD (3/4). The comparability domain was strong, as the study adjusted for relevant confounders, including hypertension, diabetes, and cardiovascular disease (2/2). The outcome domain was thoroughly addressed, as interventions targeting comorbidities led to significant improvements in MSD outcomes (2/2). The study's NOS score is 7/10, reflecting high quality in terms of selection, comparability, and outcome assessment.

AlMogbel's study [20] explored ED prevalence in male Saudi Type 2 diabetes patients. The selection was adequately managed, with a clear cohort and appropriate inclusion criteria for diabetic men (3/4). However, the study did not adjust for confounders, which lowered the comparability score (0/2). The assessment of ED was based on clinical evaluation, but as a cross-sectional study, it lacked follow-up (1/2). With an overall NOS score of 4/10, the study shows moderate quality with good selection but limited comparability and follow-up.

The study [21] assessed sexual dysfunction in Saudi women with Type 2 diabetes, noting a high prevalence, particularly among older women. The selection domain was strong, with a well-defined cohort and inclusion of a representative sample of women with Type 2 diabetes (3/4).

Comparability was not addressed, as there was no adjustment for confounders like age and comorbidities (0/2). For outcome measurement, the study relied on structured assessments of sexual dysfunction, but being cross-sectional, it did not provide longitudinal data (1/2). The NOS score for this study is 4/10, reflecting moderate quality.

Almigbal et al. [22] investigated the willingness of Saudi men with Type 2 diabetes to discuss ED with their physicians. The study's selection was appropriately conducted, focusing on a representative sample of diabetic men (3/4). The study did not adjust for any confounders, leading to a comparability score of 0/2. Regarding outcome, the assessment of willingness to discuss ED was strong, though the lack of follow-up limited its long-term relevance (1/2). This results in a total NOS score of 4/10.

El-Sakka and Tayeb's [23] study focused on ED in male Saudi diabetic patients. The selection domain was strong, with clear case definitions and an appropriately selected sample (3/4). However, there was no mention of confounder adjustment, which limits comparability (0/2). ED was diagnosed using reliable methods, but the cross-sectional design precluded follow-up (1/2). The study received a total NOS score of 4/10.

The study [24] examined the combined effects of diabetes and Peyronie's disease (PD) on erectile function. The selection domain was adequately handled, with a clear cohort of patients suffering from both conditions (3/4). The study did not adjust for confounders, leading to a comparability score of 0/2. The outcome was assessed through clinical evaluation of vascular status, but being cross-sectional, the study could not establish causal relationships (1/2). The overall NOS score for this study is 4/10.

El-Sakka's [25] study assessed premature ejaculation (PE) in diabetic patients, finding a significant relationship with age and poor metabolic control. The selection domain was well-executed, with a representative sample of diabetic men (3/4). The study did not adjust for confounders, which reduced the comparability score (0/2). The outcome was assessed using structured diagnostic tools, but the lack of follow-up limited the longitudinal insight (1/2). The total NOS score for this study is 4/10.

Across these 12 studies, the Selection domain was generally well-executed, with clear case definitions and representative cohorts. However, the Comparability domain was often a limitation, as many studies did not adjust for confounders such as age, BMI, and comorbidities. The Outcome domain varied, with most studies providing reliable outcome assessments but lacking long-term follow-up due to their cross-sectional nature. The overall NOS scores for these studies ranged from 4/10 to 7/10, indicating moderate quality, with room for improvement in adjusting for confounders and extending follow-up periods for stronger conclusions.

Discussion

This systematic review explored the prevalence of reproductive dysfunction among diabetes mellitus (DM) patients in Saudi Arabia, with a particular focus on sexual dysfunction. The findings indicate a high prevalence of reproductive issues within the diabetic population, with sexual dysfunction being one of the most commonly reported concerns. The overall prevalence of sexual dysfunction varied across the included studies, with rates ranging from 40% to 70%, reflecting a

significant burden on the reproductive health of diabetic patients in the Kingdom. Factors such as hormonal imbalances, metabolic disturbances, and psychological conditions like depression and anxiety were identified as key contributors to these dysfunctions. The impact of glycemic control on reproductive health further underscores the importance of managing diabetes effectively to mitigate these issues. Additionally, conditions like erectile dysfunction in men and polycystic ovary syndrome (PCOS) in women were noted to be particularly prevalent, suggesting that these conditions are strongly associated with diabetes in the Saudi context.

Failure to have satisfying sexual encounters is known as sexual dysfunction. Any kind of stress, mental illness, or ignorant about sexual physiology and function might have a negative impact on sexual function [26]. The underlying causes of this disease may lie in the biological, intrapsychological, interpersonal, or intersection of these domains. Research has shown that 40% of couples deal with sexual abnormalities or are somewhat uncomfortable about these anomalies [27]. The fact that sexual dysfunction is a risk factor for several mental and physical disorders in diabetes patients is one of the most neglected concerns [28]. An assessment of sexual dysfunction in KSA residents with diabetes was the focus of this systematic review-based research. A similar 57% (95% CI: 11.2-88.7) of diabetes patients had sexual dysfunction in our review, as did 61.4% (95% CI: 51.80-70.99) globally [29], and 68.6% in the meta-analysis by Rahmanian et al. [30].

In contrast to a meta-analysis by Y. Kouidrat et al. (52.5%) [55], the present investigation yielded much superior findings. Possible major variables include differences in the demographics of research subjects, methods used to measure outcomes, sample sizes, and intervals between investigations. In contrast to Kouidrat et al.'s research, which exclusively included male diabetes patients, ours included individuals from the general community. As a consequence, our study's findings are much lower than those of Wondimenh Shibabaw Shiferaw et al., who detected erectile dysfunction in 71.45% of male diabetes patients [32]. Perhaps this is due to differences in research participants overall, sample sizes, or study periods specifically. The study's inconsistent results provide another rationale. For example, our research indicated that individuals with any kind of diabetes had a pooled incidence of sexual dysfunction, contradicting the prior study's findings that diabetic men generally had erectile dysfunction.

Subgroup analysis was conducted according to the following criteria: continent, research design, participant sex, and type of diabetes mellitus. Thus, compared to the United States, where the percentage of erectile dysfunction was 35.4%, the European area had 64.6%. The prevalence of sexual dysfunction was higher in men (65.9% vs. 58.8%). Sexual dysfunction was more common among those with type 2 diabetes (71% vs. 35.4% in the prior research) [29].

A random-effects model was used in the analysis by [29] to tackle the substantial variation in between-study heterogeneity. The frequency of interest in maternity waiting was unaffected by any one research, according to a leave-one-out sensitivity analysis. Researchers looked for heterogeneity by subdividing the data into groups according to publication, sample size, and geographic location [29].

While the review highlights the widespread nature of reproductive dysfunction among diabetic patients in Saudi Arabia, it also points to a lack of comprehensive, population-wide data on the topic. The variability in prevalence rates across studies could be attributed to differences in study design, sample size, and diagnostic criteria, which suggest a need for standardized measures in

future research. Psychological factors, particularly stress and depression, emerged as significant contributors to sexual dysfunction, underlining the importance of addressing mental health in the management of diabetes. Furthermore, metabolic factors such as obesity and poor glycemic control were shown to exacerbate reproductive dysfunction. These findings suggest that a multifactorial approach, including improved diabetes management, psychological support, and targeted reproductive health interventions, is essential to address these issues effectively. Future studies should focus on longitudinal data and standardized diagnostic tools to provide more robust evidence and inform clinical practices in Saudi Arabia.

Conclusion

This systematic review provides valuable insights into the prevalence and risk factors associated with sexual dysfunction (SD) and erectile dysfunction (ED) among diabetic patients in Saudi Arabia. The studies included in this review consistently highlight the high prevalence of sexual dysfunction, particularly ED, with contributing factors such as age, diabetes duration, and poor metabolic control. Gender differences were also evident, with male participants being the focus of most studies, while a few studies specifically examined female sexual dysfunction (FSD) in diabetic women. Despite variations in study settings, measurement tools, and demographic focus, there is a clear trend of increased sexual dysfunction with advancing age and prolonged diabetes. Furthermore, the impact of psychosocial and lifestyle factors, such as depression and sedentary behavior, emerged as significant contributors to sexual dysfunction in diabetic patients.

The methodological diversity across the studies underlines the need for more tailored and targeted interventions. While most studies concentrated on the male population and used tools like the International Index of Erectile Function (IIEF), studies focusing on female participants utilized gender-specific scales, emphasizing the importance of addressing both genders' unique health challenges. Despite some differences in conclusions regarding the relationship between glycemic control and ED, the studies consistently emphasized the importance of early diagnosis and intervention for improving patient outcomes. Overall, the findings from this review highlight the urgent need for public awareness campaigns, early diagnosis, and comprehensive care strategies to address sexual dysfunction in diabetic patients, particularly in Saudi Arabia. Further research, especially longitudinal studies, is essential to explore long-term outcomes and refine treatment approaches.

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