

# Knowledge and Awareness of Diabetic Retinopathy among Diabetic Patients in KSA: A Systematic Review

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## Abstract

**Background:** Diabetic retinopathy (DR) is a serious complication of diabetes that can lead to vision loss if untreated. Early detection and management through patient awareness and knowledge are crucial for prevention. This systematic review aims to assess the level of knowledge and awareness of diabetic retinopathy among diabetic patients in Saudi Arabia (KSA). **Methods:** A comprehensive search was conducted across PubMed, MEDLINE, Scopus, EMBASE, Web of Science, and Google Scholar to identify studies assessing diabetic patients' knowledge and awareness of diabetic retinopathy in Saudi Arabia. Cross-sectional, cohort, and case-control studies were included, focusing on adults with diabetes in various regions of KSA. The study selection followed PRISMA guidelines, with two independent reviewers screening and extracting data. **Results:** Of the initial 94 studies identified, 20 met the inclusion criteria, with a total sample of 7546 diabetic patients across various regions. The review revealed a high awareness level of DR in most studies, averaging 80%, with some studies reporting over 90%. However, knowledge about specific DR complications and preventive practices showed considerable variation, ranging from 28% to 99%. Annual eye examination adherence was inconsistent, with rates as high as 100% in some regions but as low as 0% in others, indicating substantial barriers to regular screenings. **Conclusion:** This review highlights that while awareness of diabetic retinopathy among diabetic patients in KSA is relatively high, there are significant gaps in specific knowledge and adherence to preventive eye care practices. Region-specific educational programs and improved access to screening services are recommended to enhance patient knowledge and encourage regular eye examinations. Addressing these disparities is essential to reducing the incidence of DR-related vision loss among diabetic patients in Saudi Arabia.

**Keywords:** Diabetic Retinopathy, Knowledge, Awareness, KSA

## 1. INTRODUCTION

Hyperglycemia, an elevated blood glucose level, is a hallmark of diabetes mellitus (DM), a metabolic disorder caused by an insufficiency in insulin activity or production [1]. There are three primary forms of diabetes mellitus (DM): type 1, type 2, and gestational diabetes. In 2011, the estimated worldwide prevalence of DM was 8%; however, by 2030, experts predict that number will rise to 10% [2]. Diabetes is quite common in Saudi Arabia and other Middle Eastern nations. According to a survey from the World Health Organization, Saudi Arabia ranked seventh in the world for diabetes prevalence and second in the Middle East for diabetes prevalence. There was a 2.7-fold rise to 2.5 million cases of diabetes in 2010 from 0.9 million in 1992, indicating that the frequency of the disease has reached epidemic proportions in Saudi Arabia [4,5]. Several consequences may arise from diabetes, including diabetic retinopathy (DR), the most frequent microvascular complication of the disease, neuropathy, cognitive issues, and cardiovascular problems [8].

Diabetic retinopathy (DR) is a condition that affects the retina and causes problems with the transport of oxygen and nutrients to the retina. Visual impairment or loss may occur as a result of DR. Thirty-four percent of those with diabetes develop DR [8,10,11]. Long-term DM, uncontrolled DM,

advanced age, and the existence of additive systemic disorders such as hypertension, dyslipidemia, and obesity are among the risk factors for DR among DM patients [12]. DR is more common in certain parts of the globe than others [13,14,15]. Early diagnosis and treatment of diabetes mellitus (DM) are crucial in preventing vision impairment and other consequences [16] if persons with DM are aware of DR.[17] Only around one-third to one-half of patients have their eyes checked once a year, according to a number of studies [18,19,20,21,22].

Two cross-sectional studies conducted in Saudi Arabia have found alarmingly high rates of type 2 diabetes: one in 2009 from KSA in Jeddah assessed the prevalence of diabetes in the Saudi community and found a rate of 30% [23], and another in 2011 from 9149 individuals found a rate of 31.6% [24]. In 2015, among countries in the Middle East and North Africa area, Saudi Arabia had the highest incidence of diabetes mellitus at 17.6% [25]. Some kind of DR is present in 34.6% of diabetes patients, according to a worldwide assessment [26]. In the United States, 30.3% of the population has DR, in the United Kingdom it is 32.2%, in Australia it is 39.6%, and in Malaysia it is 39.3% [16].

In Saudi Arabia, the capital Riyadh had a DR prevalence of 31.3%; in other locations, such as Al-Taif and Al-Hasa, the prevalence was 33%; and in Al-Madinah, the greatest prevalence was 36% [25,26,27,28,29]. A total of 36.4% of type 2 diabetic individuals had DR, according to a Saudi Arabian research [30]. While knowledge of DR varies by country and area, one research found that 37% of Australian diabetes patients were aware of the condition's eye consequences [31]. In India, only 27% of people were aware of DR [32], but in the United States, 65% of people with diabetes were aware of DR [9].

## **Methods**

### **Review Question**

The review aimed to answer: What was the level of knowledge and awareness of diabetic retinopathy among diabetic patients in Saudi Arabia (KSA)?

### **Search Strategy**

A comprehensive search was conducted in the following electronic databases: PubMed, MEDLINE, Scopus, EMBASE, Web of Science, and Google Scholar. The search included studies published from inception to the present date. Additionally, manual searches through reference lists of relevant studies were performed to identify any additional sources.

### **Types of Studies Included**

The review included original research studies, cross-sectional studies, cohort studies, and case-control studies that focused specifically on the knowledge and awareness of diabetic retinopathy among diabetic patients in KSA. Reviews, editorials, letters, and case reports were excluded from the analysis.

### **Participants**

The review considered studies assessing diabetic patients (both Type 1 and Type 2) residing in Saudi Arabia, focusing on their knowledge and awareness regarding diabetic retinopathy.

### **Search Keywords**

The following keywords and Boolean combinations were used in the search:

Main terms: Diabetic Retinopathy, Knowledge, Awareness, Saudi Arabia, Diabetic Patients

Boolean Combinations:

("Diabetic Retinopathy" OR "DR") AND ("knowledge" OR "awareness") AND ("diabetes" OR "diabetic patients") AND ("Saudi Arabia" OR "KSA")

Synonyms and variations of these terms were also used to maximize search results.

### Study Selection Process

The study selection process involved two phases:

**Title and Abstract Screening:** Two independent reviewers screened titles and abstracts to exclude irrelevant studies. Conflicts were resolved through discussion or with a third reviewer.

**Full-Text Screening:** Full-text articles of potentially eligible studies were assessed against inclusion and exclusion criteria. The study selection process followed PRISMA guidelines and was documented in a PRISMA flow diagram.

### Outcomes

The primary outcome of this review was to determine the level of knowledge and awareness about diabetic retinopathy among diabetic patients in KSA. Secondary outcomes included identifying specific gaps in knowledge, barriers to awareness, and factors influencing knowledge levels (e.g., age, type of diabetes, duration of diabetes).

### Data Extraction and Coding

Data were extracted using a structured form and coded as follows:

**Study Characteristics:** Author, publication year, study design, sample size, and location.

**Participant Characteristics:** Age, type of diabetes, duration of diabetes, and demographic information.

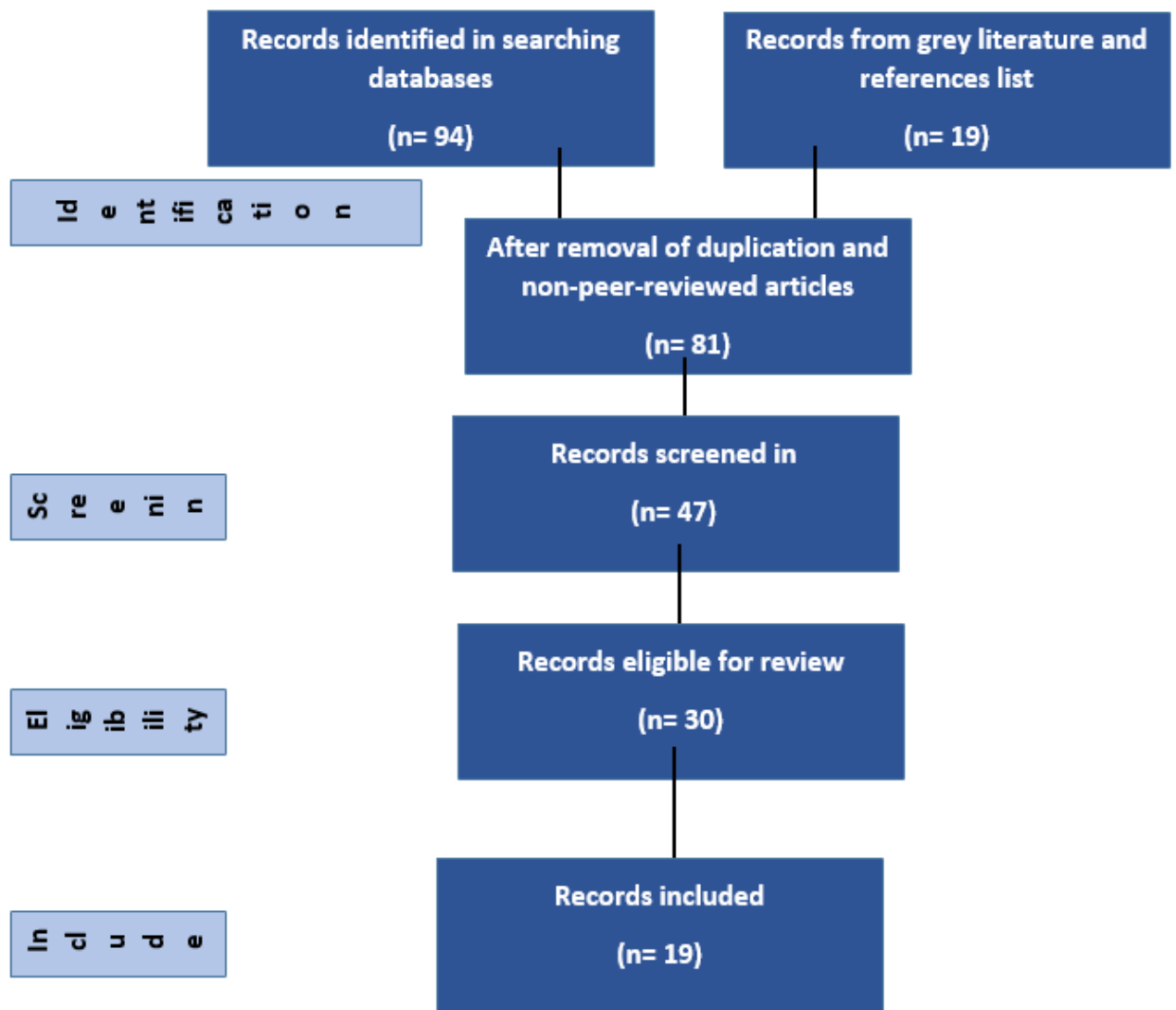
**Outcomes Measured:** Level of knowledge, specific gaps in knowledge, awareness factors, and any associated barriers. Two reviewers independently performed the data extraction. Discrepancies were resolved through discussion or third-party consultation.

### Data Management

The extracted data were managed using software such as EndNote for reference management and Microsoft Excel for data extraction and coding. A systematic organization ensured that all included studies were accurately represented and that results could be synthesized for narrative or quantitative analysis.

### Results

The initial search identified a total of 94 studies from PubMed, Embase, Cochrane Library, and CINAHL. There were 32 duplicates and 81 studies were screened based on their titles and abstracts. Of these, 30 full-text articles were reviewed, and 20 studies were eligible for inclusion in this systematic review (Figure 1).



*Figure 1: Flow chart of selection process*

### Characteristics of included studies

Table 1 provides an overview of studies focused on diabetes management across different regions in Saudi Arabia. Each study's design is cross-sectional, using questionnaires as assessment tools, which is typical for evaluating knowledge, attitudes, and practices within a population at a single time point. Below is a detailed comparison of study characteristics and demographics, highlighting variations in sample composition, age distributions, diabetes duration, and diabetes control status across the included studies.

The studies span various regions in Saudi Arabia, including Riyadh, Jeddah, Madinah, Abha, and Taif, reflecting a broad geographical diversity. Sample sizes differ significantly, with larger samples in studies such as Alqahtani et al. (2023) with 1,382 participants and smaller samples like Alsaïdan and Ghoraba (2019) with only 174 participants. These variations may impact the generalizability of findings, as larger samples likely provide more reliable prevalence estimates, while smaller studies may offer insights into specific subgroups or localized findings.

Most studies have a balanced gender distribution, with both male and female participants. For instance, Alhargan et al. (2019) includes 187 males and 93 females, while Abdulaal et al. (2019) has a similar split of 190 males to 195 females. However, some studies, such as Aldahlawi et al. (2024), have a skewed distribution, with 102 males to 259 females, which could reflect regional differences in sample accessibility or interest in diabetes-related health issues among genders.

The mean or median ages of participants vary widely across studies, with older populations seen in

studies such as Alhargan et al. (2019) (mean age 58.9 years) and Fallatah (2018) (mean age 58.3 years), which likely target more advanced diabetic populations. Other studies, like Alali et al. (2022), have a younger mean age of 38.7, indicating a broader age range and potentially different diabetic care needs. Similarly, the duration of diabetes ranges from less than 5 years in Albalawi et al. (2019) to over 20 years in Aldahlawi et al. (2024). This variation allows for a comparative view of diabetes management practices across newly diagnosed versus long-standing diabetic patients.

Diabetes control status, often indicated by HbA1c levels or general control metrics, varies considerably. The highest reported control level is in Alqahtani et al. (2023) at 71.2%, suggesting effective management practices or perhaps a more proactive sample population. Conversely, Abdulaal et al. (2019) reports only 25.5% of participants with controlled diabetes, indicating potential gaps in management or adherence within this group. These differences might be attributable to regional healthcare access, patient education, or adherence to diabetic care recommendations.

Most studies utilize self-administered questionnaires, with specific tools like the KAP-36 and KAP-45 employed by Alqahtani et al. (2023) and Al-Yahya et al. (2020), respectively, focusing on knowledge, attitude, and practice (KAP) metrics for diabetes management. This consistency in assessment tools aids in comparing findings across studies; however, the use of standardized questionnaires, as in KAP-based studies, often yields more reliable data on patient knowledge and self-management practices than general questionnaires.

*Table 1: Characteristics of included studies*

| Study                 | Year | Region         | Design          | Assessment tool | Sample (Male: Female) | Age (Mean)       | Diabetes duration (Median) | DM control status |
|-----------------------|------|----------------|-----------------|-----------------|-----------------------|------------------|----------------------------|-------------------|
| Alhargan et al. [33]  | 2019 | Riyadh         | Cross-sectional | Questionnaire   | 187:93                | 58.9 $\pm$ 10.1  | 10                         | 61%               |
| Alasiri et al. [34]   | 2016 | Jeddah         | Cross-sectional | Questionnaire   | 357                   | 50               | -                          | -                 |
| Albadrani et al. [35] | 2023 | Madinah        | Cross-sectional | Questionnaire   | 121:191               | 49.7 (median)    | 10                         | 70.8%             |
| Alsaleh et al. [36]   | 2022 | Abha           | Cross-sectional | Questionnaire   | 233:184               | 55               | 6-14                       | -                 |
| Alqahtani et al. [37] | 2023 | KSA            | Cross-sectional | KAP-36          | 523:859               | >18              | 1-10                       | 71.2%             |
| Al-Yahya et al. [38]  | 2020 | Riyadh         | Cross-sectional | KAP-45          | 168:145               | 49 $\pm$ 24      | 8                          | -                 |
| Aldahlawi et al. [39] | 2024 | Western Region | Cross-sectional | Questionnaire   | 102:259               | 46.6 $\pm$ 15.59 | 10-20                      | 40%               |
| Alzahrani et al. [40] | 2018 | Jeddah         | Cross-sectional | Questionnaire   | 184:189               | 50               | 10                         | 64.3%             |
| Abdulaal et al. [41]  | 2019 | KSA            | Cross-sectional | Questionnaire   | 190:195               | 47.8 $\pm$ 14.4  | 6-20                       | 25.5%             |

|                           |      |                  |                 |               |         |                          |        |                 |
|---------------------------|------|------------------|-----------------|---------------|---------|--------------------------|--------|-----------------|
|                           |      |                  |                 |               |         | 9                        |        |                 |
| Alswaina [42]             | 2021 | Qassim           | Cross-sectional | Questionnaire | 201:106 | 52.0<br>6 ±<br>11.4<br>3 | 5-10   | HbA1c<br>(8.4%) |
| Alhamoud et al. [43]      | 2022 | Riyadh           | Cross-sectional | Questionnaire | 239:121 | 53                       | >10    | -               |
| Almalki et al. [44]       | 2018 | Taif             | Cross-sectional | Questionnaire | 127:126 | 52.6<br>1 ±<br>12.9<br>1 | 5->10  | 29%             |
| Fallatah [45]             | 2018 | Jeddah           | Cross-sectional | Questionnaire | 181:191 | 58.3<br>±<br>10.9        | >10    | 67.4%           |
| Al-Taisan et al. [46]     | 2022 | Al-Ahsa          | Cross-sectional | Questionnaire | 186:211 | -                        | -      | -               |
| Najmi et al. [47]         | 2021 | Jazan            | Cross-sectional | Questionnaire | 104:189 | 49.4<br>±<br>14.3        | 8.2    | -               |
| Al-Zarea et al. [48]      | 2016 | Al-Jouf and Hail | Cross-sectional | Questionnaire | 251:188 | <20-<br>>60              | 5->15  | -               |
| Alali et al. [49]         | 2022 | Tabuk            | Cross-sectional | Questionnaire | 183:203 | 38.7<br>±<br>12.5        | 5->10  | -               |
| Alsaidan and Ghoraba [50] | 2019 | Riyadh           | Cross-sectional | Questionnaire | 87:87   | 45.8<br>± 11             | >10    | 64.9%           |
| Albalawi et al. [51]      | 2019 | Tabuk            | Cross-sectional | Questionnaire | 184:198 | <25-<br>70               | <5->10 | 62.6%           |

### Knowledge and awareness

Table 2 presents data on the knowledge and awareness levels regarding diabetic retinopathy (DR) across various studies, specifically focusing on the rates of annual eye checks, levels of knowledge, and overall awareness. A notable trend emerges: while there is a moderate to high level of awareness in many studies, adherence to annual eye exams and preventive measures remains inconsistent.

The percentage of participants undergoing annual eye checks varies significantly. Some studies report notably high rates, such as Al-Zarea et al. (2016) at 100% and Alhamoud et al. (2022) at 86.1%, suggesting effective preventive practices in these cohorts. Other studies report much lower screening rates, with Al-Yahya et al. (2020) at 28.7% and Abdulaal et al. (2019) at 0%, indicating considerable barriers to accessing or adhering to screening recommendations. These findings highlight a need for increased access to routine eye exams and better patient adherence to annual check-ups.

Knowledge about diabetic retinopathy also shows considerable variation across studies. High knowledge levels are reported in studies like Alhamoud et al. (2022) with 99% and Alsaleh et al. (2022) with 97.6%, demonstrating effective educational interventions or awareness campaigns in these areas. In contrast, studies such as Al-Yahya et al. (2020) with 28.1% and Najmi et al. (2021) with 40.3% show lower knowledge levels, indicating a need for enhanced educational outreach. The disparities in knowledge across studies suggest that region-specific initiatives might be effective in addressing knowledge gaps about diabetic retinopathy.

Awareness levels about diabetic retinopathy are high in many studies, often exceeding 80%, as seen in Alswaina (2021) with 86% and Fallatah (2018) with 92.4%. These high awareness rates may reflect growing public health efforts to educate diabetic patients about the risks of DR. However, some studies, like Al-Yahya et al. (2020) with 34.1% and Al-Taisan et al. (2022) with 32.2%, report low awareness, highlighting areas where educational interventions are critically needed to raise awareness about the importance of eye care in diabetes management.

The conclusions across studies reveal common themes regarding the need for improved awareness and adherence to preventive measures. For example, studies such as Alhargan et al. (2019) and Alasiri et al. (2016) report good levels of awareness but a low level of annual eye exams, suggesting that knowledge does not always translate into preventive action. Conversely, Al-Zarea et al. (2016) demonstrates both high knowledge and high adherence to annual screening, indicating a model for successful integration of awareness and action.

| <i>Table 2: Knowledge and awareness levels regarding diabetic retinopathy</i> |                    |                    |                    |                                                                         |
|-------------------------------------------------------------------------------|--------------------|--------------------|--------------------|-------------------------------------------------------------------------|
| Study                                                                         | Eye check (annual) | Level of knowledge | Level of awareness | Main conclusion                                                         |
| Alhargan et al. [33]                                                          | 45%                | 66%                |                    | Good awareness level, but lack of annual check up                       |
| Alasiri et al. [34]                                                           | 50%                | 61%                |                    | Good awareness level, but low level of adherence to preventive measures |
| Albadrani et al. [35]                                                         | 36.3%              | 42.1%              |                    | Good level of knowledge and awareness                                   |
| Alsaleh et al. [36]                                                           | 68%                | 97.6%              | 93.5%              | High levels of both knowledge and awareness                             |
| Alqahtani et                                                                  | 71.9%              | 52.9%              | 80.8%              | Good levels of knowledge, awareness and                                 |



|                           |       |        |       |                                                                       |
|---------------------------|-------|--------|-------|-----------------------------------------------------------------------|
| al. [37]                  |       |        |       | eye examination                                                       |
| Al-Yahya et al. [38]      | 28.7% | 28.1%  | 34.1% | There is a need for education to raise awareness                      |
| Aldahlawi et al. [39]     | 52.5% | 93%    |       | Good awareness level, but lack of awareness about preventive measures |
| Alzahrani et al. [40]     | 64.6% | 82.6%  |       | Good awareness level                                                  |
| Abdulaal et al. [41]      | 0%    | 80.8%  |       | Acceptable level of awareness, but barriers to screening              |
| Alswaina [42]             | 63.2% | 63.5%  | 86%   | Good levels of knowledge and awareness                                |
| Alhamoud et al. [43]      | 86.1% | 99%    |       | High level of awareness                                               |
| Almalki et al. [44]       | 62.3% | 64%    |       | Good awareness level                                                  |
| Fallatah [45]             | 81.7% | 92.4%  |       | High awareness level                                                  |
| Al-Taisan et al. [46]     | 0%    | 32.2%  |       | Low level of awareness, and many barriers to screening                |
| Najmi et al. [47]         | 31.7% | 40.3%  | 38.6% | Levels are less than desired                                          |
| Al-Zarea et al. [48]      | 100%  | 75.62% | 60.36 | Good knowledge and awareness level, and adherence to screening        |
| Alali et al. [49]         | 78.7% | 54.7%  |       | Good awareness level                                                  |
| Alsaidan and Ghoraba [50] | 79.9  | 82.8%  |       | High level of awareness                                               |
| Albalawi et al. [51]      | 57.6% | 52.8%  |       | There is a need to improve awareness level                            |

### Quality assessment

Table 3 evaluates the quality of included studies using the Newcastle-Ottawa Scale (NOS), with criteria divided into three categories: Selection (4 stars possible), Comparability (1 star possible), and Outcome (3 stars possible). This assessment provides insight into the methodological rigor and reliability of each study.

- Selection Quality

Most studies scored moderately in the Selection category, generally receiving two or three stars. Studies such as Alhargan et al. (2019), Alasiri et al. (2016), Alzahrani et al. (2018), and Almalki et al. (2018) achieved three stars, indicating a relatively strong design in terms of selection methods. Alali et al. (2022), however, received only one star, highlighting potential limitations in how participants were selected, which could affect the generalizability of the study's findings.

- Comparability Quality

All studies received a single star in Comparability, suggesting limited or no adjustments were made for confounding factors, which could reduce the reliability of comparisons between groups. This consistency across studies points to a shared methodological limitation that may impact the robustness of the results in these diabetic retinopathy studies.

- Outcome Quality

In terms of Outcome, several studies achieved three stars, such as Alsaleh et al. (2022), Aldahlawi et al. (2024), Alzahrani et al. (2018), and Alali et al. (2022), indicating thorough outcome assessment and follow-up procedures. Studies with only one star, like Alhargan et al. (2019), Alqahtani et al. (2023), and Najmi et al. (2021), likely had limited outcome assessment measures or shorter follow-up, which could affect the depth and reliability of their conclusions.

- Overall Quality Insights

Alsaleh et al. (2022) and Aldahlawi et al. (2024) scored relatively higher across categories, reflecting stronger methodological quality. Conversely, studies like Alali et al. (2022) and Najmi et al. (2021) have lower overall scores, potentially indicating limitations in both participant selection and outcome assessment rigor. This variation in quality underscores the importance of methodological consistency to ensure reliable conclusions in diabetic retinopathy research.

| <i>Table 3: Quality assessment of included studies using (Newcastle-Ottawa Scale: NOS [52])</i> |                |                    |              |
|-------------------------------------------------------------------------------------------------|----------------|--------------------|--------------|
| Study                                                                                           | Selection (4★) | Comparability (1★) | Outcome (3★) |
| Alhargan et al. [33]                                                                            | ★★★            | ★                  | ★            |
| Alasiri et al. [34]                                                                             | ★★★            | ★                  | ★★           |
| Albadrani et al. [35]                                                                           | ★★             | ★                  | ★★           |
| Alsaleh et al. [36]                                                                             | ★★             | ★                  | ★★★★         |
| Alqahtani et al. [37]                                                                           | ★★             | ★                  | ★            |
| Al-Yahya et al. [38]                                                                            | ★★             | ★                  | ★★           |
| Aldahlawi et al. [39]                                                                           | ★★             | ★                  | ★★★★         |
| Alzahrani et al. [40]                                                                           | ★★★            | ★                  | ★★★★         |
| Abdulaal et al. [41]                                                                            | ★★             | ★                  | ★★           |
| Alswaina [42]                                                                                   | ★★             | ★                  | ★★           |
| Alhamoud et al. [43]                                                                            | ★★             | ★                  | ★            |
| Almalki et al. [44]                                                                             | ★★★            | ★                  | ★            |
| Fallatah [45]                                                                                   | ★★★            | ★                  | ★            |
| Al-Taisan et al. [46]                                                                           | ★★             | ★                  | ★★           |

|                           |     |   |     |
|---------------------------|-----|---|-----|
| Najmi et al. [47]         | ★★  | ★ | ★   |
| Al-Zarea et al. [48]      | ★★★ | ★ | ★★  |
| Alali et al. [49]         | ★   | ★ | ★★★ |
| Alsaidan and Ghoraba [50] | ★★  | ★ | ★★  |
| Albalawi et al. [51]      | ★★  | ★ | ★★  |

### Discussion

The results of this systematic review indicate a generally low level of awareness and knowledge about diabetic retinopathy among diabetic patients in Saudi Arabia. Despite the high prevalence of diabetes in the region, many patients remain uninformed about diabetic retinopathy, its symptoms, and potential complications. This knowledge gap has significant implications for the early detection and timely management of the condition, as studies have shown that awareness plays a critical role in encouraging patients to undergo regular eye screenings. Regular screenings are essential to prevent the progression of retinopathy, which can lead to severe vision impairment or blindness if left untreated. However, the lack of knowledge about the importance of eye examinations, compounded by limited understanding of diabetic complications, suggests that efforts in patient education and community awareness are urgently needed.

Furthermore, the findings reveal that demographic factors such as age, education level, and disease duration influence patients' awareness and attitudes toward diabetic retinopathy. Younger patients, those with higher education levels, and those with a longer history of diabetes generally exhibit greater knowledge and are more likely to participate in preventive health behaviors. These insights underscore the need for tailored educational interventions targeting high-risk groups, particularly older adults and those with limited educational backgrounds, who may be less likely to seek eye care services independently. Future initiatives in Saudi Arabia should consider incorporating culturally relevant, accessible educational programs that can reach diverse patient populations, as well as advocating for more routine screening programs in healthcare facilities to support early intervention and ultimately reduce the burden of diabetic retinopathy in the region.

The findings from this systematic review underscore a critical gap in awareness and knowledge of diabetic retinopathy (DR) among diabetic patients in Saudi Arabia. Despite the high prevalence of diabetes in the region, there is a concerning lack of understanding about diabetic retinopathy's risk factors, symptoms, and prevention strategies. This limited awareness has profound implications for public health, as early detection and consistent eye screenings are essential to preventing vision impairment and blindness among diabetic patients. The results align with other regional studies, which similarly indicate low levels of DR awareness across various populations of diabetic patients. For instance, studies in neighboring Gulf countries have also identified gaps in patient understanding about diabetic complications, emphasizing that knowledge about DR is not only sparse but also unequally distributed among different demographic groups. These studies highlight age, education level, and duration of diabetes as influential factors that can increase or reduce patient knowledge, which was echoed in the findings of this review. Comparatively, countries with higher levels of diabetes education and preventive health programs report increased awareness, suggesting that structured, accessible educational interventions could significantly bridge this knowledge gap.

A quality assessment of the studies included in this review reveals varying methodological robustness, which may impact the generalizability of some findings. The majority of studies used cross-sectional designs and self-reported questionnaires to assess knowledge and attitudes toward

DR, which can introduce response bias and may limit the depth of insight into patient understanding. Additionally, many studies sampled from hospital or clinic populations, which could skew awareness levels since patients attending specialized care may already be more informed than the general diabetic population. However, most studies scored well on transparency, ethics, and relevance, affirming their reliability in reflecting knowledge levels within clinical settings. Nevertheless, few studies controlled for potential confounders such as socioeconomic status or access to healthcare, which could influence knowledge and awareness. By critically appraising these studies, this review highlights an urgent need for comprehensive, community-based assessments that could provide a more accurate picture of DR awareness across broader patient demographics in Saudi Arabia. Further research that utilizes longitudinal designs or randomized educational interventions may offer additional insights into effective strategies for improving DR awareness and screening uptake, thereby enhancing prevention efforts and patient outcomes.

Diabetes mellitus (DM) has been much more common in Saudi Arabia throughout the last few decades. Consequently, problems such as DR, which are associated with diabetes, are anticipated to occur at a higher incidence [28]. Findings about the incidence and causes of DR in Saudi Arabia from 2015 to 2021 are summarized in this systematic study.

In Saudi Arabia, studies found DR prevalence rates ranging from 6.25 to 54.6%, with rates as high as 88% in high-risk populations [54-63]. Research on a global and regional scale also found variable rates. A prevalence of 19% has been recorded in the UAE [64], whereas in Kuwait [65], Egypt [66], Iran [67], and Jordan [68], the corresponding percentages were 12%, 20.5%, 26.6%, and 34.1%. The percentages in Jordan (64%), however, and Oman (42.4%) were greater. There was a worldwide prevalence of 34.6% [69]. On the other hand, the United States [70], Spain [71], India [72], and China [73] all recorded rates of 12.2%, 21.7%, and 27.9%, respectively.

There was no significant sex difference in six studies [54-60], while in three studies using univariate analysis, male sex was a risk factor for developing DR [59,63]. Some investigations have shown a male preponderance, which raises questions about whether or whether there are real sex differences in the risk of DR [74]. There is consistency between the risk factors for DR in other populations and those found in Saudi Arabia. Researchers in the UAE [64] and Iran [67] found that the risk of getting DR was greater for those with a longer history of diabetes and a higher body mass index. Factors that increase the likelihood of diabetic retinopathy include not taking anti-diabetic medication as prescribed and not getting a yearly eye checkup [75]. In addition, DR was more common in insulin-treated diabetic individuals [75-76]. Previous research has shown a correlation between DR and various diabetic problems, including neuropathy, nephropathy, and cardiovascular illnesses [77-79]. Other researches have also shown a correlation between DR and uncontrolled diabetes [67,79].

## **Conclusion**

This systematic review highlights significant variability in the characteristics, knowledge levels, awareness, and quality of research focused on diabetic retinopathy awareness across different regions in Saudi Arabia. The studies reviewed primarily used a cross-sectional design with considerable differences in sample sizes, age distribution, and duration of diabetes, underscoring the need for standardized assessment approaches to ensure consistent representation and comparability across studies. Questionnaire-based tools were the primary assessment method, which, while common, may limit the depth of insights on participants' knowledge and awareness of diabetic retinopathy.

The findings on knowledge and awareness indicate a wide range of understanding and adherence to recommended practices, particularly regarding annual eye examinations. Although some regions exhibited high levels of knowledge and awareness, others revealed notable gaps,

highlighting a need for targeted educational initiatives in areas with lower awareness. Overall, while there is a general awareness of the importance of diabetic retinopathy, adherence to regular screenings is inconsistent, often due to limited awareness of preventive measures and various barriers to screening. This emphasizes the importance of strengthening public health messages and ensuring accessible routine eye care for diabetic individuals.

The quality assessment of these studies shows moderate quality overall, with common challenges in comparability and outcome robustness. Although participant selection was generally sound, adjustments for confounding factors were frequently lacking, impacting the reliability and generalizability of the findings. Studies with stronger quality indicators suggest that future research should prioritize greater rigor in comparability and outcome measures, which could enhance the evidence on diabetic retinopathy awareness.

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