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Original Research Article

Diabetic retinopathy and quality of life among adults with type 2 diabetes in Saudi Arabia

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ABSTRACT

Background: Diabetic retinopathy is a common microvascular complication of type 2 diabetes mellitus and may affect quality of life. Evidence using generic quality-of-life instruments remains limited in Saudi Arabia. The objectives were to assess quality of life among adults with type 2 diabetes mellitus in Al-Ahsa, Saudi Arabia, using the WHOQOL-BREF, and to examine whether diabetic retinopathy is associated with domain scores.
Methods: This cross-sectional study included adults with type 2 diabetes mellitus identified from the management of population health records. Quality of life was assessed using the Arabic world health organization quality of life - brief (WHOQOL-BREF). Domain scores were transformed to a 0–100 scale. Independent-samples t-tests and multiple linear regression analyses were used to compare scores by retinopathy status and assess adjusted associations.
Results: A total of 529 participants were included, of whom 101 (19.1%) had diabetic retinopathy. No significant differences were found between participants with and without retinopathy in the physical, psychological, social relationships, or environmental domains in unadjusted analyses. In adjusted analyses, diabetic retinopathy was not significantly associated with any WHOQOL-BREF domain score. Cronbach's alpha ranged from 0.542 to 0.806 across domains.
Conclusion: Diabetic retinopathy was not significantly associated with WHOQOL-BREF domain scores among adults with type 2 diabetes mellitus in Al-Ahsa. These findings suggest that retinopathy status alone may not independently predict overall quality of life when assessed using a generic instrument.

Keywords: Diabetic retinopathy, Type 2 diabetes, Health related quality of life, Saudi Arabia, WHOQOL-BREF

INTRODUCTION

Type 2 diabetes mellitus accounts for over 90% of diabetes cases worldwide.[1] Diabetic retinopathy is a leading cause of vision loss and blindness among working-age adults worldwide.[2,3] In Saudi Arabia, the burden of diabetes is particularly high, and diabetic retinopathy represents a substantial clinical and public-health concern among people living with diabetes.[4]

Although clinical examination and retinal findings are essential for diagnosing diabetic retinopathy, they do not fully capture how the disease affects patients' daily lives.[5,6] Quality of life is a multidimensional concept that reflects physical, psychological, social, and environmental well-being, and these dimensions may all be influenced by diabetes and its complications.[5,6] For this reason, assessing quality of life provides an important patient-centered perspective that complements conventional clinical outcomes.

Previous studies have frequently reported poorer quality of life among patients with diabetic retinopathy, particularly when retinopathy is more severe or accompanied by visual impairment.[5,6] A 2019 case-control study using the world health organization quality of life-brief (WHOQOL-

BREF) found lower quality-of-life scores among patients with type 2 diabetes and diabetic retinopathy compared with those without retinopathy.[6] More broadly, a recent systematic review and meta-analysis concluded that diabetic retinopathy is associated with poorer quality of life overall, with especially consistent effects observed in vision-related measures.[5] However, a large proportion of the existing literature has relied on vision-specific instruments rather than broader generic tools, which may capture different aspects of patient experience.[5,7]

Compared with vision-specific measures, fewer studies have assessed diabetic retinopathy using the WHOQOL-BREF, which evaluates broader life domains beyond visual function alone. This is important because the WHOQOL-BREF is a generic quality-of-life instrument that assesses physical, psychological, social, and environmental domains, allowing a broader evaluation of the impact of disease beyond condition-specific symptoms.[8] Therefore, the present cross-sectional study aimed to assess quality of life among adults with type 2 diabetes mellitus in Al-Ahsa, Saudi Arabia, using the WHOQOL-BREF and to examine whether diabetic retinopathy is associated with WHOQOL-BREF domain scores.[8]

Herein, this research article hypothesized that adults with type 2 diabetes mellitus and diabetic retinopathy would have lower WHOQOL-BREF domain scores than those without diabetic retinopathy.

METHODS

Study design and setting

This cross-sectional study was conducted in Al-Ahsa, Saudi Arabia, between 28 December 2025 and 23 February 2026. Participants were identified through chronic disease records in Al-Ahsa. Records of patients with type 2 diabetes mellitus (T2DM) with diabetic retinopathy and those without diabetic retinopathy were obtained from this source. This study is reported in accordance with the STROBE guidelines for cross-sectional studies.[9]

Study population and eligibility criteria

All eligible patients during the study period were included to minimize selection bias. The study included adults aged 18 years or older who had been diagnosed with T2DM for at least one year, and were willing to participate and provide informed consent.

Patients were excluded if they had type 1 diabetes mellitus or gestational diabetes, were older than 80 years, had a history of major psychiatric disorders that could affect quality-of-life assessment, had severe cognitive impairment preventing reliable questionnaire completion, were undergoing active cancer treatment, or had incomplete medical records regarding diabetes management and comorbidities.

Sampling and sample size

All eligible patients identified from the available health records during the study period were included. The final sample comprised 529 participants.

Assessment of diabetic retinopathy

Diabetic retinopathy status was determined from existing medical records. The diagnosis was based on prior ophthalmic assessment and was already documented in the patients' health files. No additional ophthalmic examinations or diagnostic procedures were performed specifically for the purpose of this study. For analysis, retinopathy status was categorized as present or absent.

Data collection and study variables

Data were collected using the Arabic version of the WHOQOL-BREF questionnaire. The primary exposure variable was diabetic retinopathy status (present versus absent), and the outcome variables were the WHOQOL-BREF domain scores (physical, psychological, social relationships, and environment).

The questionnaire was interviewer-administered either by telephone or during clinic visits. In addition to WHOQOL-BREF responses, demographic and background data were collected, including age, gender, marital status, educational level, occupational status, and diabetic retinopathy status.

WHOQOL-BREF scoring

The WHOQOL-BREF was scored according to standard procedures. Domain scores were calculated from item-level responses after appropriate coding of the questionnaire items, including reverse coding where required. Raw domain scores were then transformed to a 0-100 scale, with higher scores indicating better quality of life. The four WHOQOL-BREF domains assessed were physical health, psychological health, social relationships, and environment. There were no missing data in the final dataset.

Bias

Potential sources of bias were considered. Selection bias may be present as participants were identified from existing health records and may not fully represent all patients with type 2 diabetes in the community. Information bias may also be present due to the use of self-reported quality-of-life measures. Efforts were made to minimize bias by including all eligible patients during the study period and using a standardized, validated instrument (WHOQOL-BREF).

Statistical analysis

Data were analyzed using IBM statistical package for the social sciences (SPSS) statistics version 30. Age was analyzed as a continuous variable. Gender, marital status, and diabetic retinopathy were analyzed as binary variables. Educational level and occupational status were analyzed as categorical variables using dummy coding, with the lowest or most appropriate reference category used in regression models. Continuous variables were summarized as mean±standard deviation, while categorical variables were presented as frequency and percentage. Baseline characteristics were compared between participants with and without diabetic retinopathy. The independent-samples t-test was used for continuous variables, and Pearson's Chi-square test was used for categorical variables. For occupational status, Fisher-Freeman-Halton exact testing was used because of sparse expected cell counts.

Internal consistency of the WHOQOL-BREF domains was assessed using Cronbach's alpha. Independent-samples t-tests were then used to compare WHOQOL-BREF domain scores between participants with and without diabetic retinopathy. Assumptions for the t-test were assessed by visual inspection of histograms for approximate normality and by Levene's test for homogeneity of variances.

To identify factors independently associated with WHOQOL-BREF domain scores, multiple linear regression analyses were performed separately for each domain. The dependent variables were the transformed domain scores for physical health, psychological health, social relationships, and environment. The independent variables entered into the models were age, gender, marital status, educational level, occupational status, and diabetic retinopathy. Age, gender, marital status, educational level, and occupational status were included as potential confounders based on their plausible associations with both diabetic retinopathy and quality of life. Binary variables were entered directly, whereas educational level and occupational status were represented using dummy variables. Regression assumptions were evaluated using residual histograms, normal probability plots, scatterplots of standardized residuals versus standardized predicted values, and collinearity statistics including tolerance and variance inflation factor. All tests were two-sided, and a p value of less than 0.05 was considered statistically significant.

RESULTS

Participant characteristics

A total of 529 participants with T2DM were included in the study, of whom 428 (80.9%) had no diabetic retinopathy and 101 (19.1%) had diabetic retinopathy. The mean age of the participants was 53.30±11.90 years. The mean age did not differ significantly between participants without retinopathy and those with retinopathy (53.46±12.04 versus 53.68±11.34 years, p=0.866) (Table 1). There were no missing data for the variables included in the final analyses.

Of the total sample, 229 (43.3%) were male and 300 (56.7%) were female. There was no significant difference in gender distribution by retinopathy status (p=0.104). Similarly, marital status did not differ significantly by retinopathy status (p=0.972). Most participants were married (76.4%), while 23.6% were single (Table 1).

With respect to educational level, 19.1% had no formal education, 18.5% had elementary school education, 12.5% had middle school education, 23.8% had high school education, 5.1% had a diploma, and 21.0% had a bachelor's degree or higher. Educational level did not differ significantly by retinopathy status (p=0.590). Occupational status was also comparable between groups (p=0.816). Overall, 52.2% of participants were unemployed, 28.5% were working, 18.7% were retired, and 0.6% were students (Table 1).

Table 1: Sociodemographic characteristics by retinopathy status.

Characteristic		No retinopathy	Retinopathy	Total	P value
Age, years (mean±SD)		53.46 (±12.037)	53.68 (±11.337)	53.30 (±11.896)	0.866
Gender, N (%)	Male	178 (41.6)	51 (50.5)	229 (43.3)	0.104
	Female	250 (58.4)	50 (49.5)	300 (56.7)	
	Total	428 (100.0)	101 (100.0)	529 (100.0)	
Marital status, N (%)	Single	101 (23.6)	24 (23.8)	125 (23.6)	0.972
	Married	327 (76.4)	77 (76.2)	404 (76.4)	
	Total	428 (100.0)	101 (100.0)	529 (100.0)	
Educational level, N (%)	No formal education	80 (18.7)	21 (20.8)	101 (19.1)	0.59
	Elementary school	74 (17.3)	24 (23.8)	98 (18.5)	
	Middle school	54 (12.6)	12 (11.9)	66 (12.5)	
	High school	97 (22.7)	29 (28.7)	126 (23.8)	
	Diploma	22 (5.1)	5 (5.0)	27 (5.1)	
	Bachelor's degree or higher	101 (23.6)	10 (9.9)	111 (21.0)	
	Total	428 (100.0)	101 (100.0)	529 (100.0)	
	Unemployed	222 (51.9)	54 (53.3)	276 (52.2)	0.816*

Continued.

Characteristic		No retinopathy	Retinopathy	Total	P value
Occupational status, N (%)	Student	2 (0.5)	2 (1.0)	3 (0.6)	
	Working	123 (28.7)	28 (27.7)	151 (28.5)	
	Retired	81 (18.9)	18 (17.8)	99 (18.7)	
	Total	428 (100.0)	101 (100.0)	529 (100.0)	

Data are presented as mean±standard deviation for continuous variables and number (percentage) for categorical variables. P values were calculated using the independent-samples t-test for age, Pearson's Chi-square test for categorical variables, and *Fisher-Freeman-Halton exact test for occupational status due to sparse expected cell counts

Reliability of the WHOQOL-BREF domains

Internal consistency varied across the WHOQOL-BREF domains. Cronbach's alpha was 0.806 for the physical health domain, 0.685 for the psychological domain, 0.542 for the social relationship's domain, and 0.752 for the environment domain (Table 2).

Table 2: Cronbach's alpha coefficients for WHOQOL-BREF domains.

Domain	Number of items	Cronbach's Alpha
Physical health	7	0.806
Psychological	6	0.685
Social relationships	3	0.542*
Environment	8	0.752

*The social relationships domain often has a lower alpha because it contains only 3 items. With very short scales, Cronbach's alpha can be underestimated, so this should be interpreted cautiously rather than treated as a fatal problem

Unadjusted comparison of WHOQOL-BREF domain scores by retinopathy status

Unadjusted comparisons showed no statistically significant differences in WHOQOL-BREF domain scores between participants with and without diabetic retinopathy (Table 3). Physical health scores were 58.85±20.21 in participants without retinopathy and 59.05±19.41 in those with retinopathy (t (527) =-0.093, p=0.926). Psychological scores were 71.95±15.89 and 72.15±16.10, respectively (t (527) =-0.114, p=0.909). Social relationships scores were 72.33±18.22 in participants without retinopathy and 69.22±19.18 in those with retinopathy (t (527) =1.527, p=0.127). Environmental scores were 69.12±15.32 and 70.95±13.51, respectively (t (527) =-1.100, p=0.272).

Multiple linear regression analysis

Multiple linear regression analyses were performed for each WHOQOL-BREF domain after adjustment for age, gender, marital status, educational level, and occupational status (Table 4). Diabetic retinopathy was not significantly associated with any WHOQOL-BREF domain score. For the physical health domain, the adjusted regression coefficient for retinopathy was 0.672 (95% CI: -3.133 to 4.477, p=0.729), and the model explained 26.0% of the variance (adjusted R^2=0.260).

For the psychological domain, the adjusted regression coefficient was 0.631 (95% CI: -2.780 to 4.042, p=0.716), with an adjusted R^2 of 0.056. For the social relationship's domain, the adjusted regression coefficient was -2.487 (95% CI: -6.411 to 1.437, p=0.214), with an adjusted R^2 of 0.069. For the environmental domain, the adjusted regression coefficient was 2.705 (95% CI: -0.408 to 5.819, p=0.088), with an adjusted R^2 of 0.115.

Table 3: Unadjusted WHOQOL-BREF domain scores by retinopathy status (t-tests).

Domain	No retinopathy (n=428) mean±SD	Retinopathy (n=101) mean±SD	t (df)	P value
Physical health	58.8451±20.20510	59.05±19.41	527	0.926
Psychological	71.95±15.89	72.15±16.10	527	0.909
Social relationships	72.33±18.22	69.22±19.18	527	0.127
Environment	69.12±15.32	70.95±13.51	527	0.272

Data are presented as mean±standard deviation. P values were calculated using the independent-samples t-test. Equal variances were assumed based on Levene's test (p>0.05 for all domains)

Table 4: Multiple linear regression analysis of the association between diabetic retinopathy and WHOQOL-BREF domain scores.

Outcome domain	Adjusted B for retinopathy	95% CI	P value	F (df1, df2)	Adjusted R^2
Physical health	0.672	-3.133-4.477	0.729	16.43 (12, 516)	0.260
Psychological	0.631	-2.780-4.042	0.716	3.63 (12, 516)	0.056
Social relationships	-2.487	-6.411-1.437	0.214	4.26 (12, 516)	0.069
Environment	2.705	-0.408-5.819	0.088	6.70 (12, 516)	0.115

Each model was adjusted for age, gender, marital status, educational level, and occupational status. B=unstandardized regression coefficient; CI=confidence interval

DISCUSSION

The main finding of this study was that diabetic retinopathy was not significantly associated with any WHOQOL-BREF domain score in either the unadjusted or adjusted analyses. This consistency across the physical, psychological, social relationships, and environmental domains suggests that, in this sample of adults with T2DM in Al-Ahsa, retinopathy status alone was not an independent determinant of overall quality of life.

This finding differs from several previous studies that reported poorer quality of life among patients with diabetic retinopathy. Ligda et al found significantly lower WHOQOL-BREF scores among people with T2DM and diabetic retinopathy compared with those without retinopathy, Granado-Casas et al also reported poorer quality of life and treatment satisfaction among patients with diabetic retinopathy in a cohort of patients with type 1 diabetes.[6,10] More recently, the systematic review and meta-analysis by Zayed et al concluded that diabetic retinopathy is associated with poorer quality of life overall, with stronger and more consistent effects seen for vision-related outcomes and for more advanced disease.[5]

One plausible explanation for the difference between the present findings and earlier work is the type of instrument used. Much of the diabetic retinopathy literature has relied on vision-specific or retinal-disease-specific measures, whereas the WHOQOL-BREF is a generic instrument intended to capture broader aspects of well-being. Vujosevic et al emphasized that generic, vision-specific, and diabetic-retinal-disease-specific patient-reported outcome measures differ in the domains they assess and in their sensitivity to the burden of retinal disease.[11] Similarly, Purohit et al showed that using both generic and disease-specific instruments in diabetic retinopathy can reveal different aspects of patient-reported burden.[12] In that context, it is plausible that the WHOQOL-BREF was less sensitive to the functional impact of retinopathy in our sample, particularly if many participants had limited visual impairment or had adapted to their condition.

A second explanation relates to how retinopathy was measured in the present study. Retinopathy was analyzed as a binary variable, present or absent, without grading its severity or incorporating visual acuity, treatment history, or duration of ocular disease. Prior evidence indicates that quality-of-life impairment becomes more apparent as retinopathy severity worsens and as visual function declines.[5,7] Therefore, the absence of a significant association in the current analysis may reflect the fact that the retinopathy group likely included individuals with varying severity, including some with relatively preserved vision.

The local healthcare context may also help explain the nonsignificant findings. Participants were identified from chronic disease records in Al-Ahsa, and it is plausible that continuity of diabetes care, routine follow-up, and earlier ophthalmic recognition reduced the broader impact of retinopathy on daily life. This interpretation cannot be confirmed directly from the present data, but it is consistent with evidence that structured diabetes care and screening initiatives can improve complication monitoring and reduce unmet care needs.[13,14] In a population receiving ongoing chronic disease management, the burden of retinopathy may be less likely to translate into marked impairment in a generic quality-of-life measure.

Our findings are also compatible with a wider body of research showing that quality of life in T2DM is shaped by multiple social, behavioral, and clinical determinants rather than by a single complication alone. In a study from Al-Ahsa, AbuAlhommos et al found that quality of life among people with T2DM was associated with several demographic and disease-related characteristics.[15] More recent regional studies have similarly shown that age, sex, education, diabetes complications, hypertension, and psychosocial burden can all influence quality of life in people with diabetes.[13,16,17] This broader literature supports the interpretation that a generic instrument such as the WHOQOL-BREF may reflect the combined influence of social and clinical context more strongly than the isolated presence of retinopathy.

The pattern across individual domains in the present study also deserves brief consideration. Although no domain showed a statistically significant association with retinopathy, the social relationships scores were somewhat lower among participants with retinopathy, and the environmental domain showed the smallest p value in the adjusted analysis. This suggests that, if retinopathy influences overall quality of life, its effect may be modest and may vary across domains. A recent systematic review likewise suggested that diabetic retinopathy does not affect all dimensions of quality of life equally and that stronger effects are usually detected when vision-related outcomes are measured directly.[5]

The reliability findings should also be considered when interpreting the present results. The physical and environmental domains demonstrated acceptable internal consistency, whereas the psychological domain was borderline and the social relationships domain was lower. Because lower reliability can reduce the ability of an instrument to detect true group differences, the relatively low alpha of the social domain may have limited sensitivity in that domain. This issue is not unique to the present study, as short-domain quality-of-life measures in diabetes research have sometimes shown weaker internal consistency, particularly when the number of items is small.[15,17]

This study has several strengths. It included a relatively large sample of adults with T2DM from a real-world healthcare setting in Al-Ahsa, used a standardized Arabic WHOQOL-BREF instrument, and assessed the association between retinopathy and quality of life using both crude and adjusted analyses. The consistency of the non-

significant findings across multiple domains and across both unadjusted and multivariable models strengthens confidence in the internal coherence of the results.

This study has several limitations. First, the cross-sectional design precludes causal inference. Second, selection bias may be present as participants were identified from existing health records and may not fully represent all individuals with T2DM in the community. Third, information bias may have occurred due to the use of self-reported quality-of-life measures. These sources of bias may have reduced the ability to detect true differences in quality of life between groups and may have biased the associations toward the null. Finally, diabetic retinopathy was classified as present or absent without accounting for severity or visual acuity, which may have influenced the observed associations.

CONCLUSION

Overall, this study found that diabetic retinopathy was not significantly associated with WHOQOL-BREF domain scores among adults with T2DM in Al-Ahsa. Rather than suggesting that retinopathy has no impact, these findings may indicate that its effect is less apparent when broad generic quality-of-life domains are assessed without accounting for severity or visual function. Future studies in Saudi Arabia and similar settings would benefit from combining generic instruments such as the WHOQOL-BREF with vision-specific measures, while also incorporating retinopathy grading and visual acuity, to provide a more complete understanding of the patient burden associated with diabetic retinopathy.

The findings may be most generalizable to adults with T2DM receiving routine care in ministry of health-affiliated chronic disease programs in Saudi Arabia but may not fully apply to community populations or patients with more advanced diabetic retinopathy.

Diabetic retinopathy was not significantly associated with any WHOQOL-BREF domain score in this sample of adults with T2DM in Al-Ahsa, Saudi Arabia. The absence of a significant association in both crude and adjusted analyses suggests that retinopathy status alone may not be an independent predictor of overall quality of life as measured by a generic instrument. These findings highlight the importance of considering the multidimensional and context-dependent nature of quality of life in diabetes. Future studies should combine generic and vision-specific quality of life measures and account for retinopathy severity and visual function to provide a more comprehensive understanding of the patient burden associated with diabetic retinopathy.

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