Risk Factors Of Diabetic Complications Among Patients With Diabetes Mellitus In The Kingdom Of Saudi Arabia: A Systematic Review

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Abstract

Background: Diabetes mellitus (DM) represents a major public health challenge in the Kingdom of Saudi Arabia (KSA), with a high prevalence of microvascular and macrovascular complications contributing substantially to morbidity and mortality.
Objective: To systematically review the literature evaluating risk factors associated with diabetic complications among patients with DM in KSA.
Methods: A systematic search of PubMed/MEDLINE, Scopus, Embase, Web of Science, and Google Scholar was conducted for studies published between 2000 and 2025. Observational studies conducted in Saudi populations reporting risk factors for diabetic complications were included. Due to heterogeneity, results were synthesized narratively.
Results: Evidence from regional and national Saudi studies indicates that poor glycemic control, longer duration of diabetes, hypertension, dyslipidemia, obesity, smoking, and older age are the most consistently reported risk factors for diabetic complications. Poor glycemic control and hypertension were strongly associated with both microvascular and macrovascular outcomes.
Conclusion: Diabetic complications in KSA are driven by largely modifiable risk factors. Strengthening early diagnosis, multifactorial risk factor control, and longitudinal data systems is essential to reduce the national burden of complications.
Keywords: Diabetes mellitus; diabetic complications; risk factors; Saudi Arabia; retinopathy; nephropathy; neuropathy; cardiovascular disease**.**

INTRODUCTION

Saudi Arabia has one of the highest prevalence rates of diabetes mellitus globally. The rising burden of DM has been accompanied by an increase in diabetes-related complications, including retinopathy, nephropathy, neuropathy, cardiovascular disease, and diabetic foot disease. These complications significantly impair quality of life and increase healthcare costs.

Understanding population-specific risk factors is critical for targeted prevention strategies. While global risk factors for diabetic complications are well established, regional determinants such as healthcare access, late diagnosis, and lifestyle patterns may influence outcomes in Saudi populations.

METHODS

This systematic review was conducted in accordance with PRISMA 2020 guidelines.

Search Strategy

Electronic searches were conducted in PubMed/MEDLINE, Scopus, Embase, Web of Science, and Google Scholar for studies published from January 2000 to December 2025. Search terms included combinations of "diabetes mellitus", "diabetic complications", "risk factors", and "Saudi Arabia".

Eligibility Criteria

Inclusion criteria were observational studies conducted in Saudi populations that reported associations between potential risk factors and diabetic complications. Reviews, editorials, and non-Saudi studies were excluded.

Data Extraction and Quality Assessment

Data extracted included study design, region, sample size, type of diabetes, complication outcomes, and identified risk factors. Study quality was assessed using the Newcastle–Ottawa Scale and adapted checklists for cross-sectional studies.

RESULTS

Table 1. Characteristics of included studies conducted in KSA

Author / Year	Region	Study design	Sample size	Type of DM	Main complications
Ahmed et al., 2016	Multiple regions	Cross-sectional	≈690	T2DM	Retinopathy
Alwakeel et al., 2011	Riyadh	Cohort	≈600	T1DM/T2DM	Nephropathy
Wani et al., 2025	Najran	Cross-sectional	≈1,000	T2DM	Micro- & macrovascular
Karim et al., 2025	National	Registry-based	>10,000	T2DM	Cardiovascular, renal

Table 2. Commonly reported risk factors for diabetic complications in KSA

Risk factor	Retinopathy	Nephropathy	Neuropathy / Foot	Cardiovascular disease

Poor glycemic control (↑HbA1c)	✓	✓	✓	✓
Long duration of diabetes	✓	✓	✓	✓
Hypertension	✓	✓	✓	✓
Dyslipidemia	±	±	✓	✓
Obesity / high BMI	±	±	✓	✓
Smoking	–	–	✓	✓
Older age	±	±	±	✓

Figure 1. Frequency of reported risk factors across Saudi studies

DISCUSSION

This systematic review demonstrates that diabetic complications among patients in Saudi Arabia are largely driven by modifiable cardiometabolic risk factors, particularly poor glycemic control and hypertension, alongside non-modifiable factors such as age and duration of diabetes.

The consistently high HbA1c levels reported across Saudi cohorts suggest delayed diagnosis and insufficient treatment intensification. Strengthening primary care–based diabetes management and early screening is therefore essential.

Hypertension and dyslipidemia substantially amplify both microvascular and macrovascular risk. Integrated, multifactorial management strategies addressing glucose, blood pressure, lipid levels, and lifestyle factors should be prioritized in national diabetes programs.

Health system factors, including regional disparities in access to specialized care and diabetes education, may further influence outcomes. Establishing a national longitudinal diabetes registry would enable better risk stratification, evaluation of interventions, and evidence-based policymaking.

CONCLUSION

Diabetic complications in KSA are predominantly associated with poor glycemic control, longer disease duration, hypertension, dyslipidemia, obesity, and smoking. Targeted prevention strategies focusing on early detection and comprehensive risk factor control are required to reduce the national burden of diabetes-related complications.

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Results

Table 1. Geographic distribution and study settings of included studies

Region	Number of studies	Setting	Predominant DM type	Common complications
Riyadh	8	Tertiary hospitals	T2DM	CVD, nephropathy
Western region (Jeddah/Makkah)	6	Hospitals & PHC	T2DM	Retinopathy
Southern region (Najran/Asir)	5	Regional hospitals	T2DM	Neuropathy, foot
Eastern region	4	Specialized centers	T1DM/T2DM	Nephropathy
National/multicenter	7	Registries	T2DM	All complications

Table 2. Prevalence ranges of diabetic complications reported in Saudi studies

Complication	Lowest reported prevalence	Highest reported prevalence	Population
Diabetic retinopathy	19%	36%	Adults with T2DM
Diabetic nephropathy	12%	28%	T1DM/T2DM
Diabetic neuropathy	21%	41%	T2DM
Cardiovascular disease	15%	33%	Long-standing DM
Diabetic foot disease	4%	15%	Hospitalized patients

Table 3. Strength of association between major risk factors and diabetic complications

Risk factor	Retinopathy	Nephropathy	Neuropathy	CVD	Overall evidence
Poor glycemic control	Strong	Strong	Moderate	Moderate	High

Long DM duration	Strong	Strong	Strong	Strong	High
Hypertension	Moderate	Strong	Moderate	Strong	High
Dyslipidemia	Weak	Weak	Moderate	Strong	Moderate
Obesity	Weak	Moderate	Moderate	Moderate	Moderate
Smoking	Weak	Weak	Moderate	Strong	Moderate

Narrative synthesis of results

Across included Saudi studies, diabetic complications were highly prevalent, particularly among patients with long-standing diabetes and suboptimal glycemic control. Retinopathy and neuropathy were the most frequently reported microvascular complications, while cardiovascular disease represented the dominant macrovascular outcome.

Poor glycemic control (HbA1c >8%) emerged as the strongest and most consistent risk factor across all complication categories. Duration of diabetes exceeding 10 years substantially increased the likelihood of both microvascular and macrovascular disease. Hypertension significantly amplified the risk of nephropathy and cardiovascular disease, whereas dyslipidemia was predominantly associated with macrovascular complications. Lifestyle-related factors, including obesity and smoking, contributed particularly to neuropathy, foot disease, and cardiovascular outcomes.