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Prevalence of Adhesive Capsulitis in Patient with Type II Diabetes Mellitus and Its Impact on Shoulder Function

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ABSTRACT

Background: Type 2 diabetes mellitus is associated with musculoskeletal complications that may impair upper-limb function, including frozen shoulder characterized by painful restriction of glenohumeral motion and activity limitation. Objective: To determine the prevalence of frozen shoulder among adults with type 2 diabetes and to assess the association between glycemic-control category and shoulder function using the Shoulder Pain and Disability Index (SPADI). Methods: A cross-sectional observational study enrolled 138 adults with type 2 diabetes (HbA1c ≥6.5%) from diabetic care settings in Lahore. Frozen shoulder was identified clinically by capsular-pattern restriction of shoulder range of motion without traumatic history. Shoulder function was assessed using SPADI and categorized into normal, mild, moderate, severe, and very severe disability. Associations between glycemic-control categories (mild, moderate, severe uncontrolled) and SPADI disability strata, and between glycemic category and pain severity, were tested using chi-square. Results: Frozen shoulder was present in 39/138 participants, yielding a prevalence of 28.3% (95% CI 21.4%–36.3%). Mean SPADI score was 39.94±24.64 (range 9–121). Glycemic-control category was significantly associated with SPADI disability severity (p=0.0055; Cramer's V=0.280), with Severe/Very severe disability increasing from 10.0% in mild uncontrolled to 42.1% in severe uncontrolled diabetes. Pain severity was not significantly associated with glycemic category (p=0.1652). Conclusion: Frozen shoulder was common in adults with type 2 diabetes and poorer glycemic category was associated with higher disability burden, supporting routine screening for functional limitation in diabetic care.

Keywords

Frozen shoulder; adhesive capsulitis; type 2 diabetes mellitus; HbA1c; shoulder function; SPADI; disability; prevalence.

INTRODUCTION

Type 2 diabetes mellitus (T2DM) is a rapidly expanding public health problem with substantial musculoskeletal morbidity that remains under-recognized in routine diabetes care. Global estimates indicate hundreds of millions of adults live with diabetes, and recent national data show that Pakistan has experienced a marked rise in diabetes prevalence over recent years, translating into a large and growing population at risk for long-term disability and health system burden (1). T2DM is characterized by chronic hyperglycemia driven predominantly by insulin resistance and relative insulin deficiency, and its clinical course is strongly influenced by modifiable lifestyle and metabolic risk factors such as excess body weight, physical inactivity, and related cardiometabolic derangements (2,3). Beyond classical microvascular and macrovascular sequelae, diabetes is increasingly associated with connective tissue and periarticular disorders that limit mobility, compromise independence, and amplify the functional impact of the disease (4).

Frozen shoulder (commonly termed adhesive capsulitis in clinical practice) is a frequent shoulder disorder characterized by progressive pain and restriction of both active and passive glenohumeral motion, typically affecting middle-aged and older adults and often following a prolonged course (4,5). Contemporary evidence supports diabetes as both a risk factor for the onset of frozen shoulder and a determinant of worse clinical trajectory, with systematic reviews and meta-analyses indicating a higher likelihood of developing frozen shoulder among individuals with diabetes compared with non-diabetic populations, alongside clinically meaningful differences in prognosis and recovery patterns (6,7). Pathobiological explanations include glycation-related collagen changes, fibroblast proliferation with capsular fibrosis, and a pro-inflammatory milieu that collectively promote capsular thickening, stiffness, and restricted movement, with poorer glycemic control frequently implicated as a contributor to severity and persistence (4–7).

Despite consistent evidence that diabetes increases risk, the reported burden of frozen shoulder varies substantially across studies due to differences in case definitions, sampling frames, and outcome tools, and this variability limits local clinical planning and patient counseling. Regional literature has documented notable frequencies of frozen shoulder among people with T2DM and among broader shoulder-pain populations, but estimates differ widely across settings and measurement approaches (8–10). Moreover, population-based evidence suggests that dysglycemia across the spectrum, including prediabetes and established T2DM, may confer elevated risk over time, reinforcing the need to characterize burden in clinically relevant local cohorts (11). A critical practical gap is that prevalence estimates alone do not adequately communicate the functional consequences of frozen shoulder in diabetic patients; therefore, quantifying disability using a validated shoulder-specific instrument is necessary to translate epidemiologic findings into clinically interpretable impact.

Accordingly, this cross-sectional study evaluated adults with T2DM and elevated glycated hemoglobin to determine the prevalence of frozen shoulder and to examine the association between glycemic status and shoulder-related function measured by the Shoulder Pain and Disability

Index. The study addressed the research question: among adults with T2DM and HbA1c in the diabetic range, what is the prevalence of frozen shoulder and is poorer glycemic control associated with greater shoulder pain-related disability as measured by SPADI?

MATERIALS AND METHODS

A cross-sectional observational study was conducted in Lahore, Pakistan, with participant recruitment and data collection undertaken at the Diabetic Institute of Pakistan and Fatima Memorial Hospital (Shadman, Lahore) over a six-month period following synopsis approval. Adults with a diagnosis of T2DM were approached through non-probability convenience sampling and enrolled after obtaining written informed consent. Eligibility criteria included age above 35 years, both sexes, and glycated hemoglobin (HbA1c) in the diabetic range (≥6.5%). Exclusion criteria comprised current or recent steroid use, known rheumatological disease, history of alcohol intake, and receipt of intra-articular injections within the preceding six months, in order to reduce confounding by alternative inflammatory or iatrogenic causes of shoulder pain and stiffness.

The primary outcome was the presence of frozen shoulder, operationalized clinically as restricted glenohumeral range of motion on physical assessment in the absence of traumatic shoulder injury. Shoulder movement assessment followed a capsular-pattern approach using standardized active and passive range-of-motion testing of key planes reported for frozen shoulder within the study protocol (including shoulder flexion, abduction, and rotational movement assessment), and participants demonstrating restriction consistent with capsular involvement were classified as positive for frozen shoulder. The prevalence of frozen shoulder was calculated as the proportion of participants meeting the capsular restriction criteria divided by the total number of enrolled participants.

The secondary outcome was shoulder pain-related disability, assessed using the Shoulder Pain and Disability Index (SPADI), a 13-item patient-reported measure capturing pain intensity and difficulty performing upper-limb activities of daily living, with established reliability metrics reported for the instrument (12). After completion of the clinical shoulder assessment, all participants completed the SPADI questionnaire. For analytic purposes, SPADI scores were summarized descriptively and categorized into ordinal severity strata (normal, mild, moderate, severe, very severe) as per the study's scoring framework. Glycemic status was categorized into levels of uncontrolled diabetes (mild, moderate, severe) according to HbA1c-based groupings prespecified in the study analysis plan.

The sample size was calculated as 138 participants using a single-proportion formula at a 95% confidence level (Z=1.96), anticipated proportion P=0.10, and margin of error e=0.05. Demographic and clinical variables were summarized as mean ± standard deviation for continuous variables and as frequency (percentage) for categorical variables. Associations between categorical groupings of glycemic control and SPADI disability strata were examined using the chi-square test. A separate chi-square analysis evaluated the relationship between glycemic-control categories and pain severity categories. Statistical analyses were conducted using SPSS (version 27), with hypothesis testing interpreted at the conventional significance threshold, and results presented in frequency tables and comparative distributions.

Ethical approval was obtained from Fatima Memorial Hospital prior to study initiation. Participant confidentiality was maintained throughout data collection and analysis, informed consent was obtained from all participants, and participants retained the right to withdraw from the study at any stage without penalty.

RESULTS

When SPADI disability was dichotomized into Severe/Very severe versus all other categories, a clear gradient was observed across glycemic-control strata. Participants with mild uncontrolled diabetes showed Severe/Very severe disability in 4 out of 40 cases (10.0%), which increased to 14 out of 79 (17.7%) among those with moderate uncontrolled diabetes, and rose markedly to 8 out of 19 (42.1%) in the severe uncontrolled group. In odds-based comparisons, the likelihood of Severe/Very severe disability was higher in moderately uncontrolled diabetes compared with mildly uncontrolled diabetes (OR 1.94, 95% CI 0.59–6.33), while the odds were substantially elevated in severely uncontrolled diabetes relative to mild uncontrolled diabetes (OR 6.55, 95% CI 1.65–25.94), indicating a strong functional deterioration pattern with worsening glycemic status.

Table 1. Key study outcomes summary (n=138)

Outcome	Estimate
Frozen shoulder prevalence	39/138 = 28.3% (95% CI 21.4%–36.3%)
SPADI total score	Mean ± SD: 39.94 ± 24.64; Min–Max: 9–121

Table 2. Prevalence of frozen shoulder based on capsular restriction (n=138)

Frozen shoulder status	n	%
Negative	99	71.7
Positive	39	28.3

Table 3. Distribution of SPADI disability severity categories (n=138)

SPADI severity category	n	%
Normal	37	26.8
Mild	36	26.1
Moderate	39	28.3
Severe	18	13.0
Very severe	8	5.8

A total of 138 adults with type 2 diabetes were analyzed. Based on capsular restriction criteria, 39 participants met the definition of frozen shoulder, yielding a prevalence of 28.3% (39/138) (Table 2). The estimated prevalence precision was moderate, with a 95% confidence interval of 21.4%–36.3% (Table 1). SPADI scores ranged from 9 to 121, with a mean ± SD of 39.94 ± 24.64, reflecting wide dispersion in symptom burden (Table 1). In categorical terms, disability severity clustered most commonly in the moderate SPADI category (28.3%), followed by normal (26.8%) and mild (26.1%), while severe and very severe disability together accounted for 18.8% of the sample (Table 3).

Table 4. Association of glycemic-control category with SPADI disability severity (n=138)

SPADI disability severity	Mild uncontrolled (n=40)	Moderate uncontrolled (n=79)	Severe uncontrolled (n=19)	Row total
Normal	13	20	4	37
Mild	14	20	2	36
Moderate	9	25	5	39
Severe	4	11	3	18
Very severe	0	3	5	8
Column total	40	79	19	138
Chi-square p-value		0.0055		
Effect size (Cramer's V)		0.280		

Table 5. Association of glycemic-control category with pain severity (n=138)

Diabetes category	Mild pain	Moderate pain	Severe pain	Row total
Mild uncontrolled	17	21	2	40
Moderate uncontrolled	27	42	10	79
Severe uncontrolled	4	10	5	19
Column total	48	73	17	138
Chi-square p-value		0.1652		
Effect size (Cramer's V)		0.153		

Glycemic-control category demonstrated a statistically significant association with SPADI disability severity (χ^2 test p=0.0055; Cramer's V=0.280, indicating a small-to-moderate association) (Table 4). Clinically, the proportion of participants in the Severe/Very severe disability strata rose from 10.0% among mildly uncontrolled diabetes to 17.7% among moderately uncontrolled and reached 42.1% among severely uncontrolled diabetes. Relative to mild uncontrolled diabetes, the odds of Severe/Very severe disability were 6.55-fold higher in the severe uncontrolled category (95% CI 1.65–25.94) (Table 4). In contrast, the relationship between glycemic-control category and pain severity did not reach statistical significance (p=0.1652; Cramer's V=0.153) (Table 5). Although severe pain occurred more frequently in the severely uncontrolled group (5/19; 26.3%) than in the mildly uncontrolled group (2/40; 5.0%), the overall distribution across pain strata was not sufficiently different to support a significant association in this sample (Table 5).

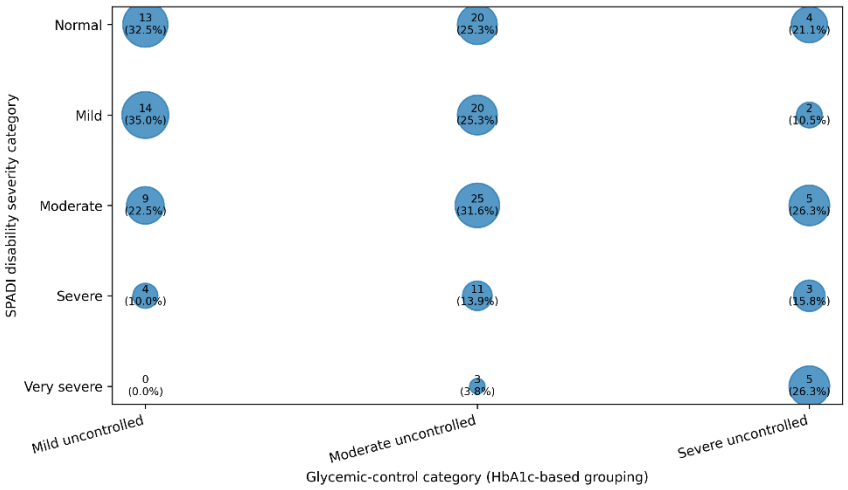

Figure 1 Distribution of SPADI disability severity across glycemic-control categories (n=138)

The integrated distribution shows a clear disability-severity gradient across glycemic-control strata, with Severe/Very severe disability comprising 10.0% (4/40) of the mild uncontrolled group, 17.7% (14/79) of the moderate uncontrolled group, and 42.1% (8/19) of the severe uncontrolled group, driven particularly by a marked concentration of Very severe disability in severe uncontrolled diabetes (26.3%; 5/19) versus near absence in mild uncontrolled diabetes (0%; 0/40). In contrast, the mid-spectrum (moderate disability) remains present across all strata (22.5%–31.6%), indicating that worsening glycemic category is associated less with uniform score inflation and more with polarization toward high-disability states, consistent with the significant association observed in Table 4 (p=0.0055).

DISCUSSION

This cross-sectional study quantified frozen shoulder burden and functional impact among adults with type 2 diabetes and HbA1c in the diabetic range, demonstrating a 28.3% prevalence of capsular restriction consistent with frozen shoulder and a statistically significant association between glycemic-control category and SPADI disability severity (p=0.0055, Cramer's V=0.280). The prevalence estimate is clinically meaningful and aligns with the long-standing observation that frozen shoulder is substantially more frequent in diabetes than in non-diabetic populations, as supported by systematic evidence identifying diabetes as a risk factor for onset and progression of frozen shoulder (13). Local and regional studies have also reported notable frequencies of frozen shoulder among individuals with T2DM, reinforcing that shoulder capsular disorders represent a common source of morbidity in diabetic care pathways, particularly in clinic-based cohorts where metabolic control is often suboptimal (14,15).

When compared with previous reports using SPADI-based assessments, the magnitude of functional compromise in the present cohort is directionally consistent with regional observational findings reporting high burdens of shoulder pain and disability in diabetic populations, albeit

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with variability attributable to sampling frames and case definitions (16,17). Importantly, the present analysis adds clinically interpretable stratification by glycemic category: the proportion of participants classified as Severe/Very severe disability increased from 10.0% (mild uncontrolled) to 42.1% (severe uncontrolled), and severe uncontrolled diabetes was associated with markedly higher odds of Severe/Very severe disability relative to mild uncontrolled diabetes (OR 6.55, 95% CI 1.65–25.94). This gradient supports the biologically plausible model in which chronic hyperglycemia contributes to capsular fibrosis, altered collagen remodeling, and soft-tissue stiffening, thereby disproportionately affecting functional performance rather than pain intensity alone (18,19). Evidence from prognostic investigations similarly indicates that diabetes is linked to worse recovery trajectories and persistence of functional limitation over time in frozen shoulder, even when pain may fluctuate across stages of the condition (20).

A notable finding in the present dataset is the divergence between disability and pain associations: while glycemic category showed a significant relationship with SPADI disability strata, it did not show a statistically significant relationship with pain severity (p=0.1652). This pattern is clinically coherent because frozen shoulder is staged, and pain intensity may be influenced by stage (freezing versus frozen), analgesic use, activity modification, and individual pain perception, whereas disability, especially in higher SPADI strata, may more consistently reflect capsular stiffness and motion loss that directly impairs dressing, reaching, overhead tasks, and other daily activities. The clinical implication is that relying primarily on pain intensity to screen diabetic patients may miss individuals with substantial functional restriction; integrating brief disability screening (e.g., SPADI) with targeted range-of-motion assessment may better capture those with clinically significant limitation and prompt earlier rehabilitation referral (21,22).

These findings underscore the practical need for integrated musculoskeletal surveillance in diabetes services, particularly for patients with poorer glycemic profiles who appear overrepresented in the highest disability categories. From a service perspective, early identification of motion restriction and disability in diabetic populations may reduce downstream participation restriction and productivity loss through earlier physiotherapy intervention, self-management education, and structured mobility programs tailored to shoulder capsular stiffness. Future work should extend beyond cross-sectional association by incorporating stage-specific diagnosis, standardized goniometric thresholds for ROM restriction, and longitudinal follow-up to clarify whether improving glycemic control modifies disability trajectories or treatment responsiveness in frozen shoulder (23). Additionally, incorporating multivariable models that adjust for age, sex, diabetes duration, BMI, and comorbidities would refine causal inference and quantify independent contributions of glycemic control to disability severity.

Several limitations should be considered when interpreting these results. The non-probability convenience sampling and single-city clinical setting may limit generalizability, and the cross-sectional design cannot establish temporal direction between glycemic status and disability severity. Case ascertainment relied on a clinical capsular-pattern assessment without imaging confirmation, which is common in pragmatic settings but can introduce misclassification where rotator cuff pathology or osteoarthritis coexists. Nevertheless, the study's strengths include a clearly defined diabetic cohort, a pragmatic diagnostic approach aligned with routine practice, and the use of a validated disability instrument (SPADI) to translate shoulder impairment into patient-relevant functional impact (24). Overall, the evidence supports a clinically important burden of frozen shoulder in T2DM and highlights that worsening glycemic category is associated more strongly with disability than with pain severity in this cohort.

CONCLUSION

Among 138 adults with type 2 diabetes and HbA1c in the diabetic range, frozen shoulder prevalence was 28.3%, and glycemic-control category demonstrated a significant association with SPADI disability severity (p=0.0055, Cramer's V=0.280), with a marked increase in Severe/Very severe disability in the severe uncontrolled group (42.1%) compared with mild uncontrolled (10.0%); in contrast, pain severity did not show a statistically significant association with glycemic category (p=0.1652), suggesting that functional disability may be the more sensitive clinical signal of shoulder involvement in this diabetic cohort.

REFERENCES

1. Azeem S, Khan U, Liaquat A. The increasing rate of diabetes in Pakistan: A silent killer. Ann Med Surg (Lond). 2022;79:103901.
2. Alam S, Hasan MK, Neaz S, Hussain N, Hossain MF, Rahman T. Diabetes Mellitus: Insights from Epidemiology, Biochemistry, Risk Factors, Diagnosis, Complications and Comprehensive Management. Diabetology. 2021;2:36–50.
3. Shofian S, Wilson S. Characteristics of types of diabetes mellitus II in Regional General Hospital Than Rondahaim, Simalungun District. Medalion Journal: Medical Research, Nursing, Health and Midwife Participation. 2022;3:144–148.
4. Millar NL, Meakins A, Struyf F, Willmore E, Campbell AL, Kirwan PD, et al. Frozen shoulder. Nat Rev Dis Primers. 2022;8:59.
5. de la Serna D, Navarro-Ledesma S, Alayón F, López E, Pruimboom L. A comprehensive view of frozen shoulder: a mystery syndrome. Front Med (Lausanne). 2021;8:663703.
6. Dyer BP, Rathod-Mistry T, Burton C, van der Windt D, Blagojevic-Bucknall M. Diabetes as a risk factor for the onset of frozen shoulder: a systematic review and meta-analysis. BMJ Open. 2023;13:e062377.
7. Dyer BP, Burton C, Rathod-Mistry T, Blagojevic-Bucknall M, van der Windt DA. Diabetes as a prognostic factor in frozen shoulder: a systematic review. Arch Rehabil Res Clin Transl. 2021;3:100141.
8. Akhuand MA, Tunio SAP, Tunio ZH, Siyal S, Memon GA, Shah SMA, et al. Frequency of frozen shoulder amongst T2DM patients. J Peoples Univ Med Health Sci Nawabshah (JPUMHS). 2020;10.
9. Mamun K, Husain MN, Mansur F, Alam M. Adhesive capsulitis of shoulder (frozen shoulder) among the diabetic patients with rheumatic complaints. Med Today. 2020;32:67–69.
10. Seher Z, Goher N, Hamid A, Latif U, Bukhari A, Rafique H, et al. Prevalence of adhesive capsulitis among diabetics and non-diabetics with shoulder pain in general population. Pak J Health Sci. 2023;67–71.
11. Kim JH, Kim BS, Kwon HS. The risk of shoulder adhesive capsulitis in individuals with prediabetes and type 2 diabetes mellitus: a longitudinal nationwide population-based study. Diabetes Metab J. 2023;47:869.
12. Shoulder Pain and Disability Index (SPADI). Physio-pedia. Available from: https://www.physio-pedia.com/Shoulder_Pain_and_Disability_Index_(SPADI) (accessed date not stated).

DOI: https://doi.org/10.61919/c45apq59

13. Dyer BP, Rathod-Mistry T, Burton C, van der Windt D, Bucknall M. Diabetes as a risk factor for the onset of frozen shoulder: a systematic review and meta-analysis. BMJ Open. 2023;13:e062377.
14. Hassankhani EG, Pettersson H, Hassankhani SG, Hassankhani GG. Prevalence of diabetes and its effect on the course and treatment of frozen shoulder. Open J Orthop. 2022;12:463–473.
15. Suleman S, Tariq H, Asif T, Khan AQ, Sehar H, Akhtar M, et al. Frequency of shoulder pain in type 2 diabetes mellitus patients. J Riphah Coll Rehabil Sci. 2023;11.
16. Younas S, Fatima A. Comparison of shoulder pain, disability and range of motion in diabetic and non-diabetic patients with frozen shoulder. Khyber Med Univ J. 2020;12:221–224.
17. Seher Z, Goher N, Hamid A, Latif U, Bukhari A, Rafique H, et al. Prevalence of adhesive capsulitis among diabetics and non-diabetics with shoulder pain in general population. Pak J Health Sci. 2023;67–71.
18. Pandey V, Madi S. Clinical guidelines in the management of frozen shoulder: an update. Indian J Orthop. 2021;55:299–309.
19. Su YD, Lee TC, Lin YC, Chen SK. Arthroscopic release for frozen shoulder: does the timing of intervention and diabetes affect outcome? PLoS One. 2019;14:e0224986.
20. Gundtoft PH, Attrup ML, Kristensen AK, Vobbe JW, Sørensen L, Hölmich P. Diabetes mellitus affects the prognosis of frozen shoulder. Dan Med J. 2020;67:1–8.
21. Pandey V, Aier S, Agarwal S, Sandhu AS, Murali SD. Prevalence of prediabetes in patients with idiopathic frozen shoulder: a prospective study. JSES Int. 2024;8:85–89.
22. Obeagu EI. Red blood cells as biomarkers and mediators in complications of diabetes mellitus: a review. Medicine (Baltimore). 2024;103:e37265.
23. Akhuand MA, Tunio SAP, Tunio ZH, Siyal S, Memon GA, Shah SMA, et al. Frequency of frozen shoulder amongst T2DM patients. J Peoples Univ Med Health Sci Nawabshah (JPUMHS). 2020;10.
24. Shoulder Pain and Disability Index (SPADI). Physio-pedia. Available from: https://www.physio-pedia.com/Shoulder_Pain_and_Disability_Index_(SPADI)