

Association between Frozen Shoulder and Diabetes among Women of Reproductive Age (15–49 Years): A Systematic Review

SHAHZAIB UD DIN HAMZA¹, AMSHA ISHAQ², MUHAMMAD SHERAZ ALI¹, MUHAMMAD BABAR¹, TAHIRA FAROOQ¹, RABIA SAEED QURESHI³

¹Allied Health & Sport Sciences Department, Health Services Academy, Islamabad 44000, Pakistan;

²Military Hospital Rawalpindi;

³District Headquarter Hospital Jhelum;

Correspondence to: Muhammad Sheraz Ali; Email: sherazalimalik89@gmail.com; Cell: +92 314 9516026

ABSTRACT

Background: Diabetes mellitus (DM) has devastating effects on articulating joints, particularly the shoulder joint, which plays a critical role in mobility and functional activities. As a highly mobile synovial joint, the shoulder is more prone to degenerative changes, especially in individuals with DM.

Purpose of Study: To evaluate the association between frozen shoulder (FS) and diabetes mellitus among diabetic women of reproductive age (15–49 years) through a systematic review of relevant studies.

Materials and Methods: A systematic review was conducted on studies published in the last 10 years. Inclusion criteria were cross-sectional, case series, cohort, observational, and comparative studies in the English language. Exclusion criteria included studies published in non-English languages and articles older than 10 years. Articles were retrieved from various search engines and databases.

Results: An initial search yielded 33,127 articles. After screening and refining based on inclusion and exclusion criteria, 15 articles were selected for detailed review. Of these, 10 studies (66.6%) reported a strong association between frozen shoulder and diabetes mellitus, while 1 study (6.6%) reported no significant association. Factors influencing the association included obesity, sedentary lifestyle, family history, physical inactivity, occupation, and trauma. The majority of studies highlighted a higher prevalence of frozen shoulder in women with Type 1 diabetes, particularly those aged around 45 years.

Conclusion: This systematic review concludes that diabetes mellitus significantly affects the shoulder joint, leading to a higher prevalence of frozen shoulder among diabetic women of reproductive age. Contributing factors such as obesity, sedentariness, family history, and physical inactivity further exacerbate the condition.

Keywords: Frozen shoulder, Diabetes mellitus, Type 1 diabetes, Women, Shoulder joint, Reproductive age, Occupation, Physical inactivity.

INTRODUCTION

Frozen shoulder, also known as adhesive capsulitis, is a chronic musculoskeletal disorder characterized by significant pain and progressive stiffness in the shoulder joint, leading to functional disability. This condition commonly affects individuals aged 40 to 60 years, with a higher prevalence in women. Frozen shoulder typically develops insidiously and progresses through three distinct stages: freezing, frozen, and thawing phases, each lasting several months to years¹. While the exact etiology remains unclear, frozen shoulder is often associated with metabolic conditions, particularly diabetes mellitus.

The shoulder joint, or glenohumeral joint, is a ball-and-socket joint formed by the articulation of the humeral head and the glenoid cavity of the scapula. This highly mobile joint relies on a complex interplay of bones, ligaments, tendons, and muscles for stability and function². In adhesive capsulitis, inflammatory changes lead to fibrosis and thickening of the joint capsule, reducing the intra-articular space and causing restricted mobility. Histopathological findings demonstrate fibroblastic proliferation, chronic inflammation, and increased expression of cytokines such as interleukin-1 (IL-1) and tumor necrosis factor-alpha (TNF- α), contributing to joint stiffness and pain³.

Diabetes mellitus is a significant risk factor for frozen shoulder, with studies indicating that individuals with diabetes are 2 to 4 times more likely to develop this condition compared to the general population⁴. The pathophysiological link between diabetes and frozen shoulder is multifactorial, involving chronic hyperglycemia, glycosylation of collagen fibers, and reduced joint elasticity. Poor glycemic control exacerbates inflammation and fibrosis, increasing the likelihood of adhesive capsulitis⁵. Additionally, obesity, a common comorbidity of diabetes⁶⁻⁹, further compounds the risk of frozen shoulder due to increased systemic

inflammation and mechanical stress on joints. Obesity contributes to metabolic dysregulation¹⁰⁻¹³, which may exacerbate fibrosis and impair shoulder mobility. Addressing obesity alongside diabetes management is therefore crucial to reducing the risk and severity of frozen shoulder¹⁴⁻¹⁷.

While frozen shoulder predominantly affects middle-aged and older adults, its occurrence among women of reproductive age (15–49 years) presents a unique concern. Hormonal changes, sedentary lifestyles, and comorbidities like gestational diabetes may contribute to the increased risk in this demographic. Literature indicates a higher prevalence of frozen shoulder among women, suggesting that gender-specific factors play a critical role¹⁸.

Despite the established link between diabetes and frozen shoulder, limited data exist on its prevalence and determinants among women of reproductive age. Understanding this association is crucial for early diagnosis, intervention, and improving quality of life in this vulnerable group. This systematic review aims to evaluate the evidence on the relationship between frozen shoulder and diabetes among women aged 15–49 years, addressing gaps in existing literature and proposing recommendations for future research and clinical practice.

METHODS

Study Design: Not applicable

Setting: Not applicable

Study Population: Not applicable

Duration of Study: The study was conducted over a period of 6 months.

Sample Size: Not applicable

Sampling Technique: Not applicable

Sample Selection:

Inclusion Criteria:

1. Randomized Controlled Trials (RCTs), cohort studies, and case studies related to the association between frozen shoulder and diabetes were included.

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2. Studies published within the past 10 years (2013–2023) were reviewed.
3. Literature published in the English language was included.

Exclusion Criteria:

1. Studies published in languages other than English were excluded.
2. Articles published before the last 10 years were not included.
3. Studies involving invasive procedures were excluded.

Hypothesis: Not applicable

Data Collection Procedure: A systematic review was conducted by searching relevant articles using various databases, including **PubMed**, **Google Scholar**, and **Medline**. The search focused on English-language articles published in the last 10 years, from 2013 to 2023. Keywords such as “frozen shoulder,” “adhesive capsulitis,” “diabetes mellitus,” “reproductive age women,” and “systematic review” were used to retrieve appropriate literature. Duplicates and irrelevant studies were removed after an initial screening of titles and abstracts. Eligible full-text articles were then reviewed for inclusion based on the predefined criteria.

Data Analysis Procedure: Not applicable

Data Collection Instrument: Not applicable

Ethical Considerations: As this study was a systematic review of previously published articles, ethical approval was not required.

RESULTS

A total of 33,127 articles were identified through searches on Google Scholar, PubMed, and Medline. After initial screening, 32,700 articles were eliminated: 29,852 had irrelevant search terms, 1,802 were non-English, and 1,500 were duplicates. This left 427 articles for further evaluation, from which 412 were excluded after full-text review for not meeting the inclusion criteria. The remaining 15 articles were studied in detail.

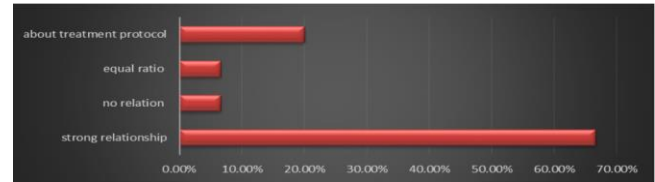


Figure 1: Association of FS & DM

According to Figure 1, 10 out of 15 studies (66.6%) demonstrate a strong relationship between frozen shoulder (FS) and diabetes mellitus (DM). One study (6.6%) reports no association between FS and DM, while another (6.6%) shows an equal prevalence of FS in diabetic and non-diabetic populations. The remaining three studies (20%) focus on treatment protocols or lack any association between FS and DM.

Table 1 summarizes 15 studies investigating the relationship between frozen shoulder (FS) and diabetes mellitus (DM), their methodologies, outcomes, and conclusions. The evidence levels range from cross-sectional and cohort studies to case series and retrospective analyses. The table highlights the prevalence, demographic correlations, diagnostic findings, and treatment outcomes in diabetic patients with FS. Key findings include associations between FS and factors like uncontrolled blood glucose, insulin dependence, and psychiatric issues such as anxiety and depression. Some studies also detail improved outcomes through physiotherapy or intra-articular interventions, while others show similar symptom relief across diabetic and non-diabetic groups post-treatment. The overall data reinforces a significant relationship between FS and DM, particularly in chronic or poorly controlled diabetes.

Table 1: Summary of Key Studies Examining the Association Between Frozen Shoulder and Diabetes Mellitus

Author	Year	Research methods	Evidence level	Patients with complete data	Management/methods	Outcomes assessed	Conclusion
Faisal I, Nouman S A, Haroon S, Fariha Y.	2017	Cross sectional study	4	80 patients with diabetes (38=males, 48= females)	A questionnaire was designed and patients' responses recorded.	NIL	Female gender, insulin dependence, uncontrolled blood glucose levels, and a positive family history were associated with increased prevalence of frozen shoulder.
Juel NG, Brox JJ, Brunborg C, Holte KB, Berg TJ	2017	Cross sectional study	4	105 patients were included. 50 % women with mean age 61.9 y. study completed with the 73 diabetic free subjects (55 % of women , mean age 62.5 y)	Frozen shoulder was diagnosed in 60 (59%) Patients with diabetes and 0 diabetes free subject. Life time prevalence; 76% = in diabetes group 14% = diabetes free group	Quick DA SH Score	The point prevalence of frozen shoulder in patients with long lasting type I diabetes was concluded as 59%. People of diabetic group had more shoulder disability. HbA1c Level was associated with increased shoulder disability.
Farshid B, Mohammad H. E., Ali M, Hamid F B	2016	Cross sectional	4	120 patients (37 men & 83 women) With phase – II idiopathic frozen shoulder.	Demographic data, and data from different questionnaire were collected.	ROM, VAS, SF-36, DASH, Hamilton anxiety and depression questionnaires.	Patients with frozen shoulder are prone to pain and disability in response to psychiatric issues such as anxiety and Depression as compare to the demographic features and even restricted ROM
Kristen Bech Holte, Niels Gunnar Juel, Jens Ivar Brox, Kristian Folkvord Hanssen, Dag SF, David RS, Vincent M.M, Tore JB	2017	Cross sectional controlled	4	Patients with type I diabetes mellitus from 1970 or earlier	HbA1 and HbA1c measurements were taken from 1980 to 2015.	Interview, charts, standard examination, skin biopsies, liquid chromatography mass spectrometry.	Patients with type I diabetes mellitus age more than 45 years had a very high prevalence of hand and shoulder diagnosis vs controls. Joint stiffness was associated with collagen AGEs
Mohammad Moin Uddin, Aminuddin AK, Andrew JH, Mohammad Kafil Uddin	2014	Prospective comparative study	2	40 persons with frozen shoulder attending OPD were selected after consecutive sampling. (26= males, 14= female) (17= diabetic, 2= impaired glucose tolerance test, 21= non – diabetic)	Disability levels were assessed by using shoulder pain & disability index. Mean values were compared by using unpaired t test.	SPADI	There was no difference found in level of pain and disability Level b/w frozen shoulder patients with and without diabetes.
Lee SY, Lee KJ, Kim W, Chung SG	2015	Case series	4	107 consecutive patients with ACS At university outpatient clinic of physical medicine and rehabilitation.	Severity of pain, duration of symptoms, shoulder joint rom and diabetes status were obtained by retrospective chart review.	ROM	Capsular stiffness of shoulder joint significantly correlated with limitation in shoulder ROM (Especially in abduction and external rotation)
Lo SF, Chu SW, Muo CH, Meng NH, Chou LW, Huang WC, et al.	2014	Cohort study		1 million people (5109= newly diagnosed diabetic patient, 20473= randomly selected non diabetic subjects age more than or equal to 20 years in the year 2000.	Both cohorts were followed up to 8 years. Incidence of adhesive capsulitis in the diabetes mellitus cohort was 3.08 times that of the comparison cohort.	NIL	Hazard ratio of adhesive capsulitis for diabetes mellitus subjects was higher than that for non- DM subjects.
Alhashimi RAH	2018	Analytical Observational Study	3	216 patients with DM	Data were analyzed by using standard deviation, standard error, mean and confidence interval at 95%	Medical histories, scratch test, hemoglobin A1c, BMI	There is a strong association b/w FS & DM. Prevalent more in females than males Chronic diabetic patient was commonly affected.
Cho C-H, Jin H-J, Kim DH	2020	Retrospective	2	142 FS patient (32= FS Diabetic, 110 with idiopathic FS)	Intra articular corticosteroid injection to the painful and stiff shoulder.	VAS, PROM, ASES, SVV	Significant improvements in all outcome measures.no serious side effect in patients reported.
S.S Mehta, H. P. Singh, R. Pandey	2014	Prospective		21= diabetes 21= no- dietetic Mean age ratio of male and female (18: 24)	Study group include patients with diabetes and control group include people without diabetes. Arthroscopic capsular release given	Modified constant score	The results in diabetic were worse than in non-diabetic 6 months post operatively.

Yian, Edward H., Contreras, Richard, Jeffrey F.	2012	Retrospective	2	201513= diabetic patients	Analysis included determining the relation between frozen shoulder and HbA _{1c} Level, type & duration of diabetes treatment.	NIL	Insulin –dependent patients who used or did not use oral hypoglycaemic were 1.93 times more prone than the non-insulin dependent diabetic patients to FS.
Johanny M.L, Jon R.J, Soren J.H, Carsten M.J, Soren R.D.	2019	Retrospective	2	93 Patients.	Patients were retrospectively divided into 2 groups, Group 1= patients with type 1 or type 2 diabetes Group 2= remaining patients. Evaluation was performed before arthroscopic release and at 6 months follow up	OSS, VQS	Diabetic and non-diabetic report equal symptom relief after arthroscopic capsular release.
Shakeel A, Dr. M Sohail R, Iqbal A S, Khurram H, Nabihah M F	2012	Cross sectional study		325 patients 170= men 155 =women Age b/w 40 79 years	325 DM patients 81 diagnosed with AC.	NIL	Frequency of frozen shoulder was 24.9 among diabetic patients.
Carlo D, Guilia RM, Francescae B, Leonardo P, Gianfilippo C	2017	Cross sectional study	4	943 Patients with T1DM	Criteria for diagnosing AC was Pain for at least 1 month, inability to lie on the affected shoulder, restricted ROM (active+ passive), age gender, duration of DM, Blood pressure, neuropathy.	Glycosylated haemoglobin A1c blood concentration.	Study shows that AC of the shoulder is a common disorder in patients with T1DM.
Helena S W, Tomas T, Anne S	2013	Longitudinal study		Group of 10 subjects	Treatment protocol was: muscle relaxation, light load exercise.	NIL	It is possible to relieve intensity of shoulder pain and improve activities of daily living in diabetes related shoulder problems by applying physiotherapy treatment program.

DISCUSSION

This systematic review highlights the significant association between frozen shoulder (FS) and diabetes mellitus (DM) among women of reproductive age (15–49 years). The findings of the included studies consistently demonstrate that DM increases the risk of FS, reducing shoulder mobility and impairing quality of life. These results are consistent with the existing literature, which reports a higher prevalence of FS in individuals with long-standing diabetes compared to the general population.

The prevalence of FS was notably higher among patients with a long history of diabetes. In one study, the lifetime prevalence of shoulder disorders in patients with over 50 years of diabetes reached significantly high rates, corroborating the increased risk of FS in diabetic populations¹. Arkkila et al. reported that among patients with type 1 diabetes lasting approximately 29 years, the prevalence of painful FS was 18.6%, nearly twice that of the general population². This observation underscores the role of prolonged hyperglycemia in the development of musculoskeletal complications, including FS.

FS, also referred to as adhesive capsulitis, is a multifactorial condition that can arise from metabolic, vascular, or systemic pathologies. Although FS is not exclusive to individuals with DM, it is more prevalent among diabetic patients due to glycation-induced changes in collagen structure and reduced tissue elasticity³. In addition to diabetes, FS has been associated with other conditions such as trauma, myocardial infarction, cerebrovascular incidents, and hyperthyroidism⁴.

The present findings suggest that the duration and type of diabetes are critical factors influencing the risk of FS. Research indicates that type 1 and type 2 diabetes are both linked to FS, with a stronger association observed in patients with poor glycemic control and a longer disease duration⁵. This aligns with evidence that chronic hyperglycemia induces changes in connective tissue and joint structures, resulting in stiffness and restricted mobility.

Given the high prevalence of FS in diabetic patients, especially women of reproductive age, early diagnosis and glycemic management are essential. Screening for FS should be an integral part of diabetes care protocols, particularly for patients with long-standing or poorly controlled diabetes. Future studies should explore targeted interventions to prevent or manage FS, focusing on improving shoulder mobility and quality of life in this population.

CONCLUSION

This systematic review highlights a significant association between frozen shoulder and diabetes mellitus among women of reproductive age (15–49 years). The prevalence of frozen shoulder among diabetic patients ranged from 59% to 76%, indicating a markedly higher occurrence compared to non-diabetic controls. Diabetic women exhibited greater shoulder dysfunction, which not

only restricted shoulder mobility but also significantly impaired their daily activities and quality of life.

Long-term diabetes, particularly type 1 diabetes, emerged as a key risk factor for the development of frozen shoulder. The condition often imposes severe mobility limitations, causing substantial disability. While frozen shoulder may resolve spontaneously over 1–3 years in some cases, the protracted recovery period underscores the need for timely intervention to mitigate its impact.

Given these findings, it is imperative that management plans for diabetic patients include routine assessment and monitoring for shoulder dysfunction. Early identification and intervention can prevent progression and alleviate symptoms. Physiotherapy, particularly structured shoulder and arm exercises, has shown promise in reducing symptom severity and improving shoulder mobility.

Further research is warranted to explore the underlying mechanisms linking diabetes mellitus and frozen shoulder, as well as to identify optimal therapeutic approaches. Public health initiatives should focus on raising awareness among healthcare providers and diabetic patients regarding this association to ensure comprehensive care and better long-term outcomes.

Data Availability Statement: The corresponding author can provide the data used in this work upon request.

Competing interests: The authors have declared they have no competing interests.

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