

# Association of Shoulder Pain and Dysfunction with Diabetes

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## Abstract

**Background:** This study aimed to investigate the prevalence of shoulder pain and dysfunction in patients with type 2 diabetes mellitus (DM) and examine the relationship between shoulder pain and dysfunction with diabetes control.

**Material and Methods:** A total of 300 consecutive patients with type 2 DM were included in the study. The presence of shoulder pain and dysfunction was assessed using the modified University of California at Los Angeles Shoulder Rating Scale (UCLA-m). Epidemiological data, treatment information, and measurements of Hb A1C and fasting plasma glucose were collected and analysed.

**Results:** Among the participants, 63.4% reported shoulder pain, while 53.4% exhibited shoulder dysfunction. Approximately 26.6% of patients rated their shoulder performance as poor. No significant associations were found between Hb A1C or plasma glucose levels and shoulder function, except for an association between active shoulder flexion and fasting glucose ( $p=0.026$ ). Female patients demonstrated poorer shoulder performance compared to male patients ( $p=0.0043$ ), and there was a correlation between older age and decreased shoulder function ( $p < 0.0001$ ).

**Conclusions:** This study highlights a high prevalence of shoulder pain and dysfunction among patients with type 2 diabetes mellitus. These issues tend to affect more female patients and the elderly population.

**Keywords:** diabetes mellitus; shoulder; pain; peri-arthritis

## Introduction

Diabetes mellitus (DM) is a clinical condition that gives rise to a wide range of complications [1]. While complications like nephropathy, retinopathy, heart disease, and stroke have received significant attention from healthcare professionals, it is important to recognize that musculoskeletal complications also contribute to the reduced quality of life experienced by DM patients. Among the various forms of musculoskeletal involvement that have been identified [1,2], some examples include stiff hand syndrome, different types of tendinitis, Dupuytren's contracture, peri-arthritis of the shoulder, and adhesive capsulitis (frozen shoulder) [1,2]. Pain in the shoulder and the occurrence of adhesive capsulitis are reported to be more prevalent in individuals with DM compared to the general population [3].

The shoulder joint is a complex structure that plays a critical role in upper limb function. However, the mechanisms underlying shoulder involvement in DM are not yet fully understood. Some studies have suggested a relation between the duration of diabetes

and disease control (measured by fasting glucose and HbA1C) with shoulder complications [3,4], while other studies have not observed these relationships [5-7]. Possible explanations for these discrepancies include genetic, environmental, and social factors related to joint usage, as well as early diagnosis and effective management of diabetes.

To address these uncertainties, we conducted a study to investigate the prevalence of shoulder involvement in individuals with type 2 DM and its potential association with disease control and duration.

## Materials And Methods

Our study employed a cross sectional and design. All participants provided informed consent prior to their involvement in the study. The study included 300 patients with type 2 diabetes mellitus (DM) who visited an outpatient clinic. To complete the UCLA-m (modified University of California at Los Angeles Shoulder Rating Scale) questionnaire, each patient had an interview and a physical examination [8]. Additionally, data regarding epidemiological

information and diabetes treatment were collected, along with fasting glucose and HbA1C levels.

The UCLA-m questionnaire has a total of 35 points, including patient satisfaction (5 points), function (10 points), range of active flexion (5 points), manual flexion strength test (5 points), and pain (10 points). While range of active flexion and manual flexion strength are tested by physical examination, pain, function (activities of daily life), and patient satisfaction are assessed through questionnaire-based questions. The following is the scoring: 34–35 points are awarded for superior shoulder function, 28–33 for good, 21–27 for reasonable, and 0–20 for subpar shoulder function [8]. Patients with rheumatological and neurological conditions, a history of shoulder trauma, and vocations requiring severe upper limb activity were all excluded from the study.

Data analysis involved the construction of frequency and contingency tables. For nonparametric variables, central tendency measurements were performed using medians, while parametric variables were described using means and standard deviations (SD). The association between numeric variables was assessed using unpaired t-tests for parametric variables and Mann-Whitney tests for nonparametric variables. Correlation analysis was conducted using Spearman's test. A significance level of 5% was adopted, and calculations were performed using GraphPad Prism version 4.0.

## Results

Out of the 300 patients included in the study, 190 (63.3%) were women, and 110 (36.7%) were men. The age of the participants ranged from 24 to 90 years, with a mean of  $56.5 \pm 10.0$  years. The duration of diabetes ranged from 1 to 55 years, with a median of 8 years. HbA1C levels ranged from 5.4 to 15.3%, with a median of 8.8%. Fasting blood glucose levels ranged from 65 to 375 mg/dL, with a median of 141 mg/dL.

Regarding the domains of pain and dysfunction assessed by the UCLA-m questionnaire, it was found that 63.4% of patients experienced pain, while 53.4% experienced dysfunction. In terms of shoulder flexion range and strength, 50.6% of patients exhibited some degree of active flexion dysfunction, and 37.2% had decreased flexion strength. Based on the total UCLA-m score, 40 (26.2%) patients rated their shoulder function as bad, 26 (17.3%) as reasonable, 35 (23.3%) as good, and 49 (32.6%) as excellent.

The analysis of UCLA-m scores in relation to sex and age revealed that women had worse scores than men ( $p = 0.0043$ ), and increasing age was associated with poorer shoulder joint performance ( $p < 0.0001$ , Spearman's  $r = -0.344$ , 95% CI  $-0.47$  to  $-0.23$ ).

When examining the relationship between UCLA-m scores and fasting blood glucose and HbA1C levels, no significant associations were observed for any of the domains or the total UCLA-m score ( $p > 0.05$ ; not significant). However, in analysing UCLA-m variations in relation to medication use, it was found that individuals using insulin had better active flexion compared to those on diet and oral hypoglycaemic agents ( $p = 0.026$ ), with no significant differences observed for the other domains.

## Discussion

Shoulder pain is a common musculoskeletal condition that often becomes chronic [9]. In individuals with diabetes, shoulder problems are described as the most disabling musculoskeletal manifestation [10]. The exact mechanism behind these problems is not well understood. However, it is known that persistently high glucose levels lead to the accumulation of advanced glycosylation end-products (AGEs), which form cross-links with collagen, making it less elastic and more susceptible to degeneration [11]. Collagen undergoes age-related changes characterized by yellowing, in solubilization, and resistance to enzymatic digestion, and these changes are accelerated in diabetes. It is estimated that individuals with diabetes have at least twice as much of this altered collagen compared to non-diabetic individuals of the same age [11].

In our study, we observed a high prevalence of shoulder pain and functional impairment in the study population, with 26.6% of the participants rating their shoulder function as poor. The analysis of pain showed that 63% of patients experienced pain, while 53% exhibited some form of dysfunction, which is higher compared to findings from other studies. For example, Laslett et al. reported that one-third of diabetic patients had shoulder-related complaints [5]. On the other hand, studies by Aydeniz et al. [13], Mathew et al [14], and Ramchurn et al [15] reported lower prevalence rates of frozen shoulder in diabetic patients. It is important to note that most of these studies focused specifically on frozen shoulder, which represents the most severe form of shoulder joint disorder characterized by significant loss of mobility and joint contracture. Another possible explanation for the

discrepancy in prevalence rates is that our study included patients from a lower socioeconomic background who may have poorer diabetes control, which could contribute to the higher prevalence observed.

Interestingly, the presence of shoulder pain can also lead to the diagnosis of diabetes. A study found that among 88 patients initially diagnosed with adhesive capsulitis, 38% were found to have diabetes, and 32.9% were pre-diabetic [10]. This highlights the importance of recognizing the association between shoulder problems and diabetes, as it can enable early diagnosis of diabetes. Some studies have reported higher HbA1C levels in patients with musculoskeletal complaints in the hand or shoulder [3]. Arkkila et al [4]. found an association between poor glycaemic control (HbA1C > 9%) and shoulder capsulitis in type 2 diabetes patients. However, other clinical studies did not find a significant correlation between HbA1C levels and musculoskeletal symptoms in individuals with diabetes [4-7]. In our study, we also did not find such an association. It should be noted that HbA1C is an intermediate marker for the formation of AGEs, and its level may not necessarily reflect the degree of extracellular matrix changes. Thus, although HbA1C levels did not correlate with upper limb problems in our study, poor glycaemic control over time is likely to influence the development of shoulder problems, even if it is not reflected by a single laboratory test [1]. Some studies have linked shoulder involvement to diabetic retinopathy, autonomic neuropathy, and myocardial infarction, which are well-known complications of long-standing diabetes [1,16,17,18].

The higher prevalence of shoulder problems in females and the elderly, as observed in our study, has also been reported in the literature. Arkkila et al. [4] demonstrated an association between older age and adhesive capsulitis regardless of diabetes type, while Cagliero et al [3]. and Laslett et al. [19] noted a predominance of shoulder complaints in female patients.

The lack of association between disease duration and the onset of joint involvement may be explained by the fact that individuals with type 2 diabetes often have hyperglycaemia for several years before the formal diagnosis of diabetes.

## Limitations

It is crucial to realise that the cross-sectional methodology of our study has limitations since it

prevents investigation of past glycaemic control in relation to the incidence of shoulder discomfort and dysfunction. Further research in longitudinal cohorts would provide valuable insights.

## Conclusion

We concluded that people with type 2 diabetes have a significant prevalence of shoulder pain and dysfunction with a higher prevalence in women and the elderly. Understanding the association between diabetes and shoulder problems is crucial for improving the quality of life for these patients.

## Declarations

The authors have no conflict of interests. No Funding was received for the study.

## References

1. Lebiedz-Odrobina D, Kay J. (2010). Rheumatic manifestations of diabetes mellitus. *Rheum Dis Clin North Am*, 36(4):681-699.
2. Arkkila PE, Gautier JF. (2003). Musculoskeletal disorders in diabetes mellitus: an update. *Best Pract Res Clin Rheumatol*, 17(6):945-970.
3. Cagliero E, Apruzzese W, Perimutter GS, Nathan DM. (2002). Musculoskeletal disorders of hand and shoulder in patients with diabetes mellitus. *Am J Med*, 112(6):487-490.
4. Arkkila PE, Kantola IM, Viikari JS, Rönnemaa T. (1996). Shoulder capsulitis in type I and II diabetic patients: association with diabetic complications and related diseases. *Ann Rheum Dis*, 55(12):907-914.
5. Laslett LL, Burnet SP, Dick WC, Griffiths ID. (2007). Musculoskeletal morbidity: the growing burden of shoulder pain and disability and poor quality of life in diabetic outpatients. *Clin Exp Rheum*, 25(3):422-429.
6. Pal B, Anderson J, Dick WC, Griffiths ID. (1986). Limitation of joint mobility and shoulder capsulitis in insulin and non-insulin-dependent diabetes mellitus. *Br J Rheum*, 25(2):147-151.
7. Thomas SJ, McDougall C, Brown ID, Jaber MC, Stearns A, Ashraf R, et al. (2007). Prevalence of symptoms and signs of shoulder problems in people with diabetes mellitus. *J Shoulder Elbow Surg*, 16(6):748-775.
8. Oku EC, Andrade A, Stadiniky SP, Carrera EF, Tellini GG. (2006). Tradução e adaptação cultural

- do Modified-University of California at Los Angeles Shoulder Rating Scale para Língua Portuguesa. *Rev Bras Reumatol*, 46(4):246-252.
9. Cole A, Gill TK, Shanaham EM, Phillips P, Taylor AW, Hill C. (2009). Is diabetes associated with shoulder pain or stiffness? Results from a population-based study. *J Rheumatol*. 36(2):371-377.
  10. Tighe CB, Oakley Jr WS. (2008). The prevalence of a diabetic condition and adhesive capsulitis of the shoulder. *Southern Med J*, 101(6):591-595.
  11. Isdale AH. (1993). The ABC of the diabetic hand - advanced glycosylation end products, browning and collagen. *Br J Rheumatol*, 32(10):859-861.
  12. Monier VM, Sell D, Abdul-Karin FW, Emancipator SN. (1988). Collagen browning and cross-linking are increased in chronic experimental hyperglycemia. *Diabetes*, 37(7):867-872.
  13. Aydeniz A, Gursoy S, Guney F. (2008). Which musculoskeletal complications are most frequently seen in type 2 diabetes mellitus? *J Intern Med Res*, 36(3):505-511.
  14. Mathew AJ, Nair JB, Pillai SS. (2011). Rheumatic musculoskeletal manifestations in type 2 diabetes mellitus patients in South India. *Int J Rheum Dis*, 14(1):55-60.
  15. Ramchurn N, Mashamba C, Leitch E, Arutchelvam V, Narayanan K, Weaver J et al. (2009). Upper limb musculoskeletal abnormalities and poor control in diabetes. *Eur J Intern Med*, 20(7):718-721.
  16. Reeves B. (1975). The natural history of the frozen shoulder syndrome. *Scand J Rheumatol*, 4(4):193-196.
  17. Vinik AI, Maser RE, Mitchell BD, Freeman R. (2003). Diabetic autonomic neuropathy. *Diab Care*, 26(5):1553-1579.
  18. Macisaac RJ, Jerums G. (2011). Intensive glucose control and cardiovascular outcomes in type 2 diabetes. *Heart Lung Circ*, 20(10):647-654.
  19. Laslett LL, Burnet SP, Redmond CL, Mc Neil JD. (2008). Predictors of shoulder pain and shoulder disability after one year in diabetic outpatients. *Rheumatology*, 47(10):1583-1586.

**Cite this article:** C. Desouza, S. Pereira. (2023). Association of Shoulder Pain and Dysfunction with Diabetes. *Journal of Clinical Rheumatology and Arthritis*, BRS Publishers. 1(1); DOI: 10.59657/jcra.brs.23.004

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**Article History:** Received: June 17, 2023 | Accepted: June 30, 2023 | Published: July 05, 2023