# Study the Prevalence and Correlation of Various Musculoskeletal Manifestations among Type II Diabetic Patients

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**Abstract:** _Objective: Diabetes mellitus is a most common major public health problem worldwide. The prevalence of DM is increasing worldwide therefore the complication of DM is increasing significantly. The Musculoskeletal manifestation is generally ignored and there is little of literature about musculoskeletal prevalence in our Northern India so my aim is to estimate the prevalence of musculoskeletal manifestation among Type-2 Diabetic patients and it's correlation to different variables like age, BMI, duration of diabetes, controlled or uncontrolled diabetes, HbA1c and vitamin-D level. Material and Methods: We conducted a cross-sectional study from September 2019 to July 2022. On the basis of inclusion and exclusion criteria, 200 randomly selected patients of type-2 diabetes mellitus were studied. We estimated the musculoskeletal manifestations among type-2 diabetic patients in a tertiary care hospital of Northern India. Data were analysed by using SPSS software. Results: A total of 200 patients of type-2 diabetes mellitus were assessed clinically for various musculoskeletal manifestations. Among 200 patients, 118 (59%) patients have musculoskeletal manifestations. The age ranges from 20 to 90 years with a mean age of the population is 50.72 +/-12.07. The duration of Diabetes was 1-5 years in 37% patients and 6-10 years in 61.5% patients. Conclusions: On the basis of above observations it is concluded that about 59% patients are suffering from musculoskeletal manifestations among which Osteoarthritis and Limited joint mobility are the most common manifestations. Duration of diabetes, uncontrolled diabetes and raised BMI are the major cause of increase prevalence of these musculoskeletal disorders._

**Keywords:** Musculoskeletal manifestations, Diabetes mellitus, Osteoarthritis, Limited joint Mobility and Body Mass Index, BMI

## 1. Introduction

The worldwide prevalence of diabetes mellitus has risen dramatically over the past 2 decades, from an estimated 30 million cases in 1985 to 415 million in 2017. Based on current trends, The International Diabetes Federation projects that 642 million individuals will have diabetes by the year 2040. Although the prevalence of type 1 and type 2 DM is increasing worldwide but the prevalence of type 2 DM is rising much more rapidly, presumably because of increasing obesity, reduced activity level and aging of population. (1)

Persistent hyperglycemia in diabetic patients causes increased morbidity and mortality as a result of associated microvascular, macrovascular and musculoskeletal complications.

These musculoskeletal manifestation are usually neglected and poorly treated as compared to other complications like nephropathy, retinopathy, neuropathy. (2)

Musculoskeletal manifestations are more common in diabetes mellitus. Both the incidence of diabetes mellitus as well as the life expectancy of diabetic patients have increased causing increased prevalence and the clinical importance of musculoskeletal disorders in diabetic patients. (3)

More than 150 musculoskeletal conditions affect the locomotor system. These conditions are characterized by pain and reduced physical activity. These musculoskeletal conditions act as a risk factors that are common to other chronic health conditions such as obesity, poor nutrition and a sedentary lifestyle. Musculoskeletal disorders account for the maximum proportion of persistent pain across the world and ages. (4)

Musculoskeletal manifestations are a major cause of years lived with disability in all continents and economies. The prevalence of physical disabilities is higher among women and increases markedly with age. (5)

Musculoskeletal problems are the second most common reason for consulting a doctor and it constitute up to 10-20% of primary care consultations.

According to Ontario Health Survey, musculoskeletal complaints were the reason for almost 20% of all health care utilization. They were the most expensive disease category in the Swedish cost of illness study, showing 22.6% of the total cost of illness. (6)

Despite the multifactorial nature of musculoskeletal disease, obesity emerges as a key and potentially modifiable risk factors in the onset and progression of musculoskeletal disorders. Emerging evidence indicates that Diabetes mellitus is associated with obesity and has profound effect on soft tissue structures such as tendons, fascia and cartilage. (7)

The pathophysiological mechanism of MSK disorders is not fully understood, but evidence suggests that increased accumulation of advanced glycation end-products (AGEs) leads to collagen disposition in the periarticular connective tissue causing the damage to the tendons, joint capsule, ligaments and nerves, which leads to structural and functional deterioration. (8)

Due to the paucity and ignorance by general practitioner, the musculoskeletal disorders are diagnosed lately because of this, its prevalence is quite high in diabetic patients. And there is also lack of musculoskeletal disorders studies in North India region as compared to South India. Hence, we have planned to study the musculoskeletal manifestations in diabetic patients. Early and timely diagnosis can reduce the burden of musculoskeletal complications; otherwise, these complications can compromise the quality of life in diabetic patients. (9)

## 2. Material and methods

A cross sectional observational study was conducted at Post Graduate Department of Medicine, Sarojini Naidu Medical College and Hospital Agra, Uttar Pradesh from September 2019 to March 2022. Written informed consent was taken from the participating patients before participating in this study. The study was done after getting clearance from the Ethical committee of our institute and permission from the appropriate authority (Institutional Ethical Committee approval number-IEC/2021/92).

For the study known case of type 2 diabetic patients of age group 20-90 years attending OPD (medicine, orthopaedic, Arthritis and diabetes) and admitted in the wards of Department of Medicine at S. N. Medical College Agra were selected.

A detailed clinical history was taken and physical examination was done of all 200 participating patients (type-2 DM) after fulfilling the inclusion and exclusion criteria. The diagnosis was made on the basis of American Diabetes Association (ADA) criteria, 2018. According to this, the Fasting Plasma Glucose $\geq$126 mg/dl or 2 hr. Plasma Glucose $\geq$ 200 mg/dl during an oral glucose tolerance test or Hba1c $\geq$ 6.5 %. Or Symptoms of diabetes plus random blood glucose concentration $\geq$ 200 mg/dl (11.1 mmol/L) In the presence of unequivocal hyperglycemia, result should be confirmed by repeat testing. (1)

All the patients who are having such types of diseases like Type1 Diabetes Mellitus, Rheumatoid Arthritis, Autoimmune disorders, Hypothyroidism, Gout, Chronic Kidney Disease, Pregnancy, H/O trauma, Cerebrovascular accident, Tuberculosis are excluded.

The following data were collected from all participants like particulars, lab investigations (CBC, ESR, RAF, CRP, HbA1c, Fasting and pp blood sugar, S. vit-D level), BMI, VAS, X-ray or USG of involved joint and duration of diabetes. Poor glycemic control was considered if HbA1c level >7%. A structural questionnaire and demographic information chart used as a data collection tool. The English questionnaire will be converted into Hindi to ask the participants during interviews.

We examined all the patients on the basis of Gait Arms Leg Spine and Regional Examination of Musculoskeletal System. The various musculoskeletal disorders were diagnosed on according to the clinical features. (10)

1) Diabetic cheiroarthropathy or limited joint mobility was evaluated by the patient 'prayer sign' and 'table top sign'. (10).
2) Diabetic sclerodactyly was defined as thickening of the skin on the dorsal aspect of the hand in association with limited joint mobility in the absence of Raynaud phenomenon, calcinosis, and telangiectasia.
3) CTS was defined as weakness or pain of the hand, evidence of thenar atrophy, or nocturnal paresthesia of the thumb, index, and long fingers, with or without a positive Tinel's or Phalen's sign. CTS was excluded if other causes, such as thyroid disease, acromegaly, or C5/C6 radiculopathy were suspected. We also considered a history of surgery as evidence of the disease.
4) Flexor tenosynovitis or stenosing tenosynovitis or trigger finger was diagnosed by palpating a nodule or thickened flexor tendon with locking phenomenon during finger flexion or extension.
5) The diagnosis of Dupuytren's contracture was based on one of the following features: a palmar or digital nodule; tethering of palmar or digital skin; a pretendinous band and a digital flexion contracture, palpable thickening of the palmar fascia, with a flexor deformity of the second, third, fourth, or fifth fingers.
6) RSD was defined as unilateral, localized, or diffused pain associated with swelling or trophic changes and vasomotor disturbance with impaired mobility of the affected limb.
7) Diabetic osteolysis was characterized by osteoporosis of the proximal phalanges in the hands and feet, documented by X-ray radiographs.
8) Patients with unilateral shoulder pain for at least 1 month, an inability to lie on the affected shoulder, and restricted active and passive shoulder joint movement of less than 50% in at least three planes were diagnosed as frozen shoulder or adhesive capsulitis.
9) Diffuse idiopathic skeletal hyperostosis syndrome was diagnosed based on the classification criteria set by Resnick and Niwayama, which requires radiographically recognized bridges connecting at least four contiguous vertebrae of the thoracic spine, with preservation of the intervertebral disk space and absence of apophyseal joints or sacroiliac inflammatory changes. Only those with back pain had an X-ray of the spine.
10) Charcot joint or neuropathic arthropathy was defined as painless swelling and deformity at the weight-bearing joints and the classical finding of articular

surface destruction, dislocation, disorganization, and increased density of the involved joint on X-ray radiographs.

11) Diabetic amyotrophy was defined as wasting of the proximal upper or lower extremity muscles or the paraspinal muscles, preceded by severe pain and dyesthesia of the involved part.

12) Diabetic muscle infarction was defined as a palpable painful mass with swelling and induration of the surrounding tissue without systemic symptoms, in addition to evidence of edema in the muscle on magnetic resonance imaging. A history of surgery for was also considered as evidence of the disease.

## 3. Statistical analysis

Data were analyzed using the SPSS software. Test used in this analysis are 't' test and chi-square test. The 'p' value of less than 0.05 is considered significant.

## 4. Result

Among the participating type 2 diabetic patients (n=200), about 59% (118) of diabetic patients are suffering from musculoskeletal problems and 41% (82) are not suffering from musculoskeletal problems. The distribution of musculoskeletal problems in diabetic patients are presented here.

| Musculoskeletal Diseases | Prevalence (%) |
|---|---|
| Osteoarthritis | 25% (50) |
| Limited Joint Mobility | 12% (24) |
| Frozen shoulder | 11% (22) |
| Diffuse Idiopathic skeletal Hyperostosis | 4% (8) |
| Flexor Tenosynovitis | 3% (6) |
| Dupuytren's contracture | 2.5% (5) |
| Charcot's Joint | 1% (2) |
| Carpal Tunnel Syndrome | 0.5% (1) |
| Reflex Sympathetic Dystrophy | 0% |
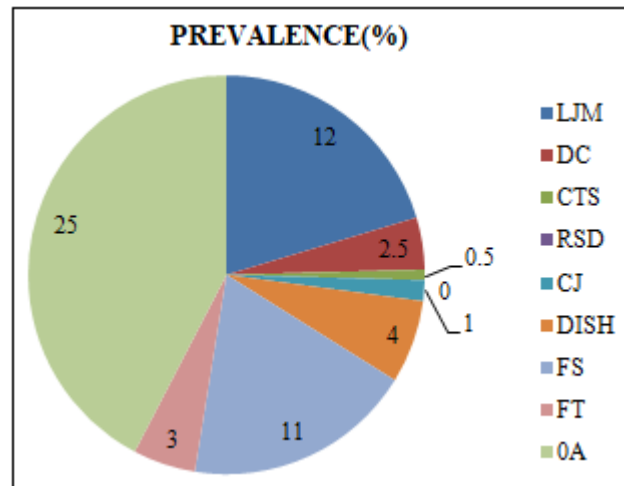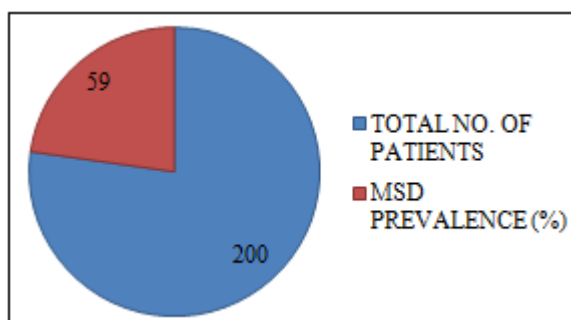




The age of the patients is ranges from 20 to 90 years.

In our study, a large number (124) of the participating patients comes under age group 41 to 60 years and the mean age of the population is $50.72 \pm 12.07$ years.

The distribution of body weight of the participating patients are as

Follows: 30-40 kg (3), 41-50 kg (32), 51-60 kg (25), 61-70 kg (67), 71-80 kg (43), 81-90 kg (29), 91-100 kg (1). The average weight of our patients is 65.55 kg.

Among the 200 participating patients, 113 (56.5%) patients are female and rest 87 (43.5%) patients are male. Male to female ratio is 1: 1.3.

Most of the patients are housewife in our study so that they contain a large number of patients 110 (55%), rest 29.5% (59) are skilled worker, teacher 10.5 (21) and 5% (10) are farmers.

Most common musculoskeletal complaint is pain i. e. in 59% (118) patients and rest 41% (82) are free of symptoms.
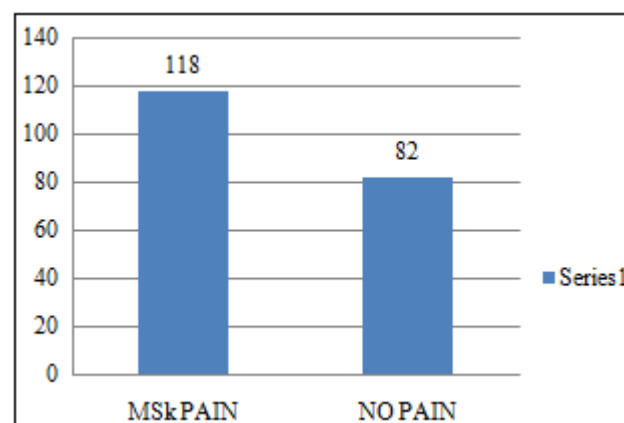


Among the 200 participating patients, 49% patients have their BMI ≥30 (obesity). Only 13% (26) patients have their BMI within normal range and next 38% (76) patients have their BMI within 25-29.9 range (overweight).
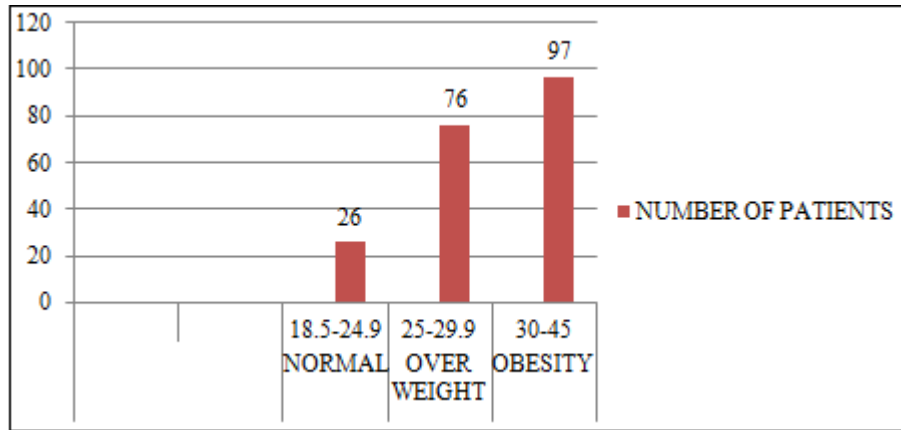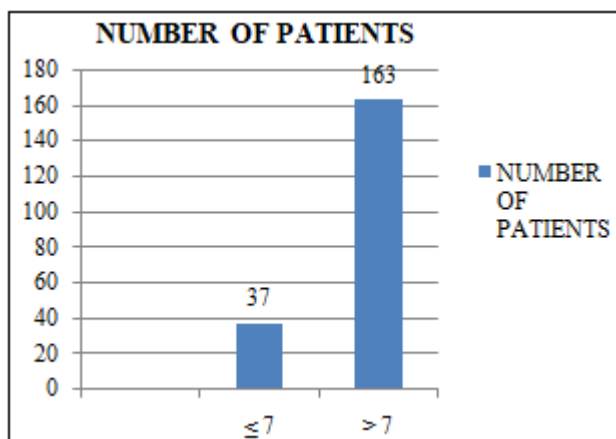
Graph showing duration of diabetes among type 2 diabetic patients:
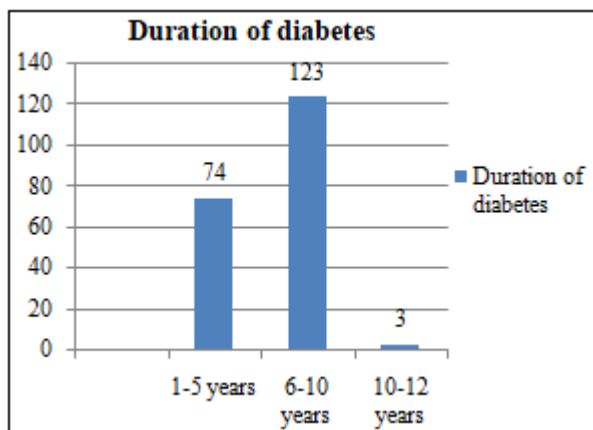


In our study, 61.5% patients have 6-10 year of diabetes and 37% patients 1-5 year of diabetes.

The graph showing below shows distribution of HbA1c level among type 2 diabetic patients:



In our study, 81.5% patients have poor glycemic control means having HbA1c level >7 and rest 18.5% patients have good glycemic control means ≤7.

## 5. Discussion

In this current study, A total number of 200, type 2 diabetic patients are selected for the study. Out of 200 patients, 43.5% (87) patients are males while 56.5% (113) patients are females and the male to female ratio is 1: 1.3. so we can say that females are slightly more in our sample. However the prevalence of musculoskeletal disorders in our study is 59% (118) in which 41.52% (49) are males and 58.47% (69) are females.

The complications of chronic hyperglycemia such as connective tissue disorders, neuropathy and vasculopathy all have cumulative effect on increased incidence of musculoskeletal disorders in diabetic patients. In our present study, 61.5% (123) patients have duration of diabetes more than 5 years.

It is also note that lack of good glycemic control in long time leads to microvascular and macrovascular complications. These complications may also amplify the musculoskeletal manifestation and end organ damage. In our study, 81.5% (163) cases have HbA1c >7.

The result our study indicate that with advancing age, the incidence of musculoskeletal manifestations increases. This is statically significant for osteoarthritis ($p < 0.05$).

The prevalence of musculoskeletal disorders is significantly higher in patients with BMI >25 kg/m$^2$.

In the observation of our study as the duration of diabetes increases, the prevalence of musculoskeletal manifestations also increases.

The most common musculoskeletal manifestation and long-term complication in our study is osteoarthritis (OA). The prevalence of osteoarthritis in our study is 25% (50 cases). Most common joint involved by OA is knee. In our study, Osteoarthritis is mainly present in old age, females, obese and uncontrolled diabetic patients. Osteoarthritis is significantly statistically associated with age ($p < 0.05$). A similar study was done by AJ Mathew et al., Douloumpakas et al., Laura I AlOayan., Basavanna D et al. and the prevalence of these studies were 20.64%, 31.2%, 65.38%, 38% respectively.

The prevalence of osteoarthritis in diabetic patients is mainly because of obesity but obesity alone can not explain osteoarthritis of upper extremity. So here certain other factor is involved in this pathophysiology such as Adipokines. (5)

According to AJ Mathew et al., age, duration of diabetes and glycosylated haemoglobin were found to have significant association with musculoskeletal disorder. (11) while Douloumpakas et al. explained that duration of diabetes is important not type of diabetes mellitus. (12)

Limited joint mobility is the second most common presentation among studied musculoskeletal disorders. The prevalence of Limited joint mobility is 12% (24 cases). In our study, Limited joint mobility was mainly present in females, obese, uncontrolled diabetic patients. Our study is consistent with Sarkar et al. (16 cases) And Bhat et al. (32 cases). Limited joint mobility was mainly found in type 1 DM. Limited joint mobility is more prevalent in patients with diabetic neuropathy than in those without. (13)

Crispin and Alcocer in their study observed that prolonged hyperglycemia in uncontrolled diabetic patients results in collagen glycosylation. (14)

Rosenbloom et al. observed that alterations in periarticular connective tissue are related to alterations occurring in the microvasculature causing limited joint mobility syndrome. (14)

In our current study total number of frozen shoulder cases are 22 (11%) out of 200 patients. According to our study frozen shoulder mainly present in females, obese, uncontrolled diabetics and age group 41 to 60 years.

A study of Kamath et al. is very similar to our study with the prevalence of 12% (18 patients out of 150). (15)

Duration of diabetes more commonly strongly associated with microangiopathic complication, most of the symptomatic subjects are of >5 yrs. duration these findings are also seen in studies done by Ashish et al. . In this study numbers more women were affected comparing with the men.

Adhesive capsulitis of shoulder is thought to be due to fibrosis and inflammation due to increased expression of cytokines in diabetes. (15)

The prevalence of DISH in our study is 4% (8 cases). Out of 8 cases of DISH, 4 cases are males and rest 4 cases are females. Most of the cases of DISH are linked with obesity (4 cases have BMI ≥ 30), increased age (7 cases are belongs to age group 41 to 60 years), uncontrolled diabetes (all 8 cases) and duration of diabetes (all 8 cases have duration of diabetes >5 years). Most common joint involved in DISH is spine. (16)

The result of Youssef A. A. et al. study is consistent with our study with the prevalence of 0-3% out of 100 type 1 diabetic, 100 type 2 diabetic and 100 control patients.

While in Sencan D et al. (12%) and Coaccioli S et al. (30-40%) was higher but absent in study of Gharge A et al.

According to our study, the prevalence of flexor tenosynovitis, dupuytrens contractures, charcots joint and reflex sympathetic dystrophy is 3%, 2.5%, 1% and 0% respectively.

The prevalence of carpal tunnel syndrome in our study there is only 1 case of carpal tunnel syndrome out of 200 patients. It may be due to we excluded RA factor but in the study of Kamath et al. (0 cases out of 150) and Deshmukh D et al. (1 out of 100 cases) is similar to our study while Singh et al. (7 out of 100 cases) and Laura I AlOayan (15 subjects out of 208).

## 6. Conclusion

According to our study (n=200), the prevalence of musculoskeletal manifestation is 59%. The most common musculoskeletal manifestation is osteoarthritis. The prevalence of osteoarthritis is 25% (50 cases). The most common joint affected by OA is knee.

These musculoskeletal manifestations are found closely related with obesity, age of the patients, duration of diabetes, poor glycemic control. As soon as patients become more aged, obese, increased duration of diabetes, poor glycemic control and increased BMI, the chances of getting musculoskeletal manifestations highly increased.

In our study, Musculoskeletal disorders are more common in females and commonly affect upper limb than lower limb. Vitamin D level does not show any significant correlation with the musculoskeletal manifestation.

The musculoskeletal examination must be carried out in all the patients of diabetes mellitus complaining any musculoskeletal pain or discomfort.

By changing our lifestyle, exercise and healthy diet and proper awareness will help in reducing these complications. There is a need of a large scale health survey to find exact prevalence and related various risk factors.

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