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Kushdeep Singh[1], Narender Pal Jain[1], Sandeep Chhabra[1], Prannav Jain[2], Deepanshu Goel[3], Namita Bansal[4], Suman Sethi[5], Parminder Singh[6]

[1]Department of Medicine, Dayanand Medical College and Hospital, Ludhiana, India
[2]BSc (Biology), University of British Columbia, Vancouver, Canada
[3]Intern, Government Medical College, Amritsar, India
[4]Dayanand Medical College and Hospital, Ludhiana, India
[5]Department of Nephrology, Dayanand Medical College and Hospital, Ludhiana, India
[6]Department of Endocrinology, Dayanand Medical College and Hospital, Ludhiana, India

# Prevalence of Musculoskeletal Manifestations in Type 2 Diabetes: A Single Centre, Cross-Sectional Study

## ABSTRACT

**Objective: The study was aimed to evaluate the prevalence of musculoskeletal manifestations in patients with type 2 diabetes (T2D).**

**Materials and methods: In this single center, cross sectional study, 300 patients with clinically documented T2D were recruited from the outpatient clinic. Demographics, diabetes history, family history, treatment modalities, musculoskeletal symptoms were self-reported by participants. Anthropometric measurements and musculoskeletal examination were conducted by investigators. Complete blood count, fasting and postprandial plasma glucose, glycated hemoglobin (HbA1c), urine analysis, and X rays of the symptomatic joints were performed.**

**Results: Of 300 patients with T2D, musculoskeletal manifestations were observed in 50.7%. Osteoarthritis of the knee was the most common manifestation (20.3%) followed by carpal tunnel syndrome (10.7%), adhesive capsulitis (8.3%), diffuse idiopathic skeletal hyperostosis (7.3%), diabetic cheiroarthropathy (6.0%), flexor tenosynovitis (2.3%), and Dupuytren's contracture (0.7%). Age (p = 0.001), T2D duration (p = 0.004), BMI (p = 0.031) and HbA1c (p= 0.006) were associated with increased prevalence of musculoskeletal manifestations.**

**Conclusions: Prevalence of musculoskeletal manifestations is higher in people with T2D. Advanced age, longer duration of disease, overweight and high HbA1c levels are associated with increased prevalence of musculoskeletal manifestations. (Clin Diabetol 2023; 12; 5: 301–307)**

**Keywords: type 2 diabetes, musculoskeletal manifestations, adhesive capsulitis of shoulder, osteoarthritis of knee, carpal tunnel syndrome, diffuse idiopathic skeletal hyperostosis, diabetic cheiroarthropathy**

## Introduction

Type 2 diabetes (T2D) is an increasing global health problem. In contrast to microvascular complications of diabetes; musculoskeletal manifestations of diabetes are often overlooked, misdiagnosed or managed suboptimally. These complications may lead to physical disability and impair quality of life. Musculoskeletal manifestations are classified into four broad categories: those that are intrinsic to the disease, those that are

**Address for correspondence:**
Suman Sethi, Associate Professor
Department of Nephrology
Dayanand Medical College and Hospital
Ludhiana, India 141001
e-mail: suminitin@gmail.com; narenjain21@gmail.com
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related to metabolic abnormalities, those that share similar etiological mechanisms, and those that are more prevalent in the patients with diabetes [1, 2].

The exact etiology of diabetes associated with musculoskeletal disorders remains unknown. Evidence indicates that hyperglycemia may accelerate nonenzymatic glycation and abnormal collagen deposition in periarticular connective tissues. The structural matrix and mechanical properties of the musculoskeletal tissues are altered and lead to diffuse arthrofibrosis and stiffness [3].

Studies exploring the prevalence and associated factors of musculoskeletal manifestations of diabetes from India are limited. Therefore, we aimed to evaluate the distribution of different musculoskeletal manifestations in the Indian patients with T2D and the factors associated with them.

## Materials and methods

### Study design

In this single-center, cross-sectional study, adults (age 18 and above) with clinical diagnosis of T2D attending the outpatient clinic of Dayanand Medical College and Hospital, a tertiary care center in North India, between January 1, 2020 to June 30, 2021 were invited to participate in this research project. The ethical review board of the institution approved the study. The clinical diagnosis of diabetes was defined as per American Diabetes Association 2007 guidelines; fasting plasma glucose ≥ 126 mg/dL, postprandial plasma glucose ≥ 200 mg/dL, or symptoms of diabetes plus random plasma glucose ≥ 200 mg/dL [4].

Patients with other forms of diabetes such as monogenic diabetes [5], latent autoimmune diabetes in adults (LADA) [6], musculoskeletal manifestations due to non-rheumatological causes (e.g., cerebrovascular accident with frozen shoulder, Dupuytren's contracture due to alcoholism), pre-existing CKD based on eGFR [7], and history of trauma-related musculoskeletal morbidities were excluded from the study.

The following criteria were used to define the musculoskeletal manifestations:

— Adhesive capsulitis (frozen shoulder): Pain in shoulder for at least 1 month, an inability to lie on the affected shoulder and limitation of active and passive range of movement greater than 25% in both abduction and external rotation compared to the other shoulder [8].
— Carpal tunnel syndrome: Positive Tinel test — tingling sensation in the distribution of the nerve on light percussion over median nerve at flexor retinaculum. Positive Phalen test — tingling and numbness over median nerve distribution on flexion of wrist at 90 degrees angle for 30–60 seconds [9].
— Dupuytren's contracture: Pitting and thickening of the palmar skin with a firm, painless nodule, fixed to the skin and deep fascia with contracture of the ring and little finger [10].
— Diabetic cheiroarthropathy (limited joint mobility): Positive Prayer sign — Inability to touch the palmar surface of the interphalangeal joints together with the fingers fanned and the wrist maximally extended [11].
— Flexor tenosynovitis (trigger finger): Presence of a palpable nodule, usually in the area overlying the meta-carpophalangeal joint (MCP), thickening along the affected flexor tendon sheath on the palmar aspect of the finger and hand, occurrence of locking phenomenon with either active or passive finger flexion [12].
— Diffuse idiopathic skeletal hyperostosis (DISH): Radiographic finding of calcification of at least four contiguous vertebrae of thoracolumbar spine, with preservation of the intervertebral disc space and absence of sacroiliitis [13].
— Osteoarthritis: Altman's clinical criteria of radiographic osteophytes along with one of the four criteria: pain, crepitus, morning stiffness < 30 min, age > 60 years [14].
— Rheumatoid arthritis (RA): EULAR/ACR classification criteria for rheumatoid arthritis [15].

### Study procedure

A detailed medical history, general physical and musculoskeletal examination was done after obtaining informed written consent. Data collected included age, sex, duration of diabetes, mode of treatment, musculoskeletal symptoms and their duration (pain, restriction of movement, swelling of the joint), family history of diabetes. The anthropometric measurements taken were weight (kilogram), height (meter), body mass index (weight in kilogram/height in meter squared), waist and hip circumference (cm). Investigations done were complete blood count, fasting and postprandial plasma glucose (by hexokinase method in venous blood), glycated hemoglobin (by High Performance Liquid Chromatography), urine analysis, X-rays of the involved joints when indicated.

Data were described in terms of range; mean ± ± standard deviation (± SD), frequencies (number of cases) and relative frequencies (percentages) as appropriate. The Chi-square ($\chi^2$) test was used to compare categorical data, and exact test was used when the expected frequency was less than 5. A probability value (p value) less than 0.05 was considered statistically significant. All statistical calculations were done using (Statistical Package for the Social Science) SPSS version 21 (SPSS Inc., Chicago,

IL, USA ) statistical program for Microsoft. There was no formal sample size calculation done for this study.

## Results

The mean age of the study participants was 58.8 ± ± 10.1 years (range: 32–88 years), with the age at T2D onset of 49.8 ± 7.9 years and mean T2D duration of 8.9 ± 5.8 years. The mean BMI of the study participants was 24.2 ± 0.08 kg/m$^2$ (range: 18.9–44.20 kg/m$^2$). One hundred fifty one (50.3%) patients had abnormal waist-to-hip ratio (> 1.0) and the mean waist-to-hip ratio was 0.9 ± 0.08. The mean fasting plasma glucose, postprandial plasma glucose and HbA1c were 137.3 ± ± 43.7 mg/dL, 199.1 ± 70.3mg/dL and 8.1% ± 1.9%, respectively. A history of hypertension was found in 30.3% of participants,, 3.3% had a history of coronary artery disease, 2.7% had hypothyroidism and 0.3% had undergone knee replacement in the past.

Table 1 shows the distribution of subjects in various groups and their association with musculoskeletal manifestations. In our study, musculoskeletal manifestations were seen in 152 people with T2D (50.7%). Most of the study participants (54.7%) had diabetes for 5 to 10 years, followed by 19% who had duration of diabetes less than 5 years.

Table 2 shows the association of musculoskeletal manifestations with different variables. In the study population, 21.6% of cases had a family history of diabetes mellitus. Joint pain was present in 27.3%, joint swelling in 7.3%, restriction of movements at the joints in 18.3% and Tinel/Phelan test was positive in 10.7% cases. Insulin therapy was used by 13.7% of the participants, and 98% were taking oral hypoglycemic agents for the treatment of T2D.

Adhesive capsulitis was seen in 8.3% subjects and showed a statistically significant correlation with BMI. Carpal tunnel syndrome was seen in 10.7% subjects and demonstrated a significant correlation with sex, joint pains, restriction of movements at the joints, waist-to-hip ratio and fasting plasma glucose. Dupuytren's contracture was found in 0.7% of subjects and there was a significant correlation with treatment with OHA and HbA1c levels. Diabetic cheiroarthropathy was present in 6.0% people with T2D and showed a significant correlation with age and presence of joint pains. Flexor tenosynovitis (trigger finger) was seen in 2.3% and DISH was noted in 7.3% subjects who showed a significant correlation with variables as shown in the tables 1 and 2. Osteoarthritis of the knee was present in 20.3% of subjects and it was significantly correlated with age, duration of diabetes, joint pains, joint swelling, restriction of movement at the joints, and fasting plasma glucose. No case of rheumatoid arthritis was seen, while some of the cases presented with more than one musculoskeletal manifestation.

Out of the total 300 subjects under study, the musculoskeletal manifestations were seen in hand in 4.0%, left index finger and right middle finger in 0.3% each, right index finger in 1.0%, right upper limb in 0.7% and left middle finger in 0.7% subjects. In 7.7% spine, in 7.7% shoulder, in 9.3% wrist, and in 20.3% cases knee joint was involved.

## Discussion

This study reported a higher prevalence of musculoskeletal manifestations among people with T2D. Advanced age, longer duration of disease, overweight and high HbA1c levels were associated with higher musculoskeletal complications.

Musculoskeletal disorders (one or more) were seen in 50.7% of our patients. This finding is in accordance with previous reports — 52.9% [16], and 53.3% [17]; but higher than the prevalence reported by other authors (27–42%) [18–21]. This discrepancy may be due to the larger sample size in this study compared with those mentioned above, and the fact that there were more people with T2D at advanced ages, which may have increased the likelihood of having more than one musculoskeletal manifestation at one time.

In this study, people with T2D aged above 60 years were found to have more such disorders. These findings are in accordance with previous studies [21–23] which showed that the duration of the disease is directly related to its complications. Moreover, a majority of the study participants (54.7%) in this study had diabetes for 5 to 10 years followed by those who had duration of T2D less than 5 years (19%). This is consistent with Kumar and Das [17] who observed that the odds of having musculoskeletal manifestations was 1.48 times higher in the study participants who had a duration of diabetes of more than 5 years as compared to those who had a duration of diabetes of less than 5 years.

The most common manifestation in this study was osteoarthritis of the knee (20.3%). This may be because the incidence of osteoarthritis is reported to increase with age [24], and there were 79% participants of more than 50 years in this study. The results were comparable to the studies conducted by Sarkar et al. [16] and Mathew et al. [25] who showed the prevalence of osteoarthritis of the knee to be 20.4% and 22.5%, respectively.

The prevalence of osteoarthritis and adhesive capsulitis in this study was lower than that reported by Kumar and Das (45.31%) [17], but comparable to Kannan et al.'s (11%) [19]. This inconsistency may be due to the regional differences in the incidence of these degenera-

**Table 1. Distribution of Subjects and Association with Musculoskeletal Manifestations**

| | Total | Adhesive capsulitis N ( %) | p value | Carpal tunnel syndrome N ( %) | p value | Dupuytren's contracture N ( %) | p value | Diabetic cheiro-arthopathy N ( %) | p value | Flexor teno-synovitis N ( %) | p value | DISH N ( %) | p value | Osteoarthritis N ( %) | p value |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Age [years] | | | | | | | | | | | | | | | |
| < 50 | 63 (21%) | 3 (4.8%) | 0.27 | 9 (14.3%) | 0.27 | 1 (1.6%) | 0.46 | 1 (1.6%) | 0.01* | 3 (4.8%) | 0.34 | 2 (3.2%) | 0.13 | 3 (4.8%) | 0.001* |
| 51–60 | 104 (34.6%) | 12 (11.5%) | | 13 (12.5%) | | 0 0.0% | | 3 (2.9%) | | 2 (1.9%) | | 6 (5.8%) | | 17 (16.3%) | |
| > 60 | 133 (44.3%) | 10 (7.5%) | | 1 (7.5%) | | 1 (0.8%) | | 14 (10.5%) | | 2 (1.5%) | | 14 (10.5%) | | 41 (30.8%) | |
| Mean/SD | | 58.4/8.9 | | 56.4/8.6 | | 51.5/19.1 | | 66.6/8.4 | | 54.9/14.3 | | 62.5/9.5 | | 63.7/8.5 | |
| Duration of diabetes [years] | | | | | | | | | | | | | | | |
| < 5 | 57 (19.0%) | 6 (10.5%) | 0.62 | 5 (8.8%) | 0.25 | 0 (0.0%) | 0.61 | 1 (1.8%) | 0.13 | 1 (1.8%) | 0.71 | 6 (10.5%) | 0.07 | 11 (19.3%) | 0.05* |
| 5–10 | 164 (54.7%) | 14 (8.5%) | | 23 (14%) | | 1 (0.6%) | | 8 (4.9%) | | 5 (3%) | | 9 (5.5%) | | 23 (14%) | |
| 11–15 | 40 (13.3%) | 1 (2.5%) | | 1 (2.5%) | | 1 (2.5%) | | 5 (12.5%) | | 0 (0.0%) | | 0 (0.0%) | | 13 (32.5%) | |
| 16–20 | 24 (8.0%) | 2 (8.3%) | | 2 (8.3%) | | 0 (0.0%) | | 3 (12.5%) | | 1 (4.2%) | | 3 (12.5%) | | 10 (41.7%) | |
| > 20 | 15 (5.0%) | 2 (13.3%) | | 1 (6.7%) | | 0 (0.0%) | | 1 (6.7%) | | 0 (0.0%) | | 4 (26.7%) | | 4 (26.7%) | |
| Mean/SD | | 8.6/6.46 | | 7.7/3.7 | | 9.0/2.8 | | 11.9/5.6 | | 8.7/5.2 | | 10.1/8.6 | | 10.7/6.7 | |
| BMI [kg/m$^2$] | | | | | | | | | | | | | | | |
| 18.9–22.9 | 100 (33.3%) | 4 (4.0%) | 0.01* | 8 (8.0%) | 0.23 | 1 (1.0%) | 0.60 | 6 (6.0%) | 0.47 | 1 (1.0%) | 0.10 | 7 (7.0%) | 0.04* | 17 (17%) | 0.31 |
| 23–24.9 | 101 (33.6%) | 6 (5.9%) | | 15 (14.9%) | | 1 (1.0%) | | 4 (4.0%) | | 5 (5.0%) | | 3 (3.0%) | | 19 (18.8%) | |
| > 25 | 99 (33%) | 15 (15.2%) | | 9 (9.1%) | | 0 (0.0%) | | 8 (8.1%) | | 1 (1.0%) | | 12 (12.1%) | | 25 (25.3%) | |
| Mean/SD | | 26/4.6.1 | | 24.0/2.1 | | 22.7/1.7 | | 24.7/2.4 | | 23.9/1.2 | | 25.3/3.7 | | 24.9/3.5 | |
| FPG [mg/dL] | | | | | | | | | | | | | | | |
| < 127 | 177 (59%) | 13 (7.3%) | 0.45 | 9 (5.1%) | 0.01* | 0 (0.0%) | 0.08 | 14 (7.9%) | 0.09 | 1 (0.6%) | 0.01* | 7 (4.0%) | 0.07 | 44 (24.9%) | 0.01* |
| > 127 | 123 (41%) | 12 (9.8%) | | 23 (18.7%) | | 2 (1.6%) | | 4 (3.3%) | | 6 (4.9%) | | 15 (12.2%) | | 17 (13.8%) | |
| Mean/SD | | 139.4/55.7 | | 147.16/29.2 | | 138.50/10.6 | | 125.28/41.5 | | 140.29/12.9 | | 171.95/71.6 | | 129.59/31.9 | |
| PPPG [mg/dL] | | | | | | | | | | | | | | | |
| < 180 | 159 (53.0%) | 10 (6.3%) | 0.17 | 12 (7.5%) | 0.06 | 0 (0.0%) | 0.22 | 11 (6.9%) | 0.47 | 2 (1.3%) | 0.19 | 5 (3.1%) | 0.03* | 38 (23.9%) | 0.10 |
| > 180 | 141 (47.0%) | 15 (10.6%) | | 20 (14.2%) | | 2 (1.4%) | | 7 (5.0%) | | 5 (3.5%) | | 17 (12.1%) | | 23 (16.3%) | |
| Mean/SD | | 215.8/88.4 | | 206.7/48.3 | | 186.5/3.5 | | 175.5/50.2 | | 204.0/27.9 | | 242.8/98.7 | | 190.2/65.8 | |
| HbA1c [%] | | | | | | | | | | | | | | | |
| < 7 | 121 (40.3%) | 8 (6.6%) | 0.64 | 7 (5.8%) | 0.06 | 0 (0.0%) | 0.03* | 12 (9.9%) | 0.07 | 2 (1.7%) | 0.24 | 2 (1.7%) | 0.01* | (24.8%) | |
| 7.1–8 | 55 (18.3%) | 4 (7.3%) | | 8 (14.5%) | | 2 (3.6%) | | 2 (3.6%) | | 1 (1.8%) | | 2 (3.6%) | | 5 (9.1%) | |
| 8.1–9 | 77 (25.6%) | 9 (11.7%) | | 13 (16.9%) | | 0 (0.0%) | | 1 (1.3%) | | 4 (5.2%) | | 11 (14.3%) | | 17 (22.1%) | |
| > 9 | 47 (15.6%) | 4 (8.5%) | | 4 (8.5%) | | 0 (0.0%) | | 3 (6.4%) | | 0 (0.0%) | | 7 (14.9%) | | 9 (19.1%) | |
| 30 | 0.11 | | | | | | | | | | | | | | |
| Mean/SD | | 8.3/1.9 | | 8.4/1.5 | | 7.7/0.4 | | 7.2/1.7 | | 8.0/0.8 | | 9.9/1.6 | | 7.9/2.0 | |
| Total | 300 | 25 (8.3%) | | 32 (10.7%) | | 2 (0.7%) | | 18 (6.0%) | | 7 (2.3%) | | 22 (7.3%) | | 61 (20.3%) | |

*statistically significant; BMI — body mass index; DISH — diffuse idiopathic skeletal hyperostosis; FPG — fasting plasma glucose; HbA1c — glycated hemoglobin; PPPG — post prandial plasma glucose; SD — standard deviation

**Table 2. Association of the musculoskeletal manifestations with different variables**

| | Total | Adhesive capsulitis N ( %) | p value | Carpal tunnel syndrome N ( %) | p value | Dupuytren's contracture N ( %) | p value | Diabetic cheiro-arthopathy N ( %) | p value | Flexor teno-synovitis N ( %) | p value | DISH N ( %) | p value | Osteoarthritis N ( %) | p value |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sex | | | | | | | | | | | | | | | |
| Female | 130 (43.3%) | 11 (8.5%) | 0.94 | 23 (17.7%) | 0.001* | 2 (1.5%) | 0.10 | 7 (5.4%) | 0.69 | 2 (1.5%) | 0.42 | 3 (2.3%) | 0.004* | 20 (15.4%) | 0.06 |
| Joint pain | 82 (27.3%) | 7 (8.5%) | 0.93 | 17 (20.7%) | 0.001* | 0 (0.0%) | 0.38 | 1 (1.2%) | 0.03 | 2 (2.4%) | 0.94 | 19 (23.2%) | 0.001* | 28 (34.1%) | 0.001* |
| Joint swelling | 22 (7.3%) | 0 (0.0%) | 0.142 | 1 (4.5%) | 0.33 | 0 (0.0%) | 0.69 | 0 (0.0%) | 0.21 | 2 (9.1%) | 0.02 | 0 (0.0%) | 0.17 | 19 (86.4%) | 0.001* |
| Restriction of movements at the joints | 55 (18.3%) | 5 (9.1%) | 0.82 | 10 (18.2%) | 0.04 | 0 (0.0%) | 0.50 | 1 (1.8%) | 0.14 | 2 (3.6%) | 0.47 | 0 (0.0%) | 0.02 | 26 (47.3%) | 0.001* |
| History of hypertension | 100 (33.3%) | 10 (10.0%) | 0.46 | 12 (12.0%) | 0.59 | 1 (1.0%) | 0.61 | 6 (6.0%) | 1.0 | 3 (3.0%) | 0.58 | 19 (19.0%) | 0.001* | 25 (25.0%) | 0.15 |
| Family history of diabetes | 65 (21.6%) | 8 (12.3%) | 0.19 | 8 (12.3%) | 0.62 | 1 (1.5%) | 0.32 | 2 (3.1%) | 0.26 | 4 (6.2%) | 0.021* | 11 (16.9%) | 0.002* | 10 (15.4%) | 0.25 |
| OHA | 294 (98.0%) | 25 (8.5%) | 0.45 | 31 (10.5%) | 0.63 | 1 (0.3%) | 0.001* | 18 (6.1%) | 0.53 | 6 (2.0%) | 0.01* | 22 (7.5%) | 0.48 | 61 (20.7%) | 0.21 |
| Insulin use | 41 (13.7%) | 3 (7.3%) | 0.8 | 4 (9.8%) | 0.83 | 1 (2.4%) | 0.13 | 3 (7.3%) | 0.70 | 3 (7.3%) | 0.02 | 9 (22.0%) | 0.001* | 6 (14.6%) | 0.32 |
| W/H ratio | | | | | | | | | | | | | | | |
| Abnormal | 151 (50.3%) | 17 (11.3%) | 0.06 | 22 (14.6%) | 0.02 | 1 (0.7%) | 0.99 | 8 (5.3%) | 0.60 | 3 (2.0%) | 0.68 | 6 (4.0%) | 0.02* | 25 (16.6%) | 0.10 |
| Mean/SD | 0.95 | 0.1/0.04 | | 0.9/0.06 | | 0.9/0.05 | | 0.9/0.06 | | 0.9/0.04 | | 0.9/0.06 | | 0.9/0.07 | |
| Total | 300 | 25 (8.3%) | | 32 (10.7%) | | 2 (0.7%) | | 18 (6.0%) | | 7 (2.3%) | | 22 (7.3%) | | 61 (20.3%) | |

*statistically significant; BMI — body mass index; DISH — diffuse idiopathic skeletal hyperostosis; FPG — fasting plasma glucose; HbA1c — glycated hemoglobin; OHA — oral hypoglycemic agents; PPPG — post prandial plasma glucose; SD — standard deviation; W/H — waist–hip

tive disorders, as the population studied by Kumar and Das was from a relatively poorer state of India than ours.

This study revealed the carpal tunnel syndrome in 10.7% and flexor tenosynovitis in 2.3% people with T2D, which is lower than the figures reported by other researchers [26–28]. The incidence of carpal tunnel syndrome in patients with diabetes has also been related to the occupation, sex, and anthropometric factors such as wrist shape [27]. The higher manual work and less use of gadgets for routine work in our population may be the reason for this difference.

The prevalence of diffuse idiopathic skeletal hyperostosis was 7.3% and diabetic cheiroarthropathy was 6%. A higher incidence of diabetic cheiroarthropathy was reported by many authors [17–19]. Diabetic cheiroarthropathy, also known as the stiff hand syndrome, is one of the long-term complications of diabetes [29]. The lower prevalence in this study may be due to the lesser number of participants who had long-standing diabetes of more than 11 years. Many authors reported a higher prevalence of DISH than that found in this study [30, 31]. This difference may be due to the inclusion of the study sample with other causative factors, such as obesity, deranged lipid profile and postmenopausal women in these studies.

The association of musculoskeletal complications in patients with T2D with advanced age, longer duration of disease and higher BMI observed in our study was also reported by other authors [17,19, 32]. However, they have not studied the correlation with the specific musculoskeletal manifestation and the variables in details, unlike this study.

## Limitation

The present study has few limitations including small sample size and a single-center model. Also, the design of this study was hospital-based, targeted to the patients attending the outpatient clinic, which might not reflect the accurate occurrence of musculoskeletal manifestations in this region. The study is also subject to recall bias, because it relied on self-reported data. It was a cross sectional study; therefore, a causal link cannot be established between the dependent and independent variables. In spite of its limitations, this study has a significance for public health, because it represents an important step towards establishing the relationship between T2D and the development of musculoskeletal manifestations.

## Conclusions

Musculoskeletal manifestations are common in T2D and often remain unidentified. The authors observed their prevalence of 50.7% in this study and the most frequent (20.3%) condition was osteoarthritis of the knee, followed by carpal tunnel syndrome (10.7%) and adhesive capsulitis of the shoulder (8.3%). The present study shows a statistically significant correlation with variables such as age, duration of diabetes, presence of hypertension, BMI, waist/hip ratio and HbA1c levels. A thorough physical examination of the musculoskeletal system should be an integral part of the diabetic patient workup. This would help in the early detection, the prevention and timely management of chronic disabilities due to these disorders. Future studies with larger sample sizes are required to substantiate this observation, especially in the developing countries like India.

## Article information

### Data availability statement

The data of the study will be available on request.

### Ethics statement

The project was approved by the institutional ethical committee.

### Author contributions

All authors are responsible for the study conception and design, data collection, analysis and interpretation of results, and manuscript preparation.

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### Conflicts of interest

The authors declare that there is no conflict of interest.

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