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Musculoskeletal Disorders among Bangladeshi Type 2 Diabetic Subjects

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Abstract

Musculoskeletal Disorders (MSDs) are common conditions seen in diabetic patients and major cause of morbidity, mortality and hospitalization. But these problems have been remained as very much neglected epidemic in our country and under-noticed by the health care professionals. Prevalence of musculoskeletal disorders varies from population to

population in relation to their professional hazards. The aim of this study was determining the prevalence of musculoskeletal disorders and its associated factors among the type 2 diabetic subjects. In a cross-sectional study design a total of 1800 type 2 diabetic patients were screened from BIRDEM and BIHS Hospital. Data was collected purposively by a semi-structured questionnaire and a check-list through face-to-face interview. Appropriate univariate, bivariate and multivariate analyses were done accordingly by SPSS software version 16. The mean(±SD) age of the subjects was 52.6(±11.7) years (95% CI-52.1, 53.2) and 55%(n=990) were male. The mean(±SD) duration of diabetes was 10.5(±7.1) years (95% CI-10.15, 10.8). The prevalence of musculoskeletal disorders of the study subjects (for both sex) was 77.8% (n=1400) (95% CI-75.88, 79.72). Significant mean differences ($p<0.001$) have been found for monthly family income, systolic blood pressure, diastolic blood pressure, fasting blood sugar and random blood sugar. Due to musculoskeletal disorders 62.8% (n=1130) (95% CI-4.37, 9.77) respondents changed their lifestyle for activity of daily living. Almost eight in every ten diabetic subjects are suffering from musculoskeletal disorders like pain, abnormal sensation and muscle cramp in their body. Monthly family income, raised blood pressure, elevated blood sugar, increased depression and high body weight are the major associated factors for MSDs.

Introduction

Musculoskeletal disorders include a wide range of inflammatory and degenerative conditions affecting the muscles, tendons, ligaments, joints, peripheral nerves, and supporting blood vessels. These include clinical syndromes such as tendon inflammations and related conditions (tenosynovitis, epicondylitis, bursitis), nerve compression disorders (carpal tunnel syndrome, sciatica), and osteoarthrosis, as well as less well standardized conditions such as myalgia, low back pain and other regional pain syndromes not attributable to known pathology. Body regions most commonly involved are the low back, neck, shoulder, forearm and hand, although recently the lower extremity has received more attention [1]. Diabetes predisposes to musculoskeletal diseases by a number of mechanisms; such as- Glycosylation of connective tissue; increased connective tissue deposition due to proliferation of myofibroblasts; neuropathy; vascular insufficiency and autoimmune links with type 1 diabetes which results in to obesity, abnormal levels of insulin and insulin-like growth factors in the body. Firstly there are the effects of persistent hyperglycaemia on the quality and quantity of connective tissue activities. Hyperglycaemia stimulates nonenzymatic glycosylation of protein resulting in advanced glycation end product (AGE) formation and connective tissue stiffening. In addition, the deposition of connective tissue is increased in

diabetes potentially mediated through increased proliferation of myofibroblasts [2]. Secondly the vascular insufficiency and neuropathy associated with diabetes increases the risk of osteomyelitis, avascular necrosis and joint destruction (Charcot joints). Thirdly there are shared genetic links between type 1 diabetes and other autoimmune diseases such as rheumatoid arthritis [3]. Genetic links between the organ-specific autoimmune conditions (HLA DR3/DR4 tissue antigens) explain the familial clustering of rheumatoid arthritis and type 1 diabetes [4]. Unsubstantiated reports suggest that rheumatoid arthritis is more progressive and affects large joints when accompanied by type 1 diabetes. Fourthly, the deficiency of insulin and insulin-like growth factor seen with type 1 diabetes and the hyperinsulinaemia associated with type 2 diabetes may contribute to skeletal anomalies [5]. Insulin stimulates collagen synthesis and influences the proteoglycan composition of bone and cartilage whilst insulin-like growth factors (such as IGF-1) stimulate osteoblast activity [6].

Musculoskeletal disorders (MSDs) are widespread in many countries, with substantial costs and impact on quality of life. Accurate data on the incidence and prevalence of musculoskeletal disorders are difficult to obtain, and official statistics are difficult to compare across countries [1]. Epidemiologic studies have identified several personal, occupational and psychosocial factors related to upper extremity musculoskeletal disorders [7]. These factors are additive in the presence of DM and thus increase the frequency of hand and shoulder problems in the diabetic population. The exact pathophysiology of most of these musculoskeletal disorders remains obscure; however, connective tissue disorders, neuropathy or vasculopathy may have a synergistic effect on the increased incidence of musculoskeletal disorders in DM [8]. Among the diabetic patients who were screened for musculoskeletal symptoms and findings according to the Short Musculoskeletal Function Assessment Questionnaire, 82.6% were found to exhibit musculoskeletal abnormalities, mainly of the degenerative, non-inflammatory type [9]. And the prevalence of chronic musculoskeletal disorders increased with age with a peak in the age group 60–64 years (59.7%) [10]. Disorders of musculo-skeletal (MSK) system are common conditions seen in diabetic patients

[11]. Diabetes mellitus accounts for a number of vascular complications, which impair patients' survival [12]. Whilst vascular complications are recognized as the principal cause of morbidity and mortality in diabetes, it is often forgotten that diabetes is a multi-system disease. Despite the increased prevalence of musculoskeletal disorders amongst the diabetic population, this area is frequently neglected in the clinical setting [13]. Musculoskeletal disorders are quite common in diabetics like numbness of feet, delayed wound healing, changes in triceps, waist and hip circumference, presence of Charcot's joints, hammer toes and callosities, changes (decrease) in power of quadriceps, ankle dorsiflexors and plantarflexors, foot and interdigital ulceration etc. [14].

In addition, it has been suggested that health care providers should offer counseling to their patients to promote physical activity, a healthy diet, and smoking cessation as part of the preventive health examination [15]. It is hoped that through appropriate counseling regarding a healthy lifestyle, the chiropractor may help to reduce the incidence of the musculoskeletal effects of DM ([6]. Most published international studies include data from USA [17], UK [18], Poland [19], Greece [9] and Australia [20], but there is very limited data from the Asian population [21]. However, the results cannot be directly compared because of the heterogeneity in study population, design and sample size. The study was conducted to identify the prevalence of musculoskeletal disorders and its associated factors among type 2 Bangladeshi diabetic subjects with a view to know the baseline situation, so that a preventive strategy may be developed for the improvement of quality of life of diabetic patients.

Methods and materials

A cross-sectional study was conducted among type 2 diabetic subjects of Bangladesh Institute of Research and Rehabilitation in Diabetes, Endocrine and Metabolic Disorders (BIRDEM) and Bangladesh Institute of Health Sciences Hospital (BIHSH), Dhaka, Bangladesh. These hospitals are the largest hospitals for diabetic care in Bangladesh and patients from all over the country come in these hospitals for better diabetes management and control. A total of estimated 1800 (males-990 and females-810) type 2 diabetic subjects were selected purposively. Subjects who had a history of congenital physical problem, history of trauma due to any accident, who were pregnant (for female subjects), under gone any operative procedures for at last 3 months ago and known musculoskeletal disorders before diagnosis of diabetes were excluded from the study. An interviewer administered semi-structured questionnaire has been used. Inter rater reliability test of the questionnaire has been done for the measurement of the agreement and it had shown a very good agreement. Validation of the Bengali version questionnaire also has been done by following the appropriate method. The questionnaire had four parts which comprise of socio-demographic information, lifestyle information, biochemical factors and musculoskeletal disorders related information. Some of the data related to diabetes were collected from the record book of the subjects like last reading of the fasting blood glucose, random blood glucose, HbA1c, duration of diabetes and their treatment pattern whereas some of data were measured like blood pressure by using sphygmomanometer, height and weight using scale. Musculoskeletal disorders like osteoarthritis, adhesive causalities etc. were clinically examined by the physicians and correlated with diagnostic evidences that were available. In case of BMI classification the cut off for the Asian population by WHO has been followed. Hypertension was defined as per the WHO/ISH guideline. Data collection procedure was face-to-face interview with the interviewers and physical examination by the physicians. An appropriate univariate and bivariate analysis were done accordingly. Data were analyzed using statistical software SPSS version 16 for Windows. Ethical approval was taken from the ethical review board of State College of Health Sciences and Ethical Review Committee of Bangladesh Diabetic Association (BADAS). Both written and verbal consent was taken prior data collection and subjects were free to withdraw themselves at any stage of the study.

Results and discussion

Table 1: Distribution of the subjects according to the socio-demographic factors, and association with musculoskeletal disorders *(n=1800)*

Variables	Number (n)	Percent (%)	95% CI (LB,UB)	MSD		$\chi 2$	p-value*
				Present n(%)	Absent n(%)		
Age							
< 53 years	1010	56.1	53.81, 58.39	780(77.2)	230(22.8)	0.403	0.526
≥53 years	790	43.9	41.61, 46.19	620(78.5)	170(21.5)		
Mean±SD	52.6±11.7		52.1, 53.2				
Sex							
Male	990	55	52.7, 57.23	770(77.8)	220(22.2)	0.000	1.000
Female	810	45	42.7, 47.3	630(77.8)	180(22.2)		
Religion							
Islam	1530	85	83.4, 86.6	1160(75.8)	370(24.2)	24.232	0.001*
Hinduism	250	13.9	12.3, 15.5				
Christianity + Buddhism	20	1.2	0.67, 1.7	240(88.9)	30(11.1)		
Educational status							
Illiterate	160	8.9	7.6, 10.2				
Primary	300	16.7	14.98,18.4	900(75.0)	300(25.0)	74.507	0.001*
SSC	250	13.9	12.3, 15.5				
HSC	490	27.2	25.14, 29.26				
Graduate and Above	600	33.3	31.12, 35.48	500(83.3)	100(16.7)		
Occupational status							
Service holder	370	20.6	18.73, 22.47	250(67.6)	120(32.4)	50.743	0.001*
Business	450	25	22.99, 27.0	390(86.7)	60(13.3)		
Housewife	740	41.1	38.83, 43.37				
Student + Others	240	13.4	11.83, 14.97	760(77.6)	220(22.4)		
Marital status							
Married	1520	84.4	82.7, 86.08	1350(78.5)	370(21.5)	47.005	0.000*
Unmarried+ Others	280	15	13.4, 16.7	50(62.5)	30(37.5)		
Family members							
2 to 5 persons	960	53.3	50.99, 55.6	730(76.0)	230(24.0)	3.587	0.058*
6 to 12 persons	840	46.7	44.4, 49.0	670(79.8)	170(20.2)		
Mean±SD	5.47±2.02		5.38, 5.57				
Monthly income							
5000-55000 TK	1360	75.6	73.6, 77.6	960(70.6)	400(29.4)	1.6642	0.001*
55001-160000 TK	440	24.4	22.4, 26.4	440(100.0)	0(0.0)		
Mean±SD	40800±27778		39501, 42065				
Economical status							
Rich	100	5.6	4.5, 6.7	360(80.0)	90(20.0)	10.325	0.035*
Middle class	1330	73.8	71.77, 75.8	760(77.6)	220(22.4)		
Poor	370	20.5	18.63, 22.37	280(75.7)	90(24.3)		

**=Significant, P<0.05 is considered as a level of significance*

In this study the mean age of the subjects was 52.6(±11.7) years (95% CI-52.1, 53.2) and 55% (95% CI-52.7, 57.23) were male. The male-female difference for musculoskeletal disorders was not significant whereas in a study of Norway has been found a highly significant highest number of women subjects than men in all age groups (overall 50.1% versus 42.6%, p<0.001) [10]. Maximum percentage of graduate and above subjects were suffering from musculoskeletal disorders which was statistically highly significant (p<0.001). Large number of the study subjects were business man and they had significant (p<0.001) musculoskeletal disorders.

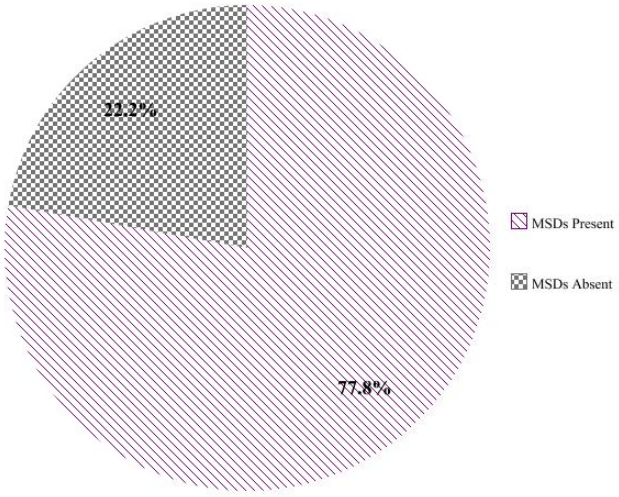

Figure-1: Prevalence of musculoskeletal disorders among the subjects *(n=1800)*
Majority (77.8%) of the subjects had musculoskeletal disorders

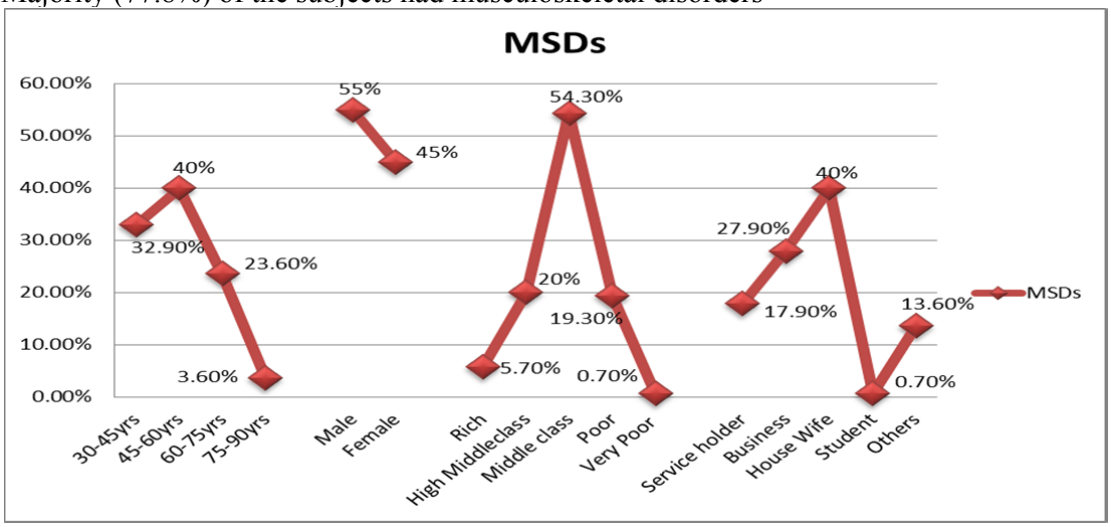

Figure-2: Prevalence of musculoskeletal disorders by age group, sex, economic classes and Occupation

Table 2: Distribution of subjects according to their lifestyle and biochemical factors, and association with musculoskeletal disorders *(n=1800)*

Variables	Number (n)	Percent (%)	95% CI (LB,UB)	MSD		$\chi 2$	p-value*
				Present n(%)	Absent n(%)		
Mean Height *cm*	163.3±10.0		162.9, 163.8				
Mean Weight *kg*	65.0±10.9		64.5, 65.5				
BMI							
Underweight	90	5	3.99, 6.0	40(44.4)	50(55.6)	64.03	0.001*
Normal weight	1110	61.7	59.45, 63.9	870(78.4)	240(21.6)		
Overweight	350	19.4	17.57, 21.2	290(82.9)	60(17.1)		
Obese	250	13.9	12.3, 15.5	200(80.0)	50(20.0)		
Mean±SD Kg/m^2	24.5±4.5		24.5, 24.7				
Hypertension related status							
Hypertensive	1200	66.7	64.5, 68.9	1010(84.2)	190(15.8)	85.02	0.001*
Normotensive	600	33.3	31.1, 35.48	390(65.0)	210(35.0)		
Duration of DM							
<10 *years*	1120	62.2	59.96, 64.4	870(77.7)	250(22.3)	0.017	0.897
≥10 *years*	680	37.8	35.6, 40.0	530(77.9)	150(22.1)		
Mean±SD	10.5±7.1		10.15, 10.8				
Treatment pattern of DM							
Lifestyle modification	60	3.3	2.5,4.1	40(66.7)	20(33.3)	21.445	0.001*
LM + OHA	490	27.2	25.1, 29.3	380(77.6)	110(22.4)		
Oral hypoglycemic agent	370	20.6	18.7, 22.5	270(73.0)	100(27.0)		
Insulin	400	22.2	20.28, 24.1	340(85.0)	60(15.0)		
Insulin + OHA + LM	480	26.7	24.7, 28.7	370(77.1)	110(22.9)		
Fasting blood glucose status							
Normal (<7 *mmol/l*)	760	42.2	39.92,44.48	550(72.4)	210(27.6)	22.27	0.001*
Diabetes (≥7 *mmol/l*)	1040	57.8	55.5, 60.08	850(81.7)	190(18.3)		
Mean±SD	8.7±2.8		8.6, 8.87				
Random blood glucose status							
Normal (<11.1 *mmol/l*)	730	40.6	38.33, 42.87	520(71.2)	210(28.8)	30.44	0.001*
Diabetes (≥11.1 *mmol/l*)	1070	59.4	57.1, 61.7	880(82.2)	190(17.8)		
Mean±SD	13.7±5.4		13.4, 13.9				
HbA1c level status							
Normal (<7 *%*)	890	49.4	47.09, 51.7	710(79.8)	180(20.2)	4.06	0.044*
Diabetes (≥7 *%*)	910	50.6	48.29, 52.91	690(75.8)	220(24.2)		
Mean±SD	8.2±3.7		8.05, 8.4				
Number of subjects changed daily life due to pain							
Yes	1130	62.8	4.37, 9.77	1070(94.7)	60(5.3)	502.4	0.001*
No	670	37.2	4.37, 9.77	330(49.3)	340(50.7)		
Treatment due to pain							
Go to Physician	310	17.2	3.42, 5.96	270(87.1)	40(12.9)	312.25	0.001*
Go to Physiotherapist	560	31.1	4.19, 8.96	520(92.9)	40(7.1)		
Take medicine	360	20.0	3.62, 6.69	310(86.1)	50(13.9)		

**=Significant, P<0.05 is considered as a level of significance, BMI= Body Mass Index*

The prevalence rate of musculoskeletal disorders among diabetic patients varies in different studies [22–25]. The musculoskeletal conditions most commonly associated with diabetes. One or more of the aforementioned pathogenic mechanisms may be implicated in an association of a musculoskeletal condition with diabetes [13]. In this study musculoskeletal disorders has been found among 77.8% (95% CI- 75.88, 79.72) subjects whereas a study from Greece showed almost similar (82.6%) proportion of type 2 diabetes mellitus patients exhibiting musculoskeletal abnormalities, mainly of the degenerative, non-inflammatory type [9]. In addition, one study from Norway found 46.5% respondents was suffering from chronic musculoskeletal conditions, 5.0% had chronic widespread musculoskeletal conditions and the remaining 41.5% had chronic non-widespread musculoskeletal conditions [10].

Significant difference was found for high BMI ($p<0.001$) in this study whereas American College of Rheumatology 2009 found association of upper-extremity musculoskeletal disorders with obesity ($p=0.014$) and high level of physical demand ($p<0.001$) in men, while in women, upper-extremity musculoskeletal disorders were associated with diabetes mellitus ($p<0.001$) [7]. Highly significant difference ($p<0.001$) has been found for systolic blood pressure, diastolic blood pressure and for hypertensive patients. Due to musculoskeletal disorders 62.8% (95% CI-4.37, 9.77) modified their lifestyle for activity of daily living and more than two-third respondents received treatment. Significant difference has been found for musculoskeletal disorders with fasting blood sugar ($p<0.001$) and random blood sugar ($p<0.001$) among the study subjects. In a study it has been seen that the prevalence of isolated impaired glucose tolerance was 11.0% among men and 10.9% among women which was higher than that of isolated impaired fasting glucose- 3.2% among men and 2.2% among women [26].

In this study, 43.9% had osteoarthritis, 29.4% had shoulder adhesive capsulitis, 15.6% had ankylosing spondylitis, 15% had planter fascitis, 12.2% had Charcot's joint, 6.7% had carpal tunnel syndrome, 5.6% had rheumatoid arthritis, 5% had trigger finger, 2.8% had Dupuytren’s contracture. One case control study in America found the prevalence of

musculoskeletal disorders greater in diabetic patients compare to control patients (36% vs. 9%, p<0.01). Adhesive capsulitis was present in 12% of the diabetic patients and none of the

Table 3: Distribution of the subjects according to types of musculoskeletal disorders *(n=1800)*

Types of musculoskeletal disorders	Number (n)	Percent (%)	95% CI (LB,UB)
Osteoarthritis	790	43.9	41.6, 46.19
Shoulder adhesive capsulitis (SAC)	530	29.4	27.3, 31.5
Ankylosing spondylitis	280	15.6	13.9, 17.3
Planter fascitis	270	15.0	13.35, 16.65
Charcot's joint	220	12.2	10.69, 13.71
Carpal Tunnel Syndrome (CTS)	120	6.7	5.5, 7.8
Rheumatoid arthritis	100	5.6	4.5, 6.7
Trigger finger	90	5.0	3.99, 6.0
Dupuytren's contracture	50	2.8	2.04, 3.6
Musculoskeletal disorders	1400	77.8	75.88,79.72

control patients (p<0.01), Dupuytren's disease in 16% of diabetic and 3% of control patients (p<0.01), and flexor tenosynovitis in 12% of diabetic and 2% of control patients (p<0.04), while carpal tunnel syndrome occurred in 12% of diabetic patients and 8% of control patients (p=0.29) [17].

Table 4: Distribution of the subjects according to factors associated with musculoskeletal disorders (*n=1800*)

Variables	Musculoskeletal Disorders		t-value	p-value*
	Present Mean±SD	Absent Mean±SD		
Age	52.79±12.091	52.15±9.855	0.964	0.335
Family members	5.59±2.064	5.08±1.768	4.499	0.001*
Monthly income	44085±29953	29225±12206	9.694	0.001*
Height	163.52±9.802	162.72±10.728	1.403	0.161
Weight	65.69±11.178	62.68±9.586	4.908	0.001*
BMI [a]	24.68±4.529	23.92±4.513	2.968	0.003*
Systolic BP [b]	133.68±17.811	125.75±12.443	8.340	0.001*
Diastolic BP	85.46±8.599	80.25±8.522	10.717	0.001*
Duration of DM	10.87±7.640	9.10±4.701	4.405	0.001*
FBG [c]	8.99±2.9	7.87±2.23	7.119	0.001*
RBG [d]	14.14±5.6	11.95±4.04	7.319	0.001*
HbA1c level [e]	8.33±3.7	7.85±3.73	2.263	0.024*

*a= Body mass index, b= Blood pressure, c=Fasting blood glucose, d=Random blood glucose, e=Glycosylated hemoglobin. *=Significant, P<0.05 is considered as a level of significance.*

Although the underlying pathological mechanisms are not yet clear, diabetes or long-term hyperglycaemia may affect the musculoskeletal system via different pathways. In the present study has been found that certain musculoskeletal disorders are more prevalent in type 2 diabetes mellitus patients. The association among socio economic factors, hypertension, glycemic status and duration of DM to the musculoskeletal disorders in patients with type 2 diabetes mellitus has been found significant. monthly income versus MSDs, Systolic BP versus MSDs, Diastolic BP versus MSDs, BMI versus MSDs, FBG versus MSDs, RBG versus MSDs were statistically highly significant ($p<0.001$) and HbA1c level versus MSDs was statistically significant ($p<0.05$).

In 2008, a study was conducted in turkey where they concentrated on "which musculoskeletal complications are most frequently seen in type 2 diabetes mellitus". In this study they identified the association between age and duration of diabetes, musculoskeletal complications and HbA1c in patients with type 2 DM (n=102). They also found significant relation of age versus diabetes duration ($p=0.001$), age versus musculoskeletal complications ($p=0.004$), age versus HbA1c ($p=0.028$), duration of DM versus HbA1c ($p>0.05$), duration of DM versus frozen shoulder ($p=0.003$) and duration of DM versus risk for cheiroarthropathy ($p=0.001$) [27]. But they did not conduct association with fasting blood sugar, random blood sugar, height, weight and monthly income.

The limitation of the study is that only those cases of diabetes were included in the study which visited to the tertiary care hospitals.

Conclusion

Almost eight in every ten diabetic subjects were suffering from different types of musculoskeletal disorders, like osteoarthritis, frozen shoulder, ankylosing spondylitis, planter fascitis, Charcot's joint etc. More than two-third of them visited health care facilities to get relief of their pain. Monthly family income, blood sugar, obesity and hypertension were the major associated factors for musculoskeletal disorders. Controlled glycemic status,

modification of lifestyle and routine screening for MSDs can minimize the sufferings- special attention is needed among the health care providers in this regard.

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