



Prevalence of Work-Related Musculoskeletal Disorders in CISF Staff of Delhi Metro, India (2019)

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Abstract

Background: Musculoskeletal disorders (MSDs) cause muscle pain or injuries from sudden or sustained contact with repetitive motion, force, vibration, or wrong postural movement. A high prevalence of MSDs has been reported amongst police staff. Still, the prevalence of MSDs in Central Industrial Security Force (CISF) metro Personnel has not been documented in literature to date. Aim/Goal of the study: To report the prevalence of MSDs in Central Industrial Security Force (CISF) metro Personnel.

Materials and Methods: A total of 401 participants were recruited for this cross-sectional study from CISF Delhi headquarters and hostels by convenience sampling. The standardized Nordic Musculoskeletal Questionnaire for investigating work-related musculoskeletal symptoms in working populations was used in this study for data collection. Data were tabulated in Microsoft Office Excel 2010 to obtain the frequency, mean, standard deviation, and percentage.

Results: The point prevalence of low back pain was reported highest, with 19.09 % in males, and amongst females, 17.39% reported pain in one/ both shoulders. Period prevalence for the last 7 days indicated that 17.79% of males and 13.04% of females reported low back pain. The 12-month prevalence of MSDs was highest for the low back region in both genders.

Conclusion: It was concluded from the study that a wide array of work-related MSDs is prevalent amongst the CISF staff of Delhi Metro, with the highest prevalent area of pain being the lower back region.

Keywords: Occupation, Musculoskeletal Diseases, Low Back Pain

Introduction

Musculoskeletal disorders (MSDs) are connective tissue or musculoskeletal diseases that cause muscle pain or injuries from sudden or sustained contact with repetitive motion, force, vibration, or wrong postural movement. MSDs involve injuries or disorders to the muscles, joints, tendons, cartilage, nerves, and spinal area of the upper limbs (UL) and lower limbs (LL), neck, and lower back [1]. MSDs are self-reported musculoskeletal

symptoms that may result in suffering among individuals and have economic effects on society [2].

Delhi Metro is a rapid transit system serving Delhi and its satellite cities in the National Capital Region since the inauguration of its first line in 2002. With the sanctioned strength of 12,528 personnel, the Unit has become the largest single-unit under the security cover of the country's Central Industrial Security Force (CISF). The CISF personnel are responsible for access control of

passengers inside the metro stations. Each passenger must go through a door frame metal detector (DFMD) before being frisked by a CISF personnel. Double-layered frisking is carried out when threat perception is high, like national days. The Unit deploys several Quick Reaction Teams (QRTs) to counter any potential man-made threat to the security of the metro system. (DMRC)

A study on police officers in Araçatuba region, Sao Paulo, Brazil, concluded a high prevalence of MSD symptoms, especially over the past 12 months involving the lower back, representing a chronic problem. These findings emphasize the importance of periodic evaluation and the need to implement strategies to promote health and improve working conditions to minimize the prevalence of MSD symptoms [3].

Unlike other work forces, the CISF force does not have a fixed work pattern and must be geared to meet unexpected emergencies for unspecified periods. A culmination of these pressures has resulted in increased stress on a day-to-day basis. This subjective stress caused by daily living or working situations may lead to various health problems such as MSDs leading further to changes in job performance and quality of life [4]

These personnel are highly likely to show musculoskeletal pains due to rough physical activities, including duties, traffic control, driving, security, sports and drills, and handling heavy equipment, and are highly hospitalized or treated [5].

The prevalence of MSDs in CISF metro Personnel has not been documented in literature to date. Thus, the present study aimed to find the prevalence of work-related musculoskeletal disorders (MSDs) in CISF staff of Delhi Metro (DMRC). This will aid in predicting risk factors for developing MSDs and suggest corrective measures for preventing MSDs in the targetted study population.

Materials and Methods

The study was performed according to the National Ethical Guidelines for Biomedical & Health Research involving human participants guidelines given by the Indian Council of Medical Research (2017) and the Helsinki Declaration (2013). Ethical approval was taken from the local Institutional Review Board, and written informed consent was obtained from CISF Headquarters, Delhi and the participants before the study.

A total of 401 participants were sought for this cross-sectional study. The sample size was determined by the G-Power calculation. CISF metro staff working with Delhi Metro Rail

Corporation (DMRC) were recruited from CISF Delhi headquarters and hostels to participate in this study by convenience sampling. The participants were recruited from headquarters and hostels to ensure data collection for our intended sample size, as the staff had shift duties and data collection was done in daytime slots. Those included were male and female CISF staff with at least 1 year of working experience a normal BMI for the Asian population. Those excluded were retired subjects, staff with a history of previous musculoskeletal injuries and/or neurological disorders, and obese subjects. The participants worked 8-10 hours on an average per day. The nature of work for males included sitting and standing for long hours without rest, carrying and loading heavy goods, and walking for long distances with or without additional weighted equipment. The nature of work among female staff was limited to standing and sitting for long hours and walking long distances.

A close-ended structured questionnaire, the standardized Nordic Musculoskeletal Questionnaire [6], for investigating work-related musculoskeletal symptoms in working populations was used in this study. The questionnaire comprised questions on the prevalence, risk factors, and coping strategies of WMSDs. Questions on prevalence portrayed a portrait of a human structure with nine body parts: neck, shoulders, upper back, lower back, elbows, wrists/hands, thighs, knees, and ankles. This structure was meant for a table that demands a "yes" or "no" response for each body part to three questions about 12 months prevalence, 7-day prevalence, and any disability during the last year (annual disability). The investigation of musculoskeletal complaints in an ergonomic or occupational health environment using standardized questionnaires is described. The free-response variations of the questions can be utilized in both self-administered tests and in-person interviews. They focus on the symptoms experienced in occupational settings the most frequently. It has been established that the questionnaires' dependability is satisfactory. The number of questionnaire replies reflects certain job strain characteristics. [7]

After a formal introduction, the staff of CISF, which were prospecting participants, was sought, and the study was explained to them in detail as much as possible. This includes the merits and demerits (if any). Confidentiality and anonymity of all information obtained were as assured. It was also made clear to them that participation was voluntary. After obtaining their informed consent, questionnaires were distributed to the participants

by one of the researchers (FDA). This questionnaire took less than 15 minutes to complete.

Data was analyzed by using proportions and chi-square test. The statistical software SPSS 29 was used to analyze the data, and Microsoft Word and Microsoft Excel have been used to generate graphs and tables.

Results

A total of 401 participants, 311 (77.55%) males and 92(22.9%) females volunteered in this study. The mean age of the participants was 32.99 years,

and the mean height and weight were 172.77 cm and 59.50 kg, respectively. Most of the participants were unmarried, and the average duration of service in the profession was 13.07 years for males and 3.31 years for females. Duration of service for males ranged from 1 to 43 years, and for females ranged from 1 to 27 years.

The point prevalence of low back pain was reported highest, with 19.09 % in males followed by 10.35% of those who reported pain in the neck. Amongst females, 17.39% reported pain in one/ both shoulders, while 13.4% reported low back pain (Table-1and Fig.1).

Table 1. Point prevalence of MSDs and pain (%) in different regions of the body in both males and females as reported by the Nordic pain questionnaire

Parameters	Point prevalence			
	Males		Females	
	Pain	No pain	Pain	No pain
Neck	277	32	84	8
Shoulder (both)	286	23	76	16
Elbow (both)	301	8	86	6
Wrist (both)	303	6	88	4
UB	293	16	87	5
LB	250	59	80	12
Hips/thighs (both)	302	7	90	2
Knee (both)	281	28	88	4
Ankle (both)	285	24	85	7

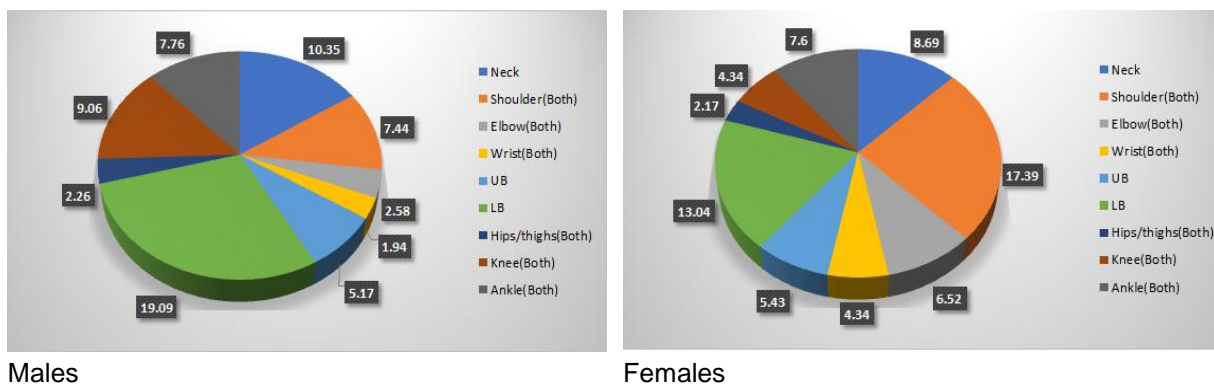


Fig.1. Point Prevalence of MSDs and % pain in Males and Females

Results for the last 7 days (Period prevalence) indicated that 17.79% of males reported low back pain, followed by 9.70% who reported pain in the

neck region. Amongst females, 13.04% reported low back pain, followed by 11.95% who reported pain in one or both shoulders (Table 2 and Fig.2).

Table 2. Period prevalence of MSDs and pain (%) in different body regions in both males and females as reported by the Nordic pain questionnaire for the last 7 days.

Parameters	Period prevalence (last 7 days)			
	Males		Females	
	Pain	No pain	Pain	No pain
Neck	279	30	85	7
Shoulder (both)	288	21	81	11
Elbow (both)	301	8	88	4
Wrist (both)	301	8	89	3
UB	294	15	86	6
LB	254	55	80	12
Hips/thighs (both)	302	7	91	1
Knee (both)	275	34	88	4
Ankle (both)	277	32	82	10

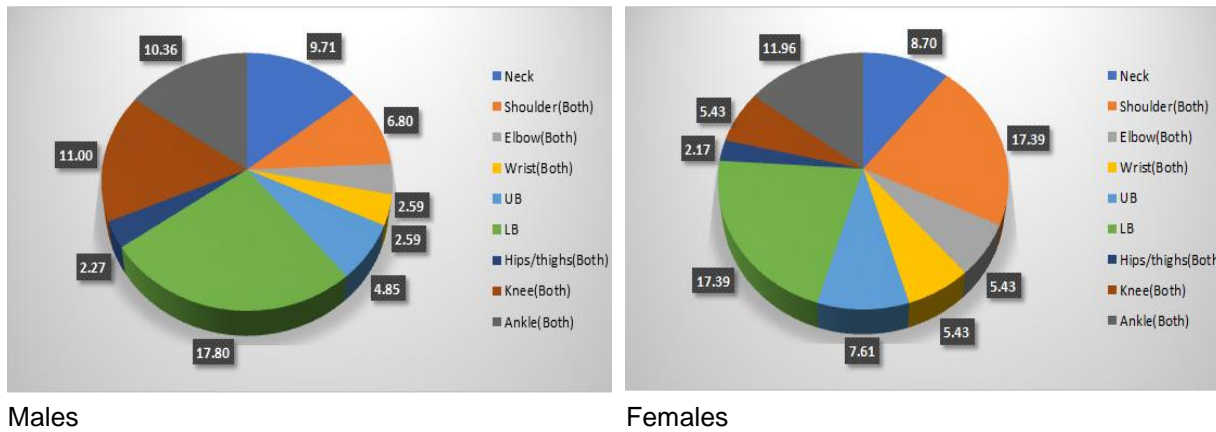


Fig.2. Period Prevalence of MSDs and % pain in Males and Females (Last 7 days)

The 12-month prevalence of MSDs was found to be highest in both men and women, i.e., 17.47% in the low back region, followed by 11% who complained of pain in one/both knees in men, and 17.39% of females reported pain in the low back and shoulder region. The participants reported that

this pain interfered with their occupation as it persisted for a longer period (Table 3 and Fig.3). The average age of CISF staff(both male and female) with back msd was 34.86 years, and the average duration of service was 12.27 years.

Table 3. Period prevalence of musculoskeletal disorders and pain (%) in different body regions in both males and females as reported by the Nordic pain questionnaire for the last 12 months and that interfered with their occupation.

Parameters	Period prevalence (last 12 months)			
	Males		Females	
	Pain	No pain	Pain	No pain
Neck	278	31	84	8
Shoulder (both)	287	22	76	16
Elbow (both)	300	9	87	5
Wrist (both)	301	8	87	5
UB	291	18	85	7
LB	255	54	76	16
Hips/thighs (both)	301	8	90	2
Knee (both)	275	34	87	5
Ankle (both)	277	32	81	11

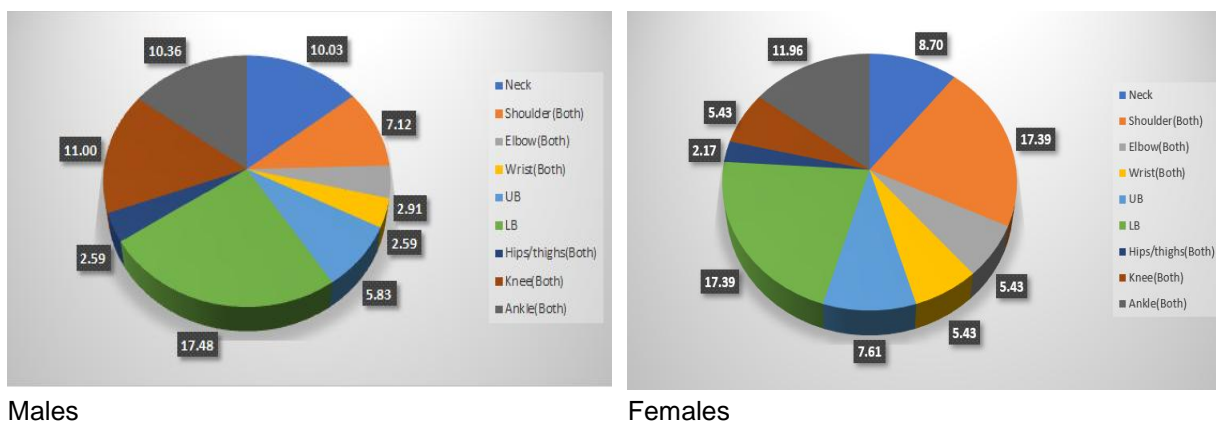


Fig.3. Period Prevalence of MSDs and % pain in Males and Females (Last 12 days)

The average age of females with musculoskeletal symptoms was 26.20, and the average duration of service was found to be 3.43 years. On the other hand, the average age of males with musculoskeletal symptoms was 38.47 years, and the average duration of service was 16.36 years. The study showed that the upper back was the most affected during the previous week (Table 4), which was statistically significant($p < 0.001$). The Association between the Standardized Nordic

Questionnaire and Demographic, duration of service, and type of work was calculated. The study reveals that MSDs in the previous 7 days were more common among 21-30 year age groups (17.21%) and were statistically significant. MSDs in the previous 1 year followed the same pattern as MSDs in the previous 7 days. Among study subjects, disabling attacks were more common among the 21-30 year age group 14.46% (Table 5). Our study also reveals that disabling attacks

and MSDs in the previous year are more common in 1-5 years of service, which is statistically significant. Also, males were found to be more

affected than females but were not statistically significant (Table 5).

Table 4. Distribution of the study subjects according to the Standardized Nordic Questionnaire

MSD		Last 12 Months	Last 7 Days	Interference with occupation in the last 12 months	Chi-square value	P-value
Neck	Yes	40	39	37	0.134	0.935
	No	361	362	364		
Shoulders	Yes	23	22	21	0.098	0.952
	No	286	287	288		
Elbows	Yes	14	14	12	0.207	0.902
	No	387	387	389		
Wrist	Yes	10	13	11	0.424	0.809
	No	391	388	390		
Upper Back	Yes	21	376	21	924.073	<0.001*
	No	380	25	380		
Lower back	Yes	71	70	67	0.151	0.927
	No	330	331	334		
Hips/thighs	Yes	9	10	8	0.227	0.898
	No	392	391	393		
Knee	yes	32	39	38	0.868	0.648
	No	369	362	363		
Ankles	Yes	31	43	42	2.538	0.281
	No	370	358	359		

(* denotes significant p-value at 0.05 level).

Table 5. Association between Standardized Nordic Questionnaire and Demographic, duration of Service and Type of Work

Variables	Last 12 months				Last 7 days				Interference with occupation in the last 12 months				
	MSD	%	No MSD	%	MSD	%	No MSD	%	MSD	%	No MSD	%	
	21-30	60.00	14.96	176.00	43.89	69.00	17.21	167.00	41.65	58.00	14.46	178.00	44.39
Age Wise	31-40	28.00	6.98	34.00	8.48	27.00	6.73	35.00	8.73	29.00	7.23	33.00	8.23
	41-50	35.00	8.73	36.00	8.98	34.00	8.48	37.00	9.23	34.00	8.48	37.00	9.23
	51-60	16.00	3.99	18.00	4.49	17.00	4.24	17.00	4.24	16.00	3.99	18.00	4.49
chi-square value	20.98				13.35				22.54				
P-Value	<0.001*				<0.001*				<0.001*				

Gender	Females	29.00	7.23	63.00	15.71	37.00	9.23	55.00	13.72	28.00	6.98	64.00	15.96
	Males	115.00	28.68	194.00	48.38	117.00	29.18	192.00	47.88	112.00	27.93	197.00	49.13
chi-square value		1.00			0.17			1.05					
P-Value		0.32			0.68			0.30					
Duration of service	1 to 5	54.00	13.47	157.00	39.15	63.00	15.71	148.00	36.91	54.00	13.47	157.00	39.15
	6 to 10	24.00	5.99	29.00	7.23	25.00	6.23	28.00	6.98	22.00	5.49	31.00	7.73
	11 to 15	11.00	2.74	13.00	3.24	11.00	2.74	13.00	3.24	10.00	2.49	14.00	3.49
	16 to 20	7.00	1.75	11.00	2.74	6.00	1.50	12.00	2.99	6.00	1.50	12.00	2.99
	21 to 25	11.00	2.74	11.00	2.74	11.00	2.74	11.00	2.74	11.00	2.74	11.00	2.74
	26 to 30	22.00	5.49	18.00	4.49	22.00	5.49	18.00	4.49	22.00	5.49	18.00	4.49
	31 to 35	11.00	2.74	14.00	3.49	12.00	2.99	13.00	3.24	11.00	2.74	14.00	3.49
	36 to 40	4.00	1.00	2.00	0.50	4.00	1.00	2.00	0.50	4.00	1.00	2.00	0.50
	41 to 45	0.00	0.00	2.00	0.50	0.00	0.00	2.00	0.50	0.00	0.00	2.00	0.50
	46 to 50	0.00	0.00	1.00	0.25	0.00	0.00	1.00	0.25	0.00	0.00	1.00	0.25
chi-square value		26.00			17.79			24.10					
P-Value		0.00*			0.02*			0.00*					
Type of Work	Walking	53.00	13.22	64.00	15.96	55.00	13.72	62.00	15.46	51.00	12.72	66.00	16.46
	Sitting	53.00	13.22	62.00	15.46	53.00	13.22	62.00	15.46	52.00	12.97	63.00	15.71
	Carrying Heavy goods	44.00	10.97	44.00	10.97	45.00	11.22	43.00	10.72	41.00	10.22	47.00	11.72
	Standing for long hours	70.00	17.46	113.00	28.18	71.00	17.71	112.00	27.93	68.00	16.96	115.00	28.68
	Loading goods or Transferring	22.00	5.49	14.00	3.49	22.00	5.49	14.00	3.49	21.00	5.24	15.00	3.74
chi-square value		8.09			8.10			6.6913					
P-Value		0.09			0.09			0.15					

(* denotes significant p-value at 0.05 level).

Discussion

Musculoskeletal disorders (MSD) rank first in frequency among work-related injuries and diseases. Musculoskeletal injuries result from acute injuries or can be chronic in nature. These disorders are seldom life-threatening, but impair the quality of life of a large proportion of the adult population. MSD causes considerable losses in productivity and high expenses as a result of short- and long-term disability and the use of health care services [8]. This is the first study by far which described the prevalence of MSDs among CISF staff of Delhi Metro.

The study was performed on 401 participants of CISF Metro staff, and it was found that the prevalence of low back pain was reported highest in males, followed by neck pain, and in females, the highest prevalence of MSDs was found in the shoulder followed by low back pain. The low back pain had the highest period prevalence for the last seven days in both males and females, as reported by Nordic Pain Questionnaire. Also, the 12 months prevalence of MSD was highest in the low back region in both genders.

The results of our study are in tandem with the extensive literature concluding low back pain to be the most prevalent MSD in a wide array of occupations. Sayed Tantawy, in the year 2019, conducted a prevalence study on the employees of Ahlia University, Bahrain, and found similar results of the highest prevalence of low back pain in both the last 7 days and 12 months. Further, age groups 32 to 36 were the most prevalent age group for MSDs, with a 30% prevalence which is in line with the average age group of this study. Further, the prevalence of low back pain in the current study was approximately the same for the 7 days and 12 months, which was not the case with the study done on Police Officers. It was reported that period prevalence for the past 12 months was greater than the last 7 days for low back pain. [3]

The probable reason for the above findings of MSD in the Central Industrial Security force can be attributed to a distinctive and adaptable training and work schedule that prepares them to handle various emergencies and disasters. The many factors operating in the family and at work are the reasons for the significant level of musculoskeletal and mental stress that the CISF personnel experience [8]. The majority of the additional stressors are connected to the workplace, including "having no regular work hours," and "having to work overtime when necessary," "having no well-defined roles"—being trained for one thing but forced to work in a different field. Apart from other variables, "being away from their families" is

recognized as a significant contributor to musculoskeletal stress since staff members are expected to handle all household duties and professional obligations. [9]

This study had a few limitations which might be considered while conducting similar studies in the future. Firstly, only the data of CISF personnel working in Delhi Metro was recorded, making it difficult to generalize the results to large impending security forces. Secondly, the nature of work for each individual was not consistent but variable, making it difficult to explain the actual mechanism behind the prevalence of MSD. Lastly, the majority of the population recruited for the study were young to middle-aged adults who had been in the profession for less than 10 years, making it hard to conclude the long-term prevalence of MSDs in CISF Metro personnel.

Similar studies could be undertaken on employees working for more than 10-15 years in a more defined role. Furthermore, the menstrual and obstetrical history of female personnel can be considered while making conclusions about the causes behind back pain being the most common long-term MSD.

Conclusion

It was concluded from the study that a wide array of work-related MSDs is prevalent amongst the CISF staff of Delhi Metro, with the highest prevalent area of pain being the lower back region. We must use this knowledge to emphasize the importance of occupational ergonomics and conscious maintenance of correct posture. Furthermore, these security personnel should regularly screen biomechanical imbalances due to consistent occupational stress, which will prevent a high incidence of MSDs amongst this targeted population.

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Conflict of interest: None declared.

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