Archives of Occupational Health | Volume 4 | Issue 1 | January 2020 | 485-92.

Original

Identification Prevalence of Musculoskeletal Disorders and its Related Factors among Street Cleaners of Isfahan Municipality

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Abstract

Background: Musculoskeletal disorders are one of the major work-related diseases resulting from repetitive motions, awkward postures and exertion of excessive force on joints or an acute trauma. The present study was an attempt to determine the Prevalence and factors associated with Musculoskeletal Disorders among street cleaners of Isfahan Municipality. **Methods**: the present article is a cross-sectional causal-comparative study conducted on street cleaners of Isfahan Municipality. Cochran's formula was used to select 173 individuals as samples through convenience sampling. The data collection instrument was a researcher-made questionnaire covering demographic data (age, marital status, previous and current work experience, type of physical activity, work-related activity, height and weight of individuals, height and weight of tools, etc.) and specialized data (Nordic Self-Reporting Questionnaire). SPSS software and independent T-test were used to analyze the collected data. **Results**: 93% of street cleaners experienced musculoskeletal disorders in at least one organ over the past 12 months and factors associated with these disorders reportedly include occupational experience, age, marital status, height and weight of instrument, Body mass index and posture). The musculoskeletal disorders were found to be most prevalent in lower back (33%) and the shoulders (32.9%) and least prevalent in thighs (5%) over the past 12 months. **Conclusion**: The results showed that musculoskeletal disorders are highly prevalent in different parts of street cleaners' body, and a variety of factors including work experience, age, marital status, tool height, tool weight, tool grip strength and posture are associated with that. The results also showed that correction of body movements and designing an ergonomic tool commensurate with the physical activity of street cleaners can prevent musculoskeletal disorders among them. .

Keywords: Musculoskeletal Disorders; street cleaners; Nordic Questionnaire; Posture

Introduction

Musculoskeletal disorders are Muscle, Tendon, Tendon sheaths, peripheral nerves, joints, bones, ligaments, and blood vessel disorders that are caused either due to repeated strikes over time or an Immediate and acute trauma (such as slipping or falling) .[1] Musculoskeletal disorders are known as the most common work-related diseases al around the world and according to the United States Census Bureau reports, this disorder

Citation: Abbaspour MR, Habibi E. **Identification Prevalence of Musculoskeletal Disorders and its Related Factors among Street Cleaners of Isfahan Municipality.** Archives of Occupational Health. 2020; 4(1): 485-92.
Article History: Received:24 June 2019; Rivised:3 September 2019; Accepted:2 October 2019

[DOI: 10.18502/aoh.v4i1.2248]

accounted for about 32 percent of work-related disease during 2014 (United States Census Bureau, 2015 quoted by.[2] This disorder also accounts for a significant part of economic burdens.[3] Typically, musculoskeletal disorders are responsible for 40% of work-related health costs worldwide.[4] In the USA, the annual economic cost of MSDs is estimated between $45 and 54 billion.[5] Musculoskeletal disorders also lead to reduced quality of work, increased health care costs, absenteeism, and also have numerous adverse economic effects on the individual, organization, and society.[6] In Iran, 15,000 work-related accidents lead to death as well as permanent or temporary maiming of workers each year.[7] Musculoskeletal disorders are among the most important work-related diseases that are highly prevalent in many work environments.[8] These disorders are known as one of the most common causes of occupational injuries and disabilities in developing countries. Studies show that despite the fact that work processes and activities are automated at an increasing trend, work-related musculoskeletal disorders are still one of the leading causes of the lost work time, increased labor costs and human injuries.[9]

According to World Health Organization (WHO) report in 2009, work-related musculoskeletal disorders account for more than 10% of total years lost due to disability[10] and over 40% of work-related illnesses in the United Kingdom are associated with Musculoskeletal disorders.[11] These disorders present in form of painful symptoms in different areas of the body such as the neck, shoulder, elbow, wrist, upper back, hip, and also in form of lesions in some body organs (Axon et al., 1999. Quoted by.[12] Symptoms of this disorder may include one or more complaints, such as pain, swelling, tingling senses, and numbness in upper or lower extremities, stiffness, or motion limitations in one of the joints that may last more than a week or recur at least once a month in a year.[13] Musculoskeletal disorders are multifactorial and aside from work, other factors such as physical, psychological, organizational and individual factors may contribute to causation or aggravation of them.[14] The physical and mechanical Risk factors that contribute to causation or progression of musculoskeletal disorders include repetitive motions, awkward posture, load carrying, application of excessive pressure, and vibration, as well as environmental factors (temperature, humidity, brightness), psychological and organizational factors (high demand and low control situations and lack of social support), and individual factors such as age, gender, and body mass index.[12]

Awkward posture of employees in workplace is one of the most important and most common risk factors that contribute to musculoskeletal disorders.[15] Awkward posture is observed in many jobs and is mainly associated with the nature of job.[16] Street sweeping is one of the jobs that, thanks to its nature, may be associated with musculoskeletal disorders risks. Population growth and uncontrollable development of cities have led to increasing production of solid wastes. These wastes originate from various sources (household, administrative, industrial, etc.) and lack of compliance with standards associated with collection, transportation and disposal of them usually give rise to some environmental problems. By nature, these wastes are contaminated with a variety of pollutants that seriously endanger the health of human and other organisms. Workers involved in waste collection and transportation are more seriously exposed to various risk factors associated with these wastes.[17] According to the estimates of The United Nations Environment Programe (UNEP), about 2.9 billion tons of solid waste are globally generated in 2012.[18] Waste collection is an essential activity worldwide and the collection, transportation and disposal (burying, composting and recycling) of wastes expose individuals to a wide range of adverse work-related factors including biological, chemical, mechanical, Physical and psychological factors. Studies that pivot around identification and control of harmful factors and pollutants associated with street sweeping and waste collection have received a lot of attention over the last few years. Due to some occupational reasons, municipality workers are more vulnerable to various diseases than other people.[19] Thanks to the nature of their job, street cleaners are potentially and practically exposed to a variety of risks and toxic substances.[20]

Street cleaners are frequently exposed to different skin, muscular, and skeletal injuries, such as fractures, sprains, and lacerations. These workers are also exposed to risk of Injuries caused by sharp-edged objects.[21] On the other hand, thanks to the nature of their work that mostly involves collection, transportation and disposal of heavy wastes, the municipality waste collectors are exposed to some risk factors that make them susceptible to back pain and other problems. The considerable pressure they bear on the joints, shoulders, arms and muscles and the frequent static muscle contractions they experience make them prone to Musculoskeletal pains. A comparative study of health problems in Danish street cleaners and waste collectors and other classes of workers in

[DOI: 10.18502/aoh.v4i1.2248]

1984-1992 showed that musculoskeletal disorders (3.5%) are ranked second in the ranking of health problems among street cleaners, while these problems are less frequently observed in other classes of workers.[22]

According to Chubineh and Amirizadeh, waste collectors are exposed to many harming factors including physical factors (heat, humidity, personal hygiene, internal and external pollutants, sound and lighting", chemical and Biologic factors such as "virus, Rickettsia, bacteria, parasites, fungi", ergonomic factors "harmful physical conditions, repetitive motions, harmful forces" and events such as "accidents, falls and injuries from penetration of sharp-edged objects" that may expose them to more serious injuries and risks.[23] Although workplace plays a major role in development of many musculoskeletal disorders, ergonomic principles can help prevent or at least reduce the severity of these disorders.[24] Despite the fact that musculoskeletal disorders lead to reduction of work quality, increased health care costs, absenteeism, and have many adverse economic effects on the individual, organization, and society.[25] Traditional methods that are mostly reliant on manpower are still being employed as the only waste collection and disposal methods in most countries of the world and the technological, mechanization and automation advances have unfortunately failed to obviate the need for manpower. A large number of workers affiliated with municipalities, companies, etc. are still offering urban services all around the world and this makes it obviously necessary to conduct some basic studies to assess their health status.[26]

Since street cleaners (urban service workers) are workers who, thanks to the nature of their job and the tools they use, are exposed to adverse physical conditions, it is necessary to study and analyze the prevalence and symptoms of these disorders and identify factors that affect them, in order to devise appropriate strategies to reduce the risk of these disorders among them. According to the afore-mentioned definitions and points, the prevalence of musculoskeletal disorders among urban service workers and their adverse financial effects on municipalities, companies and the society are of vital importance. The present study is considered innovative because, to the best of the author's knowledge, it is the first study that addresses the prevalence of musculoskeletal disorders in different anatomical regions of street cleaners and evaluates factors associated with them. Bearing in mind the afore-mentioned point, the present study seeks to find answer to the following questions: how prevalent are musculoskeletal disorders among street cleaners of the city of Isfahan? Which anatomical regions are most affected by these disorders? And what factors associated with musculoskeletal disorders are addressed in the Nordic questionnaire?

Methods

The present causal-comparative study is applied in terms of nature and cross-sectional in terms of time. Generally speaking, the present research can be regarded as a field study. The population of this study includes all the Isfahan municipal urban service workers (1500 individuals) during 2018. The sample size (at least 173 individuals) was calculated from the Cochran's formula (Equation1).

Equation 1: $$n = \frac{\frac{z^2pq}{d^2}}{1+\frac{1}{N}\left(\frac{z^2pq}{d^2}-1\right)} = \frac{196}{1+\frac{1}{1500}(195)} \cong 173$$

N: population size is 1500.

Z: confidence coefficient of 95% that is equal to 1.96.

P: estimate of the prevalence of musculoskeletal disorders among municipal urban service workers which, taking into account their considerable diversity, is considered to be equal to 0.5 in order to obtain the largest possible sample size

d: The margin of error (confidence interval) that is considered equal to 0.07.

Survey method (library and field study) was used for data collection. The collected data were analyzed using Independent T-test and SPSS 22 software. In the present study, Nordic questionnaire was used to collect the required data. The validity and reliability of the questionnaire was confirmed by Ezgeli et al. (2006) with a correlation coefficient of 0.91.[17] The Researcher-made questionnaire covered demographic data (age, marital status, previous and current work experience, type of physical activity at work, type of occupational activity, the individual's height and weight, the tool height and weight, etc.) and specialized data (Nordic Self-Report Questionnaire). The Nordic questionnaire consisted of two parts: (a) a 17-item general demographic questionnaire; and (b) a specialized questionnaire with items associated with prevalence of musculoskeletal disorder in the 9 anatomical regions of the body (neck, shoulders, back, elbows, upper back, arms, wrists, thighs, knees, ankles and legs).

Once the necessary permits for field study were obtained from the Isfahan Municipality, data collection

[DOI: 10.18502/aoh.v4i1.2248]

and sampling were carried out. Questionnaires were distributed among the literate workers (n = 51) and the necessary information for completion of them were provided. The Questionnaires considered for illiterate workers (n = 122) were also completed according to their statements. A tape measure and a digital weighing scale (Bioware) with capacity of 150 kg and accuracy of 100 grams were used to measure the workers and tools (broomstick) height as well as the workers and the tools weights respectively. The body mass index of the samples was also calculated from the following equation.

Equation 2: $Bmi=\frac{Mass\ (Kg)}{(height\ (m))2}$

Results

In the present study, 173 street cleaners were subjected to investigations. Most of the workers were married (93.1%), 41-50 years old (45.1%) and had 1- 10 years of occupational experience (45%). 88 (51%) subjects worked in both sitting and standing postures and 85 (49%) subjects worked in standing posture alone. It should be noted that 53 (31%) of the subjects performed repetitive motions including lifting, load carrying and staircase ascending - descending during their 8-hour shift (2 - 10 am). Figure 1 shows the body movements of other workers:

The street cleaners, thanks to the nature of their job, variable geographical locations and lack of access to any specific resting place, don't follow any regular work-rest schedule. Table 1 shows the prevalence of musculoskeletal disorders among these workers.

As Table 1 shows, musculoskeletal disorders are highly prevalent among Isfahan municipal urban service workers (street cleaners). According to the table, 161 individuals (93%) suffer from musculoskeletal disorders in at least one of the organs Table 2 shows Factors associated with musculoskeletal disorders among urban service workers. As the table shows, the mean value of work experience, age, tool height, tool weight, and body mass index is higher in subjects with musculoskeletal disorders.

T-test was used to evaluate the factors associated with musculoskeletal disorders among street cleaners. The T-test results are provided in Table 3.

According to Table 3, p value and t-test statistics showed that workers with and without musculoskeletal disorders (P <0.05) can be easily distinguished based on factors associated with musculoskeletal disorders (previous work experience, current work experience, age, marital status, tool height, tool weight, BMI, type of physical activity (Lifting, pulling, load carrying, pushing and staircase descending and ascending) and the type of work-related activity (sitting, standing, both). This means that there is a positive correlation between prevalence of musculoskeletal disorders and the afore-mentioned variables. Results associated with the prevalence of musculoskeletal disorders in different anatomical regions are presented in Figure 2. As the figure shows, musculoskeletal disorders are most prevalent in back (33%) and shoulders (32.9%) and least prevalent in thighs (5%).

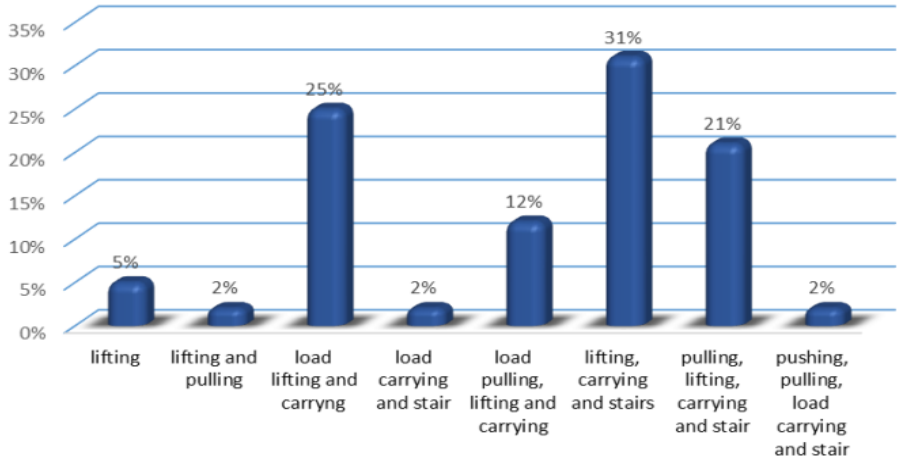

Figure 1. Column diagram of work-related physical activity of street cleaners

[DOI: 10.18502/aoh.v4i1.2248]

Table 1. Prevalence of Musculoskeletal Disorders among Urban Service Workers (street cleaners) in the city of Isfahan

		frequency	Frequency percentage	Cumulative Frequency percentage
variable	Subjects suffer from Musculoskeletal disorders in at least one of the anatomical regions of their body	161	93	93
	There are no signs of Musculoskeletal disorder in any of the organs	12	7	100
	Total	173	100	

Table 2. The relationship between musculoskeletal disorders and demographic variables among subjects (n = 173)

variables	Subjects with musculoskeletal disorders (n=161)		Subjects without musculoskeletal disorders (n=12)	
	mean	Standard deviation	mean	Standard deviation
Previous work experience(years)	13	9	12.025	6
Current work experience(years)	15	7	10	7
Age(years)	44	8	43	6
Tool height (cm)	190	16	186	16
Tool weight (gr)	1565	349	1500	369
BMI(Kg/cm2)	23	3	20	2

Table 3. T-test statistics for factors associated with musculoskeletal disorders among street cleaners

	Independent T test		
variables	T-test statistic	Degree of freedom	*P*- value
Previous work experience(years)	1	12	*0.001
Current work experience(years)	0.000	11	*0.000
age(years)	0.000	14	*0.000
Marital status	3	160	*0.000
Tool height(cm)	0.000	12	*0.001
Tool weight(gr)	0.000	12	*0.000
BMI(Kg/cm^2)	-4	15	*0.001
Type of physical activity	0	12	*0.000
Type of work-related activity	-0.060	12	*0.000

*P=0.05

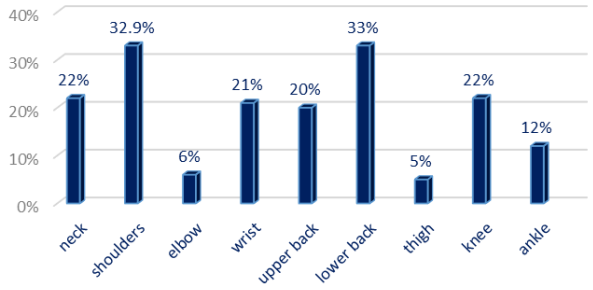

Figure 2. Prevalence of Musculoskeletal Disorders in Different anatomical regions of street cleaners

Discussion

According to the results, 161 subjects (93%) suffered from musculoskeletal disorder in at least one of the anatomical regions of their body. Thus, it can be argued that musculoskeletal disorders are highly prevalent among Isfahan municipal urban service workers (street cleaners). The results of this study are consistent with the results of studies conducted on waste collection workers in India and Brazil (musculoskeletal disorders are 79% and 88% prevalent in at least one of the nine anatomical regions respectively.[27, 28] Haghi et al [29] also showed that 82.4% of Isfahan green space workers suffer from musculoskeletal disorders. Considering the similarities between Haghi's study and the present study in terms of type of activity, the results obtained from this study are of vital importance. In interpretation of findings, it should be pointed out that the National Institute of Occupational Safety and Health (NIOSH) has classified work-related occupational health complications in terms of prevalence, severity, and preventability. In this classification work-related musculoskeletal disorders are ranked second (after respiratory diseases).[30] According to the World Health Organization (2009) 10% of total years lost due to disability can be attributed to work-related musculoskeletal disorders.[10] These disorders are among the major factors that significantly impair the efficiency and economic profits of industries, and lead to disabling injuries in workers[31]

Moreover, according to the results, workers with and without musculoskeletal disorders can be easily distinguished based on previous work experience, current work experience, age, marital status, tool height, tool weight, BMI, type of physical activity and type of work-

[DOI: 10.18502/aoh.v4i1.2248]

related activity (P <0.05). Therefore, it can be argued that work experience, age, marital status, tool height, tool weight and posture are the factors that could contribute to musculoskeletal disorders among Isfahan city municipal street cleaners. These results are consistent with Besahel [32] who showed that body posture when pulling heavy objects can significantly affect arm and lower body score and there is a positive correlation between arm and wrist score and self-reported lower arm and wrist pain. the results of the present study are also consistent with Molla Aghababaie et al.[33], who investigated the prevalence of musculoskeletal disorders and their relationship with stress in staff of a metal industry and showed that individuals are more likely to develop a variety of disorders as they grow older.

Work environment, the quality of work, as well as the worker's postures and movements especially the awkward or repetitive ones, can contribute to development of some health problems and disorders. Unsuitable tools, inadequate space, light reflection or inadequate light, inadequate or polluted air, excessive heat or cold, lack of adequate ventilation, noisy environments, as well as dangerous and health-threatening equipment and materials, contribute to development of occupational diseases and musculoskeletal disorders.[34] Awkward posture and repetitive motions increase the risk of musculoskeletal disorders, and workshops on ergonomic working principles can, to some extent, reduce the risk of these problems and diseases.[35]

According to the results, musculoskeletal disorder are most prevalent in lower back (33%) and shoulders (32.9%) and least prevalent in the thighs (5%) of municipal street cleaners over the last year.thus, it can be concluded that musculoskeletal disorders are highly prevalent in different anatomical regions of Isfahan municipal urban service workers. These results are consistent with Zarei et al.[2], who showed musculoskeletal disorders are most prevalent in the lower back, knee, arm and wrist of steel company workers and with Haghi et al. who showed that musculoskeletal disorders are most prevalent in knee (59.3%) and upper back (52.8%) of green space municipal workers in the city of Isfahan. These disorders usually involve upper back, cervical spine and upper extremities.[36] Physical factors such as awkward posture, heavy load lifting and carrying, and activities that involve repetitive motions, psychological and personal factors are among the potential risk factors that contribute to development of musculoskeletal disorders.[37] In Iran, back pain is the second most common cause of absenteeism and the fifth most common cause of hospitalization.[38] Avoiding risk factors such as long time sitting and standing, awkward posture and the unwanted forces and pressures that are usually exerted on body at work can help reduce the likelihood of developing musculoskeletal disorders and alleviate back pain.[39]

Major limitations of this study are associated with self-report measures. Considering the specific working hours of municipal urban service workers (2 to 10 am), they usually felt tired during completion of questionnaires, thus the results may have been adversely influenced by wrong or unrealistic responses. In order to counter the potential effects of the afore-mentioned factors, the workers were provided with some instructions during completion of the questionnaire. Conduction of a similar study on other Isfahan municipal workers and comparison of the results with those of the present study is recommended as a theme for further studies.

Conclusion

The results showed that musculoskeletal disorders are highly prevalent in different anatomical regions of street cleaners, and some preventive measures must be taken into account (by health experts) to reduce the risk of musculoskeletal disorders as municipal urban service workers grow old. Moreover, considering the correlation between musculoskeletal disorders and body mass index of municipal urban service workers, training courses on weight loss and BMI can help municipal urban service workers take adequate preventive measures. Since musculoskeletal disorders are directly correlated with the height and weight of the worker's tools, designing ergonomic tools commensurate with posture and body movements and training courses on proper body posture during work and load handling can significantly contribute to prevention of musculoskeletal disorders in municipal urban service workers. According to the afore-mentioned points, it is recommended to reduce the work load of municipal urban service workers (street cleaners) as they grow older and have them attend periodic preventive care courses to reduce the risk of musculoskeletal disorders in them as they age.

[DOI: 10.18502/aoh.v4i1.2248]

Acknowledgment

This research is the result of a research proposal approved by Islamic Azad University of Najafabad under code 15021214962021. The authors of the article would like to thank all the Isfahan Municipality authorities and street cleaners for their assistance during completion of this study.

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