ORIGINAL RESEARCH

Prevalence and Associated Factors of Musculoskeletal Disorders Among Cleaners Working at Mekelle University, Ethiopia

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Background: Musculoskeletal disorder is a common cause of morbidity, disability, and poor quality-of-life. Its burden among cleaners in developed countries ranges from 56–90%. However, there are a lack of studies in developing countries, particularly in the study area. Thus, the result of this study will help to resolve health problems caused by musculoskeletal disorders among cleaners.

Purpose: The objective of this study was to identify the prevalence and associated factors of musculoskeletal disorders among cleaners working at Mekelle University.

Materials and Methods: An institutional-based cross-sectional study was conducted on 270 cleaners. Simple random sampling was used to select the study participants. Data were collected through interview using the standard Nordic Musculoskeletal Questionnaire. Descriptive statistics and bivariate logistic regression were done to identify factors associated with musculoskeletal disorder. In bivariate logistic regression analysis, variables with a *P*-value<0.25 were modeled to multivariate analysis. Variables with a *P*-value≤0.05 with 95% confidence interval (CI) in multivariate model were taken as statistically significant. Finally, AOR with 95% CI at a *P*-value<0.05 was reported.

Results: This study found that the prevalence of musculoskeletal disorders among cleaners was 52.3% in the past 12 months and 31.8% in the last 7 days. Time pressure (AOR=3.25, 95% CI=1.08–9.77), work experience (AOR=2.49, 95% CI=1.12–5.52), feeling exhausted (AOR=2.68, 95% CI=1.16–6.20), working hours per day (AOR=3.55, 95% CI=1.54–8.20), awkward posture (AOR=15.71, 95% CI=6.47–38.17), and those who work more than 2 hours in sustaining position (AOR=8.05, 95% CI=2.25–28.85) showed a statistically significant association with musculoskeletal disorder.

Conclusion: Musculoskeletal disorders were commonly reported among cleaners working at Mekelle University. Time pressure, work experience, feeling exhausted, working hours per day, awkward posture, and working >2 hours in sustaining position were statistically significant in their association with musculoskeletal disorders.

Keywords: prevalence, associated factors, musculoskeletal disorders, cleaners

Introduction

Musculoskeletal disorders (MSDs) are injuries or dysfunctions affecting muscles, bones, nerves, tendons, ligaments, joints, cartilage, and spinal discs. MSDs include sprains, strains, tears, soreness, pain, carpal tunnel syndrome, hernias, and connective tissue injuries.[1,2]

Occupational injuries are the most common health problems among cleaners worldwide.[3] MSDs are the second most common cause of disability in the world,

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with a double burden of economic costs and healthcare needs of individuals and a major social problem due to the associated disability.[4] The prevalence of MSDs was 74% in the UK,[5] 90% in Taiwan,[4] 1-year prevalence was more than 70%,[6] 4-weeks prevalence at works was 84%,[7] and hospital cleaners in Norway was 56%.[8] The point prevalence rate of LBP among cleaners in Nigeria was 77.2%.[9]

Often, cleaners participate in different physical activities that may change their normal body mechanics, which potentially leads them to develop musculoskeletal disorders over time.[10–12] In addition to this, cleaners face a variety of risk factors related to repeated manual handling and the completion of repetitive work. This includes high workload, conducting the same task frequently, the speed and intensity of work, lack of involvement and participation in the design of work arrangements, low appreciation, and weak organizational strategies (eg, risk assessment, reporting systems, training).[5,13] Most specifically, repeated repetition, uncomfortable postures, and heavy lifting are biomechanical risk factors for MSDs.[1,14]

Musculoskeletal health problems among cleaners have already been investigated worldwide. However, cleaners in different parts of the world may suffer from different levels of MSDs due to the diverse working environments.[15] In Sub-Saharan countries, particularly in Ethiopia, the prevalence of musculoskeletal disorders and its associated factors among cleaners is not well known. Given these drawbacks, identifying the magnitude and risk factors of musculoskeletal disorders among cleaners might help to develop preventive health strategies and policy, interventional guidelines. Therefore, the aim of this study was to determine the burden of musculoskeletal disorders and its associated factors among the cleaners working at Mekelle University.

Materials and Methods
Study Area and Period
The study was conducted at different campuses of Mekelle University, which is one of the biggest and fastest growing Universities in Ethiopia. It is located around 780 kilometers from the Ethiopian capital city (Addis Ababa). It has five campuses; Endayesus (main), Adihaqi, Ayder college of health sciences and comprehensive specialized hospital, Aynalem, and Kalamenino.[16] There were 676 cleaners working at all campuses of Mekelle University at the time of study. This study was conducted from December 2018 to June 5, 2019. The study period was from April, 20 to May 18, 2019.

Study Design and Population
An institutional-based cross-sectional study was conducted. All cleaners who were working at Mekelle University were the source population. The study population of this study were all sampled cleaners working at Mekelle University during the study period. Participants who had major surgery during the last 6 months, and known pregnant women were excluded.

Sample Size Determination, Sampling Technique, and Procedure
The sample size was determined by using the Epi Info version 7 StatCalc. It was calculated based on the following assumptions: prevalence of musculoskeletal disorders among cleaners was assumed to be 50%, assuming a 5% margin of error (d), 95% confidence level (alpha, α=0.05, two tailed) and with the estimated number of population as 676. Therefore, the total sample size by adding 10% of the non-response rate was 270.

A proportional allocation of the participants was done among the five campuses to employ within the predetermined sample size (Figure- 1). A simple random sampling technique (lottery method) was used to select study participants.

Data Collection Procedures and Data Quality Control Issues
A standardized Nordic Musculoskeletal Questionnaire tool was used to collect the data.[17] This tool includes the following four sections; sociodemographic characteristics, psychosocial, and behavioral factors, and work-related/mechanical (working hours per day, working days per week/per month, additional tasks, ergonomic training, and MSDs).

The questionnaires were translated to Tigrigna and again back to English to confirm consistency. Data was collected by face to face interview by five trained Bsc physiotherapists. Weight was measured using a floor weighing scale (Electrolux, Japan) with participants standing without shoes and wearing light clothing and recorded to the nearest 0.5 Kg. Height was measured using a stadiometer at standing upright with the head in the Frankfort plane and recorded with an approximation of 1 cm. To check the quality of the data, the data collectors and supervisors were trained. One day training was given on how to approach study participants and how to implement the questionnaire. Supervision was also done on the spot by the principal investigator. The questionnaire was
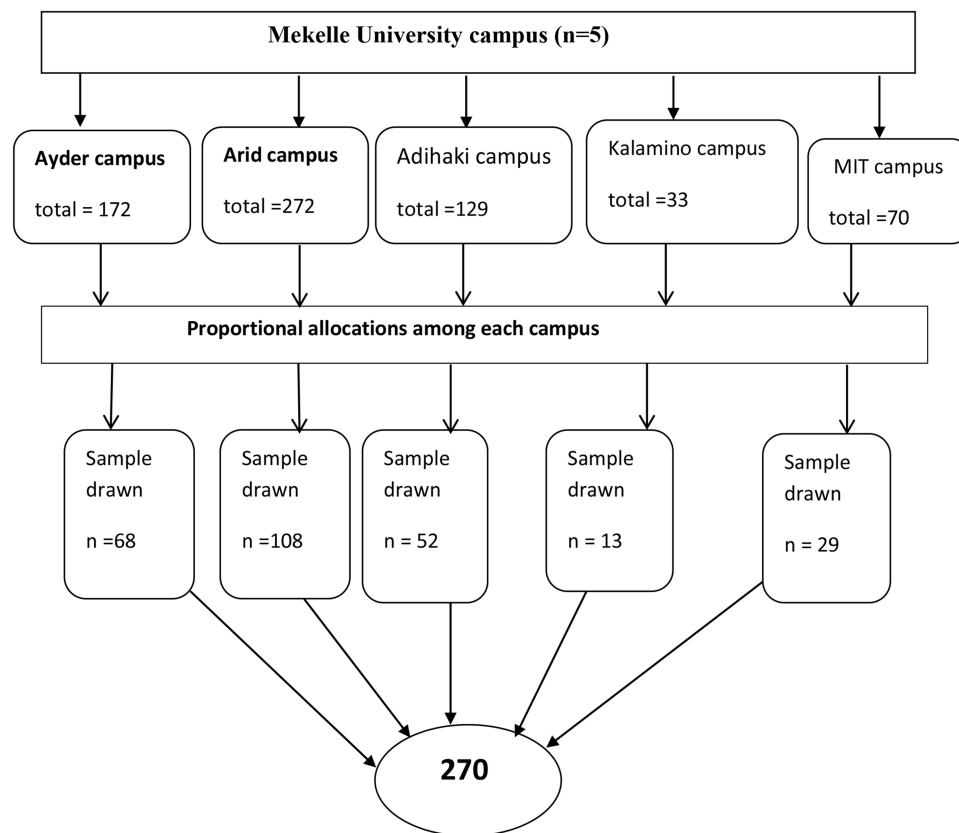
Figure 1 Schematic presentation of sampling procedure.

pre-tested with 5% of the total sample size at the Rift Valley University before the actual data collection to check for the accuracy of responses, language clarity, and appropriateness of the tools. The completeness of data was checked by interviewers and supervisors during the process. The data were checked for its completeness, accuracy, and clarity by the principal investigator and supervisors before data entry. Data cross-checking was done before analysis.

Data Management and Analysis

The data were coded and entered using Statistical Package for the Social Sciences (SPSS) Version 23 for analysis. Descriptive statistics were computed using frequencies with percentages for categorical variables, and mean and standard deviations for continuous variables. Using logistic regression analysis, the association between MSDs and the associated factors was evaluated. Bivariate logistic regression analysis was performed to identify potential associated factors. In bivariate logistic regression analysis, those variables with a P-value<0.25 were modeled in the multivariate logistic regression analysis. In multivariate

logistic regression analysis, those variables with a P-value<0.05 were considered statistically significant.

Model fitness was checked by Hosmer and Lemeshow goodness of fit test. Multi-collinearity was checked by variance inflation factor (VIF) with the cut-off point 10.[18] Finally, AOR with 95% CI at a P-value<0.05 was reported.

Operational Definition

In this study, musculoskeletal disorders means any pain and/or discomfort at least once in at least one body part of the following during the previous 12 months; neck, shoulder, upper back, elbow, lower back, wrist/hand, hips/thighs/, knee, or ankle/feet.

Results
Socio-Demographic/Individual Characteristics of Cleaners

A total of 270 cleaners with a response rate of 264 (97.8%) were enrolled in this study. One participant was excluded due to pregnancy. From the selected participants three declined to interview at the Ayder campus, and two participants at the

Arid campus. All respondents were females, with 21.94±5.6 years of mean age. The majority of the respondents (212, 80.3%) marital status was single. Approximately 75% of participants (198) had a normal body mass index (18.5–24.99). One hundred and twenty-three (46.6%) participants had job experience of less than 6 months (Table 1).

Psychosocial and Behavioral Factors of the Participants

Among the total study participants, 173 (65.5 %) had job stress. Also, 64 (24.2%) of them had time pressure during performing their work (Table 2).

Mechanical and Work-Related/Ergonomic Factors of the Participants

Out of the study participants, 49.2% of them perform their usual activity with both bending and standing positions during routine activity. Most of them (243, 92%) worked more than 2 hours in the same position (standing, bending) (Table 3).

Prevalence of Musculoskeletal Disorder Among Cleaners

The overall prevalence of musculoskeletal disorders among cleaners working at Mekelle University has been found to be 138 (52.3%) in the past 12 months. Cleaners with more than 6 months of work experience (n=91, 64.5%) had MSDs. Of the participants who had time pressure during performing their usual activity, n=53 (82.8%) of them developed MSDs. Among cleaners who had emotional stress, n=20 (69%) had MSDs. Of the participants who had worked ≥8 hours, n=40 (42.1%) of them developed MSDs. Of the participants who had sustained an awkward posture during their working time, n=121 (73.3%) of them had musculoskeletal disorders. The prevalence of MSDs was 84 (31.8%) in the last 7 days. Among the nine body parts, low back pain (n=52, 19.7%) was the most common disorder in the last 12 months. The prevalence of MSDs on the body parts among cleaners working in last past 12 months is shown in the Supplementary Appendix.

Table 1 Socio-Demographic/Individual Characteristics of Cleaners in Mekelle University, Ethiopia (n=264)

Variables		Frequency, n (%)	MSDs Yes (%)
Gender	Female	264 (100)	138 (52.3)
Age	<20 years	164 (62.1)	73 (44.5)
	21–25 years	62 (23.5)	37 (59.7)
	26–30 years	17 (6.7)	13 (76.5)
	≥30 years	21 (8)	15 (71.4)
Marital status	Married	38 (14.4)	19 (50)
	Single	212 (80.3)	107 (50.5)
	Separated	11 (4.2)	9 (81.8)
	Divorced	3 (1.1)	3 (100)
Religion	Orthodox	259 (98.1)	136 (52.5)
	Catholic	1 (0.4)	0 (0)
	Muslim	3 (1.1)	2 (66.7)
	Protestant	1 (0.4)	0 (0)
Level of education	Illiterate	15 (5.7)	8 (53.3)
	Primary school	70 (26.5)	42 (60)
	High school	100 (37.9)	50 (50)
	College and above	79 (29.9)	38 (48.1)
Experience	<6 months	123 (46.6)	47 (38.2)
	≥6months	141 (53.4)	91 (64.5)

Table 2 Annual Prevalence of MSDs on Psychosocial Factors and Behavioral Factors Among Cleaners Working at Mekelle University, Ethiopia (n=264)

Variables		MSDs Yes (%)	No (%)
Smoking	Yes	0 (0)	0 (0)
	No	138 (52.3)	126 (47.7)
Physical exercise	Yes	7 (21.2)	26 (78.8)
	No	131 (56.7)	100 (43.3)
Time pressure	Yes	53 (82.8)	11 (17.2)
	No	85 (42.5)	115 (57.5)
Emotional stress	Yes	20 (69)	9 (31)
	No	118 (50.2)	117 (49.8)
Job satisfaction	Low	95 (72)	37 (28)
	Average	37 (31.9)	79 (68.1)
	High	6 (37.5)	10 (62.5)
Job stress	Yes	103 (59.5)	70 (40.5)
	No	35 (38.5)	56 (61.5)
Feeling exhausted	Yes	106 (60.9)	68 (39.1)
	No	32 (35.6)	58 (64.4)
Additional benefits	Yes	1 (0.5)	0 (0)
	No	137 (52.1)	126 (47.9)

Table 3 Annual Prevalence MSDs on Mechanical and Work-Related/Ergonomic Factors Among Cleaners, Mekelle University, Ethiopia. (n=264)

Variables		Frequency (%)	MSDs Yes (%)
Working hours per day	< 8 hours	169 (64)	98 (58)
	≥ 8 hours	95 (36)	40 (42.1)
Working posture	Standing	20 (7.6)	16 (80)
	Sitting	15 (5.7)	12 (80)
	Bending	99 (37.5)	17 (17.2)
	Combination of movements	130 (49.2)	93 (7.5)
Awkward posture	Yes	165 (62.5)	121 (73.3)
	No	99 (37.5)	17 (17.2)
Overhead activities	Yes	175 (66.3)	102 (58.3)
	No	89 (33.7)	36 (40.4)
Working >2 hours in sustaining position	Yes	222 (84.1)	133 (59.9)
	No	42 (15.9)	5 (11.9)
Repeated movements (twisting/bending)	Yes	245 (92.8)	132 (53.9)
	No	19 (7.2)	6 (9.9)

Factors Associated with Musculoskeletal Disorders Among Cleaners

In bivariate logistic regression analysis, self-reported MSDs was significantly associated with; age, work experience, job stress, physical exercise, job satisfaction, time pressure during performing the routine activity, feeling exhausted after work, emotional stress, awkward posture, working hours per day, working overhead activity, and repeated movements from an awkward posture. In multivariate logistic regression analysis, self-reported MSDs was significantly associated with time pressure (AOR=3.25, 95% CI=1.08–9.77), work experience ≥6 months (AOR=2.49, 95% CI=1.12–5.52), feeling exhausted (AOR=2.68, 95% CI=1.16–6.20), working hours ≥8 hours per day (AOR=3.55, 95% CI=1.54–8.20), awkward posture (AOR=15.71, 95% CI=6.47–38.17), and those who work more than 2 hours in a sustaining position (AOR=8.055, 95% CI=2.25–28.85) (Table 4).

Discussion

This study was conducted to determine the prevalence and identifying associated factors of musculoskeletal disorders among cleaners working at Mekelle University, Ethiopia. The overall prevalence of musculoskeletal disorders

among cleaners working at Mekelle University was found to be 52.3%. Low back pain was the most prevalent among cleaners (34.8%), followed by wrist pain (17.4%).

This study found that the prevalence of MSDs within the past 12 months was 52.3% (95% CI=45.9–58%), which was similar to studies done in the UK (52%),[19] and Norway (56%).[8] Similarly, the findings of this study were comparable to a study done in Finland.[12] This similarity could be because both studies used the same tool (standard Nordic questionnaire) to assess musculoskeletal disorders and data was collected by interviewing the participants.

However, the findings of the present study were lower compared to studies done in Sweden (64%),[6] the UK (74%),[5] and Taiwan (90%).[4] This variation might be due to differences in the methodology, the setting of cleaning site, sample size, awareness and openness to the questions, individual perception of pain, cultural differences, and the income of study participants. Musculoskeletal disorders in cleaning work may also depend on the working tasks and cleaning equipment applied, on the cleaning products used, and on the environment to be cleaned. Despite the similarity in work tasks, there may be substantial differences in workload. Another possible explanation for the difference was the age of participants, for example a study done in Taiwan was 47.9±8.9 years,[4] and the assessment tools used to evaluate MSDs were varied. There were differences in geographical areas, and their prevailing cultures, which are related to differences in work conditions and the impact of occupational hazards.[3]

The findings of this study revealed that work experience, feeling exhausted, time pressure, awkward posture, working hours per day, and working more than 2 hours in a sustained position had a statistically significant effect on MSDs. Work experience was found to be positively associated with MSDs among cleaners. Cleaners who had more than or equal to 6 months of work experience were 3-times more likely to develop MSDs compared to those who had less than 6 months (AOR=2.5, 95% CI=1.12–5.52). MSDs are the cumulative effect of repetitive physical load. This result is supported by studies done in Taiwan and Britain.[4,11] On the contrary, work experience was not statistically significant on studies done in Australia and Denmark.[2,20] This difference may be attributed to the variation in the nature of the study and limited sample size of the study in Denmark.

Cleaners who had time pressure while performing their tasks were 3.2-times more likely to develop MSDs

Table 4 Bivariate and Multivariate Logistic Regression Analysis of Factors Associated with MSDs Among Cleaners Working at Mekelle University, Ethiopia (n=264)

Variables		MSDs		COR (95% CI)	P-value	AOR (95% CI)	P-value
		Yes	No				
Work experience	<6 months	47 (38.2)	76 (61.8)	1.00*			
	≥6 months	91 (64.5)	50 (35.5)	0.34 (0.206–0.561)	0.00	2.5 (1.127–5.522)**	0.024
Physical exercise	Yes	7 (21.2)	26 (78.8)	1.00*			
	No	131 (56.7)	100 (43.3)	4.9 (2.03–11.663)	0.00	0.54 (0.143–2.015)*	0.35
Time pressure	Yes	53 (82.8)	11 (17.2)	6.5 (3.213–13.224)			
	No	85 (42.5)	115 (57.5)	1.00*	0.00	3.25 (1.084–9.777)**	0.035
Feeling exhausted	Yes	106 (60.9)	32 (35.6)	2.8 (1.666–4.792)			
	No	68 (39.1)	58 (64.4)	1.00*	0.00	2.7 (1.161–6.203)**	0.021
Awkward posture	Yes	121 (73.3)	44 (26.7)	13.265 (7.093–24.806)			
	No	17 (17.2)	82 (82.8)	1.00*	0.00	15.7 (6.47–38.176)**	0.00**
Working hours per day	<8 hours	98 (58)	71 (42)	1.00*			
	≥8 hours	40 (42.1)	55 (57.9)	0.53 (0.317–0.877)	0.014	3.5 (1.543–8.204)**	0.003
Working >2 hours in sustaining position	Yes	133 (59.9)	89 (40.1)	11.06 (4.18–29.221)			
	No	5 (11.9)	37 (88.1)	1.00*	0.00	8 (2.25–28.85)**	0.001

Notes: *Reference 1.00, **Statistically significant.
Abbreviation: COR, crude odds ratio; AOR, adjusted odds ratio.

compared to those who had no time pressure. This result was also supported by the study done in Taiwan, where the standard Nordic Musculoskeletal Questionnaire was used and data were collected by interviewing participants, used in the current study.[4] This could be due to the cleaners substantially working hard and fast, to complete their tasks, which lead them to develop MSDs.

Feeling exhausted became statistically significant with adjusted odds (AOR=2.7, 95% CI=1.16–6.20) at P=0.02. This indicates that those who felt exhausted after their work were approximately 3-times more likely to develop MSDs than those who had not felt exhausted. This was supported by a study done in Taiwan.[4] Cleaning work had an intensive and repetitive movement in an awkward posture, which contributes to different MSDs. This intensive and repetitive movement can result in cumulative load and fatigue, which in turn affect capacity.[14]

Cleaners who were working more than or equal to 8 hours per day were 3.5-times more likely to develop MSDs than those cleaners who worked less than 8 hours per day (AOR=3.5, 95% CI=1.54–8.20) at P=0.003. This finding is confirmed by the research carried out in Nigeria with the 95% CI AOR=1.96.[9] Besides, it was also confirmed by a study carried out on 180 cleaners in Taiwan.[4] Working with minimal muscle rest for long hours is a risk factor for

the development of work-related disorders that arise in cleaning jobs.[2,6] The possible explanation could be that manual work for long hours raises feelings of fatigue or stiffness, tightness of muscles, and tender spots in the muscles. The average exposure time could have an accumulated effect on increased risk of developing MSDs.[6] Cleaners working in an awkward position were 15-times more likely to develop MSDs and were strongly associated with MSDs (AOR=15.7, 95% CI=6.47–38.17) at P<0.001. This research was consistent with results from previous US and Taiwan studies.[4,21] A possible explanation could be that, irrespective of the type of cleaning equipment used, their work had physical demands attributing static muscle loads and repetitive movements of various parts of the body (eg, low back, arms, and hands), causing MSDs.[4] Cleaners who work more than 2 hours in a sustaining position were 8-times more likely to develop MSDs compared to those who did not participate in this position (AOR=8, 95% CI=2.25–28.85). Likewise, a study performed in Australia has confirmed this.[2] The possible reason could be that much of the cleaning activity requires the repetitive movement in some positions to complete their job. This may result in stretching of muscles and other structures causing weakness, shorting of the soft tissue, and biomechanical change that leads to pain and discomfort.

Limitations of the Study

The limitation of this study was that almost half of the work experience of the study participants was shorter than 6 months. It may have underestimated the scale of the MSDs.

Conclusion

Based on this study the burden of musculoskeletal disorders among cleaners in Mekelle University is found to be moderate. Low back pain was the most prevalent among cleaners (34.8%), followed by wrist pain (17.4%). MSDs were strongly associated with time pressure, work experience, feeling exhausted, awkward posture, working hours per day, and working more than 2 hours in sustained position. Hence, the university authorities and health professionals are recommended to take preventable measures (ergonomics training, physical exercise) of musculoskeletal disorders with further experimental researches.

Data Sharing Statement

Since this is a funded work, the data sets used and/or analyzed during the current study are available from the corresponding author on reasonable formal request.

Ethics Approval and Consent to Participate

All participants signed an informed consent document approved by Mekelle University's Research Ethics Review Board and in accordance with the Declaration of Helsinki.

Disclosure

The authors declare that they have no competing interests for this work.

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