Musculoskeletal Disorders among Iranian Coal Miners at 2014

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ABSTRACT

Some factors such as stooping posture and frequent kneeling in miners can increase prevalence of their musculoskeletal disorders Present study was performed for assessment of MSDs prevalence among Iranian coal miners and finds its relationships with some their characters including age, work experience and body mass index.

Participants in the persent cross sectional study, were 505 coal miners which selected among Iranian coal miners by simple random method. Data of musculoskeletal disorders (MSDs) gathered by Standardized Nordic self-reporting questionnaire. Demographic and work related data were collected into the check list.

Findings of persent study showed that 56.1% and 66.5% of study miners claimed one of the MSDs complaints during last week and in the last year respectively. Lumbar, Knee(s) and Back had most common MSDs prevalence at last week and year. MSDs prevalence had significant association with age ($P \leq 0.02$) and non-significant association with BMI ($P \geq 0.8$) of workers.

MSDs in Iranian coal miners were happened in high rate. Ergonomic interventions strategies in the workplaces must be focussed for elimination of environmental hazards such as apposition at the time of work, manual handling of heavy loads.

Keywords: Coal Miner; Ergonomic Program; Musculoskeletal Disorders Prevalence; Nordic Questionnaire, Occupational Medicine

INTRODUCTION

Musculoskeletal disorders (MSD) had been reported as one of the increasing burden of societies and national health policy makers search to find suitable national preventive and interventional programs for MSD prevention [1, 2].

MSDs are related disorders to muscle, tendons and nerves [3]. Repetitive tasks and awkward positions are known as work related risk factors and age, gender and psychological characters are known as personal risk factors of MSD in miners [4, 5]. According to note above, MSD prevalence studies among workers follow two main purposes: detecting MSD prevalence rate and finding causative and other relative factors which had impact on this rate.

Burdens of MSD moreover miners had impacts on industries and societies in the general view. In developing countries, we have several problems had been reported about workplace related disorders. There is poor working condition and no local or national effective MSD preventive program among workers [4, 6, 7].

Some factors in miners can increase the prevalence of their musculoskeletal disorders. Frequent kneeling has been associated with an increased risk of knee disorders, including knee-joint inflammation, bursitis and osteoarthritis [8-10]. The stooping posture has similarly been associated with an increased risk of low back [11] and also have been associated with degenerative changes in the lumbar spines of underground miners [12]. According to these relationships, it is important to develop an awareness of the social burden associated with these injuries. there is worry about suspected higher rate of MSDs prevalence in Iranian miners and according search on the literature, there is no epidemiological study in Iranian miners to assess the prevalence of MSDs.

Present study was performed for evaluation of the MSDs prevalence among Iranian coal miners.

MATERIALS AND METHODS

In this cross sectional study samples were full-time workers of three main Coal mines and selected with multi stages randomize sampling. Workers at each Coal mines according to the number of workers had a chance for participation in on the study and according that we distributed 565 questionnaires and finally 505 (response rate: 89.38%) questionnaires were backed to us. MSDs Data gathered by Standardized Nordic self-reporting questionnaire [13]. Study participants must have to study inclusion criteria including 20-50 years old age and at least one-year work history without extra job. Included workers who had a history of renal or liver failure, bone fracture, neurodegenerative disease, major surgery, rheumatic or musculoskeletal disorders were excluded from the study. The questionnaire included questions about age, duration of occupation as a worker, weight of carried loads, daily working hours and musculoskeletal complaints in each of the following body regions: neck, shoulder, elbow, wrist/hand, upper back, lumbar, one or both hips/thighs, one or both knees and one or both ankle/feet. Data on daily working hours were obtained by the time spent in the workplace. The validity and reliability of the questionnaire had been investigated and approved in different studies and several languages including the Persian language [14, 15]. Musculoskeletal complaint was defined as pain or discomfort experienced in the different body regions, that had continued for at least a few hours during the past week or 12 months. Noted pain has improved on the weekends, vacations and holidays. All medical examination and questionnaire filling were supervised by the research team.

After Approving study in ethical committee of occupational medicine research center and Iran University of medical science and health services, a cover sheet was attached to the front of Nordic questionnaire and we demonstrated our study and instruction for completion of forms. Our forms were distributed and collected during one week. We had no penalties or rewards for participations to the study participants and researchers were ready to answer all of their questions. Informed consent was implied when questionnaires were voluntarily completed and returned.

Nordic questionnaire

The Nordic Musculoskeletal Questionnaire (NMQ) was developed from a project funded by the Nordic Council of Ministers [13]. The aim was to develop and test a standardized questionnaire methodology allowing comparison of low back, neck, shoulder and general complaints for use in epidemiological studies. The tool was not developed for clinical diagnosis. This questionnaire can be used as a questionnaire or interview device [16].

The NMQ has been used in several studies for musculoskeletal problems evaluation, including computer and call center workers [17], car drivers [18], coopers in the whisky industry [19] and forestry workers [20]. Previous studies reported that the NMQ is repeatable, sensitive and useful as a screening and surveillance tool. However, medical examination is essential to establish a clinical diagnosis [21, 22].

Statistical analysis

presenting study groups, data showed as mean ± standard deviation for continues variables and frequency (percentage) for discrete variables. Chi squared test was used to compared demographic variable between study groups. This article has two major propose, Firstly chi-square test was used to comparison of MSDs between study groups. Second this question is answered that are MSDs frequency different in our study samples after adjusting for demographic and health related variables. A multinomial regression model was used for answering this question. In this model one of MSDs in recent week and year selected respectively as dependent variable. Demographic variable including age, sex, dominant hand, past job history and BMI was inserted in the model. A backward (Likelihood ratio) procedure was used in this analysis. Variables are entering in the model if they had significant level lower 0.050. Calculation was done using the SPSS version 16 (SPSS Inc. Chicago Ill) statistical program and p-value lower 0.050 selected as significant level.

RESULTS

Demographic items in our subjects

We distributed a questionnaire to 505 coal miners of three Iranian mines which were selected randomly from their total workers. Their average age was 36.86±13.50 and 471 (93.27%) workers were male. Study subjects worked in the company an average 56 hours (at least one working shift) per week and average of their job experience was 11.1±8.8 years (range: 1-40 years). Among study workers 414 (81.98%) workers were right-handed and mean of their BMI was 25.5±9 Details of demographic variables were presented in Table 1.

Table 1. Frequency distribution of demographic variables among include subjects

Personal character	Mean	Standard deviation/percentage	Min-Max
Age (year)	36.86	13.50	20-65
BMI (Kg/m^2)	25.50	9	21.50-
Career duration (year)	11.1	8.80	35.7

MSD prevalence in workers at recent week and year

According to results of Nordic MSD questionnaire, one week and 12-month period-prevalence of MSD to any of the nine body sites were 56.1% and 66.65% respectively. MSD in last week was most commonly reported at the lumbar (68.82%), followed by the knee(s) (61.29%), back (51.25%), shoulder (39.07%) and in 12-months period these rates were most commonly reported at the lumbar (42.90%), followed by the knee(s) (39.88%), back (32.02%), shoulder (23.56%) and neck (22.96%). In last year workers reported that MSD of lumbar (44.82%), Knee(s) (38.69%), back (33.72%) and ankle/feet(s) (26.97%) respectively cause limitation in their function. Details of other MSD prevalence were reported in Table 2 and 3.

Table 2. MSD prevalence at recent week in our subjects (n=279)

Body region	Frequncy	Percentage
Lumbar	192	68.82
One or both knees	171	61.29
Back	143	51.25
Shoulder	109	39.07
Neck	103	36.92
Wrist/hand	97	34.76
One or both hips/thighs	94	33.69
One or both ankle/feet	84	30.11
Elbow	70	25.09

Table 3. MSD prevalence at recent year in our subjects (n=331)

Body region	Frequency	Percentage
Lumbar	142	42.90
One or both knees	132	39.88
Upper Back	106	32.02
Shoulder	78	23.56
Neck	76	22.96
One or both hips/thighs	72	21.75
One or both ankle/feet	61	18.43
Elbow	60	18.13
Wrist/hand	60	18.13

In analysis of the relationship between age and BMI of workers with MSDs prevalence in workers in last week and year, we saw that MSDs prevalence had significant association with age (P≤0.02) and non-significant association with BMI (P≥0.8) of workers. According to job experience, study participants divided to three groups: less than 5 years, 5-20 years and more than 20 years. Prevalence of musculoskeletal disorders of last week in participants with less than five and more than 20 years were significantly higher than participants in 5-20 years job experiences (P≤0.02). Similar significant difference was seen in the prevalence of musculoskeletal disorders of last year (P≤0.01)

Table 4. MSD prevalence at recent one week and year in our subjects according their age, BMI and work duration

Study variables		Work duration	MSD (%)		P-value
			Positive	Negative	
Work duration	**Recent week**	< 5 years	47.7	52.3	0.02
		5-10 years	51.6	48.4	
		10-15 years	64.9	35.1	
		15-20 ears	65.9	34.1	
		>20 years	64.6	36.4	
	Recent year	< 5 years	56.1	43.9	0.01
		5-10 years	66.2	33.8	
		10-15 years	64.9	35.1	
		15-21 ears	78.0	22.0	
		>20 years	74.6	25.4	
Age groups	**Recent week**	<25	55.8	44.2	0.01
		25-34	46.9	53.1	
		35-44	62.5	37.5	
		45-59	66.2	33.8	
		>60	100	0	
	Recent year	<25	62.8	37.2	0.03
		25-34	59.9	40.1	
		35-44	72.7	27.3	
		45-59	76.6	23.4	
		>60	100	0	
BMI groups	**Recent week**	<20	52.3	47.7	0.82
		20-24	57.3	42.7	
		25-29	53.5	46.5	
		>30	62.5	37.5	
	Recent year	<20	64.6	35.4	0.85
		20-24	66.4	33.6	
		25-29	68.8	31.2	
		>30	59.4	40.6	

Results of logistic regression analysis

Logistic regression analysis held after entering demographic data into the model, the results explained that only age in both at recent year for the Lower back troubles was significantly important. (Table 5). That means by increasing of the Age, the Low back troubles would be more occurred. Another result of the test didn't show any significant variables in the regression model for Wrist/Hand troubles. On the other hand, other demographic factors didn't have a significant impact on MSDs.

Table 5- Results of logistic regression analysis for Low Back troubles in participants at recent year

Variables	Beta	Standard Error	Significances	EXP(B)	95.0% C.I.for EXP(B)	
					Lower	Upper
AGE	.053	.009	.000	1.054	1.035	1.073
Constant	-2.597	.331	.000	.075		

DISCUSSION

Findings of persent study showed that 56.1% of workers in the last week and 66.65% of workers in the last year had claimed one of MSDs in their work places. Lumbar, knee(s), back, shoulder had lost common MSDs in last week and year. MSDs in last week and year had a significant association with job duration and age of study workers.

In mine workers, the back accounted for over 50% of reported strains/sprains and was usually attributed to materials handling activities. In coal miners, knees had the highest mean days lost per strain/sprain with a mean of 30.8 days lost in 1984 compared to 21.1 days lost for the back [23]. In noted years, low-back MSDs decreased from 41% to 31% of the reported injuries/illnesses while knee MSDs increased from 9% to 17%. In comparison with these studies prevalence of MSDs in study miners was higher than other studies. Specific and non secure mines and inattention of miners to the caution instructions without national and effective preventive strategies or programs might be responsible for this higher rate. One of the other explanations of this difference comes back to sample size and selection method of miners. On the other hand epidemiological standards must be similar for better comparison. We had not found actually similar study with our work and different inclusion criteria in noted study might impact on reported MSDs prevalence.

Lumbar, Knee(s) and Back symptoms were found to be the most frequent problem among study miners. This high prevalence might be due to awkward working postures, manual material handling and long hours of standing at work, which was common at almost all mines especially coal mines. More complain in lumbar and back were accompanied with the highest rates of sick leave. We suggested that next interventional programs for prevention of occupational injuries in coal miners must be focused on reducing physical exposure to the MSD risk factors of these regions.

Findings of the present study showed that job duration and age were significantly associated with musculoskeletal symptoms in the different body regions. Previous researches showed that recently employed miners had more chance to encounter with occupational injuries than miners who have been employed for longer [24-27]. Miners with lower job duration hadn't enough experiences for meeting with risk factors because this situation had impacts on their interactions with workplaces and other miners and knowing about surrounding hazards [24]. Other potential explanations of reporting lower MSDs prevalence in workers with high job duration might be due to selection bias in study miners selecting method. In the other hand miners who had MSDs complain might didn't remain in mine and only healthy miners without MSDs complain were participated in our study. Safety and decrease rate of MSDs in miners specially coal miners are related to interaction between miners and potential hazards of their environment [28].

Among ergonomic risk factors such as awaked posture, repetitive motions, forceful excretion and … we had some of them in the study workstation in Iranian coal mines. According to that and health surveillance ergonomic data, national ergonomic program must design for study miners. The study has some limitations; first most of the study participants were male, second, due self-reporting nature of Nordic questionnaire, the educational level of the respondent may affect on their filling. Third, we had not any measurement scale for measuring the intensity of the pain/discomfort which was reported by respondents.

CONCLUSION

It was concluded that MSDs in study coal miners was happened in high rate. Ergonomic interventions strategies must be focussed for elimination of environmental hazards such as apposition at the time of work, manual handling of heavy loads. We recommended additional studies must be performed

for accurate assessment of MSDs risk factors. Noted programs must be focused on reducing physical exposure to the MSD risk factors of these regions.

ETHICAL ISSUES

The study was approved by the ethics committee of Iran University of medical sciences.

CONFLICT OF INTERST

Author of the manuscript didn't have any conflict of interest.

AUTHORS' CONTRIBUTION

Mashallah Aghilinejad and Elaheh Kabir-Mokamelkhah designed the study and supervised that. Mohammad Hassan Nassiri-Kashani Drafted the manuscript. Mohammad Kazem Nouri, Narges Nourian and Narges Shahnaghi collected study data finally Amir Bahrami-Ahmadi performed statistical analysis of study data and revise the final version of manuscript.

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