Open Access

Original Article

Frequency of Musculoskeletal Pain Among Salt Mine Workers of Pakistan Exposed to Whole Body Vibration, A Cross Sectional Survey

Mudasar Ali,[1] Fareeha Amjad,[1] Tallat Saleem,[1] Taimoor Wajahat,[1] Mariam Razaq[2]

[1]University Institute of Physical Therapy; [2]Allam Iqbal Open University, Lahore

Abstract

The aim of the study was to determine the frequency of different musculoskeletal symptoms among salt mine workers of Pakistan.

Methodology: 61 salt-mine workers were approached in this cross sectional survey using convenient sampling. The data was collected using NORDIC questionnaire. The data was entered and analyzed using SPSS 25. Association between different risk factors like age, duration of working etc. and body pain were determined using likelihood ratio.

Results: Among the workers 5(8.2%) have Full Body pain, 23(37.7%) have pain in Neck, 5(8.2%) have pain in Shoulder, 8(13.1%) have pain Arm\Hand, 9(14.8%) have pain in Upper Back, 2(3.3%) have pain in Lower Back, 7(11.5%) have pain in Legs, 1(1.6%) has pain in Knees and one has pain in Foot. Overall 12.1% workers have history of not going to work due to pain.

Conclusion: Whole body vibration has adverse effect on body specifically on neck, shoulder and arm region among salt mine workers. Age of operator, duration of working has also significant impact on pain.

Key words: Musculoskeletal pain. salt mine workers, whole body vibration

Corresponding Author: *Mudasar Ali, Student, University of Lahore. Email: alianjum96@gmail.com*

How to cite:

Ali M, Amjad F, Saleem T, Wajahat T, Razaq M. Frequency of Musculoskeletal Pain Among Salt Mine Workers of Pakistan Exposed to Whole Body Vibration, A Cross Sectional Survey. JRLMC. 2023;

Received:27th July, 2023 Revised:15th Sep, 2023 Accepted:01st Nov, 2023

Introduction

Khewra salt mine is one of the largest pink salt reserve located in the District Jhelum of the Punjab, Pakistan. The salt is mined out using room and pillar method.[1] in this method blasting and drilling is required to create rooms. Workers exposed to these vibrations are at risk of musculoskeletal symptoms. It is also observed that exposure to whole body vibration may lead to chronic disease.[2,3] The machines used are purchased according to ISO 2631-1 (1997) guidelines. These guidelines enforce the heavy machinery maker to reduce the mechanical vibration to certain limits.[4]

There are many contributing physical, psychological and social factors. Some of the factors could be alter and some cannot. Recently a study conducted in India on iron ore mine workers revealed that rock related factors like rock density, hardness and compressive strength as well as manufacturer of machines has significant impact.[5]

A study in dumper operators, working in coal mine, reveals the highest frequency of low back pain followed by ankle and neck pain.[6] Similarly another study was conducted in open pits of Finland, Norway, Russia and Sweden, to compare the musculoskeletal symptoms between drivers of mining vehicles and non-drivers. A mix response was observed among female drivers' neck, shoulder and upper back pain was more prevalent. But difference between musculoskeletal symptoms of drivers and non drivers were not statistically significant.[2] In Pakistan most of the work has been done on coal workers. A study conducted in Peshawar reveals that Musculoskeletal was most common issue followed by respiratory, gastrointestinal, nervous, dermatological, ear, nose & throat and eye problems.[7]

Musculoskeletal issues leads to poor quality of life, low performance and high absenteeism. During the study it was observed that the patients with pain were referred to Rawalpindi for physiotherapy and other treatment. It was also a psychological and economical burden on the patients as well as the company sponsoring it. To the best of researchers, knowledge no such study has been conducted in Pakistan. The aim of the study was to find frequency of musculoskeletal symptoms in mine workers. It would be a base line study for the future researchers.

Methodology

In this cross sectional survey 61 workers of Khewra salt mine of Pakistan operating the heavy vibrating machines like drilling, cutter, grinder and Crusher were included in the study. The mining operations continue through-out the year. There were 17 portions in the mines and total numbers of employee in mine were around 600 approximately, 10% of total target population were taken as sample[8]. Nordic questionnaire[9] was used to collect the data. The questions were asked in national language. The data collecting process for this study was approved from the regional tourism department of Punjab. Data was entered and analyzed using SPSS version 25.

Results

In this study among 61 workers 11(18.0%) were in 26-30 years of age group, 18(29.5%) were between 31-35 years, 16(26.2%) were in 36-40 years of age group and 16(26.2%) were above 40 years of age. Among the workers 5(8.2%) have Full Body pain, 23(37.7%) have pain in Neck, 5(8.2%) have pain in Shoulder, 8(13.1%) have pain Arm\Hand, 9(14.8%) have pain in Upper Back, 2(3.3%) have pain in Lower Back, 7(11.5%) have pain in Legs, 1(1.6%) has pain in Knees and one has pain in Foot.

Overall 12.1% workers have history of not going to work due to pain. Among them 5(8.2%) remain absent for 1-5 days and 3(4.9%) could not perform their daily activities 6-10 days. Among the patients having the working experience between 3-4 years, 4(33.3%) have history of not going to work due to pain, among 5-6 years of working experience 1(7.1%)and among Greater than 6 years of working experience 3(17.6%) have history of not going to work due to pain.

Area of pain was found associated with Age(p-value

Table 1: *Comparison of different Study Variable According to Area of Pain*

		Where do you have pain?									Total	p-value
		Neck	Shoulder	Arm\Hand	Upper Back	Lower Back	Leg	Knees	Foot	Full Body		
Age	26-30 years	2(8.7%)	1(20.0%)	4(50.0%)	2(22.20%)					2(40.0%)	11(18.00%)	
	31-35 years	8(34.8%)		3(37.5%)	2(22.2%)		4(57.1%)		1(100%)		18(29.50%)	<0.001
	36-40 years	6(26.1%)	4(80.0%)	1(12.5%)	5(55.6%)						16(26.20%)	
	Above 40 years	7(30.4%)				2(100%)	3(42.90%)	1(100%)		3(60.0%)	16(26.20%)	
Duration of Pain	Often	23(100.0%)									23(37.70%)	
	One month		4(80.0%)	4(50.0%)	6(66.7%)		2(28.6%)			5(100%)	21(34.40%)	
	Two months		1(20.0%)		1(11.1%)	2(100%)	2(28.6%)	1(100%)			7(11.50%)	<0.001
	Three months				2(22.2%)						2(3.30%)	
	>3 months			4(50.0%)			3(42.9%)		1(100%)		8(13.10%)	
Duration of working	1-2 years	9(39.1%)	3(60.0%)	2(25.0%)		2(100%)	1(14.3%)			1(20.0%)	18(29.50%)	<0.001
	3-4 years	2(8.7%)	2(40.0%)		2 (22.2%)		4(57.1%)			2(40.0%)	12(19.70%)	
	5-6 years	11(47.8%)		2(25.0%)	1(11.1%)						14(23.00%)	
	>6 years	1(4.3%)		4 (50.0%)	6(66.7%)		2(28.6%)	1(100.0%)	1(100%)	2(40.0%)	17 (27.90%)	
Do you visit hospital for pain	Yes		4(80.00%)	2(25.00%)	1(11.10%)		4(57.10%)				11(18.00%)	<0.001
	Self Manage			4(50.0%)	2(22.2%)		3(42.9%)			4(80.0%)	13(21.30%)	
	Healthy	23(100.0%)	1(20.00%)	2(25.00%)	6(66.70%)	2(100%)		1(100%)	1(100%)	1(20.0%)	37(60.70%)	
Have you treated	Healthy	23(100.0%)	3(60.0%)	6(75.0%)	8(88.9%)	2(100%)	3(42.9%)	1(100%)	1(100%)	3(60.0%)	50(81.90%)	<0.001
	Medicine			1(12.5%)			4(57.1%)			2(40.0%)	7(11.50%)	
	Injection			1(12.5%)	1(11.1%)						2(3.30%)	
	Surgery		2(40.0%)								2(3.30%)	
Was it better after treatment	Yes		4(80.0%)	6(75.0%)	3(33.3%)		7(100.0%)			4(80.0%)	24(39.30%)	<0.001
	No		1(20.0%)	2(25.0%)	6(66.7%)	2(100%)		1(100%)	1(100%)	1(20.0%)	14(23.70%)	
	Healthy	23(100.0%)									23(37.70%)	

Likelihood ratio, *p-value significant at 0.001

Table 2: *Comparison of different Outcome Due to Area of Pain*

		Where do you have pain?									Total	p-value
		Neck	Shoulder	Arm\Hand	Upper Back	Lower Back	Leg	Knees	Foot	Full Body		
Visual analog scale	No pain	23(100.0%)									23(37.70%)	<0.001*
	Mid (1-4)		5(100.0%)	4(50.0%)	6(66.7%)		6(85.7%)		1(100%)	5(100.0%)	27(44.30%)	
	Moderate (5-6)			2(25.0%)	3(33.3%)	2(100%)	1(14.3%)	1(100%)			9(14.80%)	
	Severe (7-10)			2(25.0%)							2(3.30%)	
Days missed due to pain	No any day	23(100.0%)	5(100.0%)	7(87.5%)	8(88.9%)	2(100%)	3(42.9%)	1(100.0%)	1(100%)	3(60.0%)	53(86.89%)	<0.001*
	1-5 days			1(12.5%)			4(57.1%)				5(8.20%)	
	6-10 days				1(11.1%)					2(40.0%)	3(4.90%)	
Can walk with pain	Yes		5(100.00%)	8(100.00%)	9(100.00%)	2(100%)	7(100.00%)	1(100.0%)	1(100%)	5(100%)	38(62.30%)	<0.001*
	Healthy	23(100.0%)									23(37.70%)	
Can do household chores with pain	Yes		5(100.00%)	8(100.00%)	9(100.00%)	2(100%)	7(100.00%)	1(100.0%)	1(100%)	5(100%)	38(62.30%)	<0.001*
	Healthy	23(100.0%)									23(37.70%)	
Sleep with Pain	Yes		3(60.00%)	4(50.00%)	9(100.00%)	2(100%)	3(42.90%)	1(100%)		3(60.0%)	25(41.00%)	<0.001*
	Healthy	23(100.0%)	2(40.00%)	4(50.00%)			7(57.10%)		1(100%)	2(40.0%)	13(21.30%)	
Physical Activities increase pain	Yes		2(40.00%)	3(37.50%)	5(55.60%)	2(100%)	6(85.70%)	1(100%)	1(100%)	4(80.0%)	24(39.30%)	<0.001*
	Healthy	23(100.0%)	3(60.00%)	5(62.50%)	4(44.40%)		1(14.30%)			1(20.0%)	14(23.00%)	

Likelihood ratio, *p-value significant at 0.001

<0.001), Duration of Pain(p-value <0.001), Duration of working(p-value <0.001), Do you visit hospital for pain(p-value <0.001), Was it better after treatment(p-value <0.001) and Have you been treated(p-value <0.001) (Table 1). Similarly it region of pain was found associated with Visual analog scale (p-value <0.001), Days missed due to pain(p-value <0.001), Can walk with pain(p-value <0.001), Can do household chores with pain(p-value <0.001), Sleep with Pain(p-value <0.001) and Physical Activities increase pain(p-value <0.001). (Table 2)

Discussion

Occupational vibration can be divided into two categories depending on the vibration exposure route into the human body and its effects on the body i.e. hand-arm vibration (which is localized in exposure) and whole-body vibration, which imposes on the entire body among different occupational hazards, professional working with transportation or heavy machinery, whole body vibration is significant risk factor for musculo-skeletal symptoms.[10] Heavy machinery operators are exposed to two impor-tant risk factors for the development of musculoskeletal disorders: whole-body vibration and non-neutral body postures. Like among tractor drivers the Vertical whole body vibration may lead to back pain.[11] Recent studies have reveals that low RPM produce frequencies between 3.15–4 Hz and 8–10 Hz which is natural frequency of many body parts. Therefore these frequencies cause discomfort to the whole body.[12,13]

Multi centric study documented lower back pain followed by neck as more frequent among mine workers[2] whereas, in our study the neck pain followed by arm and shoulder pain was most common. One distinct reason could be occupational category. In the previous study most of the sample consist of drives in contrast current study documents the drill operators etc. In Pakistan most of the work has been done on coal workers. A study conducted in Peshawar reveals that Musculoskeletal was most common issue followed by respiratory, gastrointestinal, nervous, dermatological, ear, nose & throat and eye problems.[7] As compared to coal mine the salt mine has less dust issues as well as the salt mine environment has remedial effect on asthmatic patients.[14] Contributing factors like age, duration of work has significant impact on musculoskeletal symptoms; literature also supports the fact.[5, 15] In our study the no. of days lost to work due to pain were less than the coal mine workers.[16]

The current study found that the whole body vibration has an adverse impact on salt mine workers. In this it is found that among the treated 23.7% have still pain issues. Secondly due to travelling or other issues 21.3% of the workers were self managing their symptoms. So it is suggested that the salt mine worker should be facilitated with health professional like doctor and physiotherapist in their working area.

The data was collected using convenience sampling so many workers who were not present during the study period were not approached. A follow up study should be conducted to determine the impact of whole body vibration on different categories of the workers.

Conclusion

Whole body vibration has adverse effect on body specifically on neck, shoulder and arm region among salt mine workers. Age of operator, duration of working has also significant impact on pain.

References

1. Hustrulid WA. Underground mining methods handbook: Society of Mining Engineers of AIME,New York, NY; 1982. Medium: X; Size: Pages: 1768 p.
2. Burström L, Aminoff A, Björ B, Manttari S, Nilsson T, Pettersson H, et al. Musculoskeletal symptoms and exposure to whole-body vibration among open-pit mine workers in the arctic. International Journal of Occupational Medicine and Environmental Health. 2017;30(4):553-64.
3. Krajnak K. Health effects associated with occupational exposure to hand-arm or whole body vibration. Journal of Toxicology and Environmental Health, Part B. 2018;21(5):320-34.
4. ISO. Mechanical Vibration and Shock–Evaluation of Human Exposure to Whole Body Vibration. Part 1: General Requirements. Geneva, Switzerland: International Organization for Standardization,; 1997.
5. Chaudhary DK, Bhattacherjee A, Patra AK, Chau N. Whole-body Vibration Exposure of Drill Operators in Iron Ore Mines and Role of Machine-Related, Individual, and Rock-Related Factors. Safety and Health at Work. 2015;6(4):268-78.
6. Mandal BB, Srivastava AK. Musculoskeletal disorders in dumper operators exposed to whole body vibration at Indian mines. International Journal of Mining, Reclamation and Environment. 2010;24(3):233-43.
7. Ishtiaq M, Hussain H, Gul S, Jehan N, Ahmad I, Masud K, et al. Frequency of occupational health problems among coal miners. Gomal J Med Sci. 2014; 12(2): 52-5.
8. Israel GD. Determining sample size. 1992.
9. Ørhede E, Hottinen V, Skogstad A, Knardahl S, Elo A-L, Dallner M, et al. User's guide for the QPSNordic: general Nordic questionnaire for psychological and social factors at work: Nordic Council of Ministers; 2000.
10. Schneider SP. Musculoskeletal injuries in construction: a review of the literature. Applied occupational and environmental hygiene. 2001;16(11):1056-64.
11. Zeng X, Kociolek AM, Khan MI, Milosavljevic S, Bath B, Trask C. Whole body vibration exposure patterns in Canadian prairie farmers. Ergonomics. 2017; 60(8):1064-73.
12. Singh A, Singh LP, Singh S, Singh H, Prakash C. Investigation of occupational whole-body vibration exposure among Indian tractor drivers. International Journal of Human Factors and Ergonomics. 2018; 5(2):151-65.
13. Picu M, Picu L. Particular aspects regarding the effects of whole body vibration exposure. MATEC Web Conf. 2018;148:09005.
14. Zając D, Russjan E, Kostrzon M, Kaczyńska K. Inhalations with Brine Solution from the 'Wieliczka' Salt Mine Diminish Airway Hyperreactivity and Inflammation in a Murine Model of Non-Atopic Asthma. International Journal of Molecular Sciences. 2020; 21(13): 4798.
15. Chaudhary DK, Bhattacherjee A, Patra AK, Upadhyay R, Chau N. Associations Between Whole-Body Vibration Exposure and Occupational and Personal Factors in Drill Operators in Indian Iron Ore Mines. Mining, Metallurgy & Exploration. 2019;36(3):495-511.
16. Vazirinejad R, Esmaeili A. Five-year follow up of job-related injuries among Sarcheshme copper mine complex workers. Pak J Med Sci. 2009;25(3):418-23.

"Success is not plateau rather its a slop. You have to strive on daily basis to remain on the top"

Ms. Sabahat Khan
CEO
Rashid Latif Medical College, Lahore