Journal of Current Research in Engineering and Science
Bi-Annual Online Journal (ISSN : 2581 - 611X)

Volume 7-Issue 1, January 2024
Paper: 44

Determination of Musculoskeletal Disorders (MSDs) in Quarry Workers

Sandeep K S
Dept. of Mechanical Engineering
College of Engineering Trivandrum
Trivandrum, India
sandeepks311@gmail.com

Dr.Regi kumar.V
Dept. of Mechanical Engineering
College of Engineering Trivandrum
Trivandrum, India
regikumar@cet.ac.in

***Abstract*—Musculoskeletal disorders (MSDs) plays a major role in occupational health problems worldwide. MSDs are group of painful disorders affecting tendons, muscles and ligaments caused by repetitive work activities, awkward posture,exposure value,lack of rest.MSDs are commonly affected the musculoskele- tal part of the body such as muscles,ligaments,joints, nerves andblood vessels.Many of jounral studies have seen that 39percent of all work-related tasks done by the workers leads to body parts injuries and reduction of productivity,loss of job,career change, causes handicap and total or partial dependence on the society. Quarries are common in Kerala.In Kerala,there are around 300 quarries located.They are used for breaking of stones or rubbles and also production of those related products. This health problem affected by those workers has been recognized as a significant threat to the quarry workers safety but is rarely reported. In this paper, the objective is to determine the Mus- culoskeletal Disorders(MSDs) of Quarry workers. This data for study are to be collected using a questionnaire and analysed by using Statistical Package for the Social Sciences(SPSS) software. The prevalence of MSDs is high among quarry workers,with hand pain being the most common type.This obviously reveals the need to improve working conditions and enhance the safetyof the workers and the productivity.**

***Index Terms*—Musculoskeletal Disorder(MSDs),Quarry work-ers**

I. Introduction

Musculoskeletal disorders (MSD) are injuries or disorders of the muscles, nerves, tendons, joints, cartilage, and spinal discs.Work-related musculoskeletal disorders (WMSD) are conditions in which the work environment and performance of work contribute significantly to the condition and/or the condition is made worse or persists longer due to work conditions.Accordingly, MSDs causes in nine body parts such as neck, shoulders, forearms, elbows, upper back,lower back,wrists, thighs and knees with diverse rate across the parts of the body.

Quarries are used to extract rock,sand or minerals from the surface of the earth.It is a open pit type mining.Sand,gravels and crushed rock for the construction site are known as aggre-gates.For excavating aggregates, the quarry workers uses heavy equipments such as Drilling machine, Hammer etc.The quarry workers may have experienced a pain or injuries on various body parts by using these heavy equipments.Quarry workers uses explosives for blasting heavy rocks to produce wanted materials.After excavating,these materials are transported to various construction or building sites by using heavy vehicles like truck,lorry etc.It can carry tonnes of rocks or stones from mine site.In almost quarry mines,Hitachi vehicle can be used for breaking or rupture of large stones.The minerals produced from quarry provides the construction materials for making roads and buildings.The industries near to quarry centres are used to produce stones of different size according to thickness for construction purposes.

The popularity of Musculoskeletal Disorders(MSDs) is high among quarry workers,with wrists/hands being the most com-mon type. Including MSDs,a large number of quarry workers are affected by inhalation of minute sized dust particles.It leads to respiratory diseases such as Tuberculosis and Silicosis and lung function stops.It can be reduced by using Personal Protective Equipment(PPE)like masks and also gloves for reducing injuries.

A. DETERMINATION OF MSDs

Musculoskeletal disorders (MSDs) are common among workers in various industries, including quarry workers. The following are some ways to determine MSDs in quarry work-ers:

1) Worksite assessments: Conducting a worksite assess-ment can help identify any ergonomic issues that may contribute to MSDs. This can involve observing workers performing their tasks and identifying any awkward

Journal of Current Research in Engineering and Science
Bi-Annual Online Journal (ISSN : 2581 - 611X)
Volume 7-Issue 1, January 2024
Paper: 44

postures, repetitive motions, or other risk factors.
2) Worker interviews: Talking to workers about their job tasks and any discomfort or pain they experience can help identify MSDs. This can include questions about the duration and frequency of the symptoms, as well as any exacerbating or relieving factors.
3) MSD risk assessment tools: There are various tools available to assess the risk of MSDs in workers. These tools can help identify specific risk factors and prioritizeinterventions to reduce the risk of MSDs.

II. LITERATURE REVIEW

A. MUSCULOSKELETAL DISORDERS (MSDs) AND THEIR ASSOCIATED FACTORS AMONG QUARRY WORKERS IN NIGERIA:A CROSS SECTIONAL STUDY

Aimed to assess the prevalence of MSDs and their associated factors among quarry workers.Data for study are to be collected using a Nordic Musculoskeletal questionaire.The Nordic Musculoskeletal Questionnaire-Extended (NMQ-E) was used to assess work-related musculoskeletal disorders on nine body regions. Descriptive statistics and multivariable analyses were used to characterize the data and identify factors associated with work-related musculoskeletal disorders

B. INVESTIGATE THE IMPACT OF STONE DUST ON CARDIOVASCULAR AND PULMONARY HEALTH OF STONE QUARRY WORKERS AMONG AN INDIGENOUS POPULATION OF NORTH EAST INDIA

The objective of this study is evaluate the impact of stone dust on cardiovascular and pulmonary health of stone quarry workers.A total number of 152 Lotha male stone quarry workers with age 18-60 years and age matching 152 adult males as the controls were selected for the present study. Blood pressures (both systolic and diastolic), oxygen saturation, pulse rate and forced vital capacity (FVC) were measured on each participant. Body Mass Index (BMI) was calculated following standard equation.Multivariate multiple regression (MMR) analysis was used to test the effect of stone dust on the workers.

C. IMPACT OF SANDSTONE QUARRYING ON THE HEALTH OF QUARRY WORKERS AND LOCAL RESIDENTS : A CASE STUDY OF KERU,JODHPUR,INDIA.TREATMENT AND DISPOSAL OF SOLID AND HAZARDOUS WASTES,97-118

Evaluate the impacts of sandstone quarrying on the health of quarry workers and nearby residents include results of the site survey show that major reasons for onsite and nearby environmental degradation were use of improper machinery and vehicles; haphazard and unsystematic quarrying over a long period of time and dumping of quarry waste.

D. PHYSICAL RISKS OF WORK RELATED MUSCULOSKELETAL COMPLAINTS AMONG QUARRY WORKERS IN EAST OF IRAN

The aim of this study was to evaluate the working postures and prevalence of musculoskeletal problems among quarry workers.In this cross-sectional study 78 male quarry workers were assessed using the method of Rapid Entire Body Assessment (REBA), and musculoskeletal complaints data were obtained by the Standardized Nordic Musculoskeletal questionnaire(NMQs). Results of the occurence of muscu loskeletal disorder problems in body parts of stonemasonry workers was higher found than in the stonecutting workers. The highest prevalence rate of musculoskeletal problems in both stonemasonry and stonecutting workers was 65.7 and 54.8 percent respectively related to waist. The 5 stonemasons with 62percent had high level of risk and stone cutting workers with 47.6percent had moderate risk level. Significant correlation was found among age,work experience, BMI, and prevalence of musculoskeletal problems. There was also a significant relationship between the wrist and lower back pain with the risk level of REBA score. The study results showed that musculoskeletal problems of workers had high prevalence and accordingly most of the work conditions and postures needed to be improved, so prioritizing the necessity of corrective actions and intervention are to be gained.

III. OBJECTIVE

- To determine the musculoskeletal disorders(MSDs) of quarry workers.

IV. METHODOLOGY

A study must be conducted on the physcial characteristics of the workers as well as the current medical conditions of the workers.This study is mainly aimed to determine the prevalance of self reported work related musculoskeletal disorders and its associated factors.For that an institutional based cross sectional study needs to be conducted which helps to collect necessary data.Visual inspections are done to identify the postures of workers and the working environment.At start,we analyse the work activities of the quarry workers and those related factors like work experience,duration of work etc by visiting quarry mines.Then the problems were discovered.

A. DATA COLLECTION

For the completion of the study, collection of the needful data is very much important. Different types of data are needed in order to obtain the final results. The types of data needed are as follows:

1) Sociodemographic questionnaire contain questions like Age, Weight, Stature.

Journal of Current Research in Engineering and Science
Bi-Annual Online Journal (ISSN : 2581 - 611X)
Volume 7-Issue 1, January 2024
Paper: 44

2) Modified Nordic questionnaire for getting details about Musculoskeletal symptoms.

The workplaces selected for the study are located near Kilimanoor, Thiruvanathapuram (Dist), Kerala. For charac- teristics affecting Quarry worker MSDs, informal meeting was held, and a questionnaire is utilized to collect data.The data collection includes sociodemographic questionaires about age, height, weight etc and Nordic questionaires about Musculoskeletal Disorders. Due to some limitations,the sample size required for study is 52.

B. DATA INTERPRETATION

For data interpretation, Microsoft Excel 2021 software is utilized.The collected data from workers is analyzed using Statistical Package for the Social Sciences(SPSS) software.

V. RESULT AND DISCUSSION

The sample size fixed for the study is around 100 and so far data collected from 52 workers due to some limitations.All of 52 workers are male and age in between 18 to 70.

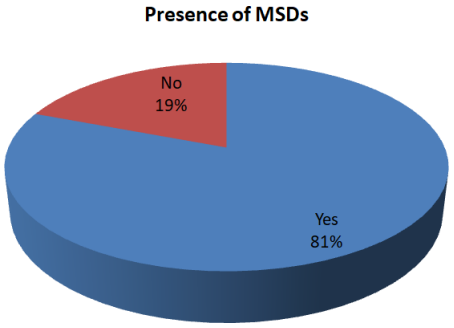

Fig. 1. Presence of MSDs in workers

Fig.1 displays that majority of the 80.8 % had MSDs problems due to some reasons like lack of rest,repetitve or forceful movements of body.

Fig.2 and Fig.3 describes the presence of MSDs in last 12 month.In this period,the MSDs is mostly affected to hand or wrist area of body parts.

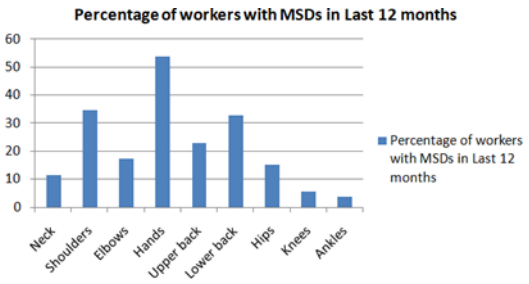

Fig. 2. Presence of MSDs in last 12 months

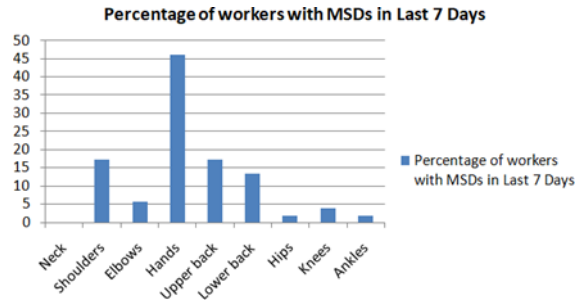

Fig. 3. Presence of MSDs in last 7days

Correlation analysis is a statistical method used to measure the strength and direction of the relationship between two variables. It helps us to understand how changes in one variable are related to changes in another variable.

To conduct a correlation analysis, we first need to collect data on two variables.We then calculate the correlation coeffi- cient using a Statistical Package for the Social Sciences(SPSS) software..Using this we find out correlation between Work

Body parts	Age		BMI		Work Experience		Working hour		Break time rating	
	r	p	r	p	r	p	r	p	r	p
Neck	-.007	.961	.176	.212	-.118	.405	-.075	.599	.070	.621
Shoulders	.107	.449	-.054	.705	.045	.754	.060	.671	-.118	.406
Elbows	.288*	.308	.093	.512	.217	.122	.168	.233	-.441**	.001
Hands	.265	.057	.077	.0585	.239	.088	-.129	.362	-.271	.052
Upper back	.318*	.021	.077	.589	-.094	.507	-.133	.346	-.070	.621
Lower back	.256	-.067	.258	.065	-.024	.865	.024	.863	-.291*	.036
Hips	.126	.372	-.112	.430	.079	.579	-.173	.220	-.093	.514
Knees	.049	.731	-.002	.989	-.027	.848	.003	.982	-.247	.077
Ankles	.180	.202	-.067	.639	.060	.671	-.115	.415	.031	.821

Fig. 4. Correlation Analysis

experience,Working hour,Break time Rating ,age, and BMI with MSD rating giving to different body parts based on

Journal of Current Research in Engineering and Science
Bi-Annual Online Journal (ISSN : 2581 - 611X)
Volume 7-Issue 1, January 2024
Paper: 44

duration of MSD. That is No discomfort = 1 , 1 to 7 days= 2 , 8 to 30 days = 3, more than 30 days = 4 and Everyday = 5.Here Spearmann rank correlation coefficient is a type of non parametric test which is used to compare or find the degree of association between various two factors or between ordinal and scaled data.The correlation coefficient is denoted as r and p is the significance level.Significance level shows probability of the null hypothesis being true.

It shows that the increase of prevalence of MSDs in elbows with decrease of break time with correlation significance at 0.01 level and also with increase of age with correlation significance at 0.05 level. It also show that the increase of prevalence of MSDs in upper back with increase of age with correlation significance at 0.05 level. Also the increase of prevalence of MSDs in lower back with decrease of breaktime rating at 0.05.

VI. CONCLUSION

Quarry workers are commonly affected by Musculoskeletal Disorder(MSDs).Majority of the quarry workers about 80.8percent are caused by Musculoskeletal Disorders(MSDs) due to lack of rest,awkward posture or repetitve movementsof body parts.By analysing data,we have seen that hands or wrists of body parts are mostly affected by MSDs.There are several factors such as age,break hour,work experience,Body Mass Index(BMI) affecting or influencing the MSDs.

REFERENCES

[1] Njaka, S., Mohd Yusoff, D., Anua, S. M., Kueh, Y. C. Edeogu, C. O. (2021b). Musculoskeletal disorders (MSDs) and their associated factors among quarry workers in Nigeria: A cross-sectional study. Heliyon, 7(2), e06130.

[2] Lohe, N. (2022, September 14). Occupational health hazards of stone quarry workers of Nagaland, India — Human Biology and Public Health.

[3] Singhal A., Goel, S. (2022). Impact of Sandstone Quarrying on the Health of Quarry Workers and Local Residents: A Case Study of Keru, Jodhpur, India. Treatment and Disposal of Solid and Hazardous Wastes, 97–118.

[4] Fouladi-Dehaghi, B., Tajik, R., Ibrahimi-Ghavamabadi, L., Sajedifar,J., Teimori-Boghsani, G., Attar, M. Physical risks of work-related muscu- loskeletal complaints among quarry workers in East of Iran. International Journal of Industrial Ergonomics, 82, 103107.

[5] Aliyu, A. B., Shehu, A.(2007b). Occupational hazards and safety measures among stone quarry workers in northern Nigeria. The Nigerian Medical Practitioner.

[6] Shaikh, A. M., Mandal, B. B., Mangalavalli, S. M. (2022). Causative and risk factors of musculoskeletal disorders among mine workers: A systematic review and meta-analysis. Safety Science, 155, 105868.

[7] Weston, E., Nasarwanji, M. F., Pollard, J. P. (2016). Identification of work-related musculoskeletal disorders in mining. Journal of safety, health and environmental research, 12(1), 274.

[8] Wang, X., Dong, X. S., Choi, S. D., Dement, J. (2017). Work-related musculoskeletal disorders among construction workers in the United States from 1992 to 2014. Occupational and environmental medicine, 74(5), 374- 380.

[9] Kuorinka, I., Jonsson, B., Kilbom, A., Vinterberg, H., Biering-Sørensen, F., Andersson, G., Jørgensen, K. (1987). Standardised Nordic question- naires for the analysis of musculoskeletal symptoms. Applied ergonomics, 18(3), 233-237.

[10] Yusof, M. Z., Nik Mahmod, N. A. K., A Rahman, N. A., Razali, A., Samsuddin, N., Nik Mohamed, N. M. N., ... Abdullah Hair, A. F. (2019). Prevalence of occupational diseases among small and medium industry workers in Malaysia: A systematic review. Journal of Clinical and Health Sciences, 4(2), 4-30.

Journal of Current Research in Engineering and Science
Bi-Annual Online Journal (ISSN : 2581 - 611X)

Volume 7-Issue 1, January 2024
Paper: 44

Journal of Current Research in Engineering and Science
Bi-Annual Online Journal (ISSN : 2581 - 611X)

Volume 7-Issue 1, January 2024
Paper: 44

Journal of Current Research in Engineering and Science
Bi-Annual Online Journal (ISSN : 2581 - 611X)

Volume 7-Issue 1, January 2024
Paper: 44