Annals of Community Health (AoCH) pISSN 2347-5455 | eISSN 2347-5714

An Indexed (Index Medicus, DOAJ and More), Peer Reviewed, Quarterly, International Journal focusing exclusively on Community Medicine and Public Health

ORIGINAL ARTICLE

Musculoskeletal Problems and Quality of Life among Quarry Workers in Rural Areas of Southern Karnataka

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ABSTARCT

Background: Work-related musculoskeletal disorders is one of the most common problem in constructing industries, affecting muscles, tendons, nerves, and bones. They are associated with four main risk factors, undesirable force, duration, repetition, and the adoption of static and awkward postures. **Objectives**: The objectives of the study were to estimate the prevalence and patterns of various musculoskeletal problems among quarry workers in rural areas and to study the quality of life (QoL) and its social implications among quarry workers. **Methodology:** A cross-sectional study was conducted in 5 quarries of Kolar taluk, where blasting and quarrying of stone are carried out from July 2016 to September 2016. Quarry workers of either sex, aged >18 years, and above were included in the study. **Results:** In our study, 92 migrant workers were analyzed. Mean age of subjects 33.39 ± 10.54 years. In our study, 35.9% were smokers, 31.5% were alcoholics, 22.8% were using tobacco, and 6.5% were chewing beetle. Mean hours of occupation per day were 8.4 ± 1.9 h among stone crushers and 10.2 ± 2.1 h among non-stone crushing type of work. In our study, there was no significant difference in physical, psychological, social, and environmental domains of QoL between two groups of work. Environmental domain was lowest compared to other domains of QoL. **Conclusion:** Most common prevalent musculoskeletal problem was low back symptoms in 65.2%, followed by it was shoulder symptoms in 48.9% and knee symptoms in 46.7%. Least prevalence musculoskeletal problem was elbow symptoms. Social and environment domain of QoL was affected in quarry workers with increase in duration of occupation.

Key words: Musculoskeletal, occupational disease, quality of life, quarray, workers

INTRODUCTION

Quarry industry is an important unorganized industrial sector in the country which engages laborers in producing crushed stone of various sizes depending on the requirement which acts as raw material for various construction activities such as construction of roads, highways, bridges, buildings, and canals.[1] Work-related musculoskeletal disorders is one of the most common problem in constructing industries, affecting muscles, tendons, nerves, and bones. They are associated with four main risk factors, undesirable force, duration, repetition, and the adoption of static and awkward postures. Various ergonomic studies in different parts of world suggest that both extreme work postures and static work postures contribute to the occurrence of low back and musculoskeletal symptoms.[2] Musculoskeletal disorders have also caused economical suffering because of reduced working capacity.[3]

Mining and quarrying, manufacturing and construction sectors have the highest relative number musculoskeletal cases (960 new cases per 100,000 workers), which is 30 times the average number of 32/100,000. Construction sectors also have the highest rate of symptoms for Work-related MSD complaints (1.2–1.6 times higher than the average in the total population).[4]

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How to cite: Kusetty VS, Vishwanath GR, Mahesh V, Shashank KJ. Musculoskeletal Problems and Quality of Life among Quarry Workers in Rural Areas of Southern Karnataka. Ann Community Health 2021;9(2):121-126.

Musculoskeletal disorders due to work affect all age groups, especially people in their working years and pattern of WRMSDs varies among different occupational groups and with different geographical locations.[5] Musculoskeletal disorders take a toll on the lives of workers by affecting their activities of daily living, leading to slow economic growth of their families, and results in poor overall quality of life (QoL).[6]

Quarry workers who comprise a part of the unorganized work sector in rural India are in a disadvantageous position and are at a higher risk for WRMSDs and literature regarding their health problems, prevalence, and needs are largely limited. Hence, this study will be carried out.

Objectives

The objectives are as follows:

1. To estimate the prevalence and patterns of various musculoskeletal problems among quarry workers in rural areas
2. To study the QoL and its social implications among quarry workers.

METHODOLOGY

Study Settings/Area

The study was conducted in five quarries of Kolar taluk, where blasting and quarrying of stone are carried out.

Study Population

This study was quarry workers of either sex, aged >18 years.

Exclusion Criteria

The following criteria were excluded from the study:

- Subjects with congenital musculoskeletal disorders
- Subjects with disability.

Study Duration

The study duration was 2 months (July to September 2016).

Study Design

This was a cross-sectional study.

Sample Size

Sample size was estimated using the prevalence of musculoskeletal problems in quarry workers at 32% from the study by Prasad *et al*. in Central India.[1] Formula used for sample size estimation is given below.

$$\text{Sample Size (n)} = Z_{1-\alpha/2}^{2} \, p \, (1-p)/d^2$$

Here

$Z_{1-\alpha/2}^{2}$ = Is standard normal Variate [at 5% type 1 error ($P < 0.05$) it is 1.96.

P = Expected proportion in population based on previous studies = 32% or 0.32

q = 1- p = 68% or 0.68

d = Absolute error or precision 10% or 0.1

Using the above values at 95% confidence level a sample size of 84 quarry and Brick factory workers will be included in the study. Considering 10% nonresponse a sample size of 84 + 8.4 ≈ 92 subjects will be included in the study.

Sampling

Five quarries were selected by simple random sampling after obtaining the list of quarries in Kolar taluk and from each quarry approximately 20 subjects were selected in to the study till the desired sample size of 92 was obtained.

Data Collection

Data were collected using a pretested and structured questionnaire after obtaining the written informed consent. Modified Nordic Questionnaire was used to obtain the data pertaining to musculoskeletal problems[7] and the WHO BREF QoL questionnaire was used to obtain data regarding QoL.[8-10] Validation of WHOQOL-BREF instrument will be done by translating into Kannada by researchers and back-translated into English by another expert not acquainted with the original versions. The back-translated version will be subsequently compared with the original by a psychiatrist for conceptual equivalence of the items. WHOQOL-BREF scale consisting 26 questions related to physical, psychological, social, and environmental domains. Each question will asked to the subject and later it will be was converted to transform score. This score was used as the outcome score.

Statistical Analysis

Data obtained were compiled in Microsoft Excel and SPSS statistical software version 22 was used to analyze the data. Descriptive statistics such as frequencies, proportions, and confidence intervals were computed. Chi-square test was the test of significance for qualitative data. Mean and Standard deviation was computed for quantitative data and Student's *t*-test was the test of significance for quantitative data. Pearson correlation was done to find the correlation between two quantitative variables. Data were graphically represented by Bar and Pie diagrams. Scatter plot was used to depict correlation. $P < 0.05$ will be considered as statistically significant.

RESULTS

In our study, 92 migrant workers were analyzed. Mean age of subjects 33.39 ± 10.54 years. Majority (37%) of the subjects

were in the age group of 21–30 years. Majority of subjects were males (88%) and 12% were females. About 92.4% of them belonged to Hindu religion and 7.6% belonged to Muslim religion. About 41.3% of subjects were illiterate among the quarry workers. About 34.8% Migrated for work from other states of India and 13% were from other parts of Karnataka. About 57.6% belonged to Middle Class according to Updated B G Prasad Classification 2014. Only 1.1% belonged to lower class and 2.2% belonged to the Upper Class. In our study, 35.9% were smokers, 31.5% were alcoholics, 22.8% were using tobacco, and 6.5% were chewing beetle. Majority of subjects in the study were performing stone crushing job (56.5%) and 43.5% were indulged in non-stone crushing such as Welder, Helper, Operator, Driver etc [Table 1]. Mean hours of occupation per day were 8.4 ± 1.9 h among stone crushers and 10.2 ± 2.1 h among non-stone crushing type of work. This difference was statistically significant. On comparing vital signs and anthropometry between different types of quarry work it was observed that there was no significant difference in mean pulse rate, blood pressure, and height between stone crushers and non-stone crushers. Mean body mass index (BMI) among stone crushers was 21.2 ± 3.1 and among Non-Stone Crushers was 23.6 ± 3.5. Subjects working as stone crushers had lower weight and BMI compared to subjects performing non-stone crushing work.

In our study, there was no significant difference in physical, psychological, social, and environmental domains of QoL between two groups of work. Environmental domain was lowest compared to other domains of QoL [Table 2].

In our study, negative correlation was observed between duration of occupation and domains of QoL. Significant negative correlation was observed between duration of occupation and social and environmental domain of QoL, that is, with increase in duration of occupation there was significant reduction in social and environmental domains of QoL. Hence, it can be suggested that with increase in duration of QoL will be affected [Table 3 and Figure 1].

In our study, most prevalence musculoskeletal problem was low back symptoms in 65.2%, followed by it was shoulder symptoms in 48.9% and knee symptoms in 46.7%. Least prevalence musculoskeletal problem was elbow symptoms.

No significant difference was observed in musculoskeletal problems between stone crushers and non-stone crushers except for ankle and foot symptoms. Higher symptom rate was observed among stone crushers [Table 4].

Table 1: General profile of subjects in the study

Profile of study subjects	Count	%
Age		
<20 years	11	12.0
21–30 years	34	37.0
31–40 years	24	26.1
>40 years	23	25.0
Gender		
Female	11	12.0
Male	81	88.0
Religion		
Hindu	85	92.4
Muslim	7	7.6
Education		
Illiterate	38	41.3
Primary school	17	18.5
Secondary school	27	29.3
PUC	4	4.3
Graduate and others	6	6.5
Migration		
Migrated from other states	32	34.8
Migrated from other parts of Karnataka	12	13.0
Local residents	48	52.2
Socio-economic status		
Lower class	1	1.1
Lower middle	16	17.4
Middle	53	57.6
Upper middle	20	21.7
Upper class	2	2.2
Type of quarry work		
Stone crushing	52	56.5
Non stone crushing	40	43.5
Habits		
Smoking	33	35.9
Alcohol	29	31.5
Tobacco chewing	21	22.8
Chewing beetle	6	6.5

DISCUSSION

In our study, 92 quarry workers from five quarries in and around Kolar taluk, fulfilling the inclusion criteria were included in the study. Mean age of subjects was 33.39 ± 10.54 years and majority of them were in the age group of 21–30 years. Males constituted for 88% and 12% were females. Hindus were majority in the study constituting up to 92.4%. Educational status was poor among the subjects, 41.3% of them were illiterate and 34.8% were migrated for work from other states of India and 13% migrated from other parts of Karnataka. About 57.6% belonged to Middle Class according to Updated B G Prasad Classification 2014. Only 1.1% belonged to lower class and 2.2% belonged to Upper Class. Most common type of work done among subjects was stone crushing 56.5%.

Similar observations were made by study by Egwuonwu *et al*. in Nigerian Community among 114 male subjects aged between

Table 2: QoL scores among subjects

QOL score	Type of quarry work						*P*-value
	Stone Crushing		Non stone crushing		Total		
	Mean	SD	Mean	SD	Mean	SD	
Physical domain	49.7	6.4	49.1	7.2	49.4	6.7	0.690
Psychological domain	51.1	6.4	52.4	9.4	51.7	7.8	0.436
Social domain	60.3	17.3	57.3	20.3	59.0	18.6	0.444
Environmental domain	34.6	8.9	36.0	13.6	35.2	11.1	0.578

QoL: Quality of life

Table 3: Correlation between duration of occupation and QoL scores

Corelation	Duration of occupation/ day in hours	Physical domain	Psychological domain	Social domain	Environmental domain
Duration of occupation/day in hours					
Pearson correlation	1	-0.152	-0.203	-0.325**	-0.342**
P-value		0.148	0.052	0.002*	0.001*
n	92	92	92	92	92

QoL: Quality of life

Table 4: Musculoskeletal problems among subjects

Musculoskeletal problems	Type of quarry work						*P*-value
	Stone crushing		Non stone crushing		Total		
	Count	%	Count	%	Count	%	
Neck symptoms	19	36.5	10	25.0	29	31.5	0.238
Shoulder symptoms	26	50.0	19	47.5	45	48.9	0.812
Elbow symptoms	7	13.5	3	7.5	10	10.9	0.362
Wrists hands symptoms	6	11.5	2	5.0	8	8.7	0.270
Upper back Symptoms	8	15.4	8	20.0	16	17.4	0.563
Lower back symptoms	36	69.2	24	60.0	60	65.2	0.357
Hips thighs symptoms	7	13.5	4	10.0	11	12.0	0.612
Knee symptoms	27	51.9	16	40.0	43	46.7	0.256
Ankles feet symptoms	8	15.4	1	2.5	9	9.8	0.039*

28.58 ± 8.09 years and age range, 16–52 years were included in the study.[5] In a study by Prasad *et al*., majority of the workers 63% of them were between 21 and 40 years of age. About 89% of the workers were staying near the stone crushing industry. About 68% of the workers were working since <5 years. About 81% of the workers were not using any protective equipment.[1]

Socio-demographic profile of subjects plays an important role in health of quarry workers. As observed from the present study and the previous literatures middle aged men, with poor educational background and migrated from other places is indulged in majority to do these works. All these factors contribute for their poor health status.

In the present study, significant difference was observed for duration of working hours between crushing and non-crushing workers. Mean hours of occupation per day were 8.4 ± 1.9 h among stone crushers and 10.2 ± 2.1 h among non-stone crushing type of work.

This pattern of work is very common among quarry workers, subjects working in stone crushers had to do hard work in the day and hence work for lesser duration to other groups in quarry factories.

In the present study, 35.9% were smokers, 31.5% were alcoholics, 22.8% were using tobacco, and 6.5% were chewing beetle. This pattern of personal habits is very common among the quarry workers to reduce the stress and body pain due to heavy manual work performed. This can indirectly lead to poverty, problem family, and poor health and poor QoL among quarry workers.

In the present study, the prevalence of musculoskeletal problem was highest for Low back symptoms, that is, 65.2%,

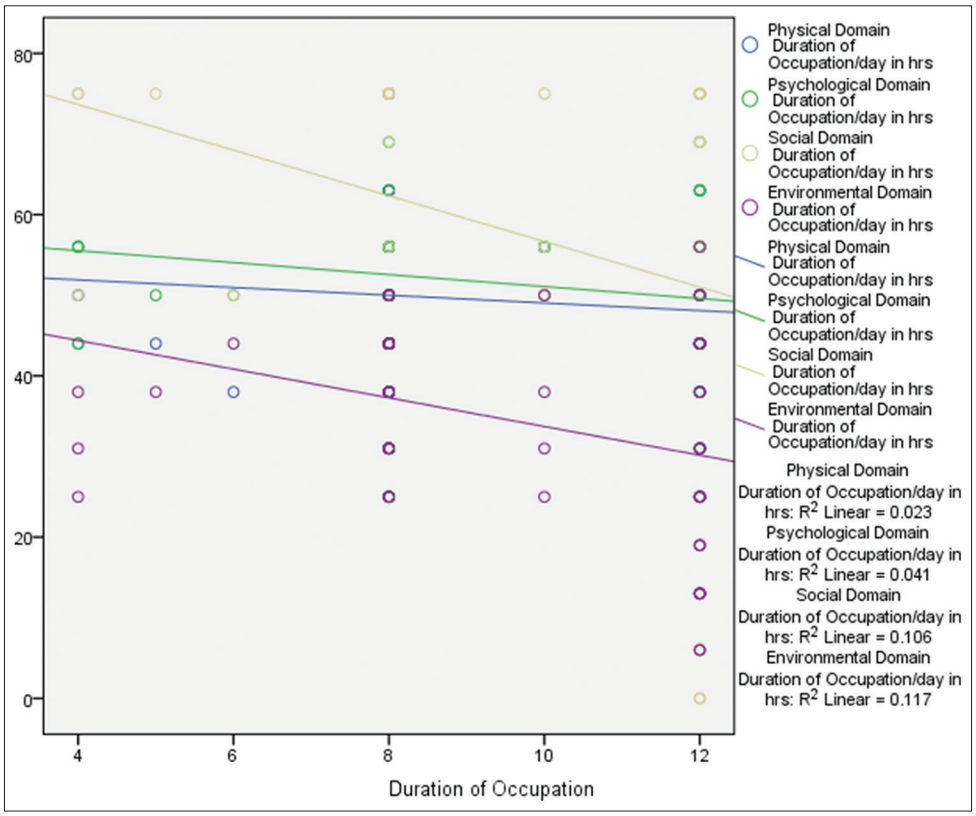

Figure 1: Scatter plot showing negative correlation between duration of occupation and quality of life domains

followed by it was shoulder symptoms in 48.9% and knee symptoms in 46.7%. Least prevalence musculoskeletal problem was elbow symptoms. No significant difference was observed in musculoskeletal problems between stone crushers and non-stone crushers except for ankle and foot symptoms.

Similarly higher pattern of prevalence was observed for WRMSDs in the study by Egwuonwu *et al*.[5] in Nigerian Community as 83.30%. Low back discomfort was the most prevalent 78.9%. All the participating drivers and mechanics were found to suffer from WRMSDs, while about 66.67, 81.25, and 77.50 of blasters, crushers, and drillers also suffered from WRMSDs respectively. Repetitive movement and years of working experience in an important risk factor for occurrence of the symptoms. Task repetition was found to be the major risk factor of low back discomfort in the study by Egwuonwu *et al*.[5] Hence, musculoskeletal problems can reduce the no of working hours, increase sickness absenteeism and decrease the QoL among quarry workers.

Swarna and Mishra, in Bhopal observed similar prevalence of musculoskeletal problems as 62.72% and 31.36% were having generalized weakness and 29.96% had breathing problem.[11]

Nouri and Ahmadi, in Iran, on 493 workers showed that 65.5% of workers in past week and 77.5% of workers in past year had claimed one of the musculoskeletal complaints in their work place. Lumbar, knee, and upper back had the most musculoskeletal complaints related to lumbar, were more prevalent in participants.[12]

Environmental domain was lowest compared to other domains of QoL in quarry workers. Environmental domain include various factors such as lack of physical safety and security, poor quality of health and social care and exposure to noise, air pollution.

However, no significant difference in physical, psychological, social, and environmental domains of QoL between stone crushers and non-crushers in the study. Both groups are equally affected for the above-mentioned environmental problems.

In the present study, significant negative correlation was observed between duration of occupation, social, and environmental domains of QoL, that is, with increase in duration of occupation there was significant reduction in social and environmental domains of QoL. Hence, it can be suggested that with increase in duration of QoL will be affected.

From the present study and review of literatures, it is clearly observed that quarry workers are prone for one or the other musculoskeletal problems in the past 1 week or 1 year. Hence, principles of ergonomics and rules pertaining to Factories and ESI act has to be enforced strictly on the factories to improve the health and QoL of quarry workers.

CONCLUSION

Most common prevalent musculoskeletal problem was low back symptoms in 65.2%, followed by it was shoulder symptoms in 48.9% and knee symptoms in 46.7%. Least prevalence musculoskeletal problem was elbow symptoms.

Social and environment domain of QoL was affected in quarry workers with increase in duration of occupation.

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