

A Cross-Sectional Survey Of Work Related Musculoskeletal Disorders Prevalence And Associated Risk Factors Among Quarry Workers In A South Eastern Nigerian Community

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Citation

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Abstract

Background: Work-related musculoskeletal disorders (WRMSDs) are worldwide problems that affect workers in a wide variety of occupations, causing workers' disability and increased health care cost. However, there is a dearth of literature on the risks and prevalence of WRMSDs among quarry workers in Nigeria.

Aim: This study estimated the risks, pattern and prevalence of WRMSDs among quarry workers in a South Eastern Nigerian community.

Methodology: This was a cross-sectional descriptive survey of quarry workers recruited using non-probability sampling technique from four purposively selected quarries registered with the federal ministry of solid minerals, in a Nigerian community. This study was conducted between May to August 2012, Parts A, B, C and D of Standard Nordic musculoskeletal questionnaire was used to collect data on the participants' demographic characteristics, job history, prevalence and risk factors of WRMSDs. Data obtained was summarized using frequency counts, mean, standard deviation, percentages and bar charts. Additionally, chi-square test was used to determine association between prevalence and risk factors of WRMSDs. Finally, logistic regression analysis was done to predict the risk factors with the highest contribution to the presence of symptoms. The alpha level was set at $p < 0.05$.

Result: A total of 114 participants (100% male) with mean age, 28.58 ± 8.09 years and age range, 16-52 years were included in the study. The prevalence rate of WRMSDs was 83.30%. Low back discomfort was the most prevalent (90 (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 were significantly associated with the occurrence of the symptoms. Task repetition was found to be the major risk factor of low back discomfort.

Conclusion: There is a dire need for designing ergonomic interventional programmes to reduce the risks of WRMSDs among quarry workers. The findings of this study highlighted the health problems faced by these workers and is also expected to improve productivity in the quarry industry if employers could minimize the ergonomic challenges of poor work design and environment. However, further studies should be conducted using a longitudinal design to take care of the limited information provided by participant during the cross sectional survey which was mainly subjective. The use of electromyography study to predict muscle fatigue time during work task to determine maximum time a worker should be on task will help reduce the risk of WRMSDs among the quarry workers.

INTRODUCTION

Work related musculoskeletal disorders (WRMSDs) are ancient and worldwide problems that affect workers in a wide variety of occupations, and are major causes of lost time from work, workers' disability, increase in compensation claims and health care costs [1]. WRMSDs usually occur when there is a mismatch between the

requirements of the job and the physical capacity of the human body, depending upon the physical movement characteristics, ergonomics and mechanical design of work tasks [2]. They range from acute traumas, such as fractures, that occur during an accident in the workplace [3] to cumulative disorders (that usually take months or even years to develop) that result from repeated exposure to high or low

intensity loads over a long period of time [1]. WRMSDs can either be specific (with well-defined signs and symptoms) or nonspecific (pain or discomfort exists without evidence of a clear specific disorder) with symptoms that may vary from discomfort and pain to decreased body functional ability, numbness and paresthesia and joint stiffness [4].

Studies have shown that musculoskeletal disorders are among the most prevalent and the most frequently reported work-related injuries that affect all age groups, especially people in their working years [5]. They mainly affect, though at varying degrees, the tissue structures such as muscles, joints, tendons, ligaments, nerves, bones and the localized blood circulatory system at the back, neck, shoulders, upper limbs, and lower limbs [3]. Similarly, the pattern of WRMSDs (the parts of the body affected by WRMSDs), has been reported to vary among different occupational groups and with different geographical locations [6]. Adedoyin et al [7] reported 74% and 73% as the prevalence of low back and neck pain among computer users in Nigeria respectively. Whereas Omokhodion et al [8] and Omokhodion and Sanya [9] reported 46% and 38% as the prevalence of low back pain among Nigerian rural and urban hospital workers respectively. An Arabian study by Shikdar and Al-Kindi [10] reported that the major WRMSDs among computer users included eyestrain (58%), shoulder pain (45%), back pain (43%), forearm pain (35%), wrist pain (30%), and neck pain (30%). However, a South Korean study Cheong et al [11], found in a related study that the prevalence of neck pain was 20% among hotel restaurant workers. Whereas another study conducted in the United States Baker [12] reported a neck pain prevalence of 57% among the same category of workers. Smith et al [13] further reported that the highest prevalence of pain as complained by workers in a nursing home was at the lower back (56.75%), followed by the neck (42.8%), upper back (38.9%) and shoulders (38.9%).

Mining work such as quarrying task is often characterized with very difficult and challenging conditions involving manual material handling, heavy lifting, repetitive movements and tasks, forceful manual-exertion and exposure to whole body or segmental vibration (as a result of the work tool handling) that are known to predispose people to WRMSDs [14, 15]. In spite of this increased risks of WRMSDs among quarry miners, there seemed to be a dearth of literature on the prevalence of work-related musculoskeletal disorders among this group of workers in Nigeria, even though research survey works have been conducted on other occupations involved in manual material

handling and physical work load in Nigeria [6, 16, 17]. This study was therefore designed to estimate the prevalence and risk factors of work-related musculoskeletal disorders among quarry workers in a South Eastern Nigerian community.

METHODS

This study was a cross-sectional descriptive survey that employed non-probability sampling technique to recruit participants from four purposively selected quarries registered with the federal ministry of solid minerals, located in Ishiagu community of Ebonyi state, South-East Nigeria from May to August 2012. Ethical approval was sought and obtained from the research and ethical committee of the Lagos University Teaching Hospital. In addition, official approval was sought and obtained from the management of the companies to carry out the study in their establishments before commencement of the study. The informed consent of the participants was also obtained before carrying out the study, and only those participants who were willing to participate in the study were included.

The quarry workers included in the study were within the age range of 16-55 years, with a minimum of 12 months working experience in the quarry sites prior to the study. Administrative Workers in the quarry sites that are not directly involved in the quarrying task (production of granite stone), and quarry workers that have less than one year working experience or those that had any previous body discomfort/pain before employment in the company were excluded. Sections A, B, C and D of Standard Nordic musculoskeletal questionnaire [18] were used to collect data on the participants' demographic characteristics, job history, information on the prevalence of WRMSDs (in the past twelve months to the time of the study). Information was also obtained on the participants perception of risk factors associated with the development of WRMSDs.

The relevant sections (A, B, C & D) of the Nordic musculoskeletal questionnaire were self-administered by the participants after the questionnaire was translated into Igbo language (the general language in the South-East Nigeria), for easy comprehension by the workers. The translation to Igbo language and back translation to English were done by language experts. The test-retest reliability of this Igbo translated instrument was found to have Cronbach's alpha value = 0.72 - 0.80 in a previous study [19]. Finally, the weights and heights of the participants were also measured using a Hana scale, model BR-9011 weighing scale and a Charder 200PW wall mounted standiometer respectively. Statistical analysis: Descriptive statistics of frequency

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counts, mean, standard deviation, percentages and bar charts were used to analyze and present the socio-demographic variables, height, weight and WRMSDs prevalence. Inferential statistics of chi-square test was used to determine association between prevalence and risk factors of WRMSDs while logistic regression was used to predict the probability of occurrence of WRMSDs. Adjustments were made for age and length of time as a quarry worker. A 3-point likert scale was used for the measurements of the risk factors. The SPSS (Statistical Package for Social Sciences, Chicago, Illinois, USA) version 12 for windows was used for the analysis and alpha level was set at $p < 0.05$.

RESULTS

A total of 114 male subjects who have completed the questionnaire were included in the analysis. The response rate was found to be 75%. Age of the participants ranged between 16-52 years with mean being 28.58 ± 8.09 . The average height, weight and Body Mass Index (BMI) of the participants were 1.74 ± 0.05 meters, 69.11 ± 8.06 kg and 23.03 ± 1.85 kg/m², respectively (Table 1). The educational level of the respondents were found to be, 76(66.66%) had formal education, while 12 (33.34%) were without any form of formal education.(Table 2).

Low back pain/discomfort was found to be most prevalent complaint {90(78.9%)} followed by wrists pain/discomfort {68 (59.6%)} while upper back {10(8.8%)} and hip {10(8.8%)} pain/discomfort were the least prevalent (Figure 1).

The participants' mean years of working experience was 9.89 ± 7.27 years. A significant positive association was observed between participants' years of working experience and prevalence of WRMSDs ($\chi^2 = 0.308$, $p = 0.000$) (Table 3).

Among the different categories of workers included in the study, all drivers and mechanics complained of WRMSDs over 12 months period, while blasters had the lowest frequency (66.67%) of WRMSDs (Table 4).

A logistic regression analysis on the influence of the risk factors of WRMSDs and the presence of symptoms showed that, task repetitive was significantly associated with the occurrence of the symptoms (OR=3.46, CI=1.23 – 6.36) (Table 5). The highest reported symptom of WRMSDs (Low back pain) was also compared using a univariate logistic regression analysis between task repetition (Risk factor with the highest OR) and low back pain and the result showed that task repetition was a significant predictor of low back pain (OR= 3.05 and C.I= 1.47 - 6.29)(Table 5)

Table 1

Physical characteristics of the respondents (n= 114)

| Variables | MEAN \pm S.D | RANGE |
|--------------------------|------------------|-------------|
| Age (years) | 28.58 ± 8.09 | 16 - 52 |
| Height (M) | 1.74 ± 0.05 | 1.62 - 1.86 |
| Weight (Kg) | 69.11 ± 8.06 | 58 - 87 |
| BMI (Kg/m ²) | 23.03 ± 1.85 | 18.1 - 30 |

Table 2

Socio-demographic Characteristics of the Respondents

| Variables | Frequency (n) | Percentage (%) |
|---|---------------|----------------|
| Age range of respondents (years) | | |
| 16-25 | 49 | 42.98 |
| 26-35 | 44 | 38.59 |
| 36-45 | 19 | 16.67 |
| 46-55 | 2 | 1.75 |
| Educational Status | | |
| Primary Education | 42 | 36.84 |
| Secondary Education | 27 | 23.68 |
| Tertiary Education | 7 | 6.14 |
| Non formal education | 26 | 22.80 |
| No response | 12 | 10.52 |

Table 3

Pearson Chi square test to find association between participants' years of working experience with the occurrence of WRMSDs

| AGE RANGE | FREQUENCY | PERCENTAGE | χ^2 | p |
|--------------|------------|------------|----------|--------|
| 1 - 11 | 65 | 57.01 | 0.308 | 0.000* |
| 12 - 21 | 37 | 32.45 | | |
| 22 - 31 | 11 | 9.65 | | |
| > 31 | 1 | 0.87 | | |
| Total | 114 | 100 | | |

* Significant at $p < 0.05$

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Table 4

Twelve Month Prevalence of Work-related Musculoskeletal Disorders (WRMSDs) among different categories of quarry workers

N =114 (April 2011 to April 2012)

| Task Group | Yes (n) | No (n) | Prevalence (%) |
|-----------------|---------|--------|----------------|
| Blasters | 8 | 4 | 66.67(12) |
| Crushers | 26 | 6 | 81.25(32) |
| Drillers | 31 | 9 | 77.50(40) |
| Drivers | 18 | 0 | 100(18) |
| Mechanics | 12 | 0 | 100(12) |
| All Respondents | 95 | 19 | 83.30(114) |

Table 5

Logistic regression analysis to find the association of work related risk factors with the report of WRMSDs symptoms

| Risk factors | OR | 95% CI |
|-----------------------------------|------|-------------|
| Task Repetition | 3.46 | 1.23 – 6.36 |
| Heavy lifting | 0.71 | 0.23 – 2.17 |
| Working in Awkward posture | 0.92 | 0.46 – 1.86 |
| Working in static posture | 1.26 | 0.53 – 2.97 |
| Poor work station design | 1.38 | 0.60 – 3.12 |
| Use of vibratory tools | 1.77 | 0.73 – 4.30 |
| Working with a confused worker | 1.85 | 0.74 – 4.63 |
| Reduced rest/break at workday | 0.73 | 0.33 – 1.61 |
| High job demand | 0.88 | 0.39 – 1.98 |
| Job dissatisfaction | 0.55 | 0.21 – 1.41 |
| Poor supervisor relation | 0.79 | 0.32 – 1.95 |
| Inadequate safety training | 1.36 | 0.61 – 3.02 |
| Working with injury | 1.27 | 0.56 – 2.65 |
| Univariate logistic Regression | | |
| Task Repetition and low back pain | 3.05 | 1.47 – 6.29 |

DISCUSSION

All the participants in this study were males. This is not surprising considering the high level of exertion involved in quarrying task, which most females may find very difficult or impossible to cope with. The age range (16-52 years) of the participants in this study, was similar to that reported in a similar study conducted in Japan with age range of 16-55

years [20]. However, it differed from the age range reported (16-35 years) in another similar but Ukrainian work [21].

The age range in these studies comprised mostly of the youthful and the middle-aged stages of life that is considered as the most virile and energetic stages in human life, which may be due to the high level manual exertion involved in quarrying task that a child or the elderly may not be able to handle.

The participants' response rate (75%) in this study was lower than that obtained (96.7%) in a similar Nigerian study [19] among timber workers. The lower response rate in the present study may be as a result of the high level of illiteracy among the participants, as a significant percentage of them (26.7%) did not have any formal education. This might have caused their lack of interest in the study.

The prevalence rate of WRMSDs among the quarry workers in this study was higher than what was reported in some other similar studies [22, 13]. Smith et al [13] reported a back pain prevalence of 56.75% among nursing home workers in Queensland, Australia, as against 78.9% reported in this study. Bovenzi [23] in his study among stone workers in Italy reported 30.2% prevalence of work related injuries compared to 83.30% obtained in this present study. This may be attributed to the fact that Italian stone quarrying environments may be more ergonomically designed than those in Nigeria, thus accounting for reduced prevalence reported by Bovenzi [23].

More so, the prevalence of low back pain in this study was higher than previous reports on the prevalence of low back pain among different categories of workers in Nigeria. Adedoyin et al [7] reported a prevalence of 74% among computer users in Nigeria. Whereas Omokhodion et al [8] and Omokhodion and Sanya, [9] quoted 46% and 38% as the prevalence of low back pain among Nigerian rural and urban hospital workers respectively. This may suggest that quarry mining poses a much higher risk of WRMSDs than many other occupations, especially in a developing nation like Nigeria where many other socioeconomic factors may also worsen the risks. For example, more than 60% of the participants in this study either did not have a formal education or stopped at primary level of education. Thus, there was the likelihood of high level of ignorance on the correct ergonomically-sound working techniques. This might have contributed to the high prevalence level of WRMSDs in this study as opposed to other reports, whose participants were more academically enlightened. Therefore, there is a need for a swift ergonomic intervention on the quarry workers in order to reduce their risk of developing

WRMSDs.

The years of working experience among the quarry workers was found to be significantly associated with the presence of symptoms which may be a pointer to the fact that occurrence of symptom is a function of exposure time to risk factors of WRMSDs during work task execution. This is also in line with the findings of Andrusaitis et al [24] who found low back pain experience among truck drivers to be associated with work time and years of experience.

The result of this study also showed that all drivers and mechanics in the quarry industry, suffered from WRMSDs, followed by crushers with 81.25% and the blasters having the least prevalence (66.67%). This pattern of prevalence might be explained by the reason that the higher demanding jobs with greater manual material handling and task repetition such as mechanical/ driving job task may have greater risk to report of injury compared to the less demanding tasks like blasting.

In addition, there was also a significant association between the workers perceived job-related risk factors such as awkward posture, high force application during task, contact stress on skin, high mental stress, task repetition and WRMSDs symptoms. This is also consistent with the findings of a related study by [25] that reported awkward posture, task repetition, irregular shifts and excessive contact stress on skin as the most implicated cause of symptoms among nurses.

Finally, the result of the multivariate logistic regression analysis showed that after, repetitive movement was a significant predictor of report of musculoskeletal injury (OR = 3.460; 95%CI 1.232-6.361). In addition, task repetition was also observed to be a significant predictor of low back pain.

CONCLUSION

The result of this study showed that, eight out of every ten quarry worker experienced WRMSDs in twelve month (April 2011 to April 2012) and that low back pain was the most common reported symptom. Years of working experience, high task repetition, awkward posture, and heavy lifting during task, poor work station design and working in static position were significantly associated with report of injury by workers. Therefore, there is dire need for workers' education on ergonomic intervention strategies to raise awareness regarding work-related musculoskeletal disorders observed among the quarry workers to ensure that they remain healthy and safe as much as possible throughout their working lifetime. The findings of this study highlighted the

health problems faced by these workers and also is expected to improve productivity in the quarry industry if employers could minimize the ergonomic challenges of poor work design and environment. However, further studies should be conducted using a longitudinal design to take care of the limited information provided by participant during the cross sectional survey which was mainly subjective. The use of electromyography study to predict muscle fatigue time during work task to determine maximum time a worker should be on task will help reduce the risk of WRMSDs among the quarry workers.

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