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Prevalence and determinants of Musculoskeletal Disorders among quarry workers in The Gambia: a cross-sectional study

Ebrima Touray^{1,2*}, Lamin Sambou⁵, Balla Jammeh⁴, Sambou L S Kinteh¹, Bakary Kinteh¹ and Amadou Barrow^{3,4}

Abstract

Background Musculoskeletal disorders (MSDs) are common work-related conditions that affect the musculoskeletal system owing to poor ergonomic practices, overexertion, and repetitive motions. Globally, MSDs account for a significant proportion of disabilities due to the physical tasks and demanding nature of jobs. Despite global efforts to reduce occupational hazards, little information is available on MSDs among quarry workers in Gambia. Therefore, this study aimed to explore the prevalence of MSDs and their associated factors in quarry workers in Gambia.

Methods This study adopted an analytical cross-sectional design that was conducted in 2023. A total of 258 quarry workers were selected from 4 quarries in the West Coast Region. Participants were randomly selected and the Standardised Nordic Questionnaire (SNQ) was modified and used with additional structured questionnaires. Data were collected using the Kobo Collect App and analyzed using IBM SPSS version 27.0. Bivariate analysis was conducted using binary logistic regression, Pearson's chi-square test, point-biserial correlation, and Fisher's exact test to identify the association between predictors and outcome variables. Statistical significance was considered at a p -value < 0.05 , and the significance was also reported using an adjusted odds ratio (aOR) with a 95% Confidence Interval (CI).

Results The study revealed a high MSD prevalence of 93% among quarry workers, with the most affected body parts being the lower back (90.3%), shoulders (68.1%), and upper back (61.3%). Significant associations were observed between MSDs and factors such as nationality ($p = 0.048$), job description ($p = 0.047$), BMI score ($p < 0.001$), periodic health examination ($p = 0.031$), years of experience ($p = 0.029$), health and safety training ($p = 0.044$), and lifting or carrying weights ($p = 0.044$). Quarry workers whose nationality was Gambian had 82.8% (aOR = 0.172; 95% CI = 0.048–0.619) reduced odds of sustaining MSDs when compared to respondents whose nationality was non-Gambian. Increasing years of experience had 15.0% (aOR = 0.850; 95% CI = 0.725–0.997), increase in hours of daily work had 40.3% (aOR = 0.597; 95% CI = 0.386–0.925), and increasing BMI score had 29.9% (aOR = 0.701; 95% CI = 0.584–0.841) reduction in the odds of sustaining MSDs. However, increasing household size among quarry workers had 1.26 (aOR = 1.261; 95% CI = 1.015–1.566) higher odds of sustaining MSDs.

Conclusion This study underscores a critical public health concern with the high prevalence of MSDs among quarry workers in The Gambia, which is associated with poor ergonomic training and inadequate safety training. Reducing

*Correspondence:
Ebrima Touray
eb2ray7@gmail.com

Full list of author information is available at the end of the article



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the burden of MSDs in this population requires interventions that focus on better working conditions, ergonomic training, and regular health evaluations.

Keywords Musculoskeletal disorders, Occupational health, Workplace safety, Quarry workers, The Gambia

Introduction

Musculoskeletal disorders (MSDs) are described as injuries or diseases of the musculoskeletal system and connective tissues that arise from work events or exposure by bodily reactions to, for example, (bending, climbing, crawling, reaching, twisting), overexertion, or repetitive motion [1]. They mostly affect body parts such as the neck, shoulders, elbows, lower back, wrists, hips, knees, and ankles, and are not only related to an acute or sudden occurrence of slip or fall [2]. The Sustainable Development Goals (SDG) Agenda for 2030, specifically SDG 3 and 8, seeks to reduce or eliminate occupational risk exposure and health-related loss [3].

Globally, MSDs have posed a great public health concern, despite several efforts to reduce their burden. The International Labor Organization (ILO) estimates that each year 2.02 million people die from work-related diseases, and 160 million non-fatal cases of work-related diseases are reported annually [4, 5]. According to 2019 data on the Global Burden of Disease, 1.71 billion people suffer from MSDs, including osteoarthritis, rheumatoid arthritis, neck discomfort, fractures, various injuries, and lower back pain. It is the largest global contributor to years lived with disability (YLDs), accounting for 17% of all YLDs, with an estimated 149 million YLDs [6]. By 2050, the global burden of MSDs is anticipated to rise much higher among adolescents and young adults between the ages of 15–39 years, which will create more health complications in old age [7].

Quarrying or mining plays a significant role in the economy, infrastructure development, and employment opportunities worldwide. There has been a rapid increase in small-scale mining or quarrying in more than half of the developing countries, especially in Africa [8]. Working in these settings is dangerous because workers are exposed to inappropriate ergonomic working conditions, leading to musculoskeletal problems [8, 9]. MSDs pose a serious threat to health, quality of life, and working abilities. They are often linked to loads (static and dynamic), vigorous exertions, repetitions, and vibrations, placing quarry workers at risk, and have been one of the contributing factors to the declining working population from ages 22 to 55 years [10, 11].

Studies have reported a growing global trend in MSDs and their associated factors [6, 7]. A study conducted among quarry workers in Nigeria by Njaka et al. in 2021, and another study among gold miners in Ghana by Tawiah et al. in 2015 reported a high prevalence of MSD over 80% among respondents, with the lower back

being the most prominent body part affected among all other body parts [12, 13]. Another study by Smith et al. in 2023 examined the relationship between workload factors and MSDs in the mining sector. The results showed particular workload factors, such as dynamic and static loads, resulting in an increased likelihood of MSDs in body parts such as the lower back, neck, shoulder, wrist, and hands [11]. A similar study also revealed a high prevalence of MSDs in the neck, shoulder, lower back, and knees, and the risk of MSDs with increasing working hours in these body parts [14]. A key insight into the determinants of MSDs among quarry workers was revealed in a study [15] in the US on the management perspectives of MSD risk factors and safety measures. Sociodemographic and personal factors were highlighted as contributing to MSD, including age, low physical fitness levels, lack of experience, and attitude towards risks. Similar findings were reported in a study in Iran, where MSDs were strongly linked with work experience, age, and BMI [8].

To the best of our knowledge, there is a lack of data on musculoskeletal disorders and fatalities in The Gambia. Quarry workers in Gambia are exposed to numerous ergonomic hazards and poor working environments. Quarrying activities are known to attract high MSDs, and there is significant underreporting of the hazards, disorders, and injuries that occur among quarry workers, particularly non-fatal injuries. Occupational Health and Safety (OHS) is an issue of oversight. The OHS standards in The Gambia have been derived from local legislation and international guidelines, and the key bases of these standards are the Labor Act (2007) and the Factories Act (Cap 70:01). The other Acts include the Public Health Act and the Workers' Compensation Act (Cap 100). These Acts are outdated and inadequate to address inappropriate ergonomic working conditions, which are the fundamental factors in the onset of musculoskeletal problems in workers, especially quarry workers. As such, this study aimed to explore musculoskeletal disorders and their associated factors among quarry workers in The Gambia.

Methods

Study design

An analytical cross-sectional study was conducted in January 2023 among quarry workers from 4 quarries in Kombo East and Kombo Central in the West Coast Region of The Gambia. All quarries are open pits used for commercial extraction of stones and gravel identified

as quarry sites by the Brikama Area Council (BAC) and have been in existence for more than 40 years.

Study population and sample size

Based on their availability during data collection and their consent to participate in the study, 248 participants were randomly selected from all departments at the quarry. These departments include blasting/drill blasting, loading, geology, driving, and other quarry-operating administrative areas.

The sample size was estimated using the Cochran (1963) single proportion method, as shown below [16]. The prevalence of MSDs was 81.2%, which was adopted from a study conducted in India [17], 95% confidence interval ($z = 1.96$), and a margin of error e expressed as 5%. The final sample size was 258, after a 10% non-response rate was added to increase the power of the study.

$$n = \frac{Z^2(p)(1-p)}{e^2}$$

where; n = number of sample size.

Z = 95% confidence interval ($z = 1.96$).

$p = 0.812$.

$q = 1 - 0.812 = 0.188$.

$e = 0.05$ margin of error.

Eligibility criteria

Inclusion criteria

Quarry workers who were at least 18 years old and had at least 12 months of work experience in a quarry were included in the study.

Exclusion criteria

Quarry workers who were not present at the time of data collection at the quarry and who did not consent to participate in the study were removed.

Data collection and measurements

The Standardised Nordic Questionnaire (SNQ) for locomotive organs [18] was modified and supplemented with other closed-ended structured questionnaires consisting of three sections: sociodemographic, health-related, and work-related factors [12, 19]. The Sociodemographic characteristics section gathered information on age, sex, educational level, nationality, ethnicity, religion, marital status, job description, household size, average monthly income, and family size. Health-related characteristics included smoking status, alcohol consumption status, Body Mass Index (BMI, weight/height²), and periodic health examinations. The work-related factors are the SNQ, which has 9 regions of the body, to examine whether respondents have sustained any trouble (ache, pain, discomfort, or numbness) in the neck, shoulders,

upper back, elbows, lower back, wrist/hands, hips/thighs, knees, and ankles/feet in the last 12 months. Work-related questionnaires also included years of experience, number of days of work per week, hours of daily work, duration of break period, health and safety training, lifting or carrying weights, exposure to vibration, repetitive work, and personal protective equipment use. Musculoskeletal Disorders were coded as “yes = 1” for respondents who have reported sustaining at least two (2) MSDs in the last 12 months, and “no = 0” for respondents who reported sustaining less than two (2) or none in the last 12 months. The questionnaires were written in English, translated, and pre-tested in local languages such as Fula, Mandinka, and Wolof. Data were collected using the Kobo Collect App through face-to-face interviews with trained students at the School of Public Health at Gambia College.

Statistical analysis

All variables were selected from the questionnaires. Data were exported, cleaned, and analyzed using IBM SPSS version 27.0. Continuous variables were presented as means and standard deviations, while categorical variables were expressed as frequencies and percentages. Descriptive analyses were presented in proportions, frequencies, and pie charts. Bivariate analysis was conducted using binary logistic regression, Pearson's chi-square test, Fisher's exact test, and point-biserial correlation to identify the association or relationship between predictor and outcome variables. Statistical significance was considered at a p -value < 0.05 , and the significance was also reported using an adjusted odds ratio (aOR) with a 95% Confidence Interval (CI).

Results

Sociodemographic and health-related characteristics of respondents

The study included 258 participants with a response rate of 96.1%. Table 1 presents the sociodemographic and health-related characteristics of the respondents, with a mean age of 35.2 (± 10.2) years. The majority of the respondents were male, accounting for more than 90%, and more than half of the respondents (65.7%) were non-Gambians. Fula ethnicity was the predominant ethnicity reported by the respondents, with 67.3% and 99.2% of the respondents reporting being of Islamic faith. Three-quarters (75.0%) of respondents were married and the average household size among respondents was 8.35 (± 5.84) people. Almost three-quarters (70.6%) of the respondents described their job description as blasters/driller-blaster, and most (66.9%) had no formal education. On average, most of the respondents earn a monthly income of 4,312.70 GMB ($\pm D2$, 739.70). Regarding some of the health-related characteristics among respondents, the

Table 1 Sociodemographic and health-related characteristics of respondents based on MSDs in the past 12 months

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Variables	Musculoskeletal Disorders			P-value
	No (n = 18)	Yes (n = 230)	Total (N = 248)	
Sociodemographic characteristics				
Age of respondents (years)				
Mean (SD)	36.8 (10.7)	35.0 (10.2)	35.2 (10.2)	0.490 ¹
Range	22.0–55.0	18.0–59.0	18.0–59.0	
Sex				
Male	17 (6.9%)	208 (83.9%)	225 (90.7%)	1.000 ³
Female	1 (0.4%)	22 (8.9%)	23 (9.3%)	
Educational level				
Non-formal	13 (5.2%)	153 (61.7%)	166 (66.9%)	0.249 ²
Primary	2 (0.8%)	58 (23.4%)	60 (24.2%)	
Secondary	3 (1.2%)	19 (7.7%)	22 (8.9%)	
Nationality				
Gambian	10 (4.0%)	75 (30.2%)	85 (34.3%)	0.048 ²
Non-Gambian ^a	8 (3.2%)	155 (62.5%)	163 (65.7%)	
Ethnicity				
Fula	10 (4.0%)	157 (63.3%)	167 (67.3%)	0.268 ²
Other ethnicities ^b	8 (3.2%)	73 (29.4%)	81 (32.7%)	
Religion				
Islam	18 (7.3%)	228 (99.1%)	246 (99.2%)	1.000 ³
Christianity	0 (0.0%)	2 (0.8%)	2 (0.8%)	
Marital status				
Single	3 (1.2%)	44 (17.7%)	47 (19.0%)	1.000 ³
Married	15 (6.0%)	186 (75.0%)	201 (81.0%)	
Job description				
Blaster/driller-blaster	9 (3.6%)	166 (66.9%)	175 (70.6%)	0.047 ²
Quarry operative ^c	9 (3.6%)	64 (25.8%)	73 (29.4%)	
Household size				
Mean (SD)	6.5 (2.1)	7.6 (4.2)	7.5 (4.0)	0.278 ¹
Range	3.0–10.0	1.0–19.0	1.0–19.0	
Average monthly income (GMB)				
Mean (SD)	5,188.9 (2,232.1)	4,244.1 (2,767.8)	4,312.7 (2,739.7)	0.159 ¹
Range	1,500.0–9,000.0	500.0–12,000.0	500.0–12,000.0	
Health-related characteristics				
Smoking status				
Yes	9 (3.6%)	70 (28.2%)	79 (31.9%)	0.086 ²
No	9 (3.6%)	160 (64.5%)	169 (68.1%)	
Alcohol drinking status				
Yes	0 (0.0%)	2 (0.8%)	2 (0.8%)	1.000 ³
No	18 (7.3%)	228 (91.9%)	246 (99.2%)	
BMI score				
Mean (SD)	26.8 (4.2)	23.6 (2.7)	23.85 (2.9)	<0.001 ¹
Range	22.0–36.0	18.0–30.0	18.0–36.0	
Periodic health examination				
Yes	8 (3.2%)	45 (18.1%)	53 (21.4%)	0.031 ³
No	10 (4.0%)	185 (74.6%)	195 (78.6%)	

¹Point-biserial correlation, ²Pearson's Chi-square test; ³Fisher's exact test; BMI=Body Mass Index; Statistical significance $p < 0.05$; ^aNon-Gambian=Bissau Guinean, Malian, Senegalese, & Sierra Leonean; ^bOther ethnicities=Aku, Balanta, Jalunka, Jola, Kasinka, Mandinka, Manjago, Serer, Sussu, Temne, & Wolof; ^cQuarry operative=Stonecutter, Clerk, Geologist, Loader, Secretary, Seller, Ticket administrator, & Truck driver

majority (68.1%) were non-smokers, and more than 90% did not drink alcohol. Less than a quarter of respondents reported conducting periodic health examinations and 23.85 (± 2.9) was the average BMI recorded among the

respondents. A chi-square test for association revealed a statistically significant association between nationality and MSDs ($\chi^2 (1) = 3.902$, $p = 0.048$) and job description and MSD ($\chi^2 (1) = 3.952$, $p = 0.047$). Point-biserial

Table 2 Work-related characteristics of respondents based on MSDs in the past 12 months

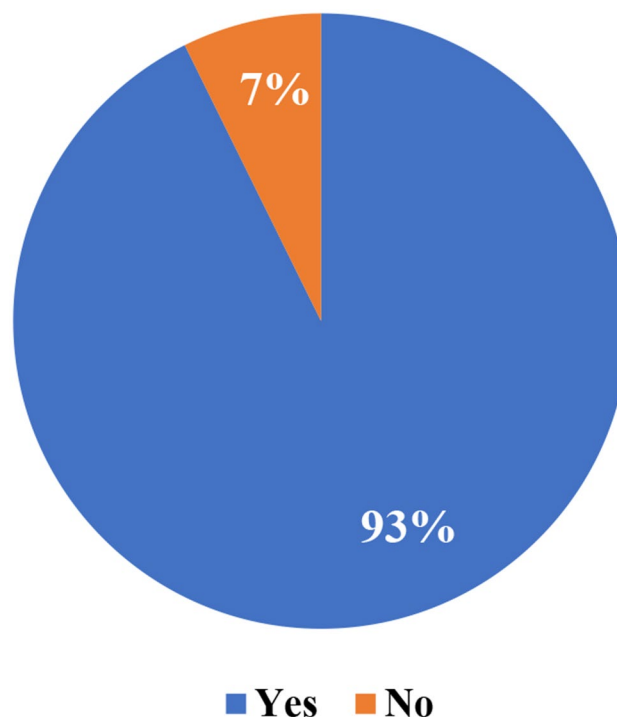
Variables	Musculoskeletal Disorders			P-value
	No (n = 18)	Yes (n = 230)	Total (N = 248)	
Years of experience				0.029¹
Mean (SD)	11.9 (6.5)	9.2 (4.8)	9.4 (5.0)	
Range	3.0–23.0	2.0–21.0	2.0–23.0	
Number of days of work in a week				0.985 ¹
Mean (SD)	5.9 (0.9)	6.0 (0.7)	6.0 (0.7)	
Range	4.0–7.0	4.0–7.0	4.0–7.0	
Number of hours of work daily				0.582 ¹
Mean (SD)	8.2 (0.8)	8.1 (1.3)	8.1 (1.3)	
Range	7.0–10.0	5.0–12.0	5.0–12.0	
Duration of break period (in minutes)				0.407 ¹
Mean (SD)	45.3 (14.2)	41.7 (17.9)	42.0 (17.6)	
Range	30.0–70.0	10.0–100.0	10.0–100.0	
Health and safety training				0.044²
Yes	2 (0.8%)	3 (1.2%)	5 (2.0%)	
No	16 (6.5%)	227 (91.5%)	243 (98.0%)	
Lifting or carrying weights				0.044²
Yes	16 (6.5%)	227 (91.5%)	243 (98.0%)	
No	2 (0.8%)	3 (1.2%)	5 (2.0%)	
Exposed to vibration				0.536 ²
Yes	17 (6.9%)	221 (89.1%)	238 (96.0%)	
No	1 (0.4%)	9 (3.6%)	10 (4.0%)	
Performing repetitive work				1.000 ²
Yes	18 (7.3%)	227 (91.5%)	245 (98.8%)	
No	0 (0.0%)	3 (1.2%)	3 (1.2%)	
Personal protective equipment				1.000 ²
Yes	3 (1.2%)	42 (16.9%)	45 (18.1%)	
No	15 (6.0%)	188 (75.8%)	203 (81.9%)	

¹Point-biserial correlation, ²Fisher's exact test; Statistical significance $p < 0.05$

correlation showed a statistically significant correlation between BMI and MSD (r_{pb} (246) = 0.285, $p < 0.001$). There was a statistically significant association between periodic health examinations and MSD, as assessed by Fisher's exact test ($p = 0.031$).

Work-related characteristics based on MSDs in the past 12 months

Table 2 presents the work-related characteristics of respondents in which the average years of experience in a quarry was 9.4 (± 5.0) years. The average number of working days of respondents, the average hours of daily work, and the duration of the break period were 6.0 (± 0.7) days, 8.1 (± 1.3) hours, and 42.0 (± 17.6) minutes, respectively. More than three-quarters of the respondents reported being exposed to vibration (96.0%), lifting or carrying weights (98.0%), and performing repetitive work (98.8%). The majority of respondents (95%) did not undergo health and safety training, and 81.9% did not wear PPE during work. A point-biserial correlation showed a statistically significant correlation between years of quarry experience and MSDs (r_{pb} (246) = 0.139, $p = 0.029$). There

**Fig. 1** Showing the prevalence of MSDs in the past 12 months among quarry workers

was a statistically significant association between health and safety training and MSDs ($p = 0.044$), and lift or carry weight and MSDs ($p = 0.044$), as assessed by Fisher's exact test.

Prevalence of MSDs among quarry workers and MSDs based on the body parts

The overall percentage of quarry workers who sustained MSDs in the past 12 months was 93%, as presented in Fig. 1. Table 3 shows the MSDs based on the nine body parts reported by the respondents, in which the lower back (small of back) accounted for the highest number of cases (90.3%), followed by both shoulders and upper back (68.1% and 61.3%, respectively).

Determinants of musculoskeletal disorder among quarry workers

Logistic regression was performed to determine the factors associated with the likelihood that quarry workers will sustain MSDs in a quarry. The model was statistically significant, χ^2 (6) = 32.649, $p < 0.001$. The model explained 30.4% (Nagelkerke R^2) of the variance in MSDs and correctly classified 93.5% of cases. Of all the predictor variables, five were statistically significant: nationality, household size, years of experience, daily work hours, and BMI, as shown in Table 4. The model predicted that respondents whose nationality was Gambian had 82.8% reduced odds of sustaining MSDs compared

Table 3 Musculoskeletal disorders based on body parts

Body parts	Frequency	Percentage (%)
Neck		
Yes	61	24.6
No	187	75.4
Shoulders		
Yes, right shoulder	14	5.6
Yes, left shoulder	15	6
Yes, both shoulders	169	68.1
No	50	20.2
Elbows		
Yes, right elbow	4	1.6
Yes, left elbow	14	5.6
Yes, both elbows	46	18.5
No	184	74.2
Wrists/Hands		
Yes, right wrist/hand	19	7.7
Yes, left wrist/hand	8	3.2
Yes, both wrists/hands	90	36.3
No	131	52.8
Upper Back		
Yes	152	61.3
No	96	38.7
Lower Back (small of back)		
Yes	224	90.3
No	24	9.7
One or Both Hips/Thighs		
Yes	35	14.1
No	213	85.9
One or Both knees		
Yes	87	35.1
No	161	64.9
One or Both Ankles/Feet		
Yes	30	12.1
No	218	87.9

Table 4 Logistic regression predicting musculoskeletal disorders among quarry workers in the Gambia

Variables	Adjusted Odd Ratio (aOR) 95% C.I.
Age	1.053 (0.973–1.140)
Nationality	
Gambian	0.172 (0.048–0.619)*
Non-Gambian (ref)	1
Household number	1.261 (1.015–1.566)*
Years of experience	0.850 (0.725–0.997)*
Daily hours of work	0.597 (0.386–0.925)*
BMI	0.701 (0.584–0.841)*

C.I. = Confidence interval; Ref=Reference category; Statistical significance $p < 0.05$

to respondents whose nationality was non-Gambian. With a unit increase in household size, respondents had 1.26-higher odds of sustaining MSDs. An increasing number of years of quarry experience was associated with a reduction in the odds of sustaining MSDs. For a

unit increase in hours of daily work, the odds of sustaining MSDs were reduced by 40.3%. An increase in BMI was also associated with a 29.9% reduction in the likelihood of sustaining MSDs.

Discussion

The quarry has contributed to a significant workforce population in the mining industry in The Gambia with the growing demand for infrastructural development. They face numerous risks associated with MSDs during their daily activities. This study assessed musculoskeletal disorders among quarry workers, with a high prevalence of 93% in this population. This high prevalence has highlighted growing concerns about MSDs and is consistent with previous studies [2, 10, 12, 20]. The quarry has contributed to the global trend of MSDs common among workers engaged in physically taxing jobs and performing heavy manual labor, affecting different parts of the body, especially in industries that require heavy lifting and repetitive motions [5, 7, 12].

The study revealed that the demographic profile of the respondents was in the working-age population with a mean age of 35.2 (± 10.2) years with 90% male predominance. This finding aligns with a study in 2017 by Ahmad A. and Alvi R., and Tawiah et al., in which the quarry workers in within the working-age population and most of the quarry workers were males [13, 17]. Gender dominance is a result of the physically demanding nature of the work and the societal norms that shape gender roles in this industry. Our findings, however, contradict a study conducted in other places such as India, where the labor force was the locals; our findings showed that 65.7% of the respondents were non-Gambians [21]. The study revealed that the demographic profile disparity may be explained by the nature of the dynamics of Gambia's labor market and immigration patterns, which reflect a reliance on migrant labor for physically demanding jobs.

The respondents had low educational levels, and 66.9% had no formal educational training. This finding is different from similar studies conducted in Nigeria and the Democratic Republic of Congo (DRC), in which most of the respondents had secondary-level formal education [12, 22]. Additionally, the Fula ethnicity (67.3%) and Islamic faith (99.2%) of the respondents emphasized the particular ethnic and religious makeup of this labor segment in The Gambia, which may have implications for educational and community health initiatives.

Our analysis revealed several notable associations between work characteristics and MSDs. While insufficient health and safety training and lack of PPE use increased MSD risk among respondents, aligning with Studies in Ghana [23] and Nigeria [24, 25], other diverged from previous literature. The relationship between carrying or lifting weights and MSDs reinforces the

importance of ergonomic interventions and proper training in safe lifting practices to reduce injury risk.

Binary logistic regression analysis identified several significant predictors of MSDs, such as household size, nationality, years of experience, BMI, and daily hours of work among quarry workers. The likelihood of developing MSDs was 82.8% lower for those with Gambian nationality than for those without, reflecting differences in access to social support networks, working conditions, and healthcare. The observed disparity in work experience between Gambians and non-Gambian nationals may be the result of disparities in how well they have adapted to local working conditions. The positive correlation between household numbers and increased odds of developing MSDs may be attributed to heightened economic pressure to work longer hours or undertake physically demanding jobs to provide for a large family.

While our findings regarding experience, BMI, and working hours contrast with previous literature, several factors may explain these differences. The inverse association between years of experience and MSDs could reflect a survival bias, where workers who develop MSDs leave the profession early, leaving a healthier veteran workforce. This contrasts with findings by Yong et al. (2020) among coal mine workers in Xinjiang, China, where MSD risk increased with experience [10]. Similarly, the protective effect of higher BMI might represent a selection process where physically stronger individuals are more likely to remain in this demanding occupation, rather than indicating a truly protective effect of higher BMI against MSDs. The association between shorter working hours and increased MSD risk may reflect reverse causation, where workers with MSDs reduce their working hours as a coping mechanism. Similar findings were also reported in studies among quarry workers in Nigeria and sawmill workers in Bangladesh, where a higher BMI score was associated with reduced odds of MSDs [12, 26].

Study limitations

Several limitations should be considered when interpreting these results. First, the cross-sectional nature of our study limits causal inference, particularly regarding the temporal relationship between risk factors and MSD development. Second, recall bias may be present since MSD data was self-reported by respondents, potentially leading to exaggerated or unclear responses. Third, a healthy worker effect may be present, where workers who develop severe MSDs leave the profession, potentially leading to underestimation of MSD prevalence and biasing our understanding of risk factors. Fourth, differences in MSD assessment methods and definitions across studies may contribute to the apparent contradictions with previous literature. Additionally, the strength of

relationships identified may be limited by the small sample size. Despite these limitations, this study is one of the first to explore MSDs and their predictors among quarry workers in The Gambia, contributing valuable evidence to this understudied area. Future longitudinal studies with larger sample sizes are needed to better understand the temporal relationships between work characteristics and MSD development, particularly focusing on worker turnover and health-related selection in this physically demanding occupation. Additionally, standardization of MSD assessment methods across studies would facilitate more meaningful comparisons of risk factors across different populations and settings.

Conclusion

The study highlighted a high prevalence of musculoskeletal disorders among quarry workers in The Gambia, with 93% of respondents reporting two MSDs in the last 12 months. The most commonly affected body parts were the lower back, shoulders, and the upper back. Sociodemographic variables, such as nationality, job description, BMI score, periodic health examinations, and work-related variables, such as years of experience, health and safety training, and exposure to lifting and carrying weights, were significant determinants of MSDs. These results highlight a critical need to improve occupational health and safety protocols in the quarry industry, including routine physical, ergonomic, and thorough safety training programs, to reduce the risk of MSDs and improve the general health and welfare of quarry workers. In light of the notable deficiencies in occupational health standards reporting and oversight, especially in developing countries such as The Gambia, this study recommends the revision and enforcement of pertinent laws to enhance worker protection against the harmful consequences of poor ergonomic settings.

Abbreviations

AOR	Adjusted Odds Ratio
BMI	Body Mass Index
CI	Confidence Interval
ILO	International Labor Organization
MSDs	Musculoskeletal Disorders
SDG	Sustainable Development Goals
SNQ	Standardised Nordic Questionnaire
YLDs	Years Lived with Disability

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Author contributions

ET, LS, AB, BJ, SLSK, and BK developed the study concept and prepared the protocol. ET, LS, BJ, and SLSK have reviewed the literature. LS and BJ conducted fieldwork. ET, LS, and BJ performed the data cleaning. Data analysis and the initial draft of the manuscript were performed by ET, LS, & AB. The final manuscript was critically reviewed for intellectual quality and approved by all authors. ET was ultimately responsible for submitting for publication.

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Data availability

The data supporting the findings of this study are available upon reasonable request from the school administration of the School of Public Health, Gambia College, sph@gambiacollege.edu.gm.

Declarations

Ethics approval and consent to participate

This study was conducted in accordance with the ethical principles set forth in the Declaration of Helsinki. The ethical approval to conduct this study was approved by the Research Committee of Gambia College after reviewing the study protocol (Ref. no. PH08014/2023). All the methods used in the study complied with the relevant guidelines and regulations. Before commencement of the study, ethical approval was obtained from the Brikama Area Council (BAC), quarry managers, and community leaders from the identified quarry communities. Verbal informed consent was obtained from all participants before the interview to ensure free participation, confidentiality, and confidentiality. Participants were made aware that data would be collected using web-based app Kobo Toolbox. Access to the data would only be restricted to the head of school and the authors, and all the data would be de-identified after the study is published.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

Author details

¹School of Public Health, Gambia College, Brikama, The Gambia

²Brown School, Washington University in St. Louis, Missouri, USA

³Department of Epidemiology, College of Public Health and Health Professions, College of Medicine, University of Florida, Gainesville, Florida, USA

⁴Department of Public & Environmental Health, School of Medicine & Allied Health Sciences, University of The Gambia, Kanifing, The Gambia

⁵National Hepatitis Control Program, Directorate of Health Services, Ministry of Health, The Quadrangle, Banjul, The Gambia

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