

Prevalence and Risk Factors of Musculoskeletal Disorder in Bricklayers among Construction Workers

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Abstract:

Introduction: Work-related musculoskeletal disorders (WMSDs) pose significant health problems for construction workers, particularly bricklayers exposed to repetitive tasks, heavy lifting, and awkward postures. To identify occupational risk factors, determine high-risk body regions, and evaluate functional limitations among bricklayers.

Methodology: A cross-sectional observational study was conducted among 178 bricklayers (174 males, 4 females) at construction sites in Pune, India. Data was collected using a purposive sampling technique. Standardized outcome measures included the Hindi version of the Nordic Musculoskeletal Questionnaire (NMQ) to assess symptoms and the Rapid Entire Body Assessment (REBA) to evaluate postural ergonomic risks.

Results: Participants had a mean age of 39.72 ± 10.36 years and average work experience of 10.27 ± 5.98 years. Based on the NMQ, the lower back was the most commonly affected body region over both 7 days ($n=43$) and 12 months ($n=125$), followed by the knees ($n=37$ at 7 days; $n=93$ at 12 months). Lower back symptoms also caused the highest rate of 12-month functional disability ($n=43$), followed by upper back ($n=35$) and knee ($n=29$) issues. Ergonomic assessment via REBA showed that 59.5% of workers were in high (46.6%, score 8–10) or very-high (12.9%, score 11–15) risk categories.

Conclusion: Bricklayers in Pune experience a high prevalence of musculoskeletal symptoms, particularly affecting the lower back, knees, and upper back. Postural risk assessments reveal high ergonomic risk levels, highlighting the urgent need for targeted ergonomic interventions and preventive strategies in this occupational group.

Keywords: Bricklayers, Ergonomics, Nordic Musculoskeletal Questionnaire (NMQ), Rapid Entire Body Assessment (REBA), Work-Related Musculoskeletal Disorders.

Introduction:

Work-related musculoskeletal disorders (WMSDs) are among the most common occupational health problems worldwide, particularly affecting workers engaged in physically demanding jobs such as construction and bricklaying ^[1]. These disorders involve injuries or pain in muscles, joints, tendons, ligaments, and nerves, and are often caused or aggravated by repetitive movements, awkward postures, and heavy manual labor ^[1]. The construction industry has consistently been identified as a high-risk sector for the development of musculoskeletal disorders due to the nature of work, which includes prolonged

standing, frequent bending, lifting of heavy loads, and repetitive tasks ^[2]. Studies among construction workers have demonstrated a high prevalence of musculoskeletal symptoms that significantly affect workers' functional capacity and quality of life ^[2].

Bricklayers, as a specific subgroup of construction workers, are exposed to unique ergonomic stressors such as repetitive brick handling, sustained trunk flexion, kneeling, squatting, and overhead work ^[1]. These work demands contribute to a high burden of musculoskeletal disorders, particularly involving the lower back, shoulders, knees, and wrists ^[1]. Case study conducted among construction workers in Malaysia reported a high prevalence of musculoskeletal disorder symptoms, with the lower back being the most commonly affected region, followed by the shoulders and knees ^[3]. The study emphasized that manual material handling and poor working postures were major contributors to these symptoms ^[3].

Similar findings were reported in a cross-sectional community-based study conducted among construction workers in India, which revealed a high prevalence of musculoskeletal morbidity, especially in the lower back, neck, and upper limbs ^[4]. The study highlighted that prolonged working hours, lack of rest breaks, and poor ergonomic conditions were significant risk factors ^[4]. Ergonomic hazards play a critical role in the development of musculoskeletal disorders among construction workers. A cross-sectional study in India identified frequent bending, twisting, repetitive movements, and carrying heavy loads as common ergonomic hazards associated with musculoskeletal pain ^[5]. These hazards were found to increase the risk of chronic musculoskeletal problems if preventive measures were not implemented ^[5]

Workers in the brick industry are particularly vulnerable to musculoskeletal disorders due to continuous exposure to physically demanding tasks without adequate ergonomic interventions. A study conducted among brick industry workers in Chilaw, Sri Lanka, reported a high prevalence of work-related musculoskeletal disorders, with the lower back and upper extremities being the most affected body regions ^[6]. Poor working postures, repetitive tasks, and sustained awkward positions have been consistently associated with increased musculoskeletal complaints among construction workers ^[3,5]. These risk factors are often compounded by lack of ergonomic awareness and absence of preventive strategies at the workplace ^[5]. Musculoskeletal disorders (MSDs) are widely recognized as a major occupational health problem among construction workers due to the physically demanding nature of construction activities. Evidence from a longitudinal study among bricklayers and construction workers demonstrated a high prevalence of musculoskeletal disorders, particularly affecting the back, knee, and shoulder regions, and highlighted that repetitive occupational tasks were strongly linked to the development of symptoms ^[1]. These findings emphasize the sustained exposure of construction workers, especially bricklayers, to physically strenuous work conditions. Systematic review and meta-analysis examining work-related musculoskeletal disorders (WMSDs) among construction workers reported an overall prevalence of approximately 59%, indicating a substantial burden of musculoskeletal health problems in this occupational group ^[2]. The review further identified demographic risk factors such as age and gender as important contributors to WMSD prevalence. Complementing this, another systematic review focusing on the prevalence of musculoskeletal symptoms in the construction industry found body site-specific prevalence rates, with low back pain reported in about 51% of workers, knee symptoms in approximately 37%, and shoulder symptoms in about 32%, across multiple construction occupations ^[3]. These findings collectively indicate that musculoskeletal symptoms are widespread and affect multiple anatomical regions among construction workers. Evidence from a cross-sectional study conducted among construction workers in India revealed a significant burden of musculoskeletal morbidity, with low back

pain identified as the most common complaint^[4]. In addition, a study investigating ergonomic hazards among Indian construction workers identified several physical ergonomic risk factors, including poor posture, lifting activities, and repetitive tasks, which were associated with the occurrence of WMSDs^[5]. These results highlight the contribution of occupational Exposure and work-related physical demands to musculoskeletal health outcomes in this population. Focusing specifically on brick field workers, a cross-sectional study from West Bengal, India, reported a high prevalence of work-related musculoskeletal disorders attributed to awkward postures and repetitive tasks inherent in brick field activities^[6]. Further support is provided by a systematic literature review that identified risk factors for musculoskeletal symptoms in construction jobs, including awkward posture, repetitiveness, forceful exertions, vibration. And static loading, based on existing literature^[7] These risk factors are commonly encountered in bricklaying tasks and may contribute to the high prevalence of MSDs observed in this occupational subgroup.

Global literature also supports the widespread occurrence of musculoskeletal symptoms among construction workers. A cross-sectional study conducted in China reported the prevalence of musculoskeletal symptoms across various body regions and identified associated factors such as work experience, fatigue. And age^[8]. Additionally, a sustaining occupational stress and quality of life in relation to WMSDs reported varying prevalence rates across countries and highlighted the role of psychosocial risk factors in addition to physical ones^[9]. Together, these findings underscore the multifactorial nature of musculoskeletal disorders among construction workers.

Existing literature indicates a high prevalence of musculoskeletal disorders among construction and brick industry workers across different countries, including Nigeria, India, Malaysia, Sri Lanka, and the UAE^[1-6]. However, there is limited occupation-specific data focusing exclusively on bricklayers, particularly in developing regions^[1,6]. Bricklayers are exposed to distinct ergonomic hazards such as repetitive lifting of bricks, prolonged stooping, kneeling, and awkward postures, which place them at a higher risk of developing musculoskeletal disorders compared to other construction workers^[1,5]. Identifying these specific risk factors is essential for targeted intervention^[5]. Studies have shown that musculoskeletal disorders significantly affect work performance, productivity, and quality of life among construction workers^[2]. Early identification of prevalence and associated risk factors can help in reducing long-term disability and socioeconomic burden^[2,4]. Many workers in the bricklaying profession lack awareness about ergonomic principles and preventive strategies, increasing their vulnerability to chronic musculoskeletal conditions^[5]. Validated tools such as the Nordic Musculoskeletal Questionnaire and OWAS have been proven reliable for assessing musculoskeletal symptoms and postural risks^[7,8]. Utilizing these tools in bricklayers will enhance the accuracy of identifying high-risk body regions and hazardous work postures^[7,8]. The findings of this study will contribute to the existing body of knowledge by providing occupation-specific data on bricklayers, which can be used by physiotherapists, occupational health professionals, and policymakers to design preventive and rehabilitative programs^[4-6]. Therefore, this study determine the prevalence and risk factors of musculoskeletal disorders among bricklayers, with the ultimate goal of promoting safer working conditions, reducing occupational health risks, and improving the quality of life of workers in the bricklaying profession^[2,5]. The study objective was to To identify the occupational risk factors associated with Musculoskeletal Disorder and to identify the problem areas in the body and to assess the Functional Limitations

Materials and Methods

Study design and population:

Crossectional Observational study design was employed for the present study with observational study type. Targeted population of the study was from varies bricklayers employed a construction sites.. The data was collected from Construction sites in Pune, India. Inclusion criteria for the study were Bricklayers currently working in the construction industry; male and/or female bricklayers aged 18 years and above and bricklayers with a minimum of 1 year of work experience, ensuring sufficient occupational exposure. Exclusion criteria for the study was Bricklayers with a history of musculoskeletal injury or disorder due to trauma, accident, or surgery not related to work; individuals diagnosed with neurological disorders, inflammatory joint diseases, or congenital musculoskeletal abnormalities and temporary workers or apprentices with less than 1 year of work experience. *The study was approved by TMV'S Indutai Tilak College of Physiotherapy Research and Ethical committee.*

Outcome Measure :

Standardized Nordic Musculoskeletal Questionnaire(NMQ) - Hindi Version and rapid Entire Body Assessment (REBA).

Sample size determination:

At the time of this study, the total population of Bricklayers employed a construction sites above 18 years of age from various community settings was $n = 170$ participants. Hence, a sample size formula, $n = 2(Z_{\alpha} + Z_{\beta})^2 \times \sigma^2/d^2$ was used to determine the sample population in this study were (n = sample size, Z_{α} = probability of falsely rejecting a true hypothesis (alpha value), Z_{β} =probability of failing to reject a false hypothesis (beta value), σ = standard deviation of the outcome or population parameter being studied, d = Size of the effect that is clinically worthwhile to detect.) n of Bricklayers employed a construction sites between 21 and 30 years was 46.

Sampling technique:

Purposive sampling technique was used as sampling technique.

Procedure:

Firstly, permission was taken from institutional ethical committee of TILAK MAHARASHTRA VIDYAPEETH, department of Physiotherapy and Ethical clearance was taken from institutional ethical committee of Tilak Maharashtra Vidyapeeth – College of Physiotherapy. The aims and objectives of the research was explained to the participants and those who fulfilling the inclusion criteria was included in the study. Administration of Questionnaires (Nordic Musculoskeletal Questionnaire + Occupational Risk Assessment) Observation of Work Postures & Load Handling Techniques; Identification of Common Risk Factors: Heavy Manual Load Lifting, Repetitive Bending & Twisting, Prolonged Standing/Kneeling; Poor Ergonomic Design. The review and rating to examine and evaluate each survey question for its relevance, clarity, sequence, and concept will be taken from the physiotherapist. Before conducting the survey consent of the participating in the survey was taken. An electronic survey was conducted and distributed via WhatsApp , and Email. The data was collected and analysed and appropriate results was found out.

Statistical Analysis:

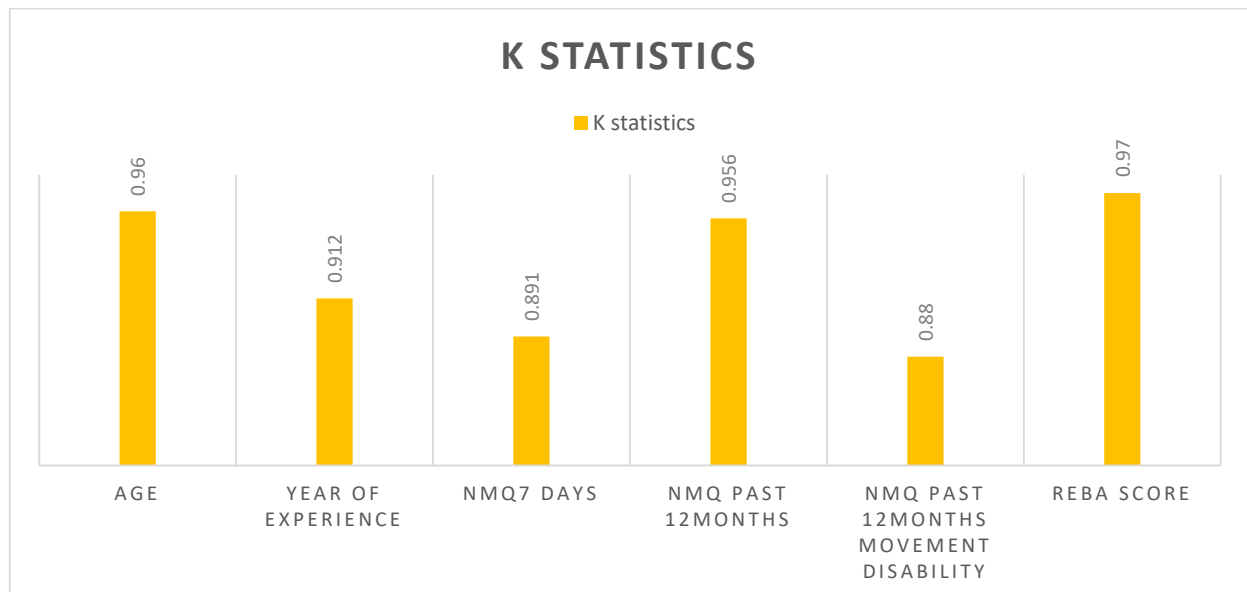
Data was analyzed using appropriate software. Descriptive statistics (Mean & SD) of the participant demographics and mean reaction times were analysed . Statistical significance was evaluated using an independent sample t-test (or Mann-Whitney U test, as appropriate). A p value of < 0.05 was considered statistically significant.

Result:

Normality of Data

Table 1 presents the results of the Shapiro wilk test for normality across all key study variables, including Age, year of experience, final REBA score, Nordic Musculoskeletal Questionnaire . The test values indicate that none of the variables violated the assumption of normality, as all p-values were less than the significance level of 0.05. This suggests that the data distributions significantly deviate from a normal distribution.

Variables	K statistics	P value	Data distribution
Age	0.960	6.33	Normally Distributed
Year of experience	0.912	7.8	Normally Distributed
NMQ – Past 7 days	0.891	3.35	Normally Distributed
NMQ – Past 12 months	0.956	2.34	Normally Distributed
NMQ – Past 12 Functional Disability	0.88	1.42	Normally Distributed
REBA Score	0.970	6.63	Normally Distributed



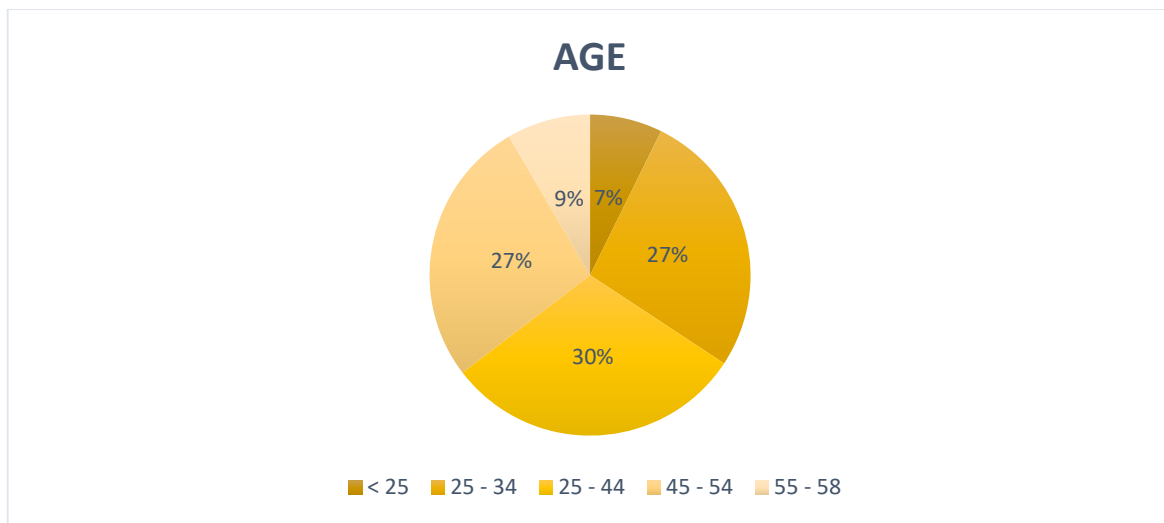
1. Demographic Data

1. Age wise Distribution –

Variable	Number of Participants
Age	

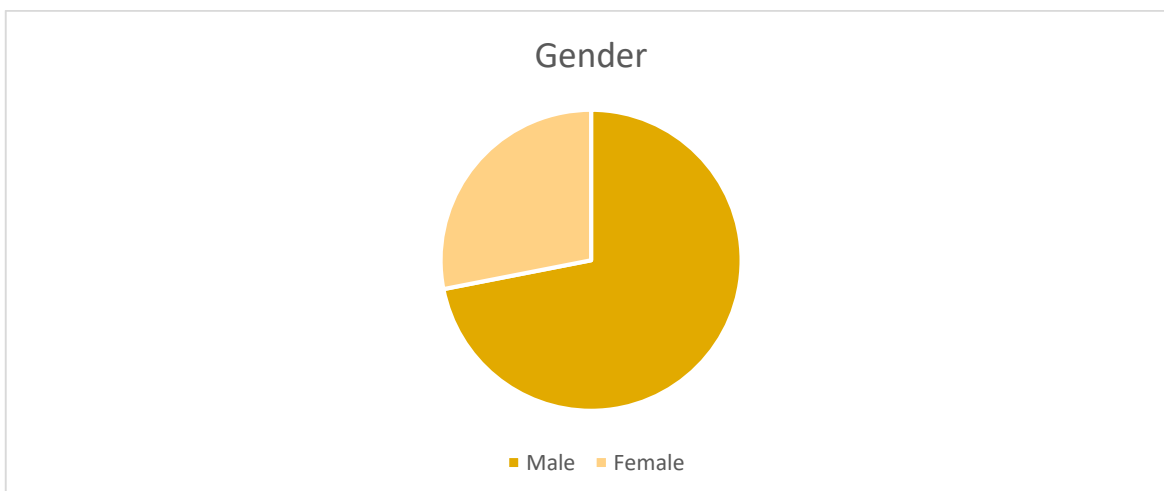
< 25 years	13
25 – 34years	48
35 – 44 years	54
45 – 54 years	48
55 – 58 years	15
	178

The age breakdown highlights a total sample of 178 participants. The largest single subgroup belongs to individuals aged 35 to 44 years with 54 individuals, followed closely by those aged 25 to 34 years and 45 to 54 years with 48 individuals each.



2. Gender wise Distribution –

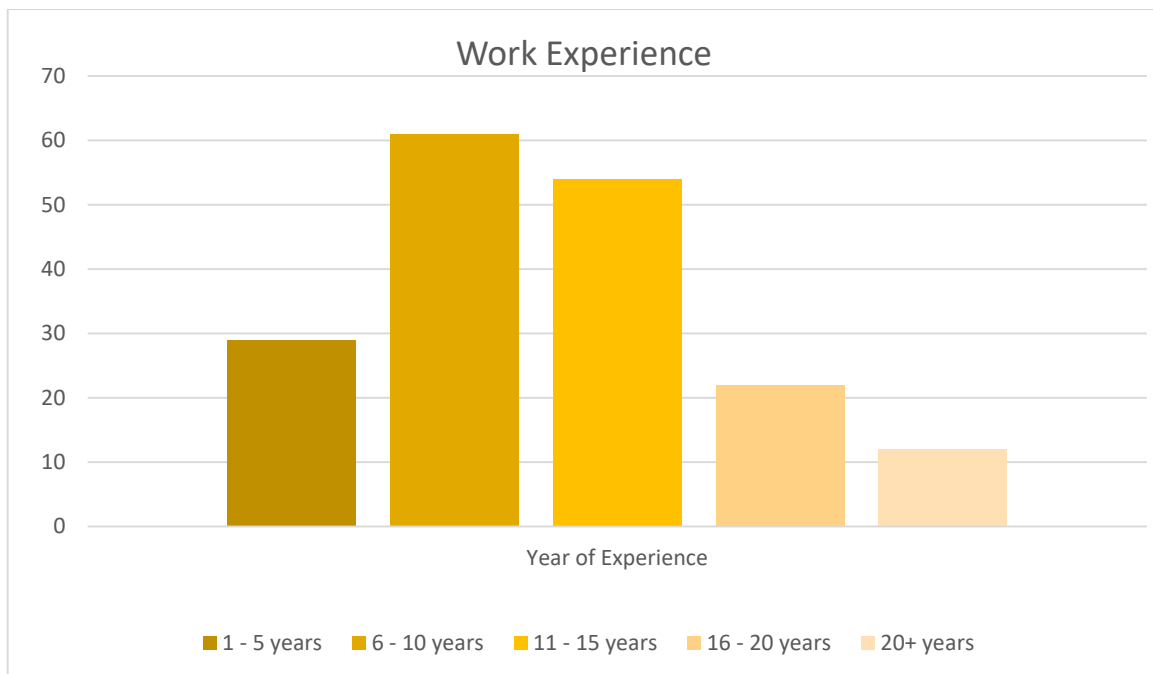
Category	No of participants	Percentage
Male	174	97.8%
Female	4	2.2%
Total	178	100%



The gender distribution exhibits a strong male representation, comprising 174 out of 178 total participants, which represents 97.8% of the study cohort. Female participants account for the remaining 2.2% with 4 individuals.

3. Year of Experience –

Variable	Number of Participants
Years of Experience	
1– 5 years	29
6 – 10 years	61
11 – 15 years	54
16 – 20 years	22
20+ years	12

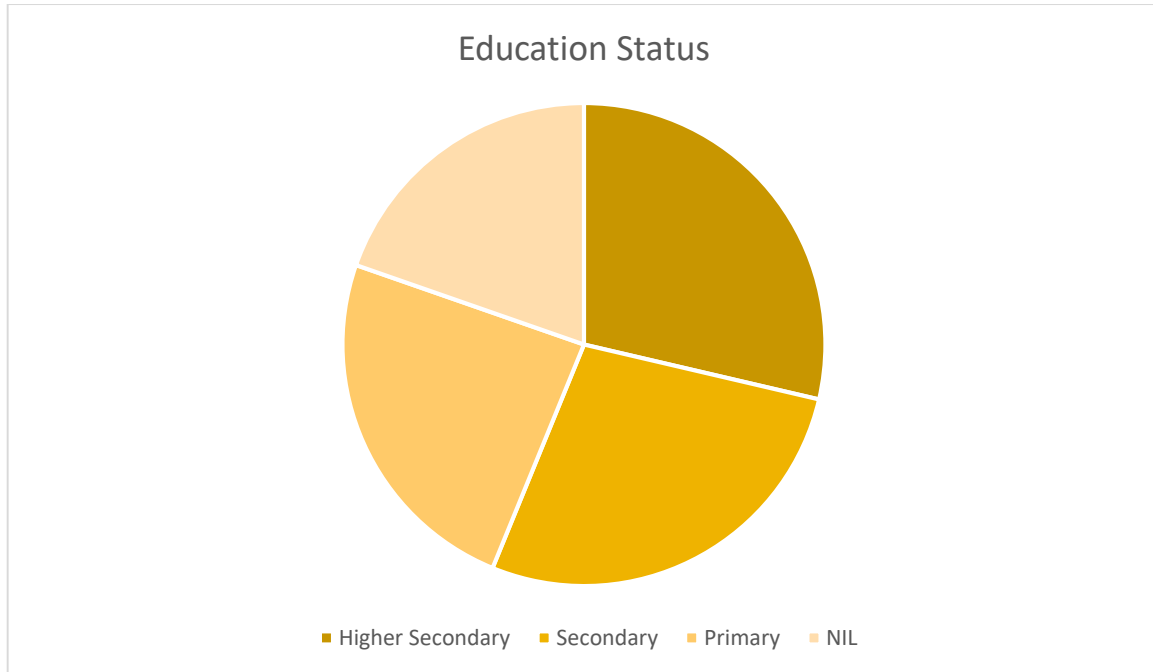


The work experience profile demonstrates that most participants have medium-range tenure. The highest concentration of participants has 6 to 10 years of experience with 61 individuals, followed by 11 to 15 years with 54 individuals. Those with 1 to 5 years total 29 participants, 16 to 20 years account for 22 participants, and those with over 20 years represent 12 participants.

4. Education Status -

Variable	Frequency (n)	Percentage (%)
Higher Secondary	51	28.7%
Secondary	49	27.5%
Primary	43	24.2%
Nil	35	19.7%
	178	100

The educational status distribution indicates that 28.7% of participants completed higher secondary education with 51 individuals, while 27.5% completed secondary education with 49 individuals.



Descriptive Statistics

Variable	Mean	SD	Min	Max
Age (years)	39.72	10.36	21	58
Work experience	10.27	5.98	2	38
REBA score	8.08	2.03	3	12
NMQ 12-month total	4.16	1.51	0	7
NMQ 12-month disability total	1.30	1.05	0	4
NMQ 7-day total	1.64	1.14	0	6

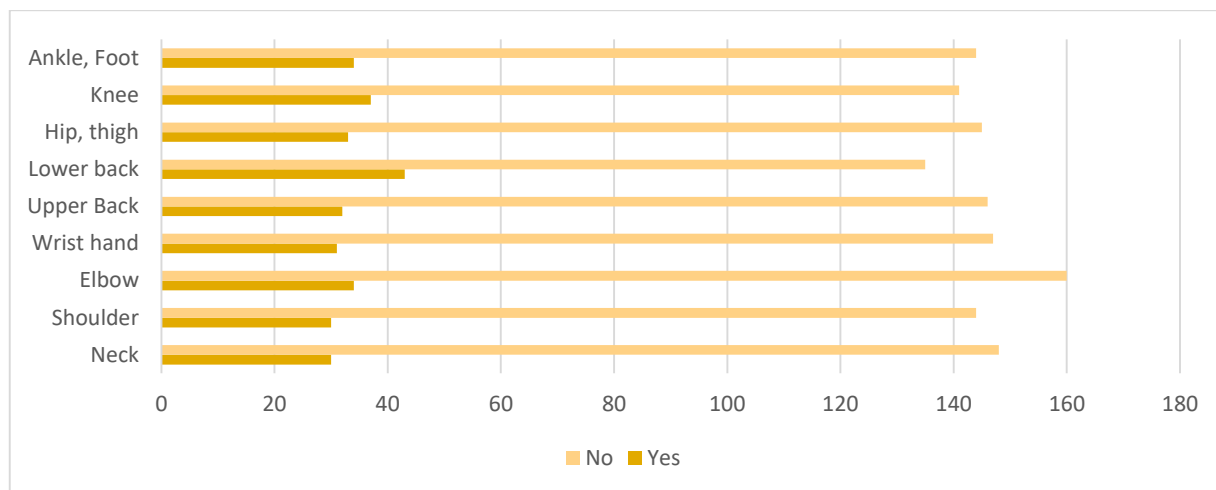
The descriptive statistics summarize the overall quantitative traits of the group. The mean age of participants is 39.72 years with a standard deviation of 10.36 years, spanning from 21 to 58 years. Work experience averages 10.27 years with a standard deviation of 5.98 years, ranging between 2 and 38 years.

2. Prevalence of Nordic Musculoskeletal Scale

• NMQ – Past 7 days

Body region	No	Yes
Neck	148	30
Shoulder	144	34
Elbow	160	18
Wrist/Hand	147	31
Upper Back	146	32
Lower Back	135	43
Hip/Thigh	145	33

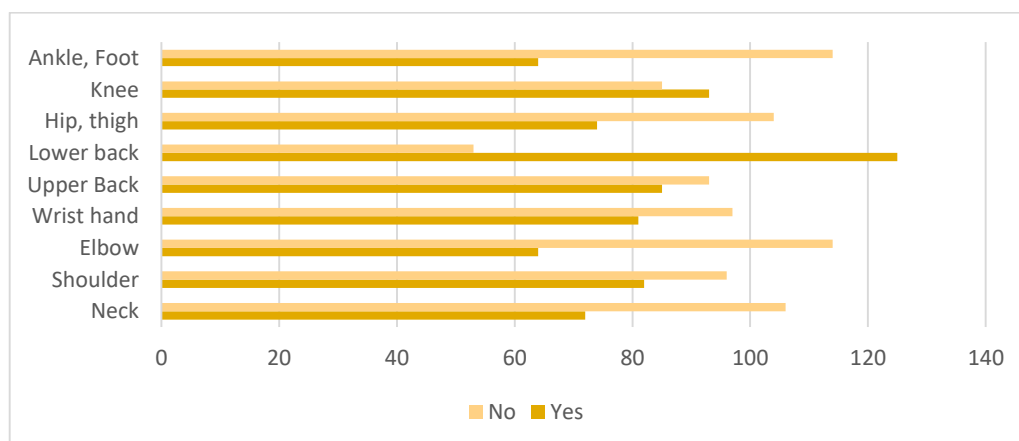
Knee	141	37
Ankle/Foot	144	34



The 7-day Nordic Musculoskeletal Questionnaire results evaluate short-term symptoms. Lower back pain reported the highest presence with 43 cases, followed by the knee region with 37 cases.

- NMQ – Past 12 months

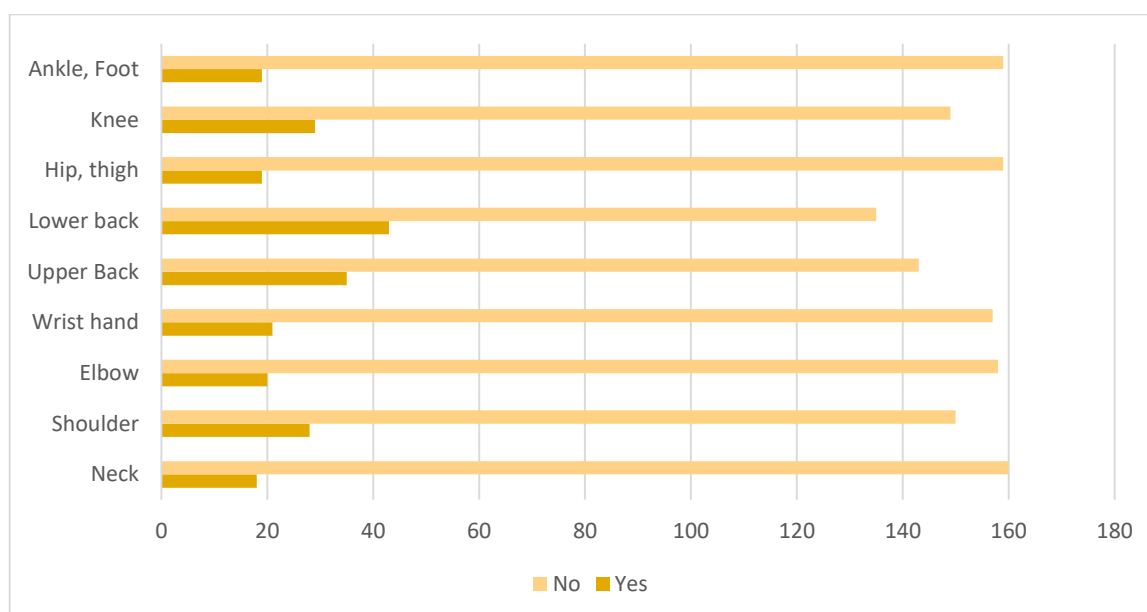
Body region	No	Yes
Neck	106	72
Shoulder	96	82
Elbow	114	64
Wrist/Hand	97	81
Upper Back	93	85
Lower Back	53	125
Hip/Thigh	104	74
Knee	85	93
Ankle/Foot	114	64



The 12-month Nordic Musculoskeletal Questionnaire highlights long-term symptom prevalence. Lower back issues represent the most widespread concern with 125 affected participants. Knee issues are second with 93 cases.

• NMQ – Past 12 Functional Disability

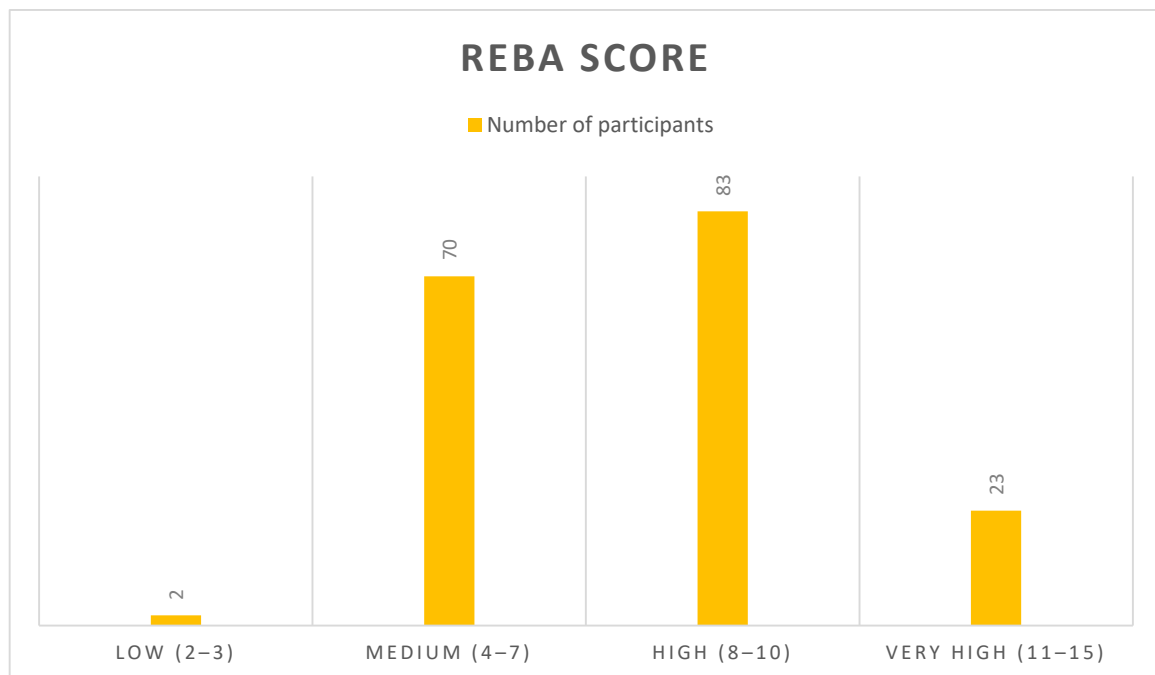
Body region	No	Yes n (%)
Neck	160	18
Shoulder	150	28
Elbow	158	20
Wrist/Hand	157	21
Upper Back	143	35
Lower Back	135	43
Hip/Thigh	159	19
Knee	149	29
Ankle/Foot	159	19



The 12-month functional disability data outlines body areas where pain hindered normal activity. Lower back pain created the highest incidence of disability with 43 participants, followed by upper back with 35 participants and knee with 29 participants.

3. REBA Score

REBA Score	Number of Participants	Percentage (%)
2–3	2	1.1%
4–7	70	39.3%
8–10	83	46.6%
11–15	23	12.9%
	178	100%



The REBA score classification categorizes ergonomic risk exposure. The majority of participants fall into high-risk tiers, with 46.6% scoring between 8 and 10 with 83 individuals and 39.3% scoring between 4 and 7 with 70 individuals.

Discussion

The present cross-sectional observational study was conducted to determine the prevalence of musculoskeletal disorders and identify occupational risk factors among bricklayers working in construction sites in Pune. A total of 178 participants were included. The mean age was 39.72 ± 10.36 years and the mean work experience was 10.27 ± 5.98 years. The study used the Standardized Nordic Musculoskeletal Questionnaire (NMQ) to assess musculoskeletal symptoms and the Rapid Entire Body Assessment (REBA) to evaluate ergonomic exposure. These methods are consistent with the approach described in the study protocol and with previous occupational research using the NMQ among construction and brick workers^[1-4]

The findings demonstrate a substantial burden of musculoskeletal symptoms among the studied bricklayers. During the preceding 7 days, the lower back was the most commonly affected region, reported by 43 participants, followed by the knee in 37 participants. Shoulder and ankle/foot symptoms were each reported by 34 participants, while hip/thigh, upper back, wrist/hand and neck symptoms were also present. Elbow symptoms were least frequent. The predominance of lower-back and lower-limb symptoms is clinically relevant because bricklaying involves repetitive lifting, carrying, bending, twisting, squatting, kneeling and prolonged standing. Such activities expose the spine and lower extremities to repeated mechanical loading and may contribute to fatigue and pain.

The 12-month NMQ findings further demonstrate the chronic occupational burden. Lower-back symptoms were reported by 125 of the 178 workers, followed by knee symptoms in 93, upper-back symptoms in 85, shoulder symptoms in 82 and wrist/hand symptoms in 81 participants. These findings are broadly consistent with previous literature showing that the lumbar region is one of the most commonly affected body regions among construction workers. Umer et al., in a systematic review and meta-analysis, reported 1-year prevalence rates of 51.1% for the lower back, 37.2% for the knee, 32.4% for the shoulder and

30.4% for the wrist among construction workers. [1] A more recent systematic review and meta-analysis also identified the lower back and shoulder as among the most affected regions and estimated an overall WMSD prevalence of approximately 59% across construction-worker studies. [2]

The present findings are also comparable with the study by Adedoyin et al. among Nigerian bricklayers. That study reported 12-month and 7-day WRMSD prevalence of 87.3% and 67.4%, respectively, with the shoulder and lower back being the most affected regions. [3] Although the present study did not calculate a single overall NMQ prevalence percentage, the high frequency of lower-back, knee, upper-back, shoulder and wrist/hand symptoms similarly indicates a considerable musculoskeletal burden in bricklayers. Differences in prevalence between studies may be explained by differences in occupation-specific tasks, workload, work environment, sample characteristics, duration of exposure and definitions used for symptoms.

The findings are further supported by research from Sri Lanka. Fernando et al. studied 192 brick-industry workers and reported that 65.6% experienced pain or discomfort lasting at least 24 hours during the preceding 12 months; low-back symptoms were particularly prominent. [4] The authors associated symptoms with physically demanding activities and unfavorable working postures. This is relevant to the present population because bricklayers similarly perform repetitive manual tasks and frequently maintain stooped, kneeling or otherwise awkward postures. The similarity across two brick-industry populations suggests that occupational exposure rather than geographical setting alone may contribute substantially to the observed symptom pattern.

Indian evidence also supports the importance of musculoskeletal health among construction workers. Reddy et al. examined 308 construction workers and reported musculoskeletal morbidity in 33.8% of participants, with low backache, wrist and shoulder complaints among the most frequent problems. Increasing age, longer duration in the construction field and longer work duration were associated with musculoskeletal morbidity. [5] In the present study, the participants had a mean age of 39.72 years and mean work experience of 10.27 years, indicating considerable cumulative occupational exposure.

The REBA findings provide important evidence regarding ergonomic exposure. The mean REBA score was 8.08 ± 2.03 , with scores ranging from 3 to 12. Forty-six point six percent of participants were classified within the high-risk category (REBA 8–10), while a further 12.9% were in the very-high-risk category (11–15). Thus, 59.5% of the sample fell into high or very-high ergonomic risk categories. Only 1.1% were in the low-risk category. These results indicate that a large proportion of the bricklayers were routinely exposed to postural demands requiring investigation and corrective action. [6] The findings correspond with the study rationale, which identified bending, twisting, repetitive movements and heavy-load handling as important ergonomic hazards among construction workers.

The functional-disability findings are also clinically important. Over the preceding 12 months, lower-back problems produced the highest reported functional limitation, affecting 43 participants, followed by upper-back problems in 35 and knee problems in 29. This suggests that symptoms were not limited to pain alone but were sufficiently relevant to interfere with normal activities in a proportion of workers. Previous research has similarly reported that work-related musculoskeletal disorders can interfere with work and daily activities and may result in reduced productivity and quality of life. [3,4] Limitations of the study involves the cross-sectional design provides information about prevalence and associations at one point in time and cannot establish causality or determine whether occupational exposures preceded musculoskeletal symptoms; the NMQ is based on self-reported symptoms and may therefore be influenced by recall bias or subjective reporting, the sample was predominantly male (174 males and 4 females),

which limits the generalizability of the findings to female bricklayers, participants were recruited from construction sites in Pune, so the findings may not be directly generalizable to bricklayers from other geographical regions or construction settings, REBA provides an observational assessment of postural risk but does not independently quantify all aspects of workload, such as exact load magnitude, frequency, vibration, psychosocial factors or cumulative exposure and although the study considered age, education and work experience, additional factors such as body mass index, smoking, sleep, physical activity, previous occupational exposure, psychosocial stress and exact daily working hours were not comprehensively incorporated into the reported analysis.

Acknowledgements

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