

Assessment of Posture-Related Musculoskeletal Risk Levels in Painters Using Reba: A Cross-Sectional Study

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Abstract: *This cross-sectional study evaluated posture-related musculoskeletal risks among wall painters using the Rapid Entire Body Assessment (REBA) and assessed pain intensity using the Numeric Pain Rating Scale (NPRS). A total of 52 male painters aged 25–40 years were selected through a convenience sampling method. Demographic characteristics, work-related variables, REBA scores, and NPRS scores at rest and during activity were recorded. Descriptive statistics, the Wilcoxon matched-pairs test, and Spearman's correlation were applied. Most participants demonstrated a medium to high postural risk levels. Pain intensity during activity was significantly higher than at rest ($p < 0.001$). The correlation between REBA scores and pain intensity was weak and not statistically significant. These findings highlight substantial ergonomic risk among painters and emphasize the need for targeted ergonomic interventions and preventive physiotherapy strategies.*

Keywords: Work-related musculoskeletal disorders; Rapid Entire Body Assessment; Numeric Pain Rating Scale; Occupational ergonomics; Construction workers

1. Introduction

Work-related musculoskeletal disorders (WMSDs) are among the most prevalent occupational health concerns, resulting from prolonged exposure to physical stressors such as repetitive tasks, awkward or sustained postures, and forceful movements [2,3]. These disorders impact muscles, joints, tendons, ligaments, and other soft tissues, often leading to pain, reduced functional capacity, decreased productivity, and long-term disability. The incidence of WMSDs is particularly high in jobs requiring continuous physical activity and postural strain, such as construction and related trades [3].

Construction finishing work involves maintaining both static and dynamic postures that impose significant biomechanical demands on the musculoskeletal system. Painters, for example, are frequently required to stand for long periods, bend their trunks, extend their necks, work overhead, and perform repetitive upper-limb movements [7,8]. These occupational exposures increase mechanical stress on the cervical spine, shoulders, lumbar region, and upper extremities, making workers more susceptible to musculoskeletal discomfort and strain [6].

Evaluating ergonomic risk is critical to understanding how postural demands contribute to musculoskeletal stress and functional limitations. Task-based exposure assessment is a structured method for analyzing the physical demands associated with specific work activities [2]. Among the various observational tools, the Rapid Entire Body Assessment (REBA) is widely employed to evaluate whole-body postural risk by considering body segment positions, force, repetition, and coupling [5]. Its simplicity and adaptability make it

suitable for use in dynamic work environments such as construction finishing occupations [11].

Alongside postural risk assessment, measuring pain intensity is essential for understanding the functional impact of musculoskeletal stress. The Numeric Pain Rating Scale (NPRS) is a commonly used self-reported tool that quantifies pain at rest and during activity, allowing comparison with ergonomic risk levels [4]. By combining assessments of postural risk and pain severity, a more comprehensive understanding of musculoskeletal health in physically demanding occupations can be achieved [7].

Need of the Study:

Painters frequently adopt awkward and sustained working postures for prolonged periods, which predisposes them to musculoskeletal pain and discomfort. Despite the high physical demands of painting work, limited objective ergonomic assessment has been conducted in this occupational group.

Previous studies have largely relied on subjective assessment methods. The present study uses the Rapid Entire Body Assessment (REBA), an objective and validated ergonomic tool, to evaluate posture-related musculoskeletal risk levels among painters.

The findings of this study may help create awareness regarding postural risks, facilitate early identification of musculoskeletal strain, and aid in planning ergonomic education, posture correction strategies, and preventive physiotherapy interventions.

Since REBA is a freely available assessment scale, which allows assessment of the whole body including lower limbs

and is less time consuming; this study aims to use REBA as an outcome measure.^[1]

Aim and Objectives

The study aimed to assess posture-related musculoskeletal risk levels among wall painters using the Rapid Entire Body Assessment (REBA) and to evaluate associated pain intensity using the Numeric Pain Rating Scale (NPRS).

2. Materials and Methods

The present study was a cross-sectional observational study conducted among male wall painters. The study population consisted of 52 male wall painters aged between 25 and 40 years, selected through a convenience sampling method. The study was carried out at selected wall-painting worksites in Mumbai, Maharashtra.

Materials used for data collection included a structured demographic data sheet, the Rapid Entire Body Assessment (REBA) scale, and the Numeric Pain Rating Scale (NPRS). The demographic data sheet was used to record information such as age, years of work experience, and daily working hours.

The Rapid Entire Body Assessment (REBA) scale was used to assess posture-related musculoskeletal risks by evaluating the positions of the neck, trunk, upper limbs, and lower limbs, along with load, coupling, and activity scores. Based on the REBA score, participants were classified into negligible, low, medium, high, and very high-risk categories.

Pain intensity were assessed using the Numeric Pain Rating Scale (NPRS), a 0–10 numerical scale, where 0 indicated no pain and 10 indicated the worst imaginable pain. Microsoft Excel software was used for data entry and statistical analysis.

To improve the reliability of REBA scoring, observations were performed by a trained assessor familiar with ergonomic evaluation techniques. Standard REBA guidelines were followed during assessment. Each participant was observed during routine work tasks, and representative postures were recorded for scoring.

Inclusion Criteria:

- 1) ≥ 8 hours of work per day
- 2) Age group: 25–40 years (More than 3 years of work experience)
- 3) Only painters willing to participate
- 4) Male wall painters

Exclusion Criteria:

- 1) Any neurological or pathological condition
- 2) Recent history of fracture or dislocation
- 3) Hypermobility

3. Procedure:

Ethical approval was obtained from the Institutional Ethics Committee prior to the study. Eligible participants were informed about the purpose of the study, and written informed consent was obtained. A total of 52 male wall painters were

selected from painting worksites in Mumbai based on the inclusion and exclusion criteria.

Demographic details including age, work experience, and daily working hours were recorded. Pain intensity were assessed at rest and during activity using the Numeric Pain Rating Scale (NPRS). Participants were observed while performing routine wall-painting tasks at ground level, and working postures were assessed using the Rapid Entire Body Assessment (REBA) scale.

REBA scores were calculated by assessing neck, trunk, upper limb, and lower limb postures along with load, coupling, and activity scores. Final REBA scores were used to categorize participants into different posture-related musculoskeletal risk levels. Collected data were tabulated and subjected to statistical analysis.

4. Statistical Analysis and Results

- The collected data were entered and analyzed using Microsoft Excel.
- Descriptive statistics were used to summarize demographic variables such as age, work experience, and hours of working using frequency, percentage, mean, and standard deviation.
- Pain intensity at rest and during activity were assessed using the Numeric Pain Rating Scale (NPRS) and was expressed as mean and standard deviation.
- The Wilcoxon matched pairs test was used to compare NPRS scores at rest and during activity.
- Postural risk levels assessed using the Rapid Entire Body Assessment (REBA) scale were categorized and presented as frequencies and percentages.
- The contribution of individual body segments to the overall REBA score was analyzed and presented using mean values and percentages.
- Spearman's rank correlation was used to determine the association between REBA scores and NPRS scores. A p-value of less than 0.05 was considered statistically significant.

Table 1: Age wise distribution

Age Groups	n	%
20-25	4	7.69
26-30	13	25.00
31-35	12	23.08
36-40	23	44.23
Total	52	100.00

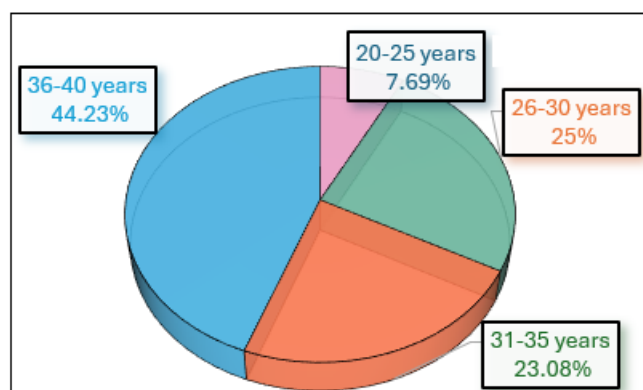


Figure 1: Age wise distribution

Table 1. depicts the age-wise distribution of painters, showing that the majority of participants belonged to the 36–40 years age group (44.23%), followed by 26–30 years (25%) and 31–35 years (23.08%).

Table 2: Experience wise distribution

Experience	Total Workers	Percentage (%)
0–5 yrs	4	7.69%
6–10 yrs	11	21.15%
11–15 yrs	14	26.92%
16–20 yrs	15	28.85%
>20 yrs	8	15.38%
TOTAL	52	100%

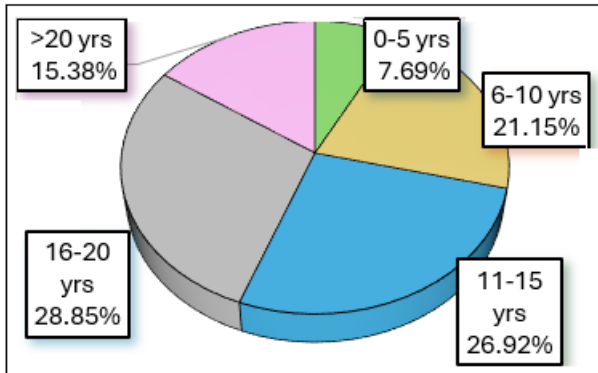


Figure 2: Experience wise distribution

Table 2 depicts the experience-wise distribution of painters, where the highest proportion had 16–20 years of work experience (28.85%), followed by 11–15 years (26.92%).

Table 3: Hours of Working wise distribution

Hours of working	n	%
8–10 hours	11	21.15%
10–11 hours	36	69.23%
11–12 hours	5	9.62%
Total	52	100%

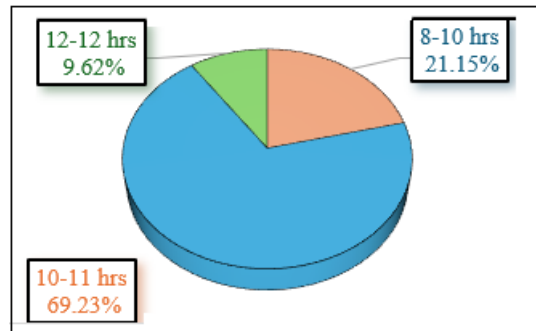


Figure 3: Depicts the distribution of working hours per day, indicating that 69.23% of the painters worked for 10–11 hours daily, while 21.15% worked for 8–10 hours.

Table 4: Summary of Age in yrs and Experience in yrs

Summary	Age(years)	Experience(years)
Min	25.00	3.00
Max	40.00	20.00
Mean	33.92	9.94
SD	5.15	4.58
Median	35.0	10.00
IQR	9.00	8.00

Table 4 depicts the summary statistics of age and work experience, showing a mean age of 33.92 ± 5.15 years and a mean work experience of 9.94 ± 4.58 years among the painters.

Table 5: Comparison of NPRS at rest and activity by Wilcoxon matched pairs test

Position	Mean	SD	Mean Diff.	SD Diff.	Effect size	Z-value	P-value
Rest	2.44	2.14	2.04	2.38	0.9540	4.3470	0.001*
Activity	4.48	2.26					

Table 5 depicts the comparison of NPRS scores at rest and during activity. The mean NPRS score during activity (4.48 ± 2.26) was higher than at rest (2.44 ± 2.14), and the difference was found to be statistically significant ($Z = 4.347, p = 0.001$).

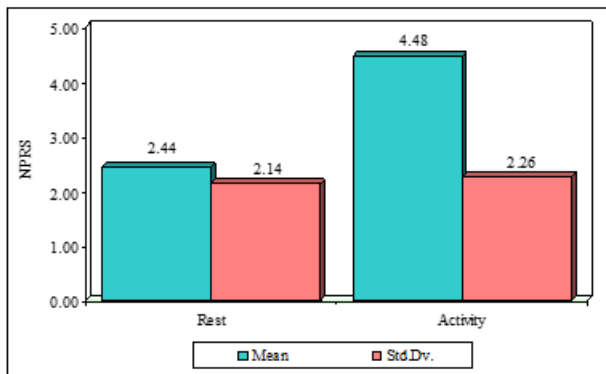


Figure 5: Comparison of NPRS at rest and activity

Figure 5: shows a graphical comparison of NPRS scores, demonstrating higher pain intensity during activity compared to rest.

Table 6: Interpretation of REBA scores

REBA	No	%	Required action
Negligible	0	0.00	None
Low	7	13.46	May be necessary
Medium	26	50.00	Necessary
High	15	28.85	Necessary soon
Very high	4	7.69	Necessary immediate
Total	52	100.00	-

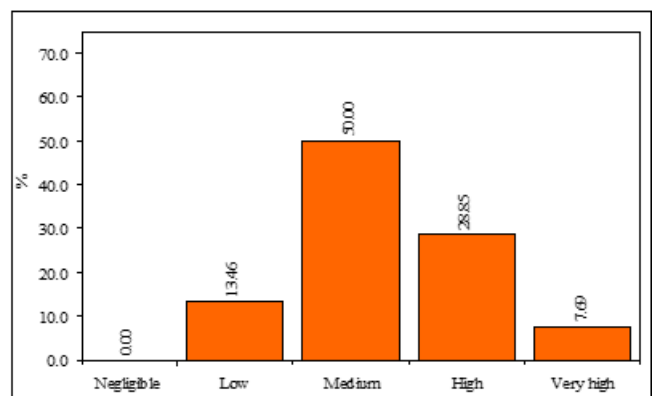


Figure 6: Interpretation of REBA scores

Table 6 depicts the interpretation of REBA scores among the painters. None of the participants were classified under the negligible risk category (0%).

A small proportion of painters (13.46%) were found to be at low risk, indicating that corrective action may be necessary. The majority of participants (50%) fell under the medium risk category, suggesting that postural correction was necessary.

Further, 28.85% of the painters were classified under the high risk category, indicating that corrective action was necessary soon. A smaller proportion (7.69%) were found to be at very high risk, requiring immediate corrective action.

Overall, the results showed that most painters were exposed to a medium to high postural risk levels according to the REBA scale.

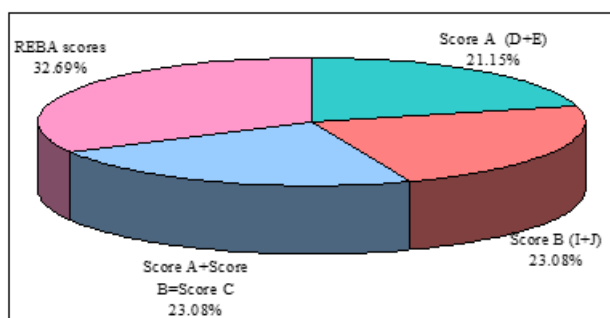


Figure 7: REBA sheet components

Table 7: Percentage contribution of each component on REBA

Tables	Components	Mean	%
Table A	Neck	1.92	27.40
	Trunk	2.44	34.79
	Leg	1.60	22.74
	Score A	3.81	54.25
Table B	Upper arm	3.81	54.25
	Lower arm	1.62	23.01
	Wrist	1.50	21.37
	Coupling	1.23	17.53
Table C	Score B	6.29	89.59
	Score C	6.00	85.48

The trunk component showed the highest contribution (34.79%), followed by the neck (27.40%), while the leg component contributed comparatively less (22.74%) among the components of Table A.

Among the upper limb components in Table B, the upper arm showed the highest contribution (54.25%), which was greater than the lower arm (23.01%), wrist (21.37%), and coupling (17.53%).

When overall scores were compared, Score B (89.59%) was higher than Score A (54.25%), indicating greater contribution from upper limb components compared to trunk and lower limb components.

The combined Score C (85.48%) was higher than individual component scores, representing the overall postural load derived from both upper and lower body components.

Table 8: Correlation between NPRS at rest, NPRS at activity with REBA scores by Spearman's rank correlation

Variables	Correlation between REBA scores with			
	Valid	Sp. R.	t-value	p-value
NPRS at rest	52	0.1059	0.7533	0.4548
NPRS at activity	52	0.256	1.8725	0.067

Correlation between NPRS at Rest and REBA Scores

- The Spearman’s correlation coefficient between NPRS at rest and REBA scores was $r = 0.1059$.
- This indicated a very weak positive correlation between pain at rest and postural risk.
- The correlation was not statistically significant with a p-value of 0.4548 ($p > 0.05$).

Correlation between NPRS during Activity and REBA Scores

- The Spearman’s correlation coefficient between NPRS during activity and REBA scores was $r = 0.2560$.
- This indicated a weak positive correlation between pain during activity and postural risk.
- The correlation was not statistically significant with a p-value of 0.067 ($p > 0.05$).

Overall Result

- Both correlations were positive but statistically non-significant.
- The association between REBA scores and pain intensity was weaker at rest and comparatively higher during activity.

5. Discussion

The present study assessed posture-related musculoskeletal risk levels among painters using the Rapid Entire Body Assessment (REBA) tool. The findings revealed that a substantial proportion of painters were exposed to medium to very high ergonomic risk levels, indicating the need for corrective and preventive ergonomic interventions.

In the present study, 50% of the painters were classified under medium risk, while 36.54% fell into high and very high risk categories. These findings suggest that painters frequently adopt awkward and sustained postures during work, particularly involving the trunk, upper limbs, and neck. Similar observations have been reported by Hignett and McAtamney, who emphasised that REBA is sensitive in identifying whole-body postural risks in occupations involving static and dynamic awkward postures^[1].

The predominance of a medium to high risk levels observed in this study is consistent with previous research on painters and finishing workers. Shanmugam et al. reported a high prevalence of musculoskeletal disorders among building painters in South India, attributing it to prolonged overhead activities and sustained standing postures^[7]. Likewise, Pandey and Kiran found significant postural discomfort and musculoskeletal complaints among painters, particularly affecting the upper limb and lower back^[8].

Analysis of REBA components in the present study showed higher mean scores for the trunk and upper arm, indicating that these body regions contribute substantially to overall

postural risk. This finding aligns with studies by **Svendsen et al.**, who highlighted the role of sustained trunk flexion and arm elevation in increasing the risk of work-related musculoskeletal disorders^[2]. Similar ergonomic risk patterns were also reported in industrial and construction painting tasks by **Jilcha** and **Assefa**, where repetitive upper limb movements and awkward trunk postures significantly increased MSD risk^[10].

The present study demonstrated a significantly higher pain intensity during activity (4.48 ± 2.26) compared to rest (2.44 ± 2.14) as measured using the Numerical Pain Rating Scale (NPRS). The Wilcoxon matched pairs test showed a highly significant difference ($Z = 4.347$, $p = 0.001$) with a large effect size (0.954). This indicates that activity markedly increases pain intensity.

This finding supports the validity of NPRS as a sensitive tool for detecting variations in clinical pain intensity, as described by **Jensen et al.**^[4]. Increased pain during activity may be attributed to repetitive movements, sustained muscle loading, and inadequate recovery during prolonged working hours.

Although the correlation between REBA scores and pain intensity (both at rest and during activity) was positive, it did not reach statistical significance. This weak association suggests that while poor posture contributes to musculoskeletal pain, pain perception may also be influenced by individual factors such as pain tolerance, duration of exposure, psychosocial factors, and cumulative workload. Similar findings have been reported by **Punnett** and **Wegman**, who noted that work-related musculoskeletal disorders are multifactorial and not solely dependent on biomechanical exposure^[5].

Recent systematic reviews have also emphasized that ergonomic risk factors show variable strength of association with pain outcomes. **Greggi et al.** reported that although awkward postures and repetitive work are consistently associated with MSDs, the magnitude of association differs across populations and study designs^[6].

The findings of the present study are in agreement with REBA-based ergonomic assessments conducted in similar occupational settings. **Sharan et al.** identified high ergonomic risk levels among workers in a paint manufacturing company using REBA, highlighting the need for ergonomic modification of workstations^[9]. Furthermore, **Ijaz et al.** demonstrated that painters and finishing workers frequently fall into a medium to high REBA risk categories, reinforcing the relevance of REBA as an effective screening tool for musculoskeletal risks assessment^[11].

The high proportion of painters exposed to moderate to very high ergonomic risk levels in the present study underscores the need for early ergonomic interventions, posture education, task modification, and regular screening using tools such as REBA. Addressing these risk factors may help reduce the burden of work-related musculoskeletal disorders and improve occupational health outcomes.

These findings have practical implications for workplace policy development, including implementation of ergonomic

training programs, work-rest cycles, and physiotherapy-based preventive strategies in construction occupations.

6. Conclusion

The study demonstrates that wall painters are exposed to moderate to high levels of posture-related musculoskeletal risks, particularly affecting the trunk, neck, and upper limbs. Pain intensity was significantly higher during activity compared to rest ($p < 0.001$), although the correlation between postural risk and pain was weak and not statistically significant.

These findings highlight the importance of early ergonomic interventions, posture correction strategies, and preventive physiotherapy programs to reduce occupational musculoskeletal burden among painters.

7. Limitations

- 1) As this was a cross-sectional study, the findings reflected only a single point in time and did not allow conclusions to be drawn about cause and effect between working posture and pain.
- 2) The study included a relatively small sample selected through convenient sampling, which may limit how well the results represent the wider population of painters.
- 3) Pain intensity and posture risk were assessed using observational and self-reported tools, which depend on individual perception and may not fully capture day-long or cumulative work exposure.

Conflict of Interest:

None

Sources of Funding:

None

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References

- [1] Hignett S, McAtamney L. Rapid entire body assessment (REBA). *Appl Ergon.* 2000;31(2):201–205.
- [2] Svendsen SW, Mathiassen SE, Bonde JP. Task-based exposure assessment of ergonomic risk factors for work-related musculoskeletal disorders. *Appl Ergon.* 2004;35(5):469–481.
- [3] Punnett L, Wegman DH. Work-related musculoskeletal disorders: the epidemiologic evidence and the debate. *J Electromyogr Kinesiol.* 2004;14(1):13–23.
- [4] Jensen MP, Karoly P, Braver S. The measurement of clinical pain intensity: a comparison of six methods. *Pain.* 1986;27(1):117–126. doi:10.1016/0304-3959(86)90207-9.
- [5] Al Madani D, Dababneh A. Rapid Entire Body Assessment: recent applications, strengths and limitations. *Ergonomics.* 2020;63(6):1–14.

- [6] Gregg C, et al. Work-related musculoskeletal disorders: a systematic review. *Int J Environ Res Public Health*. 2024;21(4):2174.
- [7] Shanmugam M, Gnanavel BK, Rajan V, Santhanam V. Prevalence of musculoskeletal disorders and occupational risk factors among building painters in South India. *J Phys Conf Ser*. 2021;1937(1):012040.
- [8] Pandey P, Kiran UV. Postural discomfort and musculoskeletal disorders among painters: an analytical study. *Indian J Occup Environ Med*. 2020;24(3):148–154.
- [9] Sharan D, Mohandoss M, Ranganathan R, Jayakumar VB, Anoop VR. Identification of ergonomic risk factors among workers of a paint manufacturing company using REBA. *Work*. 2014;47(3):347–356.
- [10] Jilcha K, Assefa H. Evaluation of musculoskeletal disorder risk factors in painting: a case study of Akaki Basic Metal Industry painters. *Int J Ind Ergon*. 2020;76:102936.
- [11] Ijaz M, Raza A, Khan MA, et al. Task-based evaluation of work-related musculoskeletal disorders among construction and finishing workers using REBA and RULA. *J Occup Health*. 2024;66(1):e12345.
- [12] Boschman JS, van der Molen HF, Sluiter JK, Frings-Dresen MHW. Musculoskeletal disorders among construction workers: prevalence and risk factors. *Scand J Work Environ Health*. 2012;38(5):433–442.
- [13] Yazdanirad S, Khoshakhlagh AH, Habibi E, Zare A, Zeinodini M. Ergonomic risk assessment of construction activities using Rapid Entire Body Assessment (REBA). *Int J Occup Saf Ergon*. 2018;24(3):1–8.