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Original Article

Physiotherapy Section

# Posterior Chain Flexibility and Lower Back Pain among Construction Workers: A Cross-sectional Study

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## ABSTRACT

**Introduction:** Lower back pain is a common issue that has a substantial impact on individuals. Patients may experience pain in the lower back region, which may vary depending on the presence or absence of nerve involvement. Lower back pain is more common in occupations involving prolonged standing, sitting, or heavy lifting. While research exists on posterior chain flexibility and lower back pain in farm workers, studies on construction workers remain limited, highlighting the need for the present study.

**Aim:** To investigate Low Back Pain (LBP) incidence and severity in construction workers, linking findings to posterior chain flexibility.

**Materials and Methods:** The present study was a cross-sectional study was conducted in South Western Assam, India,from December 2023 to May 2024. The study was affiliated to The Assam Royal Global University. The primary inclusion criteria included construction workers both male and female between the ages of 20 to 45 years of age and minimum of three months of working experience who consented to participate in the study were included and the exclusion criteria included pregnant and nursing mothers, subjects with previous back injuries and subjects with recent accident or other ailments were excluded from the study. Sampling was done using convenience sampling method. Informed consent was taken from the participants. LBP was assessed using the Visual Analog Scale (VAS), flexibility was assessed using the sit and reach test, and back pain related disability was assessed using the Oswestry LBP Disability Questionnaire.

**Results:** Out of total 95 participants,LBP prevalence was 100%. The correlation between age and VAS score is 0.173 with a p-value of 0.093 indicating a weak positive correlation. The VAS score and sit and reach test results have correlation of -0.192 with p-value of 0.062 indicating a weak negative correlation whereas age shows significant positive correlation with Oswestry LBP score, with a correlation coefficient of 0.229 and a p value of 0.025. The VAS score is strongly positively correlated with Oswestry LBP score, with a correlation coefficient of 0.595 and a highly significant p-value of less than 0.001.

**Conclusion:** Posterior chain flexibility is significantly linked to reduced LBP-related disability and weakly associated with lower LBP severity.


**Keywords:** Oswestry low backpain disability index, Sit and reach test, Visual analog scale

## INTRODUCTION

Lower back pain represents a prevalent ailment attributed to Gravitational forces (G-force), with around 80% of the population experiencing such discomfort at least once during their lifespan. The primary factors contributing to this condition include inadequate spinal adaptation to the upright posture in the evolutionary context, muscular weakness, and a deficiency in fundamental understanding of human biomechanics. LBP predominantly impacts individuals within the working-age bracket, specifically ranging from 30 to 60-year-old. Observational evidence indicates a tendency for recurrent occurrences of LBP, often progressing into a chronic condition [1]. The prevalence of LBP on a global level within the general population ranges from 15-45% [2]. The prevalence of LBP in the Indian context at specific temporal intervals, annually, and over the lifespan are higher than those observed globally and among diverse ethnic groups. This phenomenon affects considerable amount of the Indian population with particular emphasis on its impact on women, rural residents and employees in elementary occupations [3]. A previous study found that 40% of individuals aged 50 and above within the construction industry experienced enduring back pain [4]. The socioeconomic impact of LBP necessitates an exhaustive exploration of factors influencing LBP incidence and development of preventive. Many studies have examined demographic factors and lifestyle factors in relation to LBP yielding mixed findings [5]. LBP is linked to altered neuromuscular coordination and trunk rigidity, with posterior chain flexibility- comprising the hamstrings, gluteals, lumbar erectors, and calves- playing a critical role in musculoskeletal health, the optimal condition of this group of muscles such as optimal motor control, endurance and strength is an essential for prevention and treatment of lower back pain. For chronic LBP Tataryn N et al., emphasised the effectiveness of posterior chain resistance exercise [6]. The present study examined LBP, posterior chain flexibility, and their relationship among construction workers in Southwestern Assam with back pain persisting for over three months. Pain severity (VAS), disability (Oswestry Disability Index), and flexibility (Sit and Reach Test) were measured. VAS scores correlated positively with disability and negatively with flexibility, indicating that greater flexibility may reduce pain and disability. Tataryn N et al., reported pain reduction and strength improvements with resistance training, while Kripa S and Kaur H emphasised posture and muscle roles in prevention [6,7]. Hardeman A et al., suggested posterior chain exercises prevent lumbar spine injuries [8]. Conversely, Ito T et al., found no link between muscle strength and LBP in children but associated tight hamstrings with pelvic tilt [9]. Silva MR et al., observed no significant flexibility-pain correlation in workers, whereas Victora Ruas C et al., noted improvements in chronic LBP with strength and flexibility training, though pain weakly correlated with trunk strength or spinal motion [10,11]. These findings underscore the role of flexibility in LBP management alongside other contributing factors.

Lopes TJ et al., showed decreased trunk endurance, reduced posterior chain flexibility with sit and reach test and pain history reported in the last 12 months were predictors of overuse injuries in Naval cadets [12].

The aim of the study was to evaluate the prevalence of lower back pain, the average degree of posterior chain flexibility and its relationship to LBP and backpain related disability among construction workers.

## MATERIALS AND METHODS

The present cross-sectional study was conducted in southwestern Assam which examined construction workers to assess the impact of chronic LBP. The study was conducted with affiliation from The Assam Royal Global University Guwahati from December 2023 to May 2024. The present study was conducted for over six months. The study was approved by the Institutional Ethics Committee of The Assam Royal Global University bearing the number RGU/IECHR/MPT/2024/11.

**Sample size calculation:** The sample size was calculated using the formula:

$$n=\frac{(Z_{\frac{\alpha}{2}})^2\, p(1-p)}{d^2}$$

Where,

- n is the required sample size
- d is the Absolute error or precision.
- $Z_{\frac{\alpha}{2}}$ is the critical value of the normal distribution at $\alpha/2$.
- p is the expected proportion.
- For 95% confidence level $Z_{\frac{\alpha}{2}}$ is 1.96. Assuming an expected proportion of 52% and a 10% margin of error, we get the minimum sample size required for the study as 96 ≈100.

**Inclusion and Exclusion criteria:** The sample was selected using convenience sampling. The inclusion criteria included people within the age group of 25-45 years of age engaged in construction work for more than three months, subjects in whom the duration of pain lasted more than three months. Exclusion criteria included people with back injuries, co-morbidities, and pregnancy. Firstly the subjects who fulfilled the inclusion criteria were selected and were given an explanation about the study procedure and an informed consent was taken from them.

### Study Procedure

The functional disability was measured utilising the Oswestry LBP Disability questionnaire, pain intensity with VAS, and flexibility through the sit and reach test. Materials included measurement tools, consent forms, and the Oswestry Questionnaire. Participants provided informed consent, and demographic data, pain characteristics, and assessment dates were recorded. Pain and disability scores were calculated, flexibility was evaluated, and results were analysed.

**Outcome measure:**

- **Visual Analog Scale (VAS):** A VAS is one of the pain rating scale used for the first time in 1921 by Hayes and Patterson. It is often used in epidemiological and clinical research to measure the intensity or frequency of various symptoms. The intensity of pain that the patient feels ranges across a continuum from none to extreme amount of pain. The scores are based on self-reported measures of symptoms which are recorded with a handwritten mark which is placed at one point along the length of 10 cm line that represents no pain on the left-side (0 cm) and worst pain on the right-side of the scale (10 cm) [13].
- **Oswestry Low Back Pain (LBP) disability questionnaire-** It is a patient completed questionnaire which gives a subjective percentage score of level of function in activities of daily living in those rehabilitating from LBP. It was developed by Jeremy Fairy bank and Graham Pynsent in Oswestry, England in 1980 and considered one of the best accepted tools for assessment of LBP. The questionnaire examines the level of disability in 10 everyday activities of daily living. Each item consists of six statements which are scored from 0 to 5 where 0 indicates less disability and five most disability. The total score is calculated in percentage with 0% indicating no disability and 100% indicating the highest level of disability [14].
- **Sit and reach test-** The sit and reach test is one of the linear flexibility tests which help to measure the extensibility of the hamstrings and lower back. It was initially described by Wells and Dillon in 1952. It has simple procedure and is easy to administer, requires minimal skills training for its application [15].

## STATISTICAL ANALYSIS

Utilising IBM Statistical Package for Social Sciences (SPSS) version 27, statistical analysis was conducted, that includes frequency, percentages, correlations, Chi-square tests, paired and independent samples t-tests to assess outcome measures.

## RESULTS

About 95 participants in the study, whose ages ranged from 25 to 45 years, were all male construction workers with a mean age of 34. The principal findings are summarised as follows: The average oswestry LBP score was 24, the average VAS score was 5.01, and 16.8 was the average sit-and-reach test score. The predominance of LBP among participants who obtained 100%.

Age and VAS score exhibited a weakly positive correlation (r=0.173, p=0.093), according to the analysis. A marginally negative correlation (r=-0.128, p=0.217) was found between age and sit-and-reach test performance as well as a weak negative correlation between VAS score along with sit-and-reach test results (r=-0.192, p=0.062). Age showed a strong positive correlation (r=0.595, p<0.001) with the Oswestry LBP score, while the VAS score showed a significant positive correlation (r=0.229, p=0.025) with the same score. Conversely, sit and reach test results exhibited a substantial negative correlation with Oswestry LBP score (r=-0.278, p=0.006). Outcomes of this investigation indicate while higher performance on sit and reach test corresponds to lower Oswestry LBP scores, increasing age and VAS scores are linked to higher Oswestry LBP scores.

The sample of 95 participants had a mean age of 34 years (±6), varying from 25 years to 45 years, with a median of 34. The average VAS score was 5.01 (±1.81), reflecting moderate pain levels, with a range of 1.00 to 9.00 and a median of 5.00. Flexibility, evaluated via sit and reach test, averaged 16.8 inches (±3.4), with scores spanning 6.0 to 28.0 inches and a median of 17.0 inches. The mean Oswestry LBP score was 24 (±11), ranging from 0 to 53, with a median of 25, indicating varying disability levels [Table/Fig-1,2].

| Gender | Male | Female |
|---|---|---|
| Number | 95 | 0 |
| Percentage Share | 100 % | 0% |

**[Table/Fig-1]:** Gender distribution.

| Variables | Mean±SD (N=95) |
|---|---|
| Age (years) | 34 (±6) |
| VAS score | 5.01 (±1.81) |
| Sit and reach test (in inches) | |
| Oswestry Low Back Pain (LBP) score 24 (±11) | 24 (±11) |

**[Table/Fig-2]:** Description of the variables under study.
*All the participants in the study are male (n=95, 100%) so separate calculation for gender is not done

Given that the p-values from both the Kolmogorov-Smirnov (KS) as well as Shapiro-Wilk tests are >0.05, The authors infer that the present study data is normally distributed. Therefore, parametric statistical techniques may be utilised [Table/Fig-3].

The table presents multiple linear regression outcomes examining how Oswestry LBP scores and sit-and-reach test results are influenced by age, sit-and-reach scores, and VAS scores. Beta

| Variables | Statistic Shapiro Test | | KS Test | |
|---|---|---|---|---|
| | Statistic | p-value | Statistic | p-value |
| VAS Score | 0.963 | 0.069 | 0.946 | 0.09 |
| Sit and reach test (In inches) | 0.970 | 0.128 | 1.000 | 0.06 |
| Oswestry Low Back Pain (LBP) Score | 0.979 | 0.135 | 0.979 | 0.07 |

**[Table/Fig-3]:** Test for normality of the data.

coefficients, p-values, along with 95% Confidence Intervals (CI) have been stated as follows [Table/Fig-4]:

| Variables | Oswestry low backpain score | | Sit and Reach Test (In Inches) | |
|---|---|---|---|---|
| | Beta (95%CI)1 | p-value | Beta (95% CI)1 | p-value |
| Age (years) | 0.40 (0.05 to 0.75) | 0.025 | -0.07 (-0.18to 0.04) | 0.22 |
| VAS Score | 3.6 (2.6 to 4.6) | <0.001 | -0.36 (-0.74 to 0.02) | 0.062 |
| Sit and reach test (In Inches) | -0.90 (-1.5 to -0.26) | 0.006 | | |
| Oswestry Low Back Pain (LBP) Score | | | -0.09 (-0.15 to -0.02) | 0.006 |

**[Table/Fig-4]:** Multiple linear regressions to find impact of the variables on sit and reach test scores as well as Oswestry Low Back Pain (LBP) scores.
[1]CI: Confidence Interval

- **Oswestry LBP score and age:** A positive association was found, with a beta coefficient of 0.40 (95% CI: 0.05 to 0.75, p=0.025). For every additional year of age, the Oswestry score increased by 0.40 units, controlling for other variables.
- **VAS score:** A significant positive relationship was identified, with a beta coefficient of 3.6 (95% CI: 2.6 to 4.6, p<0.001). Each one-unit rise in VAS score corresponded to a 3.6-unit rise in the Oswestry score.
- **Sit-and-reach test:** A negative association had been detected, with -0.90 beta coefficient (95% CI: -1.5 to -0.26, p=0.006). Each additional inch in sit-and-reach test score was linked to a 0.90-unit reduction in the Oswestry score.
- **Sit-and-reach test and oswestry LBP score:** Higher Oswestry scores were significantly associated with reduced sit-and-reach performance, with a beta coefficient of -0.09 (95% CI: -0.15 to -0.02, p=0.006). For each unit rise in Oswestry score, sit-and-reach scores declined by 0.09 inches.

The [Table/Fig-5] presents the Pearson correlation coefficients along with their associated p-values, illustrating the relationships among age, VAS scores, sit and reach test results, and Oswestry LBP scores for the 95 participants involved in the study. Overall, the regression results, highlight that age and VAS scores are significant predictors of Oswestry LBP scores, while Oswestry scores significantly predict sit and reach test performance [Table/Fig-5].

| Variables | Age | VAS score | Sit and reach test (in inches) |
|---|---|---|---|
| VAS Score | 0.173 (0.093) | - | - |
| Sit and Reach Test (In Inches) | -0.128 (0.217) | -0.192 (0.062) | - |
| Oswestry low backpain score | 0.229 (0.025) | 0.595 (<0.001) | -0.278 (0.006) |

**[Table/Fig-5]:** Correlation between the study variables.
Pearson's Correlation (p-value)

## DISCUSSION

The LBP is a prevalent musculoskeletal disorder it is a frequent condition linked to altered neuromuscular coordination and trunk rigidity. Posterior chain flexibility, involving the hamstrings, gluteals, lumbar erectors, and calves, is essential for musculoskeletal health. A previous study emphasised resistance training targeting the posterior chain as effective for managing chronic LBP [2]. The present cross-sectional study was done to find the prevalence of lower back pain, average posterior chain flexibility and the correlation of lower back pain with posterior chain flexibility among construction workers in south western Assam. All the subjects who were taken in this study based on inclusion and exclusion criteria were seasonal construction workers who had back pain for at least more than three months, either constantly or intermittently. The subjects in this study were asked about their age as well as the duration for which they had the back pain. The VAS pain rating system was explained to the subjects and then they were asked to estimate their lower back pain severity on the scale. Their estimated pain level claims were recorded. Further, their degree of dysfunction was quantified on the Oswestry LBP disability questionnaire and their scores on the Oswestry disability index were calculated based on that. Finally, a sit and reach test was conducted to quantify their level of posterior chain flexibility and their test scores were recorded on the data collection sheet. This cross-sectional study was conducted on construction workers from various sites.

All the construction workers in the study reported varying degrees of backpain. The mean age of the construction workers sampled was found to be 34 years. The mean VAS pain score for LBP was found to be 5.01. The mean sit and reach test score was 16.8. The mean Oswestry disability index score was found to be 24. In the current study, the VAS score was found to be strongly positively correlated with the Oswestry disability index score, with a correlation coefficient of 0.595 and a highly significant p-value of less than 0.001. In other words, higher degrees of LBP was found to cause higher degrees of LBP related disability as reflected by the higher scores on the Oswestry disability index. Again, the VAS score and sit and reach test scores have a correlation of -0.192 with a p-value of 0.062, indicating a weak negative correlation that approached statistical significance. This means, construction workers with higher posterior chain flexibility are somewhat less likely to suffer from severe back pain. Also, the sit and reach test scores show a significant negative correlation with the Oswestry disability index score, with a correlation coefficient of -0.278 and a p-value of 0.006. This suggests that higher degrees of posterior chain flexibility are associated with lower levels of LBP related disability.

So, to summarise, presence of higher degrees of lower back pain, as reflected in the VAS scores and lower degrees of posterior chain disability, as reflected in the sit and reach test scores, is associated with greater degree of back pain related disability, reflected by the higher scores on the Oswestry disability index. On the other hand, better performance on the sit and reach test was found to be associated with lower scores in the Oswestry disability index. This means that, higher degrees of posterior chain flexibility is associated with lower levels of backpain related disability, along with having somewhat lesser likelihood of suffering from severe LBP in the first place as well, as can be inferred from the obtained data collected and its statistical analysis done for the present study.

Similar results have been found in other studies on this subject matter. A study by Tataryn N et al., (2021) found that posterior chain resistance training is more effective in reducing pain and disability and improving muscle strength in patients with chronic LBP than general exercise [6]. Another study by Kripa S and Kaur H discusses the importance of posture and the role of various muscle groups, including the hamstrings and broad back muscles, in maintaining posture and preventing LBP [7]. A paper by Hardeman A et al., (2020) suggests that the inclusion of posterior chain exercises may reduce the risk of lumbar spine and lower extremity injuries [8]. A cross-sectional study by Tadashi Ito et al., (2023) found no association between muscle strength and low-back pain in healthy children aged 10-16 years. However, it was reported that tight hamstring and quadriceps muscles could cause a posterior pelvic tilt in children and adolescents [9]. These studies collectively suggest that maintaining flexibility in the posterior chain can be beneficial for managing LBP. However, the correlation between posterior chain flexibility and LBP may vary depending on individual factors such as age, lifestyle, and overall health.

While, on the other hand, there are also some studies that showed results that are contradictory to the results of this study. Here are some of the studies that showed contradictory findings to this study. The study by Tataryn N et al., (2021) also found that both posterior chain resistance training and general exercise were effective in improving a number of chronic LBP- related outcomes [6]. However, these effects were often significantly greater in posterior chain resistance training than general exercise, especially with greater training durations [2]. The study by Silva MR et al., also reported that 97.8% of workers reported LBP symptoms. However, the study did not find a significant correlation between posterior chain flexibility and LBP [10]. A paper by Victora Ruas C et al., (concluded that strength and flexibility training associated with weight reduction could potentially improve the chronic LBP condition by improving trunk strength and spinal range of motion [11]. However, they were unable to find significant correlations between functionality and pain with low levels of trunk strength or spine range of motion [7].

These studies suggest that the correlation between posterior chain flexibility and LBP may not be as strong as previously thought, and other factors such as muscle strength imbalances and low flexibility levels may also play a role. Future studies can be done with larger population sizes and co relating other parameters such as torso, abdominal and lower limb muscle strength in addition to quantifying physical activities so that the results obtained can help in providing adequate preventive and therapeutic measures for population.

### Limitation(s)

While this research aimed to offer insights into the experiences of construction workers in southwestern Assam, several limitations should be noted. The study was confined to two districts, limiting the generalisability of the findings. Additionally, only male construction workers were included, as no female participants were identified during data collection. The questionnaire was administered through interviews, which may have introduced bias due to the presence of the surveyor influencing participants' responses. A language gap between surveyors and participants may have led to miscommunication or loss of information during translation. These constraints should be considered when interpreting the results and planning future studies. Further research with larger sample sizes, including both male and female workers from multiple districts, and the inclusion of additional variables for example, abdominal, torso, lower limb muscle strength, as well as physical activity levels, could enhance understanding and inform the development of effective therapeutic and preventive measures for this population.

## CONCLUSION(S)

According to the study's outcomes, LBP is more frequent in construction workers, and workers with greater posterior chain flexibility have a slightly lower risk of developing LBP-related disabilities. This study demonstrated a substantial negative relationship between posterior chain flexibility and the LBP related disability degree. Thus, keeping up high levels of posterior chain flexibility can aid in lowering the frequency, intensity, and LBP associated with disability.

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