

# Correlation Between Low Back Pain and Foot Posture Deviations in Schoolteachers of Navsari

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## Abstract

**Background:** Low back pain is the condition that significantly impacts daily life and professional activities, particularly in occupation requires prolonged standing or movements such as teaching. The aim of the study is to find the correlation between low back pain and foot posture deviations in school teaches of Navsari. The Quebec Back Pain Disability Scale (QBPDS) is a 20-item self-administered instrument designed to assess the level of functional disability in individuals with back pain. Foot Posture Index (FPI) is a diagnostic clinical tool aimed at quantifying the degree to which a foot can be pronated, supinated, neutral position. The Navicular Drop Test (NDT) is a clinical assessment that measures the amount of navicular bone movement (drop) when the foot transitions from a neutral position to a relaxed weight-bearing position. **Objective:** The aim of the study is to evaluate the correlation between low back pain and foot posture deviations in schoolteachers of Navsari. **Method:** This study was conducted with 76 schoolteachers of age group 25–50 using convenient sampling method, according to inclusion and exclusion criteria 76 schoolteachers were included in the study. The study was conducted over the period of 6 months. The outcome measures were used are QBPDS, FPI, and NDT. Correlation test was performed to analyze the correlation. **Result:** Correlation coefficient of low back pain and pronated foot is  $p < .001$ , the correlation of low back pain and supinated foot is  $p = 0.036$ , coefficient correlation of low back pain and NDT is  $p < 0.001$ . **Conclusion:** This study indicates moderate positive correlation according to Quebec and pronation + Quebec and supination + Quebec and normal feet + Quebec and navicular drop test.

**Keywords:** Low back pain, foot posture deviations, schoolteachers, foot posture index (FPI), Navicular drop test (NDT), Quebec back pain disability scale (QBPDS)

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## INTRODUCTION

Low back pain (LBP) is a widespread global health issue and a leading cause of disability, with a high recurrence rate and significant impact on quality of life and work productivity. Abnormal foot posture, especially pronated or supinated feet, is increasingly linked to LBP due to altered stress on spinal and soft tissue structures. The condition is particularly prevalent among schoolteachers – affected by prolonged standing, poor posture, and inadequate working conditions – especially in low- and middle-income African countries, where prevalence ranges from 53.2% to 82.9%. Foot posture deviations, including pronation and supination, can contribute to musculoskeletal issues such as plantar fasciitis, ankle sprains, and LBP. Early evaluation tools – like the Foot Posture Index

(FPI) and Navicular Drop Test – help assess foot alignment. The Quebec Back Pain Disability Scale (QBPDS) is used to measure functional disability in individuals with back pain.

### NEED OF THE STUDY

Low back pain is one of the leading causes of disability worldwide, characterized by discomfort or pain in the lumbar region of the spine, located between the ribcage and the pelvis. This condition significantly impacts daily life and professional activities, particularly in occupations requiring prolonged standing or movement such as teaching. Foot posture plays a vital role in maintaining the alignment and biomechanics of the entire body. Deviations in foot posture, such as over pronation or supination, can disrupt the kinetic chain, causing abnormal stress on the lower extremities and pelvis. This misalignment may lead to compensatory changes in the lumbar spine, increasing the risk of low back pain. School teachers, who often spend long hours on their feet, are particularly vulnerable to such biomechanical issues. While several studies have investigated the relationship between specific foot posture deviations, like pronation and lower back pain, there remains a significant gap in understanding how various other foot posture abnormalities contribute to this issue, particularly in schoolteachers. This study aims to fill this gap by exploring the correlation between low back pain and different foot posture deviations in schoolteachers of Navsari. Understanding this relationship will not only enhance the knowledge of musculoskeletal health in this population but also pave the way for targeted interventions to improve their quality of life and work efficiency.

### AIM AND OBJECTIVES OF THE STUDY

The aim of the study is to evaluate the correlation between low back pain and foot posture deviations in schoolteachers of Navsari.

#### Objectives

- To find correlation between low back pain and foot posture deviations in schoolteachers of Navsari.
- To assess LBP in schoolteachers of Navsari using Quebec back pain disability scale.
- To assess foot posture deviations in schoolteachers of Navsari using foot posture index.
- To assess foot posture deviations in schoolteachers of Navsari using Navicular drop test.

### METHODOLOGY

- *Study Setting* – various schools of Navsari.
- *Study Population* – schoolteachers of Navsari.
- *Study Design* – a correlation study.
- *Sample Size* – 70 (time bound).
- *Sample Design* – convenient sampling.

#### Selection Criteria

##### *Inclusion Criteria*

- Age between 25–50 years adult [1].
- Minimum teaching experience 2 years [1].
- Both male and female [1].
- 5 to 6 hours of standing [1].

##### *Exclusion Criteria*

- Any previous history of traumatic or congenital musculoskeletal or neurological disorder of lower limb [1].
- Obesity bmi above 30 [2].
- Individuals who use any supportive aids for walking [3].
- pregnant women [4].

### **Tools and Material Used**

- A Pen.
- A Paper.
- Measuring scale.
- Marker.
- Chair.

### **OUTCOME MEASURES**

#### **Quebec Back Pain Disability Scale [5]**

##### ***Reliability and Validity***

The intra-class correlation coefficient (ICC) for the total QBPDS was 0.92 (95% C.I.: 0.89 – ICC – 0.94) and for the first factor (handling of large/heavy objects) was 0.97 (95% C.I.: 0.95 – ICC – 0.98), for the second factor (movement) was 0.90 (95% C.I.: 0.85 – ICC – 0.93), for the third factor (bending/stooping) was 0.96 (95% C.I.: 0.94 – ICC – 0.97), for the fourth factor (ambulation) was 0.95 (95% C.I.: 0.93 – ICC – 0.97), for the fifth factor (sit/stand) was 0.95 (95% C.I.: 0.93 – ICC – 0.96), and for the sixth factor (bed/rest) was 0.96 (95% C.I.: 0.94 – ICC – 0.97).

#### **Foot Posture Index – [6–8]**

##### ***Interpretation***

- Normal = 0 to +5.
- Pronated = –1 to +9, highly pronated 10+.
- Supinated = –1 to –4, highly supinated –5 to –12.

##### **Reliability**

The inter- and intra-rater reliability for the FPI-6 were found to be 0.62 to 0.91 and 0.81 to 0.91, respectively.

For simplicity, in this study, an FPI-6 score of  $\geq 6+$  is used to describe subjects with foot pronation of +6 to +12 in the FPI-6.

#### **Navicular Drop Test [5, 9–11]**

The navicular drop test is a measure to evaluate the function of the medial longitudinal arch, which is important for the examination of patients with overuse injuries. In order to evaluate the inter-examiner reliability, the intraclass correlation index (ICC 2,1) was used. The test showed excellent inter-examiner reliability (ICC = 0.93). The typical error of measurement was 2.16 mm.

### **Procedure**

A written and informed consent about enrolment in the study and maintaining adequate privacy and confidentiality has been filled and taken from all subjects included in the study.

All the subjects were selected for the study based on inclusion and exclusion criteria.

The procedure has been explained to the subject.

A total of 120 schoolteachers has been selected and out of that 76 were included into our study as per inclusion criteria and age group between 25 to 35 of Navsari district (Figures 1 & 2).

After the selection of participants, Quebec back pain disability index has been taken.

Later, FPI-6 has been performed, for which the subject is first positioned in standing, i.e., weight-bearing position and observed in three directions, i.e., anterior, medial, and posterior.

**Following FPI – 6, Navicular Drop Test Has Been Assessed**

Weight bearing position and Non-weight bearing position – subject outcome measures were taken, and all measures used are valid and shown to have acceptable reliability (Figures 3 & 4).

Hence, based on statistical analysis, results – a conclusion – were noted.

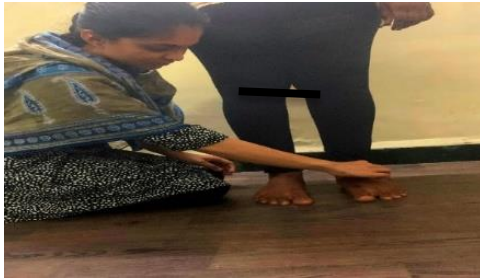


**Figure 1.** Palpating talar head.



**Figure 2.** Palpating medial arch height.



**Figure 3.** Navicular drop test.



**Figure 4.** Navicular drop test.

## RESULT

Table 1 shows total 76 participants with mean age group of 34.6 with standard deviation of 7.06

**Table 1.** Distribution of participants according to the age group.

| Descriptives       |      |
|--------------------|------|
|                    | Age  |
| N                  | 76   |
| Mean               | 34.6 |
| Standard deviation | 7.06 |

## Explanation

The age distribution of 76 participants is centered around 34.6 years, with moderate variation (SD:7.06) (Figure 5).

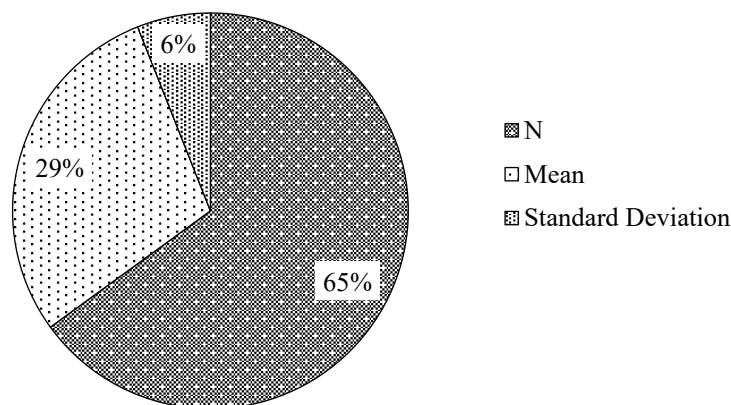


**Figure 5.** Distribution of participants according to the age group.

Table 2 shows that from 76 participants 59 were female teachers and 17 were male teachers.

**Table 2.** Distribution of participants according to gender.

| Gender | Total |
|--------|-------|
| Female | 59    |
| Male   | 17    |

## Explanation

The pie chart illustrates the gender distribution of the 76 participants involved in the study. A significant majority (approximately 78%) were female while only 22% were male (Figure 6).

Table 3 shows that out of 76 participants 74 were with right dominance and 2 were with left dominance.

**Table 3.** Distribution according to dominance.

| Dominancy | Total |
|-----------|-------|
| Right     | 74    |
| Left      | 2     |

## Explanation

Most participants (97.37%) showed right-hand dominance, reflecting the common prevalence of right-handedness in the general population (Figure 7).

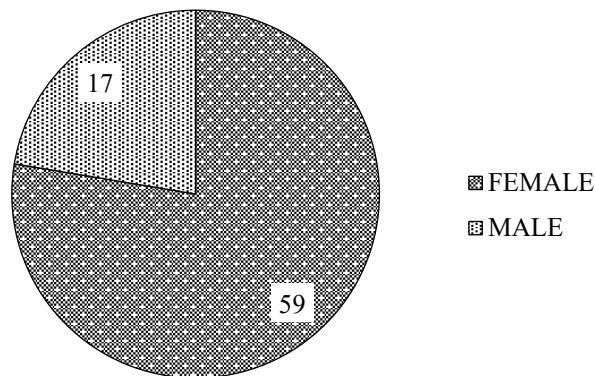


**Figure 6.** Distribution of participants according to gender.

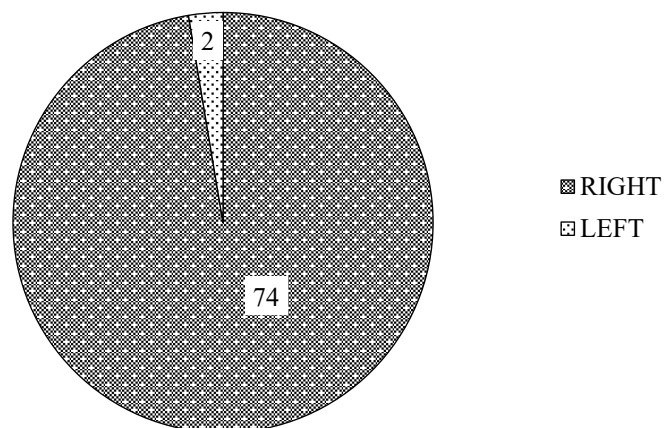


**Figure 7.** Distribution according to dominance.

Table 4 shows that out of 76 participants 55 were (2–10 years) and 13 were (11 to 20) years and 8 were (20–25 years) significant.

**Table 4.** Distribution according to the years of experience.

| Years of experience | Total hours |
|---------------------|-------------|
| 2 to 10years        | 55          |
| 11 to 20 years      | 13          |
| 20 to 25 years      | 8           |

### Explanation

Over 70% of the participants had 2–10 years of experience, indicating a predominantly younger workforce in the study sample (Figure 8).

Table 5 shows most teachers (44 out of 76) stood for 5–6 hours, followed by 24 teachers standing for 6–7 hours. Only a few teachers exceeded 7 hours of standing, indicating a clear preference for shorter working durations.

### Explanation

Most teachers (44 out of 76) stood for 5–6 hours, followed by 24 teachers standing for 6–7 hours. Only a few teachers exceeded 7 hours of standing, indicating a clear preference for shorter working durations (Figure 9).

A moderate positive correlation (Spearman's Rho = 0.565,  $p < 0.001$ ) was found between low back pain and foot posture index (FPI) in the right pronated foot. This indicates a significant association, suggesting that altered foot posture may influence the severity of LBP (Table 6).

**Table 5.** Distribution according to the hours of standing.

| Hours of standing | Total |
|-------------------|-------|
| 5–6 hours         | 44    |
| 6–7 hours         | 24    |
| 7–8 hours         | 4     |
| 8–9 hours         | 2     |
| 9–10 hours        | 0     |
| 10–11 hours       | 0     |
| 11–12 hours       | 2     |

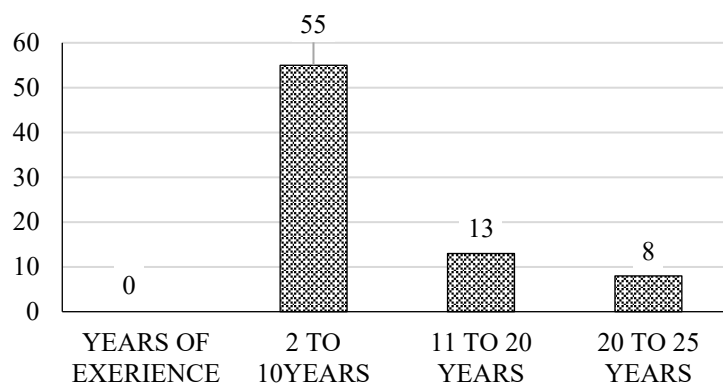


**Figure 8.** Distribution according to the years of experience.

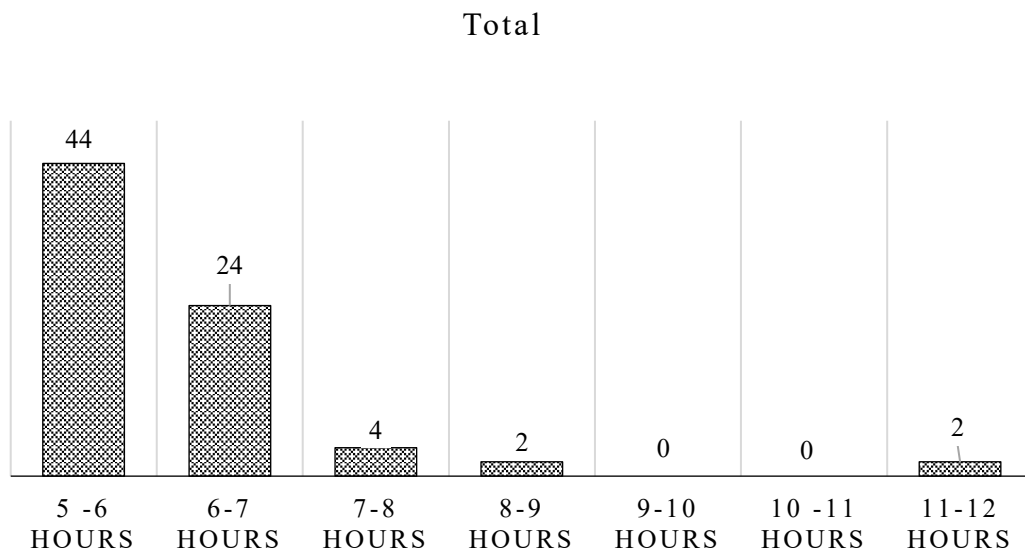


**Figure 9.** Distribution according to the hours of standing.

**Table 6.** Correlation between LBP and foot posture deviations based on FPI in right side pronated foot.

|        |                | Quebec | FPI |
|--------|----------------|--------|-----|
| Quebec | Spearman's rho | –      |     |
|        | DF             | –      |     |
|        | p-value        | –      |     |
| FPI    | Spearman's rho | 0.565  | –   |
|        | DF             | 38     | –   |
|        | p-value        | <.001  | –   |

### Explanation

A moderate positive correlation (Spearman's  $\rho = 0.565$ ,  $p < 0.001$ ) was found between low back pain and foot posture index (FPI) in the right pronated foot. This indicates a significant association, suggesting that altered foot posture may influence the severity of LBP (Figure 10).

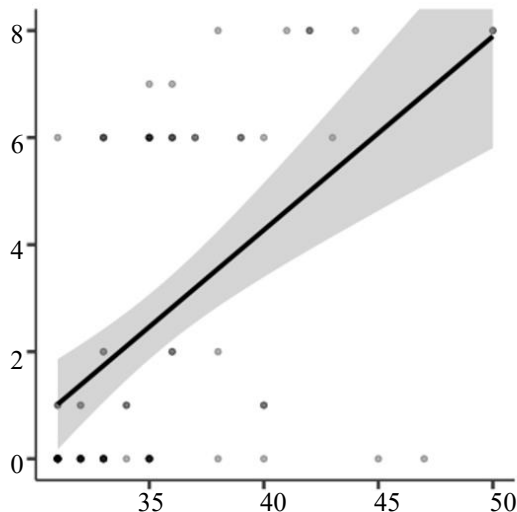


**Figure 10.** Correlation between low back pain and FPI (right pronated foot).

Table 7 represents the correlation between LBP and foot posture deviations based on the foot posture index for the normal right foot. It demonstrates a high positive correlation with strong statistical significance, indicating a meaningful association. Findings highlight the potential influence of altered foot posture on low back pain severity.

**Table 7.** Correlation between LBP and foot posture deviations based on FPI in right side normal foot.

|     |                       |              |
|-----|-----------------------|--------------|
| FPD | <b>Spearman's RHO</b> | <b>0.023</b> |
|     | DF                    | 28           |
|     | P-VALUE               | 0.904        |

### Explanation

In individuals with normal right foot posture, a weak and non-significant correlation (Spearman's  $\rho = 0.023$ ,  $p = 0.904$ ) was observed between LBP and FPI. This implies that normal foot posture may not significantly contribute to LBP severity (Figure 11).

Table 8 shows a strong negative correlation ( $\rho = -0.840$ ) between LBP and foot posture index (FPI) on the right side in individuals with supinated feet. The P-value (0.036) indicates statistical significance. This suggests that as the foot becomes more supinated, the severity of low back pain may increase. Altered biomechanics in supinated feet might contribute to LBP.

### Explanation

The graph illustrates a clear negative linear trend between FPI and LBP in right-sided supinated feet. As the FPI score decreases (indicating more supination), the LBP score increases. This supports the statistical results from Table 8 and Figure 12.

**Table 8.** Correlation between LBP and foot posture deviations based on FPI in right side supinated foot.

|        |                |            |
|--------|----------------|------------|
|        |                | <b>FPI</b> |
| Quebec | Spearman's rho | -0.840     |
|        | DF             | 4          |
|        | p-value        | 0.036      |

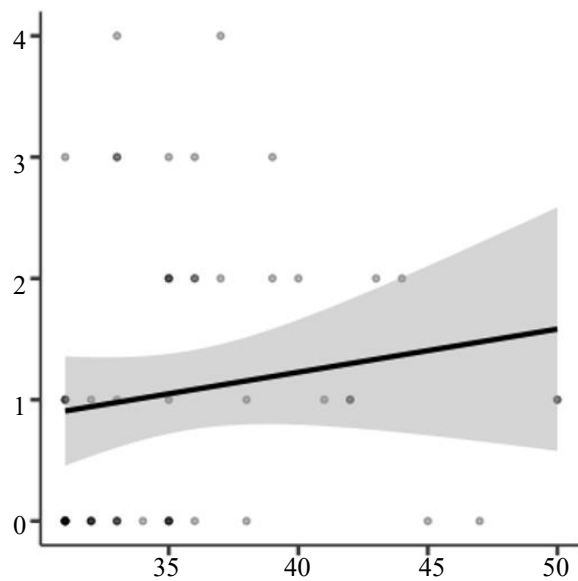


**Figure 11.** Correlation between low back Pain and FPI (right normal foot).

A Spearman's rho of 0.564 indicates a moderate to strong positive correlation between low back pain and the foot posture index (FPI) for the left pronated foot with a p-value  $<0.0001$ , the result is statically significant, implying that more pronated are associated with increased levels of low back pain – highlighting the possible impact of altered foot mechanics on spinal stress (Table 9).

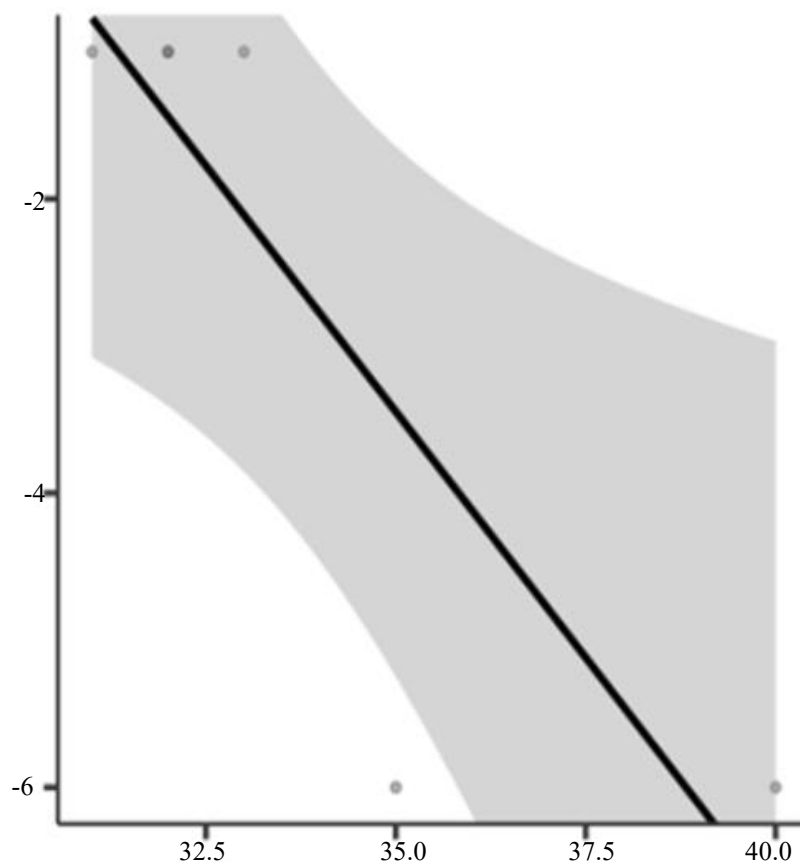


**Figure 12.** Correlation between low back pain and FPI (right supinated foot)

**Table 9.** Correlation between LBP and foot posture deviations based on FPI in left side pronated foot.

|        |                | Quebec | FPI |
|--------|----------------|--------|-----|
| Quebec | Spearman's rho | –      |     |
|        | DF             | –      |     |
|        | p-value        | –      |     |
| FPI    | Spearman's rho | 0.564  | –   |
|        | DF             | 41     | –   |
|        | p-value        | <.001  | –   |

### Explanation

This graph shows the relationship between low back pain and foot posture index (FPI) in individuals with a pronated left foot. Spearman's rho value of 0.564 and a p-value < 0.001 indicate a moderate to strong positive correlation, which is statistically significant. This suggests that as foot pronation increases, low back pain severity also tends to increase. The results underscore the possible biomechanical link between altered foot posture and spinal loading, contributing to LBP symptoms (Figure 13).

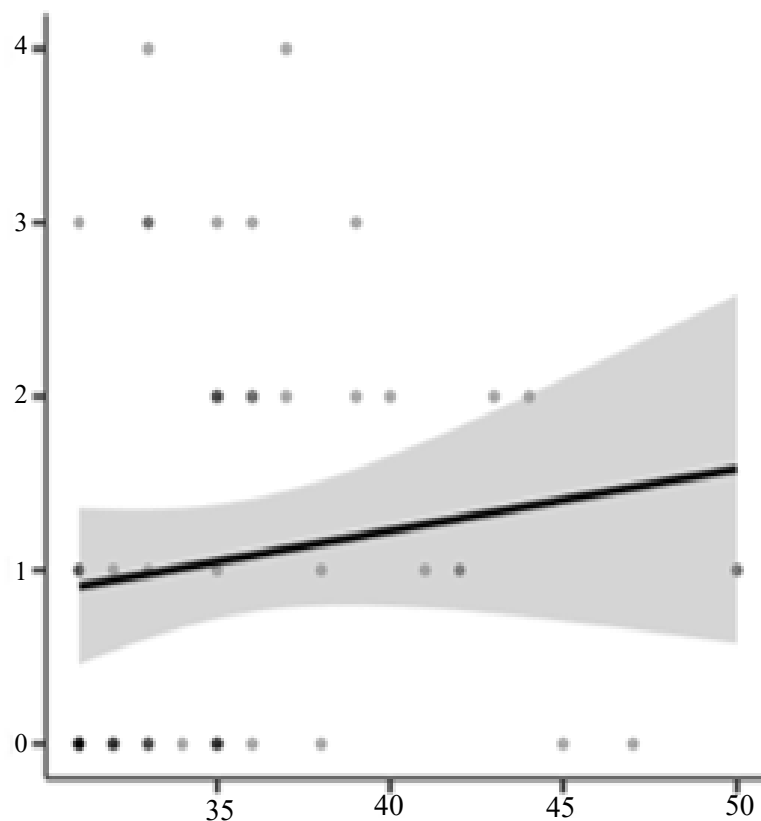
**Figure 13.** Correlation between Low Back Pain and FPI (Left Pronated Foot).

Table 10 reports a strong negative correlation (Spearman's rho =  $-0.866$ ) between low back pain and FPI for the left supinated foot. The statistically significant result implies that greater supination of the foot is associated with lower levels of low back pain, possibly due to biomechanical unloading or compensatory posture reducing lumbar stress.

### Explanation

The histogram provides insight into the distribution of a certain dataset, highlighting areas of high and low frequency across the specified range (Figure 14).

**Table 10.** Correlation between LBP and foot posture deviations based on FPI in left side supinated foot.

|        |                | Quebec | FPI |
|--------|----------------|--------|-----|
| Quebec | Spearman's RHO | –      |     |
|        | DF             | –      |     |
|        | P-Value        | –      |     |
| FPI    | Spearman,S RHO | –0.866 | –   |
|        | DF             | 1      | –   |
|        | P-Value        | 0.333  | –   |

Table 11 represents the correlation between LBP and foot posture deviations based on the foot posture index for the supinated left foot.it demonstrated a moderate positive correlation with strong statistical significance, indicating a meaningful association. Findings highlight the potential influence of altered foot posture on low back pain severity.

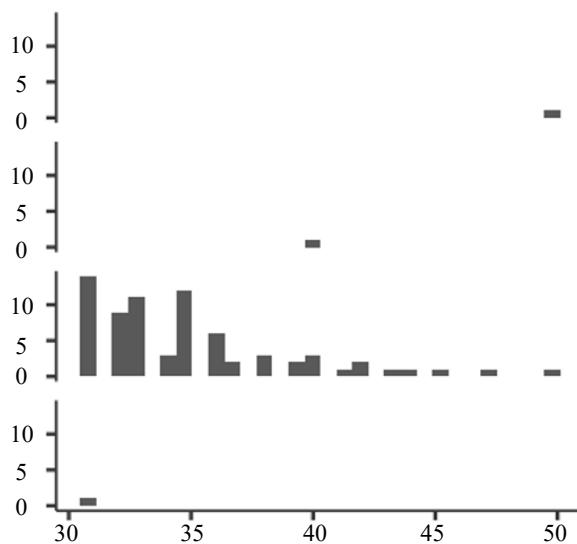


**Figure 14.** Correlation between low Back Pain and FPI (left supinated foot).

**Table 11.** Correlation between LBP and foot posture deviations based on FPI in left side normal foot

|        |                | Quebec | FPI |
|--------|----------------|--------|-----|
| Quebec | Spearman's RHO | –      |     |
|        | DF             | –      |     |
|        | P-Value        | –      |     |
| FPI    | Spearman,S RHO | 0.398  | –   |
|        | DF             | 24     | –   |
|        | P-Value        | 0.044  | –   |

### Explanation

The line shows a positive trend, indicating that as the values on the x-axis increase, the values on the y-axis also tend to increase. There may be a positive correlation between the variables depicted in the graph (Figure 15).

Spearman's rho value of 0.461 indicates a moderate positive correlation between low back pain (measured using the Quebec scale) and right-sided Neurodynamic Test (NDT) (Table 12). With a p-value < 0.001, this relationship is statistically significant, suggesting that increased nerve tension or dysfunction on the right side is moderately associated with higher levels of low back pain.

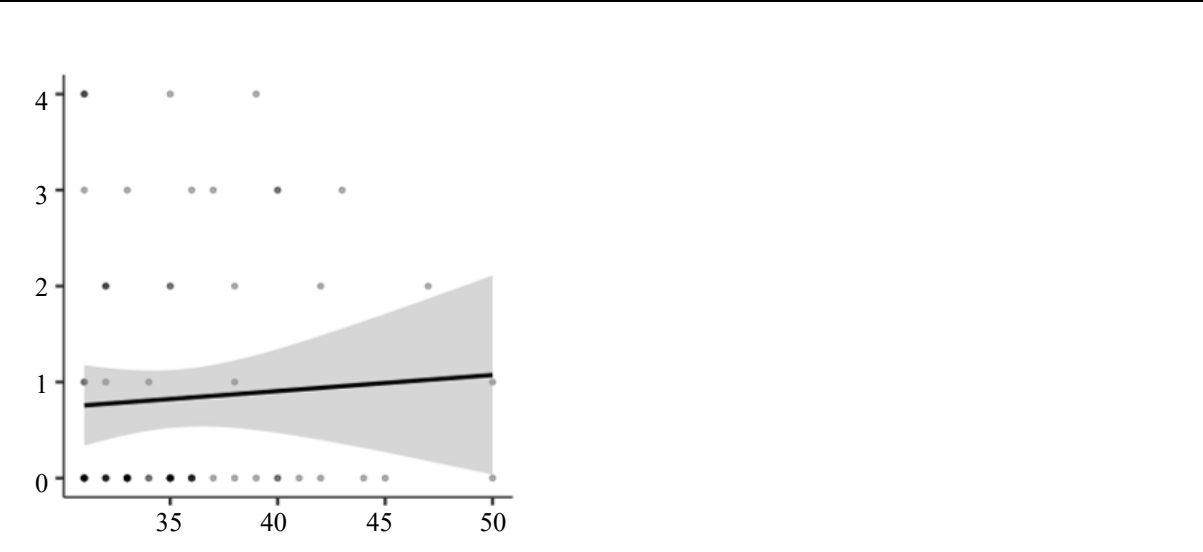


**Figure 15.** Correlation between low back pain and FPI (left normal foot).

**Table 12.** Correlation of low back pain and NDT(RT).

|        |                | Quebec | NDT |
|--------|----------------|--------|-----|
| Quebec | Spearman’s rho | –      |     |
|        | Df             | –      |     |
|        | p-value        | –      |     |
| NDT    | Spearman’s rho | 0.461  | –   |
|        | Df             | 73     | –   |
|        | p-value        | <.001  | –   |

**Explanation**

The graph confirms a moderate positive trend between low back pain and right-sided NDT scores. The upward-sloping trend line and shaded confidence interval indicate a consistent and statistically reliable correlation across the data points (Figure 16).

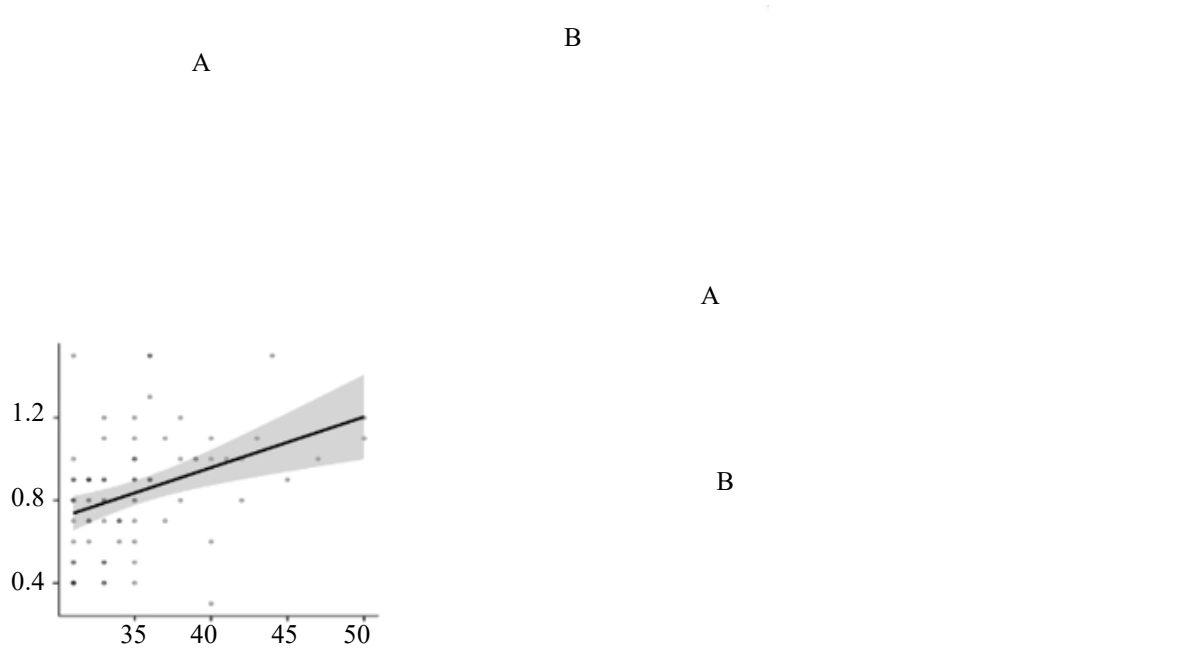


**Figure 16.** Correlation of low back pain and NDT (right side).

With a Spearman's rho of 0.476 and a p-value < 0.001, Table 13 shows a moderate, statistically significant positive correlation between low back pain and left-sided NDT. This suggests that individuals showing greater neural tension or impaired neurodynamics on the left side tend to report more severe low-back pain.

**Table 13.** Correlation of low back pain and NDT(LT).

|        |                | Quebec | NDT |
|--------|----------------|--------|-----|
| Quebec | Spearman's rho | –      |     |
|        | Df             | –      |     |
|        | p-value        | –      |     |
| NDT    | Spearman's rho | 0.476  | –   |
|        | Df             | 74     | –   |
|        | p-value        | <.001  | –   |

### Explanation

Figure 17 shows a clear upward trend, reflecting the positive correlation between low back pain and left-sided neurodynamic testing. The trend line and narrow confidence band strengthen the evidence for a meaningful association.

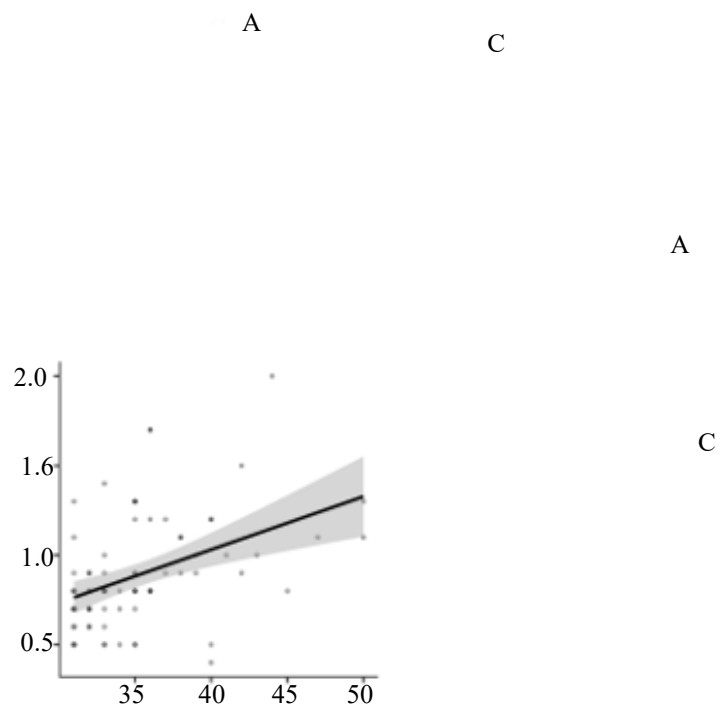


**Figure 17.** Correlation of low back pain and NDT (left side).

### DISCUSSION

This study explored the correlation between low back pain (LBP) and foot posture deviations (FPD), as assessed by the Foot Posture Index (FPI), in individuals with pronated, supinated, and normal feet on both the right and left sides. The findings provide compelling insights into how deviations in foot posture relate to the degree of functional disability associated with LBP, as measured by the Quebec Low Back Pain Disability Questionnaire.

On the right-side, individuals with pronated feet showed a positive correlation with LBP, suggesting that as the degree of pronation increased, so did the disability relate to low back pain. This aligns with

the study conducted by [12–16], which reported a \*strong positive correlation between LBP and flat feet (pronation) with a highly significant p-value ( $\leq 0.001$ ). This finding supports the theory that excessive pronation alters the kinetic chain, contributing to compensatory movements and increased lumbar stress. In contrast, Prakash & Maurya (2019) [1] found a negative correlation between pronation and LBP with a p-value of 0.09, though their results were not statistically significant, which may account for the discrepancy.

In individuals with supinated feet on the right, a less positive correlation was noted. Supinated feet tend to be rigid and offer less shock absorption, which may transmit increased ground reaction forces through the lower kinetic chain and into the lumbar spine. Although the correlation was not strong, the trend observed aligns with findings from the Framingham Foot Study, where the foot function altered (both hyperpronation and supination) was associated with increased pain and discomfort in the lower extremities and back. Interestingly, participants with normal foot posture on the right showed a strong positive correlation with LBP. This finding might suggest that even within normal FPI ranges, there could be subtle compensatory mechanisms or neuromuscular inefficiencies contributing to low back strain.

On the left side, a moderate positive correlation was found between pronated feet and LBP. This is consistent with the earlier findings of Almutairi et al. (2021) [16], who investigated gait in individuals with pronated feet and found that altered lower limb biomechanics were associated with increased back pain. Furthermore, left-sided supinated feet showed a moderate to strong positive correlation with LBP, reinforcing the idea that structural foot rigidity and impaired load distribution could have proximal effects. A similar pattern was found in individuals with normal foot posture on the left, where a moderate positive correlation was evident. This again highlights that foot posture may not be the sole factor, and aspects – such as neuromuscular control and dynamic function – play a role.

One of the most significant findings of the current study was the strong positive correlation between LBP and neurodynamic tension (NDT). This supports the existing knowledge that impaired neural mobility can exacerbate or mimic musculoskeletal symptoms. Increased neural tension, particularly in structures, like the sciatic nerve, can lead to protective postures, altered movement patterns, and eventually chronic pain. This observation is supported by Farahpour et al. (2015) [15], who noted the importance of foot and ankle alignment in influencing overall postural balance and the development of back pain.

While the findings of this study largely support a link between foot posture and LBP, they also reflect the complexity and multifactorial nature of back pain [14]. previously reported no significant association between hyperpronated feet and LBP, suggesting that posture alone may not be a reliable predictor unless considered with other factors such as muscle strength, joint mobility, and activity level. Similarly, Incel et al. (2004) [13] emphasized the importance of functional limitations rather than pain intensity alone when assessing disability due to LBP, which was considered in this study using the Quebec Disability Questionnaire.

The current study's use of the FPI-6 tool, as validated by Redmond A. (2005) [17] and supported by Yang et al. (2022) [11], ensured that foot posture was assessed in a standardized and clinically reliable manner. Additionally, the inclusion of functional and neurodynamic assessments provided a more comprehensive overview of how distal biomechanical alterations and neural structures contribute to spinal pain.

Biomechanically, excessive pronation is known to cause internal rotation of the tibia and femur, anterior pelvic tilt, and increased lumbar lordosis – all potential contributors to mechanical LBP. Supinated feet, on the other hand, decrease shock absorption and increase stiffness in the lower kinetic chain, potentially translating more force to the lumbar region. These patho-mechanical effects are well-

documented by researchers – such as Yang et al. (2022) and Aquino et al. (2018) [10, 11] – who explored the impact of foot deformities on back-related disability.

In conclusion, the study demonstrates a significant relationship between foot posture – particularly pronation – and low back pain. The moderate to strong correlations observed on both sides and across different foot types suggest that evaluating foot biomechanics should be an integral part of LBP assessment. While not all literature supports this association, the results of the current study strengthen the argument that foot posture, neural mobility, and overall biomechanical alignment can collectively influence the presence and severity of LBP. Future studies with dynamic analysis and a larger cohort would help validate these findings and contribute to targeted physiotherapeutic interventions.

## CONCLUSION

The present study investigated the correlation between low back pain (LBP) and foot posture deviations (FPD) using the Foot Posture Index (FPI) along with Navicular Drop Test (NDT) among the school Teachers with varying foot types – like pronated, supinated, and normal – on both the right and left sides. The findings revealed a significant moderate to strong positive correlation between LBP and foot posture deviations, particularly in pronated feet on the right and left sides, and normal feet on the right side. Furthermore, a strong positive correlation was also observed between LBP and neurodynamic tension (NDT). These results suggest that altered foot biomechanics may play an important role in contributing to the postural imbalances and increased mechanical stress on the lumbar spine, potentially leading to or exacerbating LBP. The inclusion of FPI and NDT as clinical tools in Physiotherapy assessments could offer a more holistic approach in managing patients with low back pain.

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