



ISSN: 2347-6567

International Journal of Allied Medical Sciences and Clinical Research (IJAMSCR)

IJAMSCR | Vol. 14 | Issue 4 | Oct - Dec 2026

www.ijamscr.com

DOI : <https://doi.org/10.61096/ijamscr.v14.iss4.2026.1642-1648>

Factors Influencing Low Back Pain for Employees Working at the Shoe Manufacturing Industry- A Survey Study

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Published on:

20-10-2026

Published by:

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Abstract:

Background: Low back pain is a common musculoskeletal problem among occupational workers and may affect pain, functional ability and work performance. Employees in shoe manufacturing industries may be exposed to prolonged and repetitive work activities, awkward postures and physical demands that may contribute to low back pain.

Aim: To identify factors influencing low back pain among employees working in a shoe manufacturing industry.

Methods: A cross-sectional survey study was conducted among 200 employees working at Alhamd overseas shoe manufacturing industry, Ambur. Participants were selected using purposive sampling. Demographic characteristics, occupational and personal factors, postural habits and history of low back pain were assessed. The Modified Oswestry Disability Index (ODI), Visual Analog Scale (VAS), Barthel Index, Finger-to-Floor Test (FTFT) and FABER test were used for assessment. Descriptive and inferential statistical analyses were performed using SPSS version 24, with statistical significance set at $p < 0.05$.

Results: The mean Barthel Index scores were 94.35 ± 3.30 and 94.60 ± 2.90 in the two groups, respectively. The mean VAS scores were 4.71 ± 1.55 and 4.59 ± 1.49 , while the mean ODI scores were 25.11 ± 5.63 and 25.87 ± 4.93 , respectively. No statistically significant differences were observed between the groups for the Barthel Index ($p = 0.571$), VAS ($p = 0.579$) or ODI ($p = 0.313$). The FTFT showed positive findings in 26% and 46% of participants, while the FABER test was positive in 39% and 36%, respectively.

Conclusion: The findings indicate the presence of low back pain and associated functional limitations among employees in the shoe manufacturing industry. The observed findings highlight the importance of considering occupational and personal factors, postural habits, pain intensity and functional disability when assessing low back pain among industrial workers.

Keywords: Low back pain; Shoe manufacturing industry; Occupational factors; Stitching operators; Cutting operators; Oswestry Disability Index; Visual Analog Scale.

INTRODUCTION

Low back pain (LBP) is a common musculoskeletal condition and an important cause of occupational disability. It can affect physical functioning, work performance and quality of life. The development of LBP is multifactorial and may be associated with occupational, postural, physical and personal factors ^[1, 2]. Occupational activities involving repetitive movements, prolonged sitting or standing, frequent bending and twisting, lifting, pushing, pulling and other physically demanding tasks may increase mechanical stress on the lumbar spine and contribute to the development of LBP. Previous research among industrial workers has also identified occupational workload, work characteristics, and personal factors as relevant considerations in the assessment of LBP. Studies of industrial workers have reported associations between LBP and occupational physical exposures, while other research has emphasized the contribution of individual characteristics and health-related factors ^[3, 4]. Poor or sustained working postures may further increase spinal loading and muscular fatigue, particularly among industrial workers who perform repetitive tasks for prolonged periods.

Personal characteristics and lifestyle factors may also influence the occurrence of LBP. Factors such as age, body weight, smoking habits, and level of physical activity have been reported as potential contributors to low back pain ^[5]. Therefore, assessment of both occupational and personal factors is important when evaluating LBP among industrial workers. The shoe manufacturing industry involves a variety of repetitive and physically demanding activities. Workers may remain in sustained postures, perform repetitive upper- and lower-limb movements, and experience prolonged periods of sitting or standing depending on their specific job role. Previous research in a shoe factory identified cutting and sewing as work situations associated with a higher risk of musculoskeletal disorders, indicating that different manufacturing tasks may expose workers to different physical demands. The shoe manufacturing industry consists of several work processes, including material cutting, stitching, assembling, finishing, and packing. Each process requires different body positions, movements, and levels of physical activity. A study conducted in a large shoe factory identified cutting and sewing among the work situations associated with a high risk of musculoskeletal disorders, demonstrating the importance of examining different occupational tasks within the same industry ^[6].

In the present study, employees were divided into two occupational groups: Group A, stitching operators, and Group B, cutting operators. Stitching operators commonly perform repetitive sewing activities while maintaining a relatively fixed working position for prolonged periods. Such work may involve sustained sitting, forward trunk positioning, repetitive movements, and limited variation in posture. A study among sewing-machine operators in shoemaking reported musculoskeletal complaints in several body regions, with low back pain being the most frequently reported complaint. Stitching operators generally perform repetitive sewing activities while maintaining a relatively fixed working position. Depending on workstation design, the worker may remain seated for prolonged periods with repetitive upper-limb activity and sustained trunk positioning. Research among shoemaking sewing-machine operators reported musculoskeletal complaints in several body regions, with low back pain being one of the most frequently reported complaints. ^[7] Cutting operators perform tasks related to the preparation and cutting of shoe materials. These activities may involve repeated handling of materials, standing, reaching, bending, and other task-specific movements. Because the physical demands of cutting work differ from those of sewing work, comparison of these two groups may provide useful information regarding differences in pain, disability, and functional findings. However, occupational posture and physical exposure should be interpreted as factors associated with LBP rather than as definite causes, particularly in a cross-sectional study. Evidence from systematic reviews indicates that the relationship between specific occupational postures and LBP is complex, and causality cannot be established consistently. ^[8]

These findings support the need to consider both occupational role and individual characteristics when evaluating LBP among industrial employees. Research specifically examining workers in the footwear sector has demonstrated a substantial burden of musculoskeletal symptoms. Studies among footwear manufacturing workers have reported low back and other musculoskeletal complaints and have highlighted the importance of workstation posture and ergonomic conditions ^[9,10]. However, limited information is available regarding differences in LBP-related pain, disability, functional independence, lumbar flexibility, and hip-related findings

between stitching and cutting operators in the same shoe manufacturing environment. Shoe manufacturing involves different occupational tasks, including stitching and cutting, which may require repetitive movements and sustained working postures. However, the available information in the present study setting is limited. Industrial workers may be exposed to repetitive movements, prolonged static postures, bending, twisting, manual handling, and other forms of physical workload during their daily activities. Previous research has reported an association between occupational physical demands and low back symptoms; however, the relationship is complex and does not necessarily establish a direct causal relationship^[11]. Therefore, assessment of workers should consider both occupational characteristics and individual factors rather than focusing on job title alone. Therefore, the present study was undertaken to identify factors influencing low back pain among employees working in a shoe manufacturing industry in Ambur. The study assessed demographic characteristics, occupational and personal factors, postural habits, pain intensity, disability and functional status using the Visual Analog Scale, Modified Oswestry Disability Index, Barthel Index, Finger-to-Floor Test and FABER test.

MATERIALS AND METHODS

Ethical committee number:

The study was approved by the Institutional Ethics Committee (IEC-RIPT/DT/21/4516).

Study design and setting

A cross-sectional survey study was conducted among employees working at ALHAMD OVERSEAS shoe manufacturing industry, Ambur. The study was carried out over a period of four months.

Participants and sample size

A total of 200 employees were included in the study. Participants of both genders were recruited for the study, with 100 participants allocated to each study group according to the original project protocol.

Sampling technique

Participants were selected using purposive sampling based on the specified eligibility criteria.

Inclusion criteria

Participants were included if they had at least one year of work experience in the shoe manufacturing industry, voluntarily agreed to participate in the study, and were able to understand either Tamil or English.

Exclusion criteria

Participants were excluded if they were above 60 years of age, had less than one year of work experience, were pregnant, or had a history of infection or inflammatory spinal disease, spinal fracture, or structural spinal deformity.

Data collection procedure

After obtaining the required permission from the concerned authorities, eligible employees were identified and informed about the purpose and procedure of the study. Relevant demographic and occupational information was collected, including age, occupational characteristics, sports activity, smoking habits and educational status. Information regarding postural habits and past or present medical history was also obtained. Participants were assessed for pain intensity, disability and functional status using standardized clinical outcome measures.

Outcome measures

The Visual Analog Scale (VAS) was used to assess the intensity of low back pain. The Modified Oswestry Disability Index (ODI) was used to assess disability associated with low back pain. The Barthel Index was used to assess functional independence. The Finger-to-Floor Test (FTFT) was used to assess functional spinal flexibility, while the FABER test was included as part of the physical assessment.

STATISTICAL ANALYSIS

The collected data were entered and analyzed using SPSS version 24. The Shapiro-Wilk test was used to assess the distribution of the data. Descriptive statistics were expressed using appropriate measures, including mean and standard deviation. An independent t-test was used to compare the outcomes between the two groups. The level of statistical significance was set at $p < 0.05$, with a 95% confidence interval

Table - 1
Comparison of borthal index score between group A and group B

TEST	GROUP A		GROUP B		t - test	df	Sig
	MEAN	S.D	MEAN	S.D			
BI	94.35	3.30	94.60	2.90	-.568	198	.571*

(* - $P > 0.05$ – Not Significant).

The above table reveals the Mean, Standard Deviation (S.D), t - test, degree of freedom (df) and p-value between Group A and Group B. There is no statistically significant difference between the Group A and Group B values at $P > 0.05$.

Table - 2
Comparison of visual analog scale score between group A and group B

TEST	GROUP A		GROUP B		t - test	df	Sig
	MEAN	S.D	MEAN	S.D			
VAS	4.71	1.55	4.59	1.49	.556	198	.579*

(* - $P > 0.05$ – Not Significant).

The above table reveals the Mean, Standard Deviation (S.D), t - test, degree of freedom (df) and p-value between Group A and Group B. There is no statistically significant difference between the Group A and Group B values at $P > 0.05$.

Table - 3
Comparison of oswestry disability index score between group A and group B

TEST	GROUP A		GROUP B		t - test	df	Sig
	MEAN	S.D	MEAN	S.D			
ODI	25.11	5.63	25.87	4.93	-1.01	198	.313*

(* - $P > 0.05$ – Not Significant).

The above table reveals the Mean, Standard Deviation (S.D), t - test, degree of freedom (df) and p-value between Group A and Group B. There is no statistically significant difference between the Group A and Group B values at $P > 0.05$.

Table-4
Comparison of finger to floor test score between group A and group B

FTFT	GROUP A	GROUP B
POSITIVE	26%	46%
NEGATIVE	74%	54%

Table - 5
Comparison of FABER test score between group A and group B

FABER	GROUP A	GROUP B
POSITIVE	39%	36%
NEGATIVE	61%	64%

RESULTS

A total of 200 employees participated in the study, with 100 participants in each of the two study groups. The outcomes were compared between the groups using the independent t-test. The mean Barthel Index score was 94.35 ± 3.30 in the first group and 94.60 ± 2.90 in the second group. The difference between the groups was not statistically significant ($p = 0.571$). The mean Visual Analog Scale (VAS) score was 4.71 ± 1.55 in the first group and 4.59 ± 1.49 in the second group. No statistically significant difference was observed between the groups ($p = 0.579$). The mean Modified Oswestry Disability Index (ODI) score was 25.11 ± 5.63 in the first group and 25.87 ± 4.93 in the second group. The difference between the groups was not statistically significant ($p = 0.313$). For the Finger-to-Floor Test (FTFT), positive findings were observed in 26% of participants in the first group and 46% in the second group, while negative findings were observed in 74% and 54%, respectively. For the FABER test, positive findings were observed in 39% of participants in the first group and 36% in the second group, while negative findings were observed in 61% and 64%, respectively. Overall, no statistically significant differences were identified between the two groups for the Barthel Index, VAS or Modified Oswestry Disability Index. The observed FTFT and FABER findings demonstrated differences in proportions between the groups

DISCUSSION

The present study was conducted to identify factors influencing low back pain among employees working in a shoe manufacturing industry, with particular comparison between stitching operators and cutting operators. A total of 200 employees were assessed using the Barthel Index, Visual Analog Scale (VAS), Modified Oswestry Disability Index (ODI), Finger-to-Floor Test (FTFT) and FABER test. The findings showed that the mean Barthel Index scores were 94.35 ± 3.30 in stitching operators and 94.60 ± 2.90 in cutting operators. The difference was not statistically significant ($p = 0.571$). This suggests that both occupational groups demonstrated broadly similar levels of functional independence. The high mean scores in both groups indicate that major limitations in basic functional activities were not evident in the study population. The mean VAS scores were 4.71 ± 1.55 among stitching operators and 4.59 ± 1.49 among cutting operators, with no statistically significant difference ($p = 0.579$). Similarly, the mean ODI scores were 25.11 ± 5.63 and 25.87 ± 4.93 , respectively, with no statistically significant difference ($p = 0.313$). These findings indicate that pain intensity and disability related to low back pain were comparable between the two occupational groups. Previous research has demonstrated that occupational physical demands and mechanical exposures, including non-neutral postures and lifting or carrying, can be associated with low back problems; however, the present

cross-sectional findings do not establish a causal relationship between a specific job task and low back pain.^[12,13]

The FTFT showed positive findings In 26% of stitching operators and 46% of cutting operators, whereas negative findings were observed in 74% and 54%, respectively. Although a higher proportion of positive findings was observed among cutting operators, this descriptive difference should not be interpreted as a statistically significant occupational effect because a corresponding inferential analysis for the FTFT proportions was not reported in the study data. The FABER test was positive In 39% of stitching operators and 36% of cutting operators, while negative findings were observed in 61% and 64%, respectively. The relatively similar proportions between the groups suggest that the findings detected by this test were comparable across the two occupational categories. Since the FABER test evaluates hip and lumbopelvic-related movement rather than being a specific diagnostic test for occupational low back pain, its findings should be interpreted as part of the overall physical assessment rather than as evidence of a direct cause of low back pain.

Overall, the present study demonstrated similar pain, disability and functional outcomes among stitching and cutting operators. The findings emphasize that low back pain among industrial workers is likely to involve multiple occupational and individual factors rather than being attributable to job designation alone. Workplace-based preventive strategies, including ergonomic education, appropriate work practices and physical activity or exercise programmes, may be useful components of occupational low back pain prevention.^[14] The study provides preliminary information regarding low back pain among employees in the shoe manufacturing industry. However, the cross-sectional design, purposive sampling and absence of longitudinal follow-up limit the ability to determine temporal or causal relationships between occupational exposures and low back pain. Further studies using larger samples, standardized ergonomic exposure assessment and multivariable statistical analysis are recommended to identify independent factors associated with low back pain in shoe manufacturing workers.

CONCLUSION

The study found that both stitching and cutting operators experienced low back pain with comparable levels of pain intensity, disability, and functional independence. No statistically significant differences were observed between the two groups in the Barthel Index, VAS, or Modified Oswestry Disability Index. The Finger-to-Floor Test showed a higher proportion of positive findings among cutting operators, while FABER findings were similar between groups. Overall, the findings indicate that both occupational groups may experience low back pain-related functional problems, highlighting the importance of ergonomic assessment and preventive physiotherapy interventions in shoe manufacturing workers.

Author 's contribution

Joyblessi J: Conceptualization, methodology, participant recruitment, data collection, data analysis, interpretation of results, manuscript drafting, and manuscript revision. P. Bright Alwin Victor MPT, PhD, Dr. Dharshini BPT, Dr. Soundharya MPT & Dr. P. Nithya: Study supervision, methodology, validation, critical review of the manuscript, and final approval of the version to be published.

Acknowledgement

I sincerely express my gratitude to the management and staff of ALHAMD OVERSEAS Shoe Manufacturing Industry, Ambur, for granting permission and providing the necessary support to conduct this study. I extend my heartfelt thanks to all the employees who voluntarily participated in the study and provided their valuable time and cooperation during the data collection process. I also express my sincere gratitude to the faculty members and mentors of Revathi Institute of Physiotherapy, Avinashi, Tirupur, for their guidance, encouragement and support throughout the completion of this research project. Finally, I thank everyone who directly or indirectly contributed to the successful completion of this study.

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