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Original Article

Prevalence of Lateral Epicondylitis in Carpenters; Its Impact on Their Functional Activities of Upper Limb

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ABSTRACT

Background: Carpenters perform repetitive and forceful upper-limb activities that may increase the risk of lateral epicondylitis and associated functional limitation. Objective: To determine the prevalence of lateral epicondylitis among carpenters and evaluate its impact on pain and upper-limb functional activities. Methods: This descriptive cross-sectional study included 126 male carpenters aged 18–58 years recruited through convenience sampling from major furniture markets in Lahore, Pakistan. Lateral epicondylitis was assessed using Cozen's test, pain intensity using the Visual Analogue Scale, and functional disability using the Patient-Rated Tennis Elbow Evaluation. Categorical variables were summarized as frequencies and percentages. Associations of working experience and smoking status with Cozen's test results were examined using chi-square tests. Results: Twenty-four carpenters had a positive Cozen's test, giving a prevalence of 19.0% (95% CI: 13.1%–26.8%). Most participants reported no pain (77.8%), and 76.2% had a PRTEE score of zero. Positive-test prevalence was highest among participants with 21–30 years of experience (27.3%), but working experience was not significantly associated with lateral epicondylitis ($\chi^2 = 2.281$, $p = 0.684$). Smoking was also not significantly associated with the condition (OR = 0.66, 95% CI: 0.26–1.68; $p = 0.380$). Conclusion: Lateral epicondylitis affected approximately one-fifth of the surveyed carpenters, although most participants had minimal pain and functional limitation. Occupational screening and ergonomic risk reduction may be beneficial. Keywords: Carpenters; lateral epicondylitis; occupational musculoskeletal disorders; PRTEE; tennis elbow; upper-limb function.

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INTRODUCTION

Work-related musculoskeletal disorders are common occupational health problems that affect muscles, tendons, ligaments, nerves, joints, and other supporting structures. These disorders frequently develop through repeated exposure to forceful movements, sustained or awkward postures, prolonged working hours, vibration, and inadequate recovery. The upper extremities, neck, and lower back are particularly vulnerable among manual workers whose occupations require repetitive handling of tools and materials (1). Tendon-related disorders of the upper limb include rotator cuff tendinopathy, bicipital tendinopathy, De Quervain tenosynovitis, trigger finger, and medial and lateral epicondylitis.

Lateral epicondylitis, commonly known as tennis elbow or lateral elbow tendinopathy, is a painful disorder involving the common wrist-extensor tendon, particularly the extensor carpi radialis brevis near its attachment to the lateral epicondyle. Although the term "epicondylitis" suggests an inflammatory process, the condition is generally regarded as an overuse-related tendinopathy characterized by degenerative tendon changes and impaired healing rather than persistent acute inflammation (2). It affects approximately 1%–3% of the general population and is an important cause of lateral elbow pain and upper-limb functional limitation (2,3). The condition is not restricted to racquet-sport athletes and frequently occurs in individuals whose occupational or recreational activities require repeated gripping, wrist extension, forearm rotation, or forceful use of the upper limb (3,4).

The clinical presentation of lateral epicondylitis commonly includes localized pain and tenderness over the lateral epicondyle, pain during resisted wrist extension, and discomfort during gripping or lifting. Symptoms may also be reproduced by resisted middle-finger extension or stretching of the wrist-extensor musculature. In more severe cases, pain may extend into the forearm and interfere with hand strength and coordinated upper-limb activities (2,5). Consequently, affected individuals may experience difficulty opening jars, turning door handles, using screwdrivers, carrying objects, shaking hands, operating a computer mouse, or performing other activities that require repetitive or sustained grip.

The development of lateral epicondylitis is multifactorial. Occupational exposure to repetitive wrist and forearm movement, forceful gripping, prolonged tool use, vibration, and insufficient rest has been associated with an increased risk of the condition (4,5). Other reported factors include advancing age, smoking, obesity, metabolic abnormalities, rotator cuff disorders, carpal tunnel syndrome, De Quervain tenosynovitis, and systemic musculoskeletal conditions (5). However, the relative contribution of these factors may vary across occupational groups according to the intensity, frequency, duration, and biomechanics of the tasks performed.

Carpentry involves repeated hammering, sawing, drilling, sanding, lifting, gripping, and manipulation of wood and tools. These tasks frequently require sustained wrist extension, repeated pronation and supination, forceful handgrip, and prolonged loading of the forearm extensor muscles. Field-based ergonomic research has demonstrated that carpentry tasks are associated with considerable perceived exertion and discomfort across multiple body regions, particularly when work is performed for prolonged periods or in ergonomically demanding positions (6). The cumulative loading associated with these activities may contribute to tendon microtrauma and reduced tolerance of the common wrist-extensor tendon to occupational stress.

Lateral epicondylitis may have important consequences for carpenters because their livelihood depends on grip strength, endurance, precision, and efficient upper-limb movement. Individuals with lateral epicondylitis may demonstrate reduced hand function, decreased grip strength, impaired force generation, and difficulty performing occupational and daily activities (7). Even mild symptoms may affect the ability to hold tools securely, control repetitive movements, lift materials, or sustain productivity throughout a working day. Persistent symptoms may contribute to activity modification, reduced work capacity, absence from work, and economic burden.

Functional impairment associated with lateral epicondylitis can be assessed using the Patient-Rated Tennis Elbow Evaluation. This condition-specific questionnaire evaluates pain and functional difficulty during specific and usual activities and provides a total score ranging from 0 to 100, with higher scores indicating greater pain and disability. The instrument has demonstrated satisfactory reliability, validity, and responsiveness for evaluating individuals with lateral elbow tendinopathy (8). Pain intensity is also commonly assessed using the Visual Analogue Scale, which provides a simple patient-reported estimate of pain severity and is widely used in clinical and research settings (9,10). Clinical provocation tests, including Cozen's test, are frequently used to reproduce pain over the lateral epicondyle during resisted contraction of the wrist-extensor muscles.

Evidence from other occupational and community populations indicates that repetitive upper-limb activity is associated with lateral epicondylitis, although reported prevalence varies considerably. A cross-sectional study of housewives in Lahore reported a substantial burden of lateral epicondylitis among individuals routinely exposed to repetitive gripping, lifting, wringing, and forearm rotation (11). Research among healthcare workers has also identified lateral epicondylitis and examined demographic and lifestyle factors associated with its occurrence (12). Similarly, studies involving occupations requiring repetitive food preparation and forceful upper-limb activity have highlighted the occupational relevance of lateral elbow symptoms (13). Nevertheless, the exposure patterns and functional demands of these populations differ from those of professional carpenters.

Despite the repetitive and physically demanding nature of carpentry, limited evidence is available regarding the prevalence of lateral epicondylitis and its effect on upper-limb function among carpenters in Pakistan. Evaluating both clinical signs and patient-reported functional difficulty may provide a more complete understanding of the occupational burden of this condition. Such evidence may support early screening, ergonomic education, task modification, and preventive rehabilitation for workers exposed to repeated upper-limb loading. Therefore, this study aimed to determine the prevalence of lateral epicondylitis among carpenters working in major furniture markets of Lahore and to evaluate its impact on pain and functional activities of the upper limb.

MATERIALS AND METHODS

A descriptive cross-sectional study was conducted among active male carpenters working in major furniture markets of Lahore, Pakistan, including the furniture-working areas of Mazang Chungi, Gulberg, and Ichra. The cross-sectional design was selected to estimate the proportion of carpenters presenting with clinical signs of lateral epicondylitis and to describe the associated pain and upper-limb functional limitations at a single assessment point.

The target population comprised professional carpenters involved in routine furniture-making and woodwork activities. Participants were recruited through non-probability convenience sampling according to their availability and willingness to participate during data collection. Carpenters were eligible when they were male, aged 18–58 years, had worked as active carpenters for more than one year, worked for more than four hours per day, were employed in one of the selected furniture markets, and voluntarily agreed to participate. Individuals were excluded when they had a history of systemic inflammatory or rheumatological disease, diabetes mellitus, major elbow surgery or an elbow fracture during the preceding year, or a neurological condition affecting the upper limb, including peripheral neuropathy or cervical radiculopathy.

A total sample of 126 carpenters was included. The required sample size was determined using the Raosoft sample-size calculator. Participants were approached at their workplaces, informed verbally about the purpose and procedures of the study, and assured that participation was voluntary. Verbal informed consent was obtained before assessment. Participants were informed that declining or discontinuing participation would not affect their employment and that the collected information would be used only for research purposes. Personal identifiers and residential information were treated confidentially, and the assessments were conducted without intentionally disrupting the participants' occupational activities. Data were collected using a demographic and occupational questionnaire, Cozen's test, the Visual Analogue Scale, and the Patient-Rated Tennis Elbow Evaluation. The demographic and occupational questionnaire recorded age, residence, duration of employment as a carpenter, daily working hours, dominant hand, smoking history, and relevant medical history. Working duration was subsequently categorized to examine its relationship with the presence of lateral epicondylitis.

Cozen's test was used as the clinical provocation test for lateral epicondylitis. During the test, the participant was seated with the involved upper limb positioned for resisted activation of the wrist-extensor musculature. The examiner stabilized the elbow, palpated the lateral epicondylar region, and instructed the participant to make a fist and extend and radially deviate the wrist against manual resistance. The test was considered positive when the manoeuvre reproduced pain over the lateral epicondyle. The same assessment procedure was applied consistently to all participants to reduce variation in clinical testing. Pain intensity elicited during the assessment was measured using a 10-cm Visual Analogue Scale anchored by "no pain" at 0 and "worst imaginable pain" at 10. Participants indicated the point that best represented the intensity of their pain. The Visual Analogue Scale is an established patient-reported measure of pain intensity with evidence supporting its validity and reliability in musculoskeletal and acute-pain assessment (9,10,14).

Upper-limb pain and functional disability associated with lateral epicondylitis were evaluated using the Patient-Rated Tennis Elbow Evaluation. The questionnaire contains 15 items divided into a five-item pain subscale and a ten-item function subscale. The function component includes six items related to specific activities and four items related to usual activities. Each item is scored from 0 to 10, with higher scores representing greater pain or difficulty. The pain-subscale items are summed to obtain a score ranging from 0 to 50. The specific-activity and usual-activity scores are combined and divided by two to produce a function score ranging from 0 to 50. The pain and function scores are then added to generate a total score ranging from 0 to 100, with 0 indicating no pain or disability and 100 indicating the greatest pain and functional limitation. The Patient-Rated Tennis Elbow Evaluation has demonstrated adequate validity, internal consistency, test–retest reliability, and responsiveness in individuals with lateral elbow tendinopathy (8).

Data collection followed a standardized sequence. After obtaining consent, the investigator recorded each participant's demographic, occupational, lifestyle, and relevant medical information. Cozen's test was then performed to assess the presence of clinically provoked lateral elbow pain. Participants subsequently rated their pain using the Visual Analogue Scale and completed the Patient-Rated Tennis Elbow Evaluation to quantify elbow-related pain and difficulty with specific and usual activities. Completed questionnaires were reviewed at the point of collection to identify incomplete or unclear responses and to improve data completeness.

All collected data were coded and entered into IBM SPSS Statistics version 26.0 for analysis. Data entry was checked against the original questionnaires to identify coding or transcription errors. Categorical variables, including dominant hand, smoking status, age category, working-duration category, and Cozen's test result, were summarized using frequencies and percentages. Available continuous or numerical variables were described using the mean, median, standard deviation, minimum, and maximum, where appropriate. The prevalence of lateral epicondylitis was calculated as the number of participants with a positive Cozen's test divided by the total number assessed and expressed as a percentage.

Cross-tabulations were used to examine the distribution of Cozen's test results across categories of occupational experience and smoking status. The Pearson chi-square test was applied to assess the association between categorical variables. The likelihood-ratio test and linear-by-linear association were also reported where generated by the analysis. Pearson and Spearman correlation coefficients were used to assess the direction and magnitude of relationships between selected ordered or numerical variables. Statistical significance was evaluated using a two-sided alpha level of 0.05. All 126 participants were included in the reported analyses because the manuscript dataset indicated no missing cases for the principal variables.

RESULTS

All 126 enrolled carpenters were included in the analysis, with no missing data reported for the principal variables. Most participants were right-hand dominant (92.1%). The largest age group was 28–38 years (33.3%), followed by 39–48 years (29.4%). Fifty-two participants (41.3%) reported a history of smoking. Nearly half of the participants worked 12 hours per day, while 38.1% had worked as carpenters for 11–20 years.

Table 1. Demographic and Occupational Characteristics of the Participants (n = 126)

Characteristic	n (%)
Dominant hand	
Right	116 (92.1)
Left	10 (7.9)
Age group, years	
18–27	32 (25.4)
28–38	42 (33.3)
39–48	37 (29.4)
49–58	15 (11.9)
Smoking history	
Non-smoker	74 (58.7)
Smoker	52 (41.3)
Daily working hours	
8 hours	14 (11.1)

Characteristic	n (%)
10 hours	18 (14.3)
12 hours	61 (48.4)
Other reported durations	33 (26.2)
Working experience, years	
1–10	34 (27.0)
11–20	48 (38.1)
21–30	33 (26.2)
31–40	10 (7.9)
41–50	1 (0.8)

Data are presented as frequency and percentage. Percentages may not total 100 because of rounding. Cozen's test was positive in 24 participants, corresponding to a lateral epicondylitis prevalence of 19.0% (95% CI: 13.1%–26.8%). The remaining 102 participants (81.0%) had a negative test. Most participants reported no pain on the Visual Analogue Scale. The mean VAS score was 1.08, the median was 0, and the observed scores ranged from 0 to 8.

Table 2. Clinical Findings, Pain and Functional Disability (n = 126)

Outcome	Value
Cozen's test, n (%)	
Negative	102 (81.0)
Positive	24 (19.0)
Prevalence of lateral epicondylitis, % (95% CI)	19.0 (13.1–26.8)
Visual Analogue Scale	
Mean	1.08
Median	0
Minimum–maximum	0–8
No pain, n (%)	98 (77.8)
Any reported pain, n (%)	28 (22.2)
PRTEE total score	
Minimum–maximum	0–46.25
Score of 0, n (%)	96 (76.2)
Score greater than 0, n (%)	30 (23.8)

CI: confidence interval; PRTEE: Patient-Rated Tennis Elbow Evaluation; VAS: Visual Analogue Scale. The prevalence confidence interval was calculated using the Wilson method. The prevalence of a positive Cozen's test varied across categories of working experience. Positive findings were observed in 14.7% of participants with 1–10 years of experience, 16.7% of those with 11–20 years, 27.3% of those with 21–30 years, and 20.0% of those with 31–40 years. The single participant with 41–50 years of experience had a negative test. However, the association between working experience and Cozen's test result was not statistically significant (Pearson χ^2 = 2.281, df = 4, p = 0.684).

Table 3. Association Between Working Experience and Cozen's Test Result

Working experience, years	Negative, n (%)	Positive, n (%)	Total, n	Positive within category, %
1–10	29 (85.3)	5 (14.7)	34	14.7
11–20	40 (83.3)	8 (16.7)	48	16.7
21–30	24 (72.7)	9 (27.3)	33	27.3
31–40	8 (80.0)	2 (20.0)	10	20.0
41–50	1 (100.0)	0 (0.0)	1	0.0
Total	102 (81.0)	24 (19.0)	126	19.0

Pearson χ^2 = 2.281; df = 4; p = 0.684. Three cells had expected frequencies below 5; therefore, the result should be interpreted cautiously. Percentages in the negative and positive columns are calculated within each working-experience category. The linear association between working experience and Cozen's test result was also weak and non-significant (linear-by-linear association = 0.832, p = 0.362). Pearson's correlation was 0.082 (p = 0.364), and Spearman's rank correlation was 0.095 (p = 0.288), indicating no statistically supported monotonic relationship between increasing occupational experience and a positive clinical test.

Among the 74 non-smokers, 16 (21.6%) had a positive Cozen's test, compared with 8 of the 52 smokers (15.4%). Smoking was not significantly associated with lateral epicondylitis (Pearson χ^2 = 0.770, p = 0.380).

The odds of a positive test among smokers were 0.66 times those among non-smokers, but the confidence interval was wide and crossed the null value (OR = 0.66; 95% CI: 0.26–1.68).

Table 4. Association Between Smoking History and Cozen's Test Result

Smoking history	Negative, n (%)	Positive, n (%)	Total, n	Positive within category, %	OR (95% CI)	p-value
Non-smoker	58 (78.4)	16 (21.6)	74	21.6	1.00	
Smoker	44 (84.6)	8 (15.4)	52	15.4	0.66 (0.26–1.68)	0.380
Total	102 (81.0)	24 (19.0)	126	19.0		

CI: confidence interval; OR: odds ratio. Non-smokers were used as the reference category. The p-value was obtained using the Pearson chi-square test.

Overall, lateral epicondylitis was identified in approximately one-fifth of the participating carpenters. Although the proportion of positive cases was numerically highest among participants with 21–30 years of occupational experience, working experience was not significantly associated with Cozen's test results. Similarly, smoking status was not significantly associated with lateral epicondylitis. Most participants had no reported pain or PRTEE-measured disability; however, a smaller subgroup demonstrated non-zero pain and functional-limitation scores, with the highest observed PRTEE score being 46.25 out of 100.

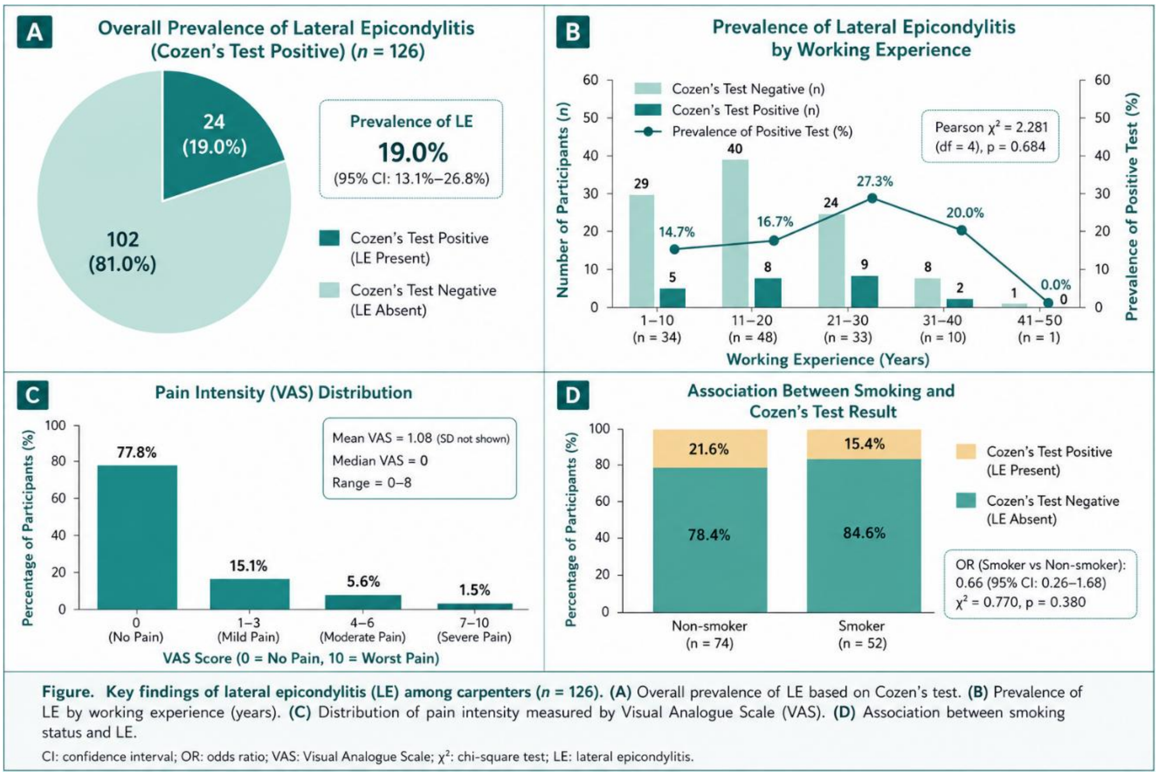

Figure 1. Multi-panel summary of the principal findings among 126 carpenters. Panel A shows an overall prevalence of lateral epicondylitis of 19.0% (24/126; 95% CI: 13.1%–26.8%) based on a positive Cozen's test, while 81.0% of participants tested negative. Panel B demonstrates the distribution of lateral epicondylitis across working-experience categories, with the highest proportion observed among carpenters with 21–30 years of experience (27.3%); however, this trend was not statistically significant (Pearson χ^2 = 2.281, p = 0.684). Panel C illustrates pain severity measured using the Visual Analogue Scale (VAS), showing that most participants (77.8%) reported no pain, with progressively fewer reporting mild (15.1%), moderate (5.6%), or severe (1.5%) pain. Panel D compares Cozen's test results according to smoking status, indicating a slightly lower prevalence of lateral epicondylitis among smokers than non-smokers; however, this difference was not statistically significant (OR = 0.66, 95% CI: 0.26–1.68; p = 0.380). Overall, the figure demonstrates that lateral epicondylitis affected approximately one-fifth of the surveyed carpenters, while pain and functional impairment remained relatively low in the majority of participants, and neither working experience nor smoking status showed a significant association with the condition.

DISCUSSION

This study identified lateral epicondylitis, based on a positive Cozen's test, in 19.0% of the 126 carpenters surveyed in Lahore. Most participants had no pain or measurable functional limitation; nevertheless, a clinically relevant subgroup reported pain and PRTEE scores indicating varying degrees of upper-limb disability. The proportion of positive cases was numerically highest among carpenters with 21–30 years of occupational experience, but neither working experience nor smoking status demonstrated a statistically significant association with lateral epicondylitis. These findings indicate that lateral epicondylitis affects a meaningful minority of carpenters, while also showing that the examined occupational-duration and smoking variables did not independently explain its distribution in this sample.

The observed prevalence of 19.0% was higher than estimates commonly reported for the general population, in which lateral epicondylitis affects approximately 1%–3% of individuals (2,3). This difference is clinically plausible because carpentry requires repetitive gripping, wrist extension, forearm rotation, lifting, hammering, drilling, sawing, and prolonged handling of tools. These activities repeatedly load the wrist-extensor tendons, particularly the extensor carpi radialis brevis, and may exceed the tendon's capacity for recovery when performed forcefully or for extended periods (4–6). The present estimate was, however, lower than the 39.3% prevalence reported among housewives in Lahore (11). Differences in diagnostic procedures, pain-reporting behaviour, task characteristics, age distribution, sampling methods, and exposure patterns may account for the discrepancy.

The prevalence observed in the present study was also higher than the 5.5% point prevalence reported among hospital healthcare workers (12). Healthcare work includes repetitive manual activity, but the magnitude and duration of forceful wrist and forearm loading may differ from carpentry. Carpenters commonly perform sustained gripping and repeated resisted wrist movements while controlling vibrating or manually operated tools, which may result in greater cumulative mechanical stress. Occupational evidence indicates that combinations of high force, repetitive movement, and inadequate recovery are more relevant to lateral epicondylitis than any single exposure in isolation (4). Nevertheless, direct comparisons across studies should be made cautiously because diagnostic definitions, workplace environments, and participant characteristics vary.

Most carpenters in this study reported no pain, and 76.2% had a PRTEE score of zero. Among participants with non-zero scores, the highest PRTEE value was 46.25 out of 100, suggesting that the observed functional burden ranged from mild symptoms to moderate pain and activity restriction rather than uniformly severe disability. Lateral epicondylitis can impair activities requiring grip, lifting, wrist extension, and forearm rotation, which are central to both occupational performance and daily living (15). Reduced grip strength, slower force generation, and impaired upper-limb endurance may affect tool control, work precision, productivity, and tolerance of prolonged manual activity (7). The presence of relatively low PRTEE scores in many affected participants may reflect early or mild disease, adaptation of work techniques, intermittent symptoms, or continued occupational activity despite discomfort. These possibilities were not directly measured and should therefore be interpreted as potential explanations rather than established findings.

Pain and disability in lateral epicondylitis do not always correspond closely. Some individuals may demonstrate a positive clinical provocation test while reporting limited interference with daily activities, whereas others may experience considerable functional restriction even with modest pain intensity. The PRTEE is valuable in this context because it evaluates both pain and difficulty with specific and usual activities rather than relying exclusively on a diagnostic manoeuvre or pain score (8). The use of Cozen's test, VAS, and PRTEE therefore allowed the study to describe complementary clinical dimensions of lateral elbow symptoms.

The proportion of positive cases increased from 14.7% among carpenters with 1–10 years of experience to 27.3% among those with 21–30 years, before declining in the smaller categories with longer occupational histories. However, the overall association between occupational experience and lateral epicondylitis was not statistically significant. The absence of a significant relationship may indicate that years of employment alone do not adequately represent cumulative biomechanical exposure. Daily force, repetition, tool type, vibration, posture, rest intervals, workload, previous injuries, and recovery time may be more informative than total years worked. In addition, the very small number of participants in the longest-experience categories reduced statistical power and contributed to low expected cell counts.

A systematic review of work-related lateral epicondylitis reported that occupational risk is influenced by combinations of forceful exertion, repetitive forearm rotation, and sustained or awkward wrist postures (4). This supports the interpretation that exposure intensity and task biomechanics may be more relevant than occupational duration considered in isolation. Future studies should therefore quantify repetitive movements, grip force, tool vibration, task duration, rest breaks, and ergonomic posture. Such information would allow more precise evaluation of dose–response relationships and potentially modifiable workplace factors.

Smoking was not significantly associated with lateral epicondylitis in the present sample. Although the prevalence was numerically lower among smokers than non-smokers, the estimated odds ratio had a wide confidence interval that included the null value. The result therefore does not support either a protective or harmful association. Previous research has identified smoking as a possible risk factor for tendon disorders and lateral epicondylitis, potentially through impaired vascularity, altered collagen metabolism, and reduced tissue healing (5,12). The difference between those findings and the present result may reflect limited sample size, unmeasured smoking intensity or duration, residual confounding, or variation in occupational exposure. Smoking status should not be interpreted as protective on the basis of these data.

The findings have practical implications for occupational health and rehabilitation. Although severe disability was uncommon, a 19.0% prevalence indicates that screening and preventive measures may be warranted in carpentry workplaces. Early recognition of lateral elbow pain, education regarding symptom reporting, appropriate work-rest cycles, task rotation, ergonomic tool selection, and modification of forceful gripping techniques may reduce cumulative tendon loading. Exercise-based rehabilitation, particularly progressive loading of the wrist-extensor musculature, is commonly recommended for lateral elbow tendinopathy and may improve pain, strength, and functional capacity (16). Rehabilitation should be individualized according to symptom irritability, work demands, and functional limitations.

Sex-related biomechanical differences in wrist-extensor strength and endurance have been reported in lateral epicondylitis (17). However, the present study included only male carpenters and therefore could not examine whether prevalence or functional impact differs by sex. Anatomical factors such as variation in the elbow carrying angle have also been proposed as potential contributors to altered tendon loading (18). These variables were not evaluated and may be relevant in future occupational studies incorporating physical examination, strength testing, and biomechanical assessment.

Work-related musculoskeletal disorders may also be influenced by psychosocial factors, including job control, workload, fatigue, economic pressure, and limited opportunity for rest (19). These factors may affect symptom reporting, persistence at work despite pain, and access to healthcare. The present study focused on clinical, demographic, and selected occupational variables and did not assess psychosocial working conditions. A broader biopsychosocial and ergonomic framework would provide a more complete understanding of lateral epicondylitis in manual workers.

This study has several strengths. It evaluated an occupational population with substantial repetitive upper-limb exposure, recruited participants directly from major furniture markets, and combined a clinical provocation test with validated measures of pain and functional disability. The complete inclusion of 126 participants in the principal analyses also reduced the effect of missing outcome data. The study provides locally relevant evidence concerning a manual workforce that remains underrepresented in lateral epicondylitis research.

Several limitations should be considered. The cross-sectional design prevents determination of temporality or causation. Convenience sampling from selected markets in Lahore limits generalizability to carpenters in other settings. A positive Cozen's test was used as the principal indicator of lateral epicondylitis without imaging or a composite diagnostic standard, which may have resulted in misclassification. The study did not quantify force, repetition, vibration, posture, tool characteristics, rest periods, or previous episodes of elbow pain. Smoking was assessed as a binary history without information about duration or intensity. Some subgroups were small, and the chi-square analysis of working experience included cells with expected counts below five. The analysis was predominantly unadjusted, so potential confounding by age, working hours, hand dominance, metabolic factors, and occupational task characteristics could not be addressed. Finally, the exclusive inclusion of men prevents application of the findings to female carpenters.

Further studies should employ multicentre recruitment, probability-based sampling, longitudinal follow-up, and more comprehensive clinical criteria. Objective measurement of grip strength, wrist-extensor endurance, task exposure, vibration, posture, and ergonomic risk would improve understanding of the mechanisms underlying lateral epicondylitis. Multivariable analysis could then determine whether occupational exposures remain associated with the condition after adjustment for demographic, metabolic, anatomical, and lifestyle factors. Research evaluating related upper-limb tendon disorders and grip performance may also help clarify the wider functional burden of repetitive carpentry work (20). Continued research is particularly important because the lateral epicondylitis literature has expanded substantially, while occupation-specific evidence remains comparatively limited (21).

CONCLUSION

Lateral epicondylitis was identified in 19.0% of the surveyed carpenters, indicating that it affects a meaningful minority of this occupational group. Most participants reported no pain or functional limitation, although a smaller subgroup experienced clinically relevant symptoms and PRTEE-measured disability. Working experience and smoking status were not significantly associated with a positive Cozen's test. These findings support occupational screening and ergonomic risk reduction while emphasizing the need for larger longitudinal studies that directly measure repetitive loading, force, vibration, posture, and other workplace exposures.

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