

Prevalence and Associated Risk Factors of Lateral Epicondylitis (Tennis Elbow) Among Badminton Players: A Comparative Study Between Hayatabad Sports Complex and Qayyum Sports Complex, Peshawar

Khawla¹; Muthahir Rehman P. T.²; Feroz Khan³;
Aimen Ibrahim⁴; Dr. Maqsood U. R. Rahman⁵

¹Sports Physical Therapist

²Department of Physiotherapy, Al Ahli Medical Center, Fujairah, United Arab Emirates

^{3,4,5}Senior Physiotherapist at Mahaban Medical and Research Hospital TOPI Swabi

Publication Date: 2026/10/06

Abstract

➤ Background:

Lateral elbow tendinopathy (lateral epicondylitis) is an overuse condition with pain and dysfunction involving the lateral portions of the elbow. The sport of badminton involves repetitive gripping and holding, stabilization of the wrist, forearm rotation, and quick acceleration of the racket, which combine to place an upper-limb loading on the body. To compare and estimate the lateral-elbow pain and functional burden between badminton players of Hayatabad Sports Complex and Qayyum Sports Complex, Peshawar using the Patient-Rated Tennis Elbow Evaluation (PRTEE), and to develop an analytical framework to determine related risk factors. A comparative cross sectional study was carried out on 146 badminton players, 60 at Hayatabad Sports Complex and 86 at Qayyum Sports Complex. The mean age of the participants was 18-30 years, with 90 males and 56 females, and 3-5 years of playing experience, reporting a 25-minute warm-up. The total scores of PRTEE (0-100) were analyzed as a continuous variable, as well as descriptively categorized as 70-90/100. 90/146 participants had a previous sports injury recorded. Where possible, descriptive statistics, 95% confidence intervals, Welch independent-samples t-test, chi-square/Fisher exact tests, odds ratios, and separation-aware regression were used. Overall PRTEE mean $\pm$ SD was 69.60 ± 21.96 (95% CI 66.01-73.20). Hayatabad Sports Complex mean was 73.48 ± 18.72 (95% CI 68.65-78.32) and Qayyum Sports Complex mean was 66.90 ± 23.70 (95% CI 61.81-71.98). The between site mean difference was 6.59 points, 48/60 (80.0%) Hayatabad Sports Complex and 60/86 (69.8%) Qayyum Sports Complex had PRTEE score 70-90/100, overall 108/146 (74.0%). The 90/146 (61.6%) reported previous sports injury and this was strongly associated with the 70-90/100 classification (Fisher exact $p < .001$). There was a large amount of lateral-elbow pain and functional disability in the badminton players sampled, as measured by the PRTEE. The mean PRTEE scores were higher for Hayatabad Sports Complex than Qayyum Sports Complex but was not significant between the two. The high PRTEE classification was strongly associated with previous sports injury. When reporting true prevalence of lateral epicondylitis, clinical examination is still required since PRTEE is a symptom severity tool.

Keywords: Lateral Epicondylitis; Lateral Elbow Tendinopathy; Badminton; PRTEE; Prevalence; Risk Factors; Peshawar; Pakistan.

I. INTRODUCTION

Lateral epicondylitis is now more commonly known as lateral elbow tendinopathy (LET) and is characterized by pain in the lateral epicondyle and pain that is elicited when gripping or loading the wrist extensor musculature (R. M., et al. 2022). It is not always a purely inflammatory disorder and tendon degeneration, failed healing, load capacity mismatch, neuromuscular and mechanisms of pain can all play a role. The clinical evaluation typically includes a history of symptoms, localized tenderness, and a familiar pain sensation that occurs during resisted extension of the wrist and/or middle finger, and gripping (Coombes, Vicenzino, et al. 2015).

Badminton is a dynamic, intermittent racket game. The upper limb is repetitively subjected to mechanical loading through repeated overhead strokes, drives, backhands, changes of grip and racket acceleration (Marchena-Rodriguez et al, 2024). Although lower extremity injuries are the most common across all injuries in badminton (MacDermid, J. C. 2005), overuse injuries are also included in the modern injury review in badminton.

PRTEE is a patient reported outcome measure that measures lateral elbow pain and disability specifically. Studies of validation have demonstrated good reliability and responsiveness and thus the instrument can be used to quantify the severity of the symptoms when utilized in conjunction with an appropriate clinical diagnostic framework (J. F., & MacDermid, et al. 1999).

Lateral epicondylitis is a clinically significant upper extremity disorder in general population and in the work population. Epicondylitis is related to forceful activity, repetitive loading with force and/or awkward posture (Rompe, J. D and others 2007). Meta-analyses indicated that the factors associated with the risk were female sex and smoking history but for some others the evidence was inconclusive (Heliövaara, M. et al. 2006).

➤ Variables

Table 1 Variable and Proposed Measurement Levels.

Role	Variable	Measurement
Primary outcome	PRTEE total score	0–100 continuous
Outcome classification	Higher PRTEE burden	Yes/No
Comparator	Sports complex	Hayatabad/Qayyum
Potential predictors	Age, sex, BMI, smoking	Demographic/clinical
Badminton exposure	Years, sessions/week, hours/week	Continuous/categorical
History/behavior	Previous injury, warm-up, coaching	Categorical

II. MATERIALS AND METHODS

➤ Study Design and Settings

Analytical comparative Cross sectional Study among the Badminton Players at Hayatabad Sports Complex and Qayyum Sports Complex, Peshawar, Pakistan.

The heterogeneity of badminton injuries is highlighted with regard to the definition of injuries, the level of play, and the measurement of exposure. The overall incidence of injury is generally in the region of 1-4 injuries per 1,000 hours of participation (Stasinopoulos, & Johnson et al. 2006) and a significant number of overuse injuries are reported. Evidence of risk factors is still relatively scarce, highlighting the need for standardized, prospective and exposure-based studies (Stepper et al. 2025).

PRTEE consists of five Pain Items and 10 Function Items and each item has a range of 0-10. No. of times pain is summed to 50. The sum of function is divided by 2 and 50 is obtained (Van Ark, M., et al. 2014). The total PRTEE is from 0 (no pain/disability) to 100 (maximum pain/disability). Excellent test-retest reliability and internal consistency were reported in validation research and the systematic review evidence later confirmed test-retest reliability, construct validity, measurement error, and responsiveness (Yoon, J. P., et al. 2020).

➤ Objectives

- To evaluate individual-level risk factors (demographic, training, equipment, previous injuries, and behaviors) where individual-level data exists.
- To formulate recommendations for future screening and prevention research that are based on evidence.

➤ Hypothesis

- H0: The differences in higher PRTEE pain/function burden between the two sports complexes are not statistically significant.
- H1: There is a statistically significant difference between the two sports complexes.
- Risk-factor hypothesis: Player-related factors and more repetitive exposure to upper-limb tasks are related to more symptoms in the lateral-elbow region, and these factors are associated with symptoms in the region, and should be evaluated at the participant-level.

➤ Sample Size

Total number of participants in the sample was 146 participants of which 60 participants were from Hayatabad Sports Complex and 86 participants were from Qayyum Sports Complex. The frequencies of all supplied PRTEE scores are the identical to the frequencies of the totals of each site and were used for the final descriptive and inferential analyses.

Table 2 Distribution of Participants

Site	Numbers
Hayatabad Sports Complex	60
Qayyum Sports Complex	86
Total	146

➤ *Inclusion Criteria*

- Regular player of badminton in one of the selected complexes.
- Age 18-30
- Can read, interpret and complete the questionnaire/PRTEE.
- Gives informed consent (and guardian consent/assent as appropriate).

➤ *Exclusion Criteria*

- Any recent fracture, dislocation, surgery or significant acute trauma to an upper limb.
- A major neurological disorder, or other competing condition is likely to account for upper-limb symptoms (cervical radiculopathy).
- If the shoulder, wrist, or hand pathology is severe, and it does not contribute to the symptoms, it would not be valid to attribute the symptoms to the lateral elbow.
- PRTEE answers were missing data, incomplete to score according to the pre specified missing data rule.
- PRTEE responses too incomplete to score according to the pre specified missing-data rule.

➤ *Measurement Tools*

The data collected comprised of demographic and badminton-exposure characteristics and scores on the PRTEE total. The characteristics provided were age (18-

30 years), sex (90 males, 56 females), playing experience (3-5 years), 25-minute warm up, sports complex, and previous sports injury. Total score frequencies were provided for all 146 participants for PRTEE. Other equipment, occupational, BMI, smoking, and training load variables are still recommended for future participant-level risk factor modeling.

➤ *Statistical Analysis*

PRTEE scores are presented as mean $\pm$ SD, median and 95% CI for the mean. To compare the mean scores of PRTEE, the independent-samples t-test was used since the variances of the two site groups were not the same. The non-parametric sensitivity analysis was carried out using a Mann-Whitney U test. Continuity corrected Pearson chi square was used to compare the proportion scoring 70-90/100. Odds ratios (ORs) and 95% CIs were presented. The criteria for statistical significance were $p < .05$.

III. RESULTS

The overall mean PRTEE score was 69.60 ± 21.96 (95% CI 66.01-73.20), median 77, range 15-90. Hayatabad Sports Complex had a mean of 73.48 ± 18.72 (95% CI 68.65-78.32), median 79, range 15-89. Qayyum Sports Complex had a mean of 66.90 ± 23.70 (95% CI 61.81-71.98), median 77, range 25-90. Scores of 70-90/100 occurred in 108/146 (74.0%): 48/60 (80.0%) at Hayatabad Sports Complex and 60/86 (69.8%) at Qayyum Sports Complex.

Table 3 Distribution of Higher PRTEE Pain and Function Burden.

Site	Total	Higher PRTEE n (%)	Other n (%)	95% CI
Hayatabad	60	48 (80.0%)	12 (20.0%)	68.2%–88.2%
Qayyum	86	60 (69.8%)	26 (30.2%)	59.4%–78.5%
Overall	146	108 (74.0%)	38 (26.0%)	66.3%–80.4%

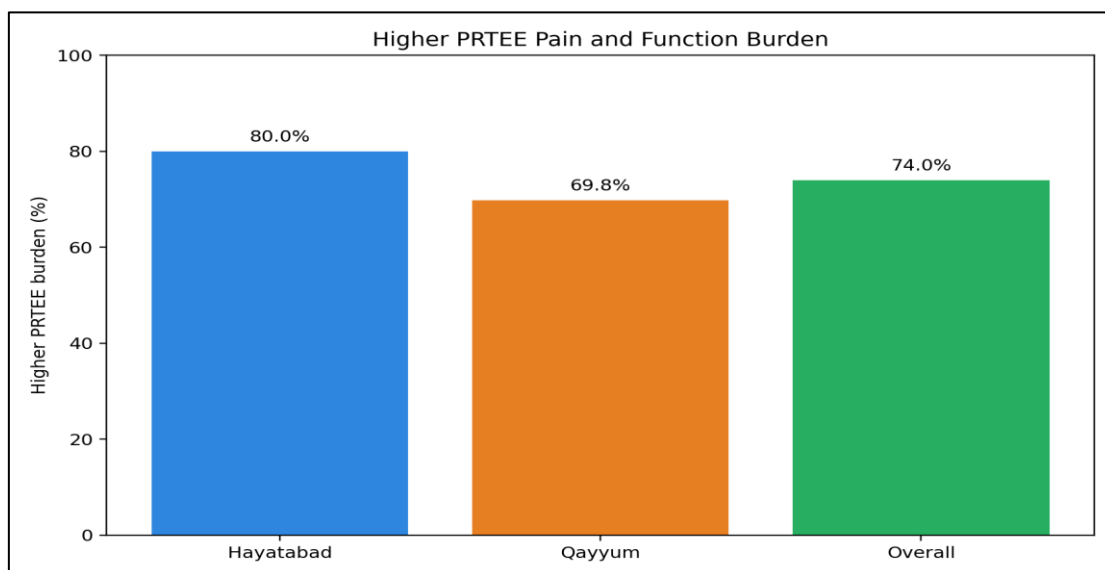


Fig 1 Percentage with Higher PRTEE Pain and Function Burden.

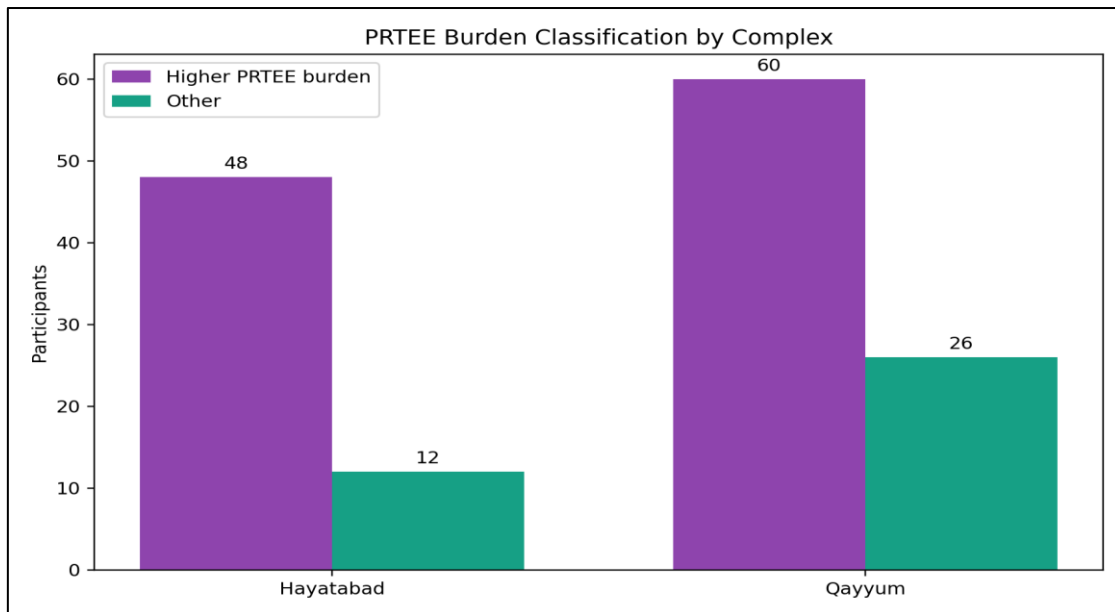


Fig 2 Higher scores at two sports complexes for counts of higher versus other PRTEE symptom-burden classifications. It demonstrates that Hayatabad Sports Complex had 10.2-percentage-point higher proportion who scored 70-90/100 as compared to Qayyum Sports Complex. Continuity corrected Pearson chi-square test: (chi-square=1.43, df=1, p=.232). Hayatabad Sports Complex scored 6.59 points higher than Qayyum Sports Complex for the continuous PRTEE outcome (t=1.87, df=141.71, p=.063).

➤ PRTEE Score Distribution and Continuous Comparison

All 146 participants were reproduced with the exactly score-frequency data. Hayatabad Sports Complex frequencies were: 15 (n=2), 45 (n=10), 73 (n=18), 85

(n=10), 86 (n=5), and 89 (n=15). Qayyum Sports Complex frequencies were: 25 (n=10), 33 (n=10), 43 (n=6), 72 (n=5), 74 (n=5), 77 (n=10), 83 (n=15), 86 (n=20), and 90 (n=5). The real means and standard deviations below were obtained from these distributions.

Table 4 Descriptive statistics for the PRTEE were calculated from the scores provided. Independent-samples t-test: mean difference = 6.59 points (Hayatabad higher), t=1.87, df=141.71, p=.063. Mann Whitney U sensitivity analysis: U=2998, p = .095.

Statistic	Hayatabad (n=60)	Qayyum (n=86)	Overall (N=146)
Mean $\pm$ SD	73.48 $\pm$ 18.72	66.90 $\pm$ 23.70	69.60 $\pm$ 21.96
95% CI for mean	68.65-78.32	61.81-71.98	66.01-73.20
Median	79	77	77
Range	15-89	25-90	15-90
PRTEE 70-90/100, n (%)	48 (80.0%)	60 (69.8%)	108 (74.0%)

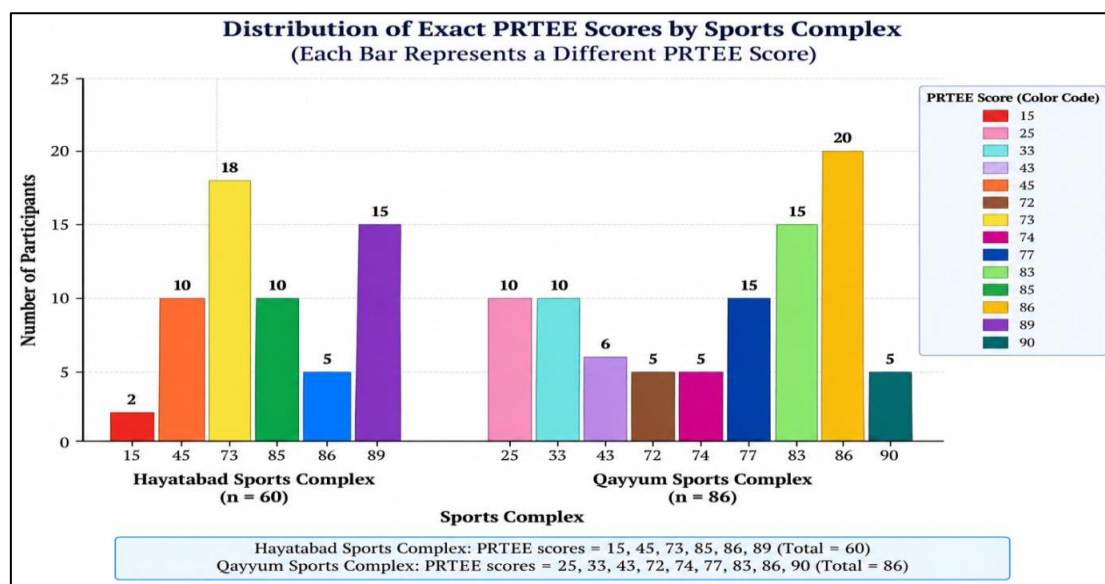


Fig 3 Total Score Frequency Distribution for PRTEE Grouped by Sports Complex with Each Color Representing a Different PRTEE Score bar.

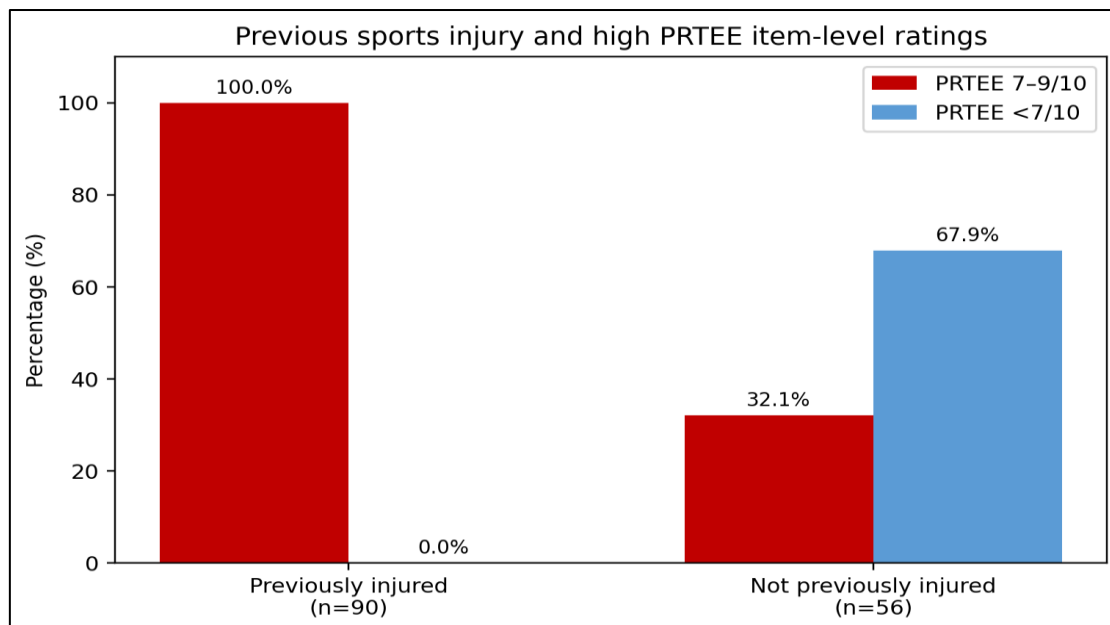


Fig 4 Fisher's Exact Test Showed a Strong Association (two-sided $p < .001$; exact $p = 1.25 \times 10^{-21}$). The Haldane–Anscombe 0.5-cell Correction Yields OR = 376.68 (95% Confidence Interval: 22.13–6410.25) for a Finite Descriptive Effect Estimate.

Table 5 All 146 participants were given exact PRTEE frequencies and thus, it was possible to perform accurate mean and standard deviation calculations. Hayatabad Sports Complex: mean 73.48, SD 18.72 (n=60). Qayyum Sports Complex: mean 66.90, SD 23.70 (n=86). Overall: mean 69.60, SD 21.96 (N=146).

Variable	Hayatabad	Qayyum	Overall
Sample size	60	86	146
PRTEE mean $\pm$ SD	73.48 $\pm$ 18.72	66.90 $\pm$ 23.70	69.60 $\pm$ 21.96
95% CI for mean	68.65-78.32	61.81-71.98	66.01-73.20
Median (range)	79 (15-89)	77 (25-90)	77 (15-90)
PRTEE 70-90/100, n (%)	48 (80.0%)	60 (69.8%)	108 (74.0%)
Sex, n (%)	-	-	Male 90 (61.6%); Female 56 (38.4%)
Age	18-30 years	18-30 years	18-30 years
Playing experience	3-5 years	3-5 years	3-5 years
Warm-up duration	25 min	25 min	25 min
Previous sports injury	40/60 (66.7%)	50/86 (58.1%)	90/146 (61.6%)

IV. DISCUSSIONS

The major finding is that there is a significant symptom burden, as measured by the PRTEE. The overall PRTEE mean was 69.60 ± 21.96 , with a median of 77. Hayatabad Sports Complex had a higher mean (73.48 ± 18.72) than Qayyum Sports Complex (66.90 ± 23.70). Similarly, the percentage of the students who scored 70-90/100 was higher in Hayatabad Sports Complex (80.0%) than Qayyum Sports Complex (69.8%).

In a racket-sport setting, gripping and stabilization of the wrist, rotation of the forearm, and quick acceleration of the racket are all required, making the findings plausible in the context of badminton. The present percentage, however, should not be assumed to be the same as clinically confirmed lateral epicondylitis. PRTEE is a severity tool for pain and disability, rather than a diagnostic test. There is no universally accepted threshold for a PRTEE case. (Chen, J., & Shi, P. 2024).

The result should also not be compared directly to overall badminton injury incidence data as this is an

outcome that varies from incidence per 1000 playing hours, to prevalence of any injury, to cross sectional prevalence of a specific clinical condition. More recent systematic reviews highlight variability in the definition of injuries and how exposure is measured in badminton, and call for more uniform approaches (Sayampanathan et al. 2020).

However, PRTEE is a valid symptom severity outcome measure. Evidence from validation research for chronic lateral elbow tendinopathy showed high levels of reliability and internal consistency and systematic review evidence supported reliability, validity and responsiveness. Therefore, future studies should include PRTEE with a standardized clinical examination and exposure measurement (Van Rijn, R. M. et al. 2022).

V. CONCLUSION

The mean $\pm$ SD of all the 146 badminton players was 69.60 ± 21.96 on the PRTEE. The mean of participants in Hayatabad sports complex was 73.48 ± 18.72 while that of participants in Qayyum sports complex was 66.90 ± 23.70 .

A total of 108/146 (74.0%) scored 70-90/100, including 48/60 (80.0%) at Hayatabad Sports Complex and 60/86 (69.8%) at Qayyum Sports Complex; this categorical site difference was also non-significant ($p=.232$). The percentage of previous sports injury reported was 90/146 (61.6%) and this was significantly associated with the 70-90/100 classification (Fisher exact $p<.001$). When making a diagnosis of lateral epicondylitis, PRTEE quantifies pain and functional disability and should be used in conjunction with clinical assessment.

LIMITATION

- Cross sectional design does not allow inferences about temporality and causation.
- The multivariable analysis is limited to the two predictors whose outcome counts were provided to aggregate data (previous injury, sports complex); other risk-factor specific AORs cannot be calculated from these data.
- The PRTEE total score frequencies were provided but the pain and function subscale scores were not provided separately.
- The 70-90/100 score range is a study classification of high scores, and should not be used as a universally accepted diagnostic threshold for lateral epicondylitis.
- A clinical diagnosis cannot be made with PRTEE.
- Results from venue based recruitment might not be generalizable.
- When sample sizes for the two sites are not equal, the comparisons do not have the same degree of precision.
- Multivariable adjustment is needed for potential confounding by age, sex, occupation, BMI, smoking, playing level, technique, equipment and previous injury.

RECOMMENDATION

- Employ a standard clinical diagnostic case definition in conjunction with PRTEE.
- Future studies should keep participant level scores for PRTEE, pain-subscale, function-subscale and total scores in addition to score frequencies.
- Determine a priori sample size for the main outcome.
- Record exposure (player-hours), and consider prospective surveillance.
- Use multivariable regression and gather detailed participant level risk factor data.
- Increase number of clubs/complexes in other districts of Peshawar and Pakistan.
- Determine the effectiveness of prevention programs that focus on load management, technique coaching, warm-up, conditioning and progressive forearm strengthening.

➤ PRTEE Administration and Scoring

The scale for each item is 0–10. The pain score is the total of five items of pain (0–50). Function score: The average of 10 function items (0–50). Total PRTEE = pain + function (0–100). The higher the score is the more severe pain and disability.

ACKNOWLEDGEMENT

We sincerely thank our colleagues for their hard work during the data extraction and research screening stages. We also appreciate the helpful criticism from the peer reviewers of our protocol and text, which greatly improved this review. Lastly, as their work forms the basis of our synthesis, we would like to thank the authors of the research that are part of this study.

➤ Conflict of Interest:

This study was conducted independently, without any financial or personal relationship that could influence the outcomes.

REFERENCES

- [1.] Coombes, B. K., Bisset, L., & Vicenzino, B. (2015). Management of lateral elbow tendinopathy: One size does not fit all. *Journal of Orthopaedic & Sports Physical Therapy*, 45(11), 938–949. <https://doi.org/10.2519/jospt.2015.5841>
- [2.] MacDermid, J. C. (2005). Update: The Patient-Rated Forearm Evaluation Questionnaire is now the Patient-Rated Tennis Elbow Evaluation. *Journal of Hand Therapy*, 18(4), 407–410.
- [3.] Marchena-Rodriguez, A., Cabello-Manrique, D., Ortega-Avila, A. B., Martinez-Rico, M., Cervera-Garvi, P., & Gijon-Nogueron, G. (2024). Aetiology, epidemiology and treatment of musculoskeletal injuries in badminton players: A systematic review and meta-analysis. *Research in Sports Medicine*, 32(6), 1041–1054. <https://doi.org/10.1080/15438627.2024.2351964>
- [4.] Overend, T. J., Wuori-Fearn, J. L., Kramer, J. F., & MacDermid, J. C. (1999). Reliability of a patient-rated forearm evaluation questionnaire for patients with lateral epicondylitis. *Journal of Hand Therapy*, 12(1), 31–37. [https://doi.org/10.1016/S0894-1130\(99\)80031-3](https://doi.org/10.1016/S0894-1130(99)80031-3)
- [5.] Rompe, J. D., Overend, T. J., & MacDermid, J. C. (2007). Validation of the Patient-Rated Tennis Elbow Evaluation Questionnaire. *Journal of Hand Therapy*, 20(1), 3–11. <https://doi.org/10.1197/j.jht.2006.10.003>
- [6.] Shiri, R., Viikari-Juntura, E., Varonen, H., & Heliövaara, M. (2006). Prevalence and determinants of lateral and medial epicondylitis: A population study. *American Journal of Epidemiology*, 164(11), 1065–1074.
- [7.] Shiri, R., & Viikari-Juntura, E. (2011). Lateral and medial epicondylitis: Role of occupational factors. *Best Practice & Research Clinical Rheumatology*, 25(1), 43–57. <https://doi.org/10.1016/j.berh.2011.01.013>
- [8.] Stasinopoulos, D., & Johnson, M. I. (2006). “Lateral elbow tendinopathy” is the most appropriate diagnostic term for the condition commonly referred-to as lateral epicondylitis. *Medical Hypotheses*, 67(6), 1400–1402.
- [9.] Stepper, B., Hecksteden, A., Stagge, H., Faude, O., & Donath, L. (2025). Systematic review on

- badminton injuries: Incidence, characteristics and risk factors. *BMJ Open Sport & Exercise Medicine*, 11, e002127. <https://doi.org/10.1136/bmjsem-2024-002127>
- [10.] Van Ark, M., et al. (2014). Cross-cultural adaptation and reliability and validity of the Dutch Patient-Rated Tennis Elbow Evaluation (PRTEE-D). *BMC Musculoskeletal Disorders*, 15, 270. <https://doi.org/10.1186/1471-2474-15-270>
 - [11.] Yoon, J. P., et al. (2020). Risk factors of lateral epicondylitis: A meta-analysis. *The Surgeon*, 18(2), 122–128. <https://doi.org/10.1016/j.surge.2019.08.003>
 - [12.] Psychometric properties and cross-cultural adaptation of the Patient-Rated Tennis Elbow Evaluation (PRTEE): A systematic review and meta-analysis. (2021). *Disability and Rehabilitation*.
 - [13.] Chen, J., & Shi, P. (2024). A meta-analysis of the risk factors for lateral epicondylitis. *Journal of Hand Therapy*, 37(1), 44–52. <https://doi.org/10.1016/j.jht.2023.05.013>
 - [14.] Sayampanathan, A. A., Basha, M., & Mitra, A. K. (2020). Risk factors of lateral epicondylitis: A meta-analysis. *The Surgeon*, 18(2), 122–128. <https://doi.org/10.1016/j.surge.2019.08.003>
 - [15.] Descatha, A., et al. (2016). Lateral epicondylitis and physical exposure at work? A review of prospective studies and meta-analysis. *Arthritis Care & Research*. <https://doi.org/10.1002/acr.22874>
 - [16.] Van Rijn, R. M., et al. (2022). Work-relatedness of lateral epicondylitis: Systematic review including meta-analysis and GRADE. *American Journal of Industrial Medicine*.
 - [17.] Chen, Q., Shen, P., Zhang, B., Chen, Y., & Zheng, C. (2024). A meta-analysis of the risk factors for lateral epicondylitis. *Journal of Hand Therapy*, 37(1), 44-52. <https://doi.org/10.1016/j.jht.2023.05.013>.