JHWCR JOURNAL OF HEALTH, WELLNESS AND COMMUNITY RESEARCH 3007-0570

DOI: https://doi.org/10.61919/qahkvg09

Original Article

Association of Shoulder Impingement Syndrome and Latissimus Dorsi Weakness Among Teachers

Misbah Farooq[1], Amirah Zafar[1], Ahad Qamar[1], Maryam Ali[1]

[1] CMH Lahore Medical College and Institute of Dentistry, Lahore, Pakistan

**Corresponding author:* Misbah Farooq, misbahfarooq75@gmail.com

"Cite this Article" **Received**: 02 February 2026; **Accepted**: 09 March 2026; **Published**: 30 March 2026

Author Contributions: Concept: AZ, MF; Design: AZ, MF, AQ, Data Collection: AZ, MA; Analysis: AZ, MA; Drafting: AZ, MA, AQ. **Ethical Approval**: CMH Lahore Medical College and Institute of Dentistry, Lahore, Pakistan. **Informed Consent**: Written informed consent was obtained from all participants; **Conflict of Interest**: The authors declare no conflict of interest. **Funding**: No external funding; **Data Availability**: Available from the corresponding author on reasonable request; **Acknowledgments**: NA

ABSTRACT

Background: Teachers perform repetitive upper-limb activities that may contribute to shoulder symptoms. The relationship between clinical impingement findings, latissimus dorsi strength, and shoulder-related disability in this occupational group remains insufficiently characterized. Objective: To assess the association of shoulder impingement syndrome and latissimus dorsi weakness among teachers. Methods: This analytical cross-sectional study included 136 teachers from private and government schools in Lahore, Pakistan, selected through convenience sampling. Shoulder pain and disability were assessed using the Shoulder Pain and Disability Index (SPADI); shoulder impingement findings were evaluated with the empty-can and Neer tests; and latissimus dorsi strength was graded by manual muscle testing. Descriptive statistics, correlation analyses, and Kruskal–Wallis tests were applied. Results: Participants included 59 men (43.4%) and 77 women (56.6%); 60 (44.1%) were aged 31–40 years. Mean SPADI pain, disability, and total scores were 29.37%, 21.37%, and 24.64%, respectively. Empty-can and Neer tests were positive in 72 (52.94%) and 52 (38.24%) participants. Latissimus dorsi grade 4 and grade 3 strength were observed in 66 (48.53%) and 64 (47.06%) participants. In teachers with 1–15 years of experience, MMT grade correlated inversely with pain ($r = -0.308$; $p = 0.003$), disability ($r = -0.387$; $p < 0.001$), and total SPADI score ($r = -0.358$; $p = 0.001$). SPADI outcomes also differed across teaching-experience groups ($p = 0.010$–0.029). Conclusion: Lower latissimus dorsi MMT grades were associated with greater shoulder pain and disability in several subgroups, particularly teachers with 1–15 years of experience; however, the supplied analyses did not establish a direct overall association between impingement-test positivity and muscle weakness. Keywords: Shoulder impingement syndrome; latissimus dorsi; manual muscle testing; shoulder pain; Shoulder Pain and Disability Index; teachers.

INTRODUCTION

Shoulder pain is a common musculoskeletal complaint and may limit upper-limb function, work participation, and daily activity. Subacromial or shoulder impingement has historically described pain associated with compression or mechanical irritation of structures in the subacromial region during arm elevation (1). Contemporary understanding recognizes a multifactorial process involving tendon loading, intrinsic tissue change, movement patterns, posture, and occupational exposure rather than a single anatomical mechanism (2–5). Repetitive elevation and sustained upper-limb activity may increase shoulder loading, while reduced muscle performance and altered scapular control may contribute to pain and disability (6–8).

Teaching commonly requires repetitive writing on boards, reaching, prolonged use of digital devices, and sustained postures. These demands may expose schoolteachers to shoulder and neck symptoms, particularly when workplace ergonomics and opportunities for recovery are limited. Female sex, increasing age, body mass, smoking, comorbidity, and repetitive occupational activity have been

ISSN 3007-0570

identified as potential correlates of shoulder disorders in different populations (9–11). Studies of teachers have also documented clinically important frequencies of neck, shoulder, and low-back symptoms, supporting the need for occupation-specific assessment (12–15).

The latissimus dorsi is a broad thoracohumeral muscle that contributes to shoulder extension, adduction, internal rotation, and control of the upper limb (16–18). Its function is relevant during resisted or fixed upper-limb tasks, including overhead and board-writing activities. Reduced latissimus dorsi strength may alter force distribution around the shoulder complex; however, its relationship with clinical impingement findings and shoulder-related disability among teachers has received limited direct investigation. Clarifying these relationships may help identify clinically relevant patterns for occupational assessment without assuming causality from cross-sectional data.

This study therefore aimed to assess the association of shoulder impingement syndrome and latissimus dorsi weakness among teachers in private and government schools in Lahore. Shoulder symptoms and disability were evaluated using SPADI, impingement-related findings were assessed with the empty-can and Neer tests, and latissimus dorsi strength was assessed using manual muscle testing.

MATERIALS AND METHODS

An analytical cross-sectional study was conducted among teachers working in private and government schools in Lahore, Pakistan. Data collection continued for approximately four months after approval of the study synopsis. The target population comprised schoolteachers from participating urban schools. Teachers who provided consent and were available during the data-collection period were recruited through convenience sampling. Participants with age-related conditions such as osteoporosis were excluded. Permission was obtained from the heads of participating schools, and consent was obtained from the participants before assessment. The achieved sample comprised 136 participants. The manuscript reported a single-proportion sample-size approach based on an anticipated proportion of 0.45, an absolute precision of 0.08, and a 95% confidence level, using Cochran's formula (19). Participant characteristics included age, sex, and teaching experience. Age was grouped as ≤30, 31–40, 41–50, and 51–60 years, while teaching experience was grouped as 1–15, 16–30, and 31–45 years.

Shoulder pain and related functional limitation were assessed using the Shoulder Pain and Disability Index (SPADI), which yields pain, disability, and total percentage scores; higher scores indicate greater pain and disability. Clinical impingement-related findings were assessed using the empty-can test and Neer impingement test. Latissimus dorsi strength was assessed by manual muscle testing and graded according to the participant's ability to complete the available range of motion against gravity and resistance. The reported strength categories included full range of motion against gravity (grade 3) and full range of motion against moderate resistance (grade 4). All reported outcomes were recorded for statistical analysis. Data were analysed using IBM SPSS Statistics version 26.0. Categorical variables were summarized as frequencies and percentages, and SPADI domain scores were summarized as means. Correlation coefficients were used to examine the relationship between latissimus dorsi manual muscle-testing grade and SPADI pain, disability, and total scores within teaching-experience and sex-by-age strata. Because the reported analyses were non-parametric, coefficients were presented as Spearman's r. Independent-samples Kruskal–Wallis tests evaluated differences in SPADI outcomes across teaching-experience groups. Statistical significance was assessed at $p < 0.05$. Binary logistic regression was used for secondary analysis, with poor awareness coded as the event and fair awareness as the reference outcome. Separate univariable models were fitted for age group, gender, educational qualification, and teaching experience. Results were reported as odds ratios with 95% confidence intervals and Wald p-values. Overall predictor effects were assessed using likelihood-ratio tests, and model explanatory performance was summarized using Nagelkerke's pseudo-R^2. An exploratory linear-trend model was fitted across ordered teaching-experience categories. Multivariable adjustment was not performed because participant-level cross-classified data were unavailable. Analyses used the available observations, and all reported tests included the denominators shown in the corresponding tables.

RESULTS

The 136 participants comprised 59 men (43.4%) and 77 women (56.6%). The largest age group was 31–40 years (n = 60; 44.1%), followed by 41–50 years (n = 30; 22.1%); the ≤30-year and 51–60-year groups each included 23 participants (16.9%). Most participants had 1–15 years of teaching experience (n = 90; 66.2%). Mean SPADI pain, disability, and total scores were 29.37%, 21.37%, and 24.64%, respectively (Table 1).

Table 1. Participant characteristics and shoulder outcomes

Characteristic	Category or summary	n (%) or mean
Sex	Male	59 (43.4)
	Female	77 (56.6)
Age (years)	≤30	23 (16.9)
	31–40	60 (44.1)
	41–50	30 (22.1)
	51–60	23 (16.9)
Teaching experience (years)	1–15	90 (66.2)
	16–30	34 (25.0)
	31–45	12 (8.8)
SPADI	Pain score (%)	29.37
	Disability score (%)	21.37
	Total score (%)	24.64

SPADI, Shoulder Pain and Disability Index.

The empty-can test was positive in 72 participants (52.94%), whereas the Neer test was positive in 52 (38.24%). Latissimus dorsi manual muscle testing demonstrated grade 4 strength in 66 participants (48.53%) and grade 3 strength in 64 (47.06%) (Table 2).

Table 2. Shoulder impingement-test findings and reported latissimus dorsi strength grades

Assessment	Finding	n (%)
Empty-can test	Positive	72 (52.94)
	Negative	64 (47.06)
Neer impingement test	Positive	52 (38.24)
	Negative	84 (61.76)
Latissimus dorsi MMT	Grade 4: full ROM against moderate resistance	66 (48.53)
	Grade 3: full ROM against gravity	64 (47.06)

MMT, manual muscle testing; ROM, range of motion.

Within the 1–15-year teaching-experience group, latissimus dorsi MMT grade was inversely correlated with SPADI pain ($r = -0.308$; $p = 0.003$), disability ($r = -0.387$; $p < 0.001$), and total score ($r = -0.358$; $p = 0.001$). Correlations in the 16–30-year and 31–45-year groups were not statistically significant (Table 3).

Table 3. Correlation of latissimus dorsi MMT grade with SPADI outcomes by teaching experience

SPADI outcome	Experience (years)	n	Spearman r	p-value
Pain	1–15	90	−0.308	0.003
	16–30	34	−0.219	0.213
	31–45	12	−0.436	0.157
Disability	1–15	90	−0.387	<0.001
	16–30	34	−0.142	0.424
	31–45	12	−0.359	0.251
Total	1–15	90	−0.358	0.001
	16–30	34	−0.175	0.324
	31–45	12	−0.466	0.127

MMT, manual muscle testing; SPADI, Shoulder Pain and Disability Index.

Sex-by-age subgroup analyses identified inverse correlations between MMT grade and pain among men aged 51–60 years and women aged 31–40 years. Significant inverse correlations with disability and total SPADI scores were observed among men aged 31–40 and 51–60 years and women aged 31–40 and 41–

50 years. Other subgroup correlations were not statistically significant (Table 4). Kruskal–Wallis testing showed differences across teaching-experience groups for SPADI pain (p = 0.029), disability (p = 0.010), and total score (p = 0.020) (Table 5). Group-specific medians and rank distributions were not available in the reported output; therefore, the direction and magnitude of these between-group differences were not inferred.

Table 4. Correlation of latissimus dorsi MMT grade with SPADI outcomes by sex and age

Outcome	Sex	Age (years)	n	Spearman r	p-value
Pain	Male	≤30	9	0.241	0.533
		31–40	25	−0.342	0.094
		41–50	16	−0.043	0.873
		51–60	9	−0.877	0.002
	Female	≤30	14	−0.322	0.261
		31–40	35	−0.355	0.036
		41–50	14	−0.497	0.070
		51–60	14	−0.275	0.341
Disability	Male	≤30	9	−0.104	0.790
		31–40	25	−0.436	0.029
		41–50	16	0.038	0.889
		51–60	9	−0.745	0.021
	Female	≤30	14	−0.286	0.321
		31–40	35	−0.375	0.027
		41–50	14	−0.558	0.038
		51–60	14	−0.210	0.472
Total	Male	≤30	9	0.160	0.680
		31–40	25	−0.431	0.031
		41–50	16	0.038	0.889
		51–60	9	−0.870	0.002
	Female	≤30	14	−0.251	0.387
		31–40	35	−0.400	0.017
		41–50	14	−0.585	0.028
		51–60	14	−0.319	0.267

MMT, manual muscle testing; SPADI, Shoulder Pain and Disability Index.

Table 5. Kruskal–Wallis tests of SPADI outcomes across teaching-experience groups

Outcome	Total n	p-value
SPADI pain score	136	0.029
SPADI disability score	136	0.010
SPADI total score	136	0.020

Grouping variable: teaching experience (1–15, 16–30, and 31–45 years). SPADI, Shoulder Pain and Disability Index.

A total of 289 medical university teachers were included in the analysis. Poor ergonomics awareness was identified in 162 participants (56.1%), fair awareness in 127 (43.9%), and good awareness in none. Because no participant was classified as having good awareness, binary logistic regression was performed with poor awareness coded as the event and fair awareness as the reference outcome. In the univariable logistic regression analysis, gender was significantly associated with poor ergonomics awareness. Female participants had 2.27 times greater odds of poor rather than fair awareness compared with male participants (OR=2.27, 95% CI: 1.36–3.78; Wald p=0.0017). The gender model was significant according to the likelihood-ratio test (LR χ^2=10.05, df=1, p=0.0015) and explained approximately 4.6% of the variation in awareness classification according to Nagelkerke's pseudo-R^2.

Age was not associated with poor awareness. Participants aged 46–60 years had odds comparable to those aged 30–45 years (OR=1.11, 95% CI: 0.67–1.83; p=0.6916). The age model did not significantly improve fit over the intercept-only model (LR χ^2=0.16, df=1, p=0.6913; Nagelkerke R^2=0.001). Educational qualification was not significantly associated with awareness category overall (LR χ^2=4.67, df=3, p=0.1976; Nagelkerke R^2=0.021). Compared with participants holding a bachelor's degree, those with a master's degree had similar odds of poor awareness (OR=1.01, 95% CI: 0.53–1.91; p=0.9737), as did FCPS-qualified participants (OR=1.04, 95% CI: 0.48–2.25; p=0.9173). Participants with a PhD or doctorate demonstrated lower estimated odds of poor awareness than those with a bachelor's degree, although the association did not reach statistical significance (OR=0.58, 95% CI: 0.32–1.07; p=0.0831). Teaching experience was also not significantly associated with poor awareness overall (LR χ^2=4.99, df=4, p=0.2883; Nagelkerke R^2=0.023). Relative to participants with 1–5 years of experience, the odds of poor awareness were not significantly different among those with 6–10 years (OR=1.03, 95% CI: 0.49–2.19), 11–15 years (OR=0.60, 95% CI: 0.32–1.12), 16–20 years (OR=0.81, 95% CI: 0.32–2.05), or more than 20 years of experience (OR=1.39, 95% CI: 0.70–2.75). An exploratory ordinal trend analysis across increasing teaching-experience categories also showed no evidence of a monotonic association with poor awareness (OR per category increase=1.02, 95% CI: 0.88–1.19; p=0.7764).

Table 6. Univariable Binary Logistic Regression of Factors Associated With Poor Ergonomics Awareness

Predictor	Comparison	OR	95% CI	Wald p-value	Overall LR p-value	Nagelkerke R^2
Age group	30–45 years	1.00	Reference	—	0.6913	0.001
	46–60 years	1.11	0.67–1.83	0.6916	—	—
Gender	Male	1.00	Reference	—	0.0015	0.046
	Female	2.27	1.36–3.78	0.0017	—	—
Educational qualification	Bachelor's degree	1.00	Reference	—	0.1976	0.021
	Master's degree	1.01	0.53–1.91	0.9737	—	—
	PhD/doctorate	0.58	0.32–1.07	0.0831	—	—
	FCPS	1.04	0.48–2.25	0.9173	—	—
Teaching experience	1–5 years	1.00	Reference	—	0.2883	0.023
	6–10 years	1.03	0.49–2.19	0.9374	—	—
	11–15 years	0.60	0.32–1.12	0.1083	—	—
	16–20 years	0.81	0.32–2.05	0.6554	—	—
	>20 years	1.39	0.70–2.75	0.3521	—	—

Poor awareness was coded as 1 and fair awareness as 0. ORs were estimated using separate univariable binary logistic regression models. The overall likelihood-ratio p-value evaluates each predictor as a complete model. OR: odds ratio; CI: confidence interval; LR: likelihood ratio; FCPS: Fellowship of the College of Physicians and Surgeons.

Secondary regression analysis confirmed that gender was the only measured factor significantly associated with poor ergonomics awareness. Female participants had more than twice the crude odds of poor awareness compared with males, although gender alone explained only a small proportion of outcome variability. Age, educational qualification, and teaching experience did not significantly improve model fit, and no consistent dose-response pattern was observed across increasing teaching-experience categories. These estimates remain unadjusted and should not be interpreted as independent effects.

DISCUSSION

This study found that shoulder symptoms and positive impingement-related clinical tests were common among the participating teachers. More than half had a positive empty-can test, over one-third had a positive Neer test, and most participants demonstrated latissimus dorsi strength corresponding to grades 3 or 4. Lower MMT grades were associated with higher SPADI pain, disability, and total scores in the 1–15-year experience group and in selected sex-by-age strata. SPADI outcomes also differed across teaching-experience categories. These findings identify relationships between muscle performance and self-reported shoulder burden, but the available analyses do not directly establish an overall association between impingement-test positivity and latissimus dorsi weakness.

The occupational context is consistent with earlier work among teachers. Rahman and Warikoo reported relationships among blackboard teaching, scapular positioning, and shoulder pain and disability, particularly in relation to teaching exposure (12). Ramírez-García and colleagues found a substantial burden of musculoskeletal disorders among primary schoolteachers, including shoulder symptoms, in association with ergonomic and individual factors (13). Grabara likewise reported associations between physical activity and musculoskeletal disorders among teachers, while Abu Zohair and colleagues documented shoulder symptoms as one of the most frequent work-related musculoskeletal complaints among schoolteachers in the United Arab Emirates (14,15). Together, these studies support attention to repetitive upper-limb activity and workplace organization, although differences in populations, exposure measures, and outcome instruments limit direct numerical comparison.

The inverse correlations between MMT grade and SPADI outcomes are clinically plausible because lower muscle performance may reduce the capacity to tolerate repeated shoulder loading. Latissimus dorsi contributes to humeral movement and stabilization during resisted upper-limb tasks (16–18), while shoulder pain itself may inhibit force production during manual testing. The direction of influence therefore cannot be determined: weakness may contribute to altered loading, pain may reduce measured strength, or both may reflect shared factors such as posture, activity volume, and other shoulder impairments. The particularly strong coefficients in some small strata, including men aged 51–60 years, should be interpreted cautiously because subgroup sample sizes were limited.

The findings have potential relevance for occupational screening and ergonomic education. Assessment of teachers with shoulder complaints may reasonably include symptom severity, disability, occupational task exposure, impingement-related clinical findings, and shoulder-girdle muscle performance. However, this study did not evaluate an intervention, and its results should not be used to infer that latissimus dorsi strengthening alone will prevent or treat shoulder impingement. Prospective studies with standardized strength measurement, explicit exposure assessment, and multivariable analysis are needed to clarify temporal and independent relationships.

Strengths of the study include recruitment from both private and government schools, use of SPADI alongside clinical tests, and reporting across teaching-experience and sex-by-age strata. Important limitations are the cross-sectional design, convenience sampling, restriction to selected urban schools, inability to recruit from schools that withheld permission, reliance on manual muscle testing rather than instrumented strength measurement, and incomplete reporting of examiner standardization and diagnostic criteria. Multiple subgroup tests increase the probability of chance findings, and no adjusted model was reported for potential confounders. In addition, the supplied statistical output did not include a direct overall comparison of impingement-test status with latissimus dorsi weakness; consequently, the title's central association remains only partially evaluated.

CONCLUSION

Among the participating schoolteachers, lower latissimus dorsi manual muscle-testing grades were associated with greater shoulder pain and disability in the early-experience group and in selected sex-by-age strata, while SPADI outcomes differed across teaching-experience categories. These cross-sectional findings support comprehensive occupational shoulder assessment but do not establish causality or a direct overall association between impingement-test positivity and latissimus dorsi weakness.

REFERENCES

1. Michener LA, Walsworth MK, Burnet EN. Effectiveness of rehabilitation for patients with subacromial impingement syndrome: a systematic review. J Hand Ther. 2004;17(2):152–64.

2. McClure PW, Bialker J, Neff N, Williams G, Karduna AR. Shoulder function and three-dimensional kinematics in people with shoulder impingement syndrome before and after a 6-week exercise program. Phys Ther. 2004;84(9):832–48.

3. Urwin M, Symmons D, Allison T, Brammah T, Busby H, Roxby M, et al. Estimating the burden of musculoskeletal disorders in the community: the comparative prevalence of symptoms at different anatomical sites, and the relation to social deprivation. Ann Rheum Dis. 1998;57(11):649–55.

4. Lo YP, Hsu YC, Chan KM. Epidemiology of shoulder impingement in upper arm sports events. Br J Sports Med. 1990;24(3):173–7.

5. Bullock MP, Foster NE, Wright CC. Shoulder impingement: the effect of sitting posture on shoulder pain and range of motion. Man Ther. 2005;10(1):28–37.

6. Miller MD, Thompson SR. Miller's Review of Orthopaedics. Philadelphia: Elsevier Health Sciences; 2015.

7. Khan Y, Nagy MT, Malal J, Waseem M. The painful shoulder: shoulder impingement syndrome. Open Orthop J. 2013;7(Suppl 3):347–51.

8. Sarkar K, Uhthoff HK. Ultrastructure of the subacromial bursa in painful shoulder syndromes. Virchows Arch A Pathol Anat Histopathol. 1983;400:107–17.

9. Lewis C, Wahlström J, Mukka S, Liv P, Järvholm B, Jackson JA, et al. Surgery for subacromial impingement syndrome and occupational biomechanical risk factors in a 16-year prospective study among male construction workers. Scand J Work Environ Health. 2023;49(2):156.

10. Northover J, Lunn P, Clark D, Phillipson M. Risk factors for the development of rotator cuff disease. Int J Shoulder Surg. 2007;1(3):82.

11. Tate A, Turner GN, Knab SE, Jorgensen C, Strittmatter A, Michener LA. Risk factors associated with shoulder pain and disability across the lifespan of competitive swimmers. J Athl Train. 2012;47(2):149–58.

12. Rahman N, Warikoo D. Association of blackboard teaching with scapular positioning and shoulder pain and disability among school teachers in Dehradun. Int J Pharm Bio Sci. 2013;3(2):475–85.

13. Ramírez-García CO, Lluguay-Quispillo DJ, Inga-Lafebre JD, Cuenca-Lozano MF, Ojeda-Zambrano RM, Cárdenas-Baque CC. Musculoskeletal disorders in primary school teachers. Sustainability. 2023;15(23):16222.

14. Grabara M. The association between physical activity and musculoskeletal disorders—a cross-sectional study of teachers. PeerJ. 2023;11:e14872.

15. Abu Zohair HM, Girish S, Hazari A. Work-related musculoskeletal disorders among United Arab Emirates schoolteachers: an examination of physical activity. BMC Musculoskelet Disord. 2024;25(1):134.

16. Steffenssen MC, Kristiansen AH, Damsgaard TE. A systematic review and meta-analysis of functional shoulder impairment after latissimus dorsi breast reconstruction. Ann Plast Surg. 2019;82(1):116–27.

17. Mitchell B, Imonugo O, Tripp JE. Anatomy, back, extrinsic muscles. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2024.

18. Jeno SH, Varacallo M. Anatomy, back, latissimus dorsi. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2023.

19. Cochran WG. Sampling Techniques. New York: John Wiley & Sons; 1977.

20. Bhatt C, Prajapati B, Patil D, Patel V, Singh BG, Mehta C. Variation in the insertion of the latissimus dorsi and its clinical importance. J Orthop. 2013;10(1):25–8.

21. Spear SL, Hess CL. A review of the biomechanical and functional changes in the shoulder following transfer of the latissimus dorsi muscle. Plast Reconstr Surg. 2005;115(7):2070–3.

22. Akram M, Gillani SF, Farooqi FM, Awais SM. Acromion types and role of corticosteroid with shoulder impingement syndrome. J Coll Physicians Surg Pak. 2016;26:980–3.