

Correspondence

✉ Zarkash Javed, zarkashjaved@gmail.com

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Declarations

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Patient Rated Wrist Evaluation Among Milk Harvesters

Sana Aziz¹, Muhammad Shazib Butt¹, Zarkash Javed¹, Muhammad Hashaam¹, Raveena Rajpoot¹

1 University of Sialkot, Sialkot, Pakistan

ABSTRACT

Background: Wrist pain from repetitive occupational activity can impair work performance and daily function, yet limited local evidence exists for milk harvesters involved in repetitive, forceful hand milking. **Objective:** To determine the prevalence and severity of wrist pain and functional disability among milk harvesters in Sialkot using the Patient-Rated Wrist Evaluation (PRWE). **Methods:** A cross-sectional observational study was conducted among 370 male milk harvesters aged 20–35 years with ≥1 year of milking experience recruited from cattle sheds and dairy farms in Sialkot using purposive sampling. Wrist pain and disability were assessed using PRWE, capturing pain severity and functional limitations in specific and usual activities. Data were analyzed descriptively using frequencies and percentages. **Results:** Moderate wrist pain was most common (47.3%), followed by mild (24.6%) and severe pain (13.8%), while 3.5% reported very severe pain. Moderate limitation was reported for specific activities (43.5%) and usual activities (43.2%). Overall functional impairment was moderate in 43.5% and severe/very severe in 25.4%. Combined total PRWE disability was moderate in 48.1% and severe/very severe in 20.8%, indicating substantial pain-related functional burden. **Conclusion:** Wrist pain and disability are highly prevalent among milk harvesters, with moderate impairment predominating and a clinically important proportion reporting severe disability, supporting the need for ergonomic prevention and early rehabilitation strategies.

Keywords

Wrist pain, Milk harvesters, Musculoskeletal disorders, Occupational health

INTRODUCTION

Wrist pain is a common upper-limb complaint that can arise from acute injury or from subacute/chronic overuse, and it can substantially restrict daily activities and work performance, particularly when repetitive wrist motion is sustained over time (1). Biomechanically, prolonged or frequent wrist deviation and non-neutral hand postures alter joint and digit alignment and increase soft-tissue loading, which may precipitate pain and functional impairment in occupational settings (2). The wrist is anatomically and functionally complex, comprising the distal radius/ulna, carpal bones, and metacarpal bases arranged to provide mobility while maintaining stability required for precision grip and load transfer across the hand–forearm interface (3,4). Because many work tasks demand combined flexion–extension and radial–ulnar deviation, repetitive exposure to these motions—particularly when paired with forceful gripping—can overload tendons, ligaments, and neurovascular structures, contributing to pain syndromes and reduced functional capacity (5–7).

Work-related musculoskeletal disorders (WMSDs) of the hand and wrist are multifactorial and are associated with repetitive motion, sustained force, awkward posture, insufficient recovery time, and broader individual and occupational determinants (8,9). Although wrist pain is less frequently highlighted than low back or shoulder pain, it still contributes meaningfully to overall musculoskeletal burden, and systematic evidence indicates that occupational and activity exposures are important risk contributors (9). In agriculture and dairy work, the ergonomic profile is particularly concerning: tasks are often labor-intensive, performed for long hours, and frequently undertaken with constrained postures and limited rest (10,11). Dairy milking—especially manual or semi-mechanized milking—requires high-frequency, repetitive thumb and finger actions and sustained gripping to express milk, handle equipment, and manage animals, thereby increasing cumulative strain on the wrist and hand musculature and tendons (12,13). Prior ergonomic studies of dairy work describe high repetition rates, forceful pinch grips, awkward wrist positions, lifting/carrying demands, and exposure durations that may exceed recommended thresholds, with electromyographic data supporting substantial forearm muscle activation during key milking subtasks (14–16). Consistent with these exposures, dairy workers have reported substantial upper-extremity symptoms, including wrist/hand pain, and occupationally linked diagnoses such as carpal tunnel syndrome and tendinopathies have been documented in milking contexts (17–20).

Despite this broader international evidence base, there remains limited field data quantifying wrist pain–related disability among milk harvesters in Pakistan, particularly using a validated patient-reported outcome measure that captures both pain intensity and functional limitations relevant to work and daily life. The Patient-Rated Wrist Evaluation (PRWE) is a widely used instrument designed to quantify wrist pain and disability across specific and usual activities and has demonstrated strong measurement properties across wrist/hand conditions and cultural adaptations (21,22). Establishing local prevalence and disability patterns using PRWE can support targeted ergonomic interventions, prevention strategies, and rehabilitation planning aligned with occupational health priorities in dairy work settings. Therefore, this study aimed to determine the prevalence and severity distribution of wrist pain and related functional disability among male milk harvesters in Sialkot using the PRWE, and to quantify the extent to which pain co-occurs with functional limitation in this occupational group (21,22).

MATERIALS AND METHODS

A cross-sectional observational study was conducted in cattle sheds and dairy farms in Sialkot, Pakistan. Male milk harvesters aged 20–35 years were recruited through non-probability purposive sampling. Eligibility required at least one year of milk-harvesting experience, routine milking

of approximately 6–8 cattle per day, and engagement in milking activities twice daily. Participants were excluded if they reported upper-limb trauma within the preceding six months, congenital hand deformity, relevant systemic musculoskeletal disease (e.g., inflammatory or degenerative arthropathies), or cervical radiculopathy that could confound wrist pain reporting.

After providing a plain-language explanation of study aims and procedures, written informed consent was obtained from each participant prior to enrollment. Data collection was performed through face-to-face administration of the Patient-Rated Wrist Evaluation (PRWE) questionnaire, a 15-item patient-reported outcome measure assessing wrist pain and functional limitations across specific tasks and usual daily activities (21,22). The PRWE includes a pain subscale and a function subscale; responses are scored on an 11-point scale per item, and subscale scores are combined into a total score on a 0–100 scale, where higher scores indicate greater pain-related disability (21). The instrument has established validity, reliability, and responsiveness, including evidence supporting robust measurement properties across translations and clinical populations (21,22). To reduce information bias in a setting with variable literacy, the questionnaire was administered by the researcher in an interview format, using standardized wording and item clarification limited to explaining question meaning without suggesting answers.

Primary outcomes were PRWE pain score, PRWE function score, and total PRWE score. For categorical reporting, total and subscale scores were grouped into ordinal severity levels (minimal, mild, moderate, severe, very severe) using predefined interpretation thresholds consistent with PRWE scoring guidance, enabling estimation of prevalence across severity strata while preserving the underlying continuous scoring for analytic summaries (21). Occupational exposure descriptors recorded for characterization included years of milk-harvesting experience and work routine consistent with eligibility criteria. To mitigate procedural bias and enhance reproducibility, the same administration approach was used for all participants, the data collection workflow was prespecified, and completed questionnaires were checked at point-of-collection for missing responses; any omissions were immediately revisited with the participant to confirm whether the item was intentionally unanswered or inadvertently skipped.

Sample size was determined a priori using a standard online sample size calculator (Raosoft) to ensure adequate precision for prevalence estimation in a cross-sectional design. Data were coded and analyzed in SPSS (version 26.0). Descriptive statistics were used to summarize participant characteristics and PRWE outcomes, including frequencies and percentages for categorical severity levels and summary statistics for continuous scores. The primary prevalence outputs were the proportions of participants within each pain severity category, function limitation category (specific and usual activities), and combined total disability category based on total PRWE score. For data integrity, double-checking of data entry was performed by verifying a subset of entries against source questionnaires, and consistency checks were applied to confirm valid score ranges and internal score aggregation. Missing data were handled using complete-case analysis for any given PRWE-derived endpoint, with the denominator for each analysis explicitly defined as the number of participants with non-missing items required to compute that endpoint.

Ethical conduct was ensured through voluntary participation, written informed consent, confidentiality of collected data, and the participant's right to withdraw at any time without consequence. All procedures were conducted in accordance with generally accepted human-subject research principles for minimal-risk observational studies.

RESULTS

All participants were male (370/370, 100%), and most were married (333/370, 90.0%) (Table 1). Work experience averaged 4.25 ± 2.55 years (95% CI 3.99–4.51), with a median of 4.0 years and a range from 1 to 15 years. The largest experience band was 3.0–4.9 years (113/370, 30.5%), followed by 1.0–2.9 years (108/370, 29.2%), indicating that approximately three-fifths of the sample had under five years of experience (221/370, 59.7%) (Table 1).

Table 1. Participant characteristics (n = 370)

Characteristic	Category / Summary	n (%)
Gender	Male	370 (100.0)
Marital status	Married	333 (90.0)
	Unmarried	37 (10.0)
Work experience (years)	Mean \pm SD	4.25 ± 2.55
	95% CI for mean	3.99 to 4.51
	Median	4.0
	Range	1 to 15
Work experience bands	1.0–2.9	108 (29.2)
	3.0–4.9	113 (30.5)
	5.0–6.9	88 (23.8)
	≥ 7.0	59 (15.9)

Table 2. PRWE-derived prevalence by domain (severity collapsed for compactness)

Domain (PRWE-derived)	Minimal	Mild	Moderate	Severe + Very severe
Pain severity	40 (10.8; CI 8.0–14.4)	91 (24.6; CI 20.5–29.2)	175 (47.3; CI 42.3–52.4)	64 (17.3; CI 13.8–21.4)
Function: specific activities	73 (19.7; CI 15.9–24.0)	46 (12.4; CI 9.5–16.1)	161 (43.5; CI 38.6–48.5)	90 (24.3; CI 20.2–28.9)
Function: usual activities	53 (14.3; CI 11.0–18.3)	67 (18.1; CI 14.5–22.3)	160 (43.2; CI 38.3–48.3)	90 (24.3; CI 20.2–28.9)
Total function impairment	68 (18.4; CI 14.8–22.6)	47 (12.7; CI 9.7–16.4)	161 (43.5; CI 38.6–48.5)	94 (25.4; CI 21.3–30.0)
Total PRWE (pain + function)	45 (12.2; CI 9.2–16.0)	70 (18.9; CI 15.2–23.3)	178 (48.1; CI 43.1–53.2)	77 (20.8; CI 17.0–25.1)

Across PRWE domains, moderate severity consistently predominated (Table 2). For pain severity, 47.3% of participants reported moderate pain (175/370; 95% CI 42.3–52.4), while 17.3% fell into severe/very severe pain (64/370; CI 13.8–21.4). Functional limitation mirrored this pattern: moderate limitation in specific activities was 43.5% (161/370; CI 38.6–48.5) and moderate limitation in usual activities was 43.2% (160/370; CI 38.3–48.3), with severe/very severe functional burden affecting about one-quarter in both domains (each 24.3%, 90/370; CI 20.2–28.9). When

function was aggregated, severe/very severe total functional impairment rose to 25.4% (94/370; CI 21.3–30.0). Critically, when pain and function were combined into total PRWE severity, nearly half of the cohort demonstrated moderate overall disability (48.1%, 178/370; CI 43.1–53.2), and an additional 20.8% experienced severe/very severe disability (77/370; CI 17.0–25.1), indicating a substantial occupational burden of wrist pain–related disability extending beyond pain alone (Table 2).

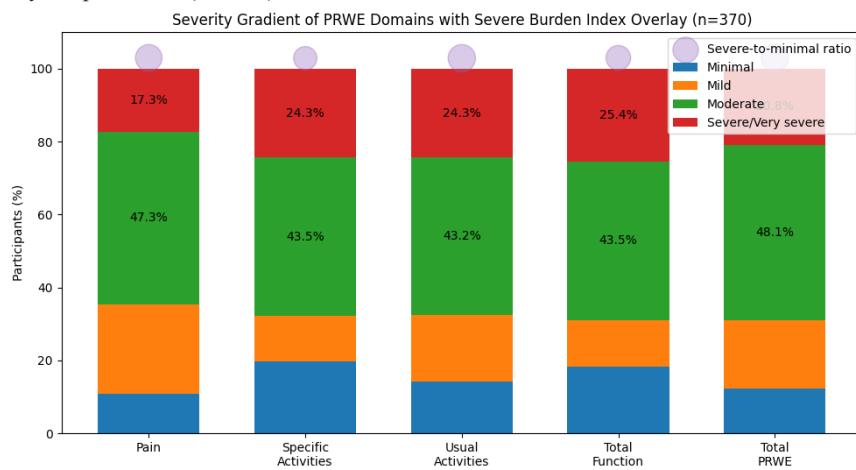


Figure 1 Severity Gradient of PRWE Domains with Severe Burden Index Overlay (n=370)

Across all PRWE-derived domains, moderate severity consistently dominated, ranging from 43.2% in usual activities limitation to 48.1% in total PRWE disability, confirming that nearly half of milk harvesters experience clinically meaningful mid-level impairment. Severe/very severe burden was substantial in functional domains, reaching 25.4% for total functional impairment and 24.3% for both specific and usual activity limitation, compared with 17.3% for severe pain alone, indicating that disability was driven more strongly by activity restriction than pain intensity. Minimal severity remained comparatively low across outcomes (10.8–19.7%), and the overlaid severe-to-minimal burden index visually emphasizes the steepest disability gradient in total function (25.4% severe vs 18.4% minimal) and activity limitations (24.3% severe vs 19.7% minimal for specific activities), highlighting that functional consequences represent a major occupational health impact beyond pain symptoms in this cohort.

DISCUSSION

This study quantified wrist pain–related disability among male milk harvesters in Sialkot using the PRWE framework and demonstrated a substantial occupational burden dominated by moderate symptom severity and functional restriction. Nearly half of participants reported moderate pain severity (47.3%) and moderate total PRWE disability (48.1%), while one in five (20.8%) fell into the severe/very severe combined disability category, indicating that wrist symptoms in this workforce are not only common but frequently function-limiting. Importantly, the pattern across subdomains suggests that disability is amplified by functional compromise: severe/very severe burden was 24.3% in both specific and usual activities and increased to 25.4% for total function impairment, compared with 17.3% severe/very severe pain alone. This gradient implies that, within repetitive dairy work, even when pain is not maximal, cumulative mechanical loading may still translate into tangible restriction in gripping, lifting, and routine daily tasks, which aligns with the PRWE construct emphasizing pain-associated functional impact rather than symptoms alone (21,22).

The observed distribution is mechanistically plausible given the biomechanics and exposure profile inherent to milk harvesting. Manual milking involves repeated wrist flexion–extension, sustained gripping, and thumb–finger force transmission that can overload soft tissues and disturb normal joint mechanics, especially when performed for prolonged periods with limited recovery (12,13). Experimental work indicates that deviated wrist postures can alter hand and wrist joint angles and contribute to discomfort and musculoskeletal strain, supporting the plausibility of postural contribution in workers repeatedly operating in constrained positions (2). Similarly, high-frequency repetitive wrist movements and prolonged manual handling are associated with reduced grip strength and functional restrictions, and these effects are influenced by occupational characteristics and cumulative exposure (7). In this context, the finding that functional impairment was proportionally higher than severe pain is consistent with the concept that repetitive strain may initially present as endurance limitation and task intolerance before progressing to higher pain intensity, particularly when work continues without rest or ergonomic modification.

International occupational evidence further supports the relevance of these findings for dairy and other repetitive occupations. WMSDs have been repeatedly associated with repetitive motion, forceful exertion, awkward posture, and socioeconomic and work-organization factors, all of which may coexist in agricultural settings (8,9). Dairy work is recognized as a high-intensity occupation with long working hours and increased injury risk, and musculoskeletal symptoms have been reported across multiple dairy-related roles (10,11). Ergonomic analyses have described milking as a task with high repetition and force demands, including pinch grip pressure and lifting or handling heavy loads, frequently exceeding safe exposure thresholds in observational risk models (14–16). These conditions are also compatible with the development of clinical syndromes such as carpal tunnel syndrome and tendinopathies. Prior comparative findings indicate markedly higher odds of carpal tunnel syndrome among milkers than non-milkers, supporting a strong occupational linkage with repetitive wrist flexion and sustained hand use (19,20). Furthermore, occupational de Quervain's tenosynovitis has been reported in agricultural workers performing repetitive thumb and wrist deviation, highlighting the spectrum of overuse pathology that can occur with milking-related mechanics (18).

From a measurement standpoint, use of the PRWE strengthens interpretability because it captures pain intensity and disability in both specific and usual activities, allowing quantification of work-relevant and daily-life consequences (21). Contemporary psychometric evidence supports PRWE/PRWHE reliability, validity, and structural adequacy across translations and wrist/hand conditions, reinforcing the credibility of the observed functional limitations as clinically meaningful rather than measurement artifacts (21,22). In occupational research, such patient-reported

outcomes are especially valuable because they reflect the worker's lived functional capacity, which may not be fully explained by imaging or examination alone, particularly in early or subclinical overuse syndromes.

Although this study provides robust prevalence estimates within the sampled workforce, interpretation should remain aligned with the descriptive scope of the design. Cross-sectional data cannot establish temporality, and purposive sampling may limit generalizability beyond the studied setting; however, the consistent predominance of moderate disability and the sizeable proportion of severe functional limitation suggest that wrist morbidity is not sporadic and should be considered a priority occupational health concern. The distribution also supports pragmatic prevention planning: interventions targeting load management (reducing repetition and force), neutral wrist posture, and scheduled micro-breaks may be particularly relevant, given that functional limitation appears to be a major driver of severe burden. Evidence from occupational ergonomics and dairy risk studies suggests that workstation redesign, altered task structure, and reduced equipment weight can reduce biomechanical strain, supporting the feasibility of intervention pathways that do not depend solely on medical treatment (16).

CONCLUSION

Wrist pain and disability were highly prevalent among milk harvesters in Sialkot, with almost half of participants demonstrating moderate PRWE-based impairment and approximately one-fifth experiencing severe/very severe combined pain-related disability, indicating that repetitive milk-harvesting activities impose a substantial functional burden that extends beyond pain intensity alone and underscores the need for targeted ergonomic prevention and early rehabilitation strategies in this occupational group.

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