

Prevalence and Associated Risk Factors of Tennis Elbow Among Housekeeping Staff at a Tertiary-Care Medical College: A Cross-Sectional Study

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Received Date: 16/06/2025

Accepted: 22/07/2026

Published Date: 21/08/2026

ABSTRACT

Background: Tennis elbow, or lateral epicondylitis, is a work-related musculoskeletal disorder characterized by pain and tenderness over the lateral epicondyle. Housekeeping personnel may be particularly vulnerable because their work frequently involves repetitive wrist movements, forceful gripping, scrubbing, mopping, lifting, and forearm rotation. Evidence regarding its prevalence and occupational determinants among hospital housekeeping staff remains limited.

Aim: To determine the prevalence and associated risk factors of tennis elbow among housekeeping staff working at a tertiary-care medical college. **Materials and Methods:** An institution-based cross-sectional study was conducted among 100 housekeeping workers at a tertiary-care medical college. Eligible participants were selected using systematic random sampling. Socio-demographic, clinical, lifestyle, and occupational information was collected using a pre-designed semi-structured questionnaire. Tennis elbow was assessed through clinical examination, including lateral epicondylar tenderness, Cozen's test, and Mill's test. Categorical variables were summarized as frequencies and percentages. Prevalence was reported with a 95% confidence interval. Associations were evaluated using Fisher's exact test, and crude odds ratios with 95% confidence intervals were calculated. A p value below 0.05 was considered statistically significant. **Results:** Tennis elbow was diagnosed in 9 of the 100 participants, giving a prevalence of 9.0% (95% CI: 4.2%-16.4%). This was significantly higher than the 3% reference prevalence in the general adult population ($p=0.003$). Prevalence was higher among males than females (11.8% versus 6.1%), although the association was not statistically significant (OR=2.04; 95% CI: 0.48-8.68; $p=0.488$). Diabetes mellitus, smoking, and alcohol consumption were not significantly associated with tennis elbow. Workers employed for more than five years had significantly higher odds than those employed for five years or less (15.9% versus 3.6%; OR=5.11; 95% CI: 1.01-25.97; $p=0.041$). Working more than eight hours daily showed an unexpected inverse association (OR=0.24; 95% CI: 0.06-0.98; $p=0.049$), which required cautious interpretation. **Conclusion:** Tennis elbow affected approximately one in every eleven housekeeping workers and was more prevalent than expected in the general population. Longer employment duration was an important associated occupational factor, suggesting a cumulative effect of prolonged exposure. Workplace screening, ergonomic interventions, task rotation, scheduled rest periods, and education regarding safe working practices may help prevent chronic elbow morbidity in this occupational group. Larger multicentre longitudinal studies with objective ergonomic exposure assessment are recommended.

KEYWORDS: Lateral epicondylitis; Housekeeping staff; Occupational risk factors.

How to cite this article: Syed Azher Hussain¹ Dr Kore Aditya Basawaraj² Dr Mohd Nadeem Ahmed³. Prevalence and Associated Risk Factors of Tennis Elbow Among Housekeeping Staff at a Tertiary-Care Medical College: A Cross-Sectional Study. Int J Drug Deliv Technol. 2026;16(83s):84-92. DOI: 10.25258/ijddt.16.83s.9.

INTRODUCTION

Lateral epicondylitis, commonly known as tennis elbow or lateral elbow tendinopathy, is a painful musculoskeletal disorder involving the common extensor tendon at its attachment to the lateral epicondyle, particularly the extensor carpi radialis brevis. It is primarily considered a degenerative tendinopathy resulting from repeated microtrauma rather than an acute inflammatory condition. Patients commonly present with pain and tenderness over the lateral epicondyle, which may radiate into the forearm

and become aggravated by gripping, lifting, wrist extension, or repetitive forearm movements. Tennis elbow affects approximately 1%-3% of adults annually and occurs most frequently among individuals of working age.^[1] Although it is often associated with racquet sports, most cases occur in people performing repetitive occupational or household activities.

Occupational exposure plays an important role in the development of tennis elbow. Repetitive wrist

extension, forceful gripping, forearm rotation, lifting of heavy objects, and prolonged performance of strenuous manual tasks have been identified as important ergonomic risk factors.^[2,3] Housekeeping personnel routinely perform sweeping, mopping, scrubbing, wringing clothes, lifting waste containers, moving furniture, and cleaning surfaces. These activities frequently require repetitive and forceful movements of the wrist, elbow, and forearm, often in awkward postures and for prolonged working hours. Consequently, housekeeping staff may be particularly vulnerable to work-related upper-limb musculoskeletal disorders. Studies involving housekeeping workers and housemaids have reported a considerable burden of musculoskeletal symptoms attributable to repetitive work, constrained postures, inadequate rest, and high physical workload.^[4]

Apart from occupational exposure, tennis elbow may be influenced by age, sex, hand dominance, duration of employment, daily working hours, smoking, obesity, diabetes mellitus, and coexisting upper-limb disorders. Evidence indicates that forceful exertion combined with repeated forearm rotation produces a greater risk than repetition alone.^[3] Tennis elbow can result in reduced grip strength, difficulty performing occupational activities, absenteeism, impaired quality of life, and loss of productivity. Symptoms may persist or recur when the precipitating occupational exposure is not corrected. A systematic review has supported the association of lateral epicondylitis with high occupational strain and repeated forearm rotation, emphasizing the need for workplace-based preventive interventions.^[5]

AIM

To determine the prevalence and associated risk factors of tennis elbow among housekeeping staff working at a tertiary-care medical college.

OBJECTIVES

1. To estimate the prevalence of tennis elbow among housekeeping staff at the tertiary-care medical college.
2. To assess the socio-demographic, clinical, lifestyle, and occupational risk factors associated with tennis elbow.
3. To examine the association of tennis elbow with daily working hours, duration and type of employment, repetitive upper-limb activities, and selected medical conditions.

MATERIALS AND METHODOLOGY

Source of Data

The study data were obtained from housekeeping personnel employed at ESIC Medical College and Hospital, Kalaburagi, Karnataka. A list of eligible housekeeping staff was obtained from the housekeeping department or administrative office and served as the sampling frame. Primary data were

collected through personal interviews, review of relevant medical history, and clinical examination of the elbow.

Study Design

This was an institution-based, analytical cross-sectional study. The design was selected to estimate the point prevalence of tennis elbow and assess its association with selected socio-demographic, lifestyle, clinical, and occupational factors.

Study Location

The study was conducted among housekeeping staff working at ESIC Medical College and Hospital, Kalaburagi, Karnataka. Participant interviews and clinical examinations were carried out within the medical college and hospital premises in an area that ensured adequate privacy.

Sample Size

A final sample of 100 housekeeping staff was included. The initial sample size was estimated using Cochran's formula:

After finite-population correction for approximately 252 housekeeping staff and adjustment for a possible non-response rate of 10%, the required sample. The sample was increased to 100 participants to improve precision and ensure adequate representation for risk-factor analysis.

Sampling Technique

Systematic random sampling was used. The sampling interval was calculated by dividing the total number of housekeeping staff in the sampling frame by the required sample size:

A random starting point was selected from the first sampling interval. Thereafter, participants were selected at alternating intervals of two and three names from the ordered staff list until the required sample of 100 was obtained. If a selected employee was ineligible, the next eligible individual on the list was approached.

Inclusion Criteria

1. Housekeeping staff aged 20 years or older.
2. Staff who had been employed at the institution for at least six months.
3. Staff directly involved in physical housekeeping or cleaning activities.
4. Staff who were not simultaneously employed in another physically demanding occupation.
5. Staff who provided written informed consent to participate.

Exclusion Criteria

1. Housekeeping supervisors who were not routinely involved in physical cleaning work.
2. Staff with a history of major injury, fracture, deformity, or surgery involving the elbow, forearm, or wrist.

3. Staff with an acute traumatic injury to the affected upper limb at the time of examination.
4. Staff who had worked at the institution for less than six months.
5. Staff who were unavailable after repeated contact or declined participation.
6. Participants with a known neurological disorder causing upper-limb pain or weakness that could interfere with clinical assessment.

Study Variables

The primary outcome variable was the presence or absence of tennis elbow. Explanatory variables included age, sex, dominant hand, body mass index, diabetes mellitus, smoking, alcohol consumption, type of housekeeping work, daily working hours, duration of employment, repetitive wrist movements, forceful gripping, lifting of heavy objects, forearm rotation, availability of rest breaks, and use of ergonomically appropriate equipment.

Procedure and Methodology

Approval was obtained from the Institutional Ethics Committee and the concerned administrative authorities before data collection. Eligible staff were approached during a time that did not interfere with their routine duties. The purpose, procedure, potential benefits, and voluntary nature of participation were explained in the participant's preferred language. Written informed consent was obtained before enrolment.

Data were collected using a predesigned, semi-structured questionnaire. The questionnaire recorded socio-demographic characteristics, hand dominance, relevant medical history, lifestyle factors, duration of employment, average working hours, principal housekeeping activities, rest breaks, and exposure to repetitive or forceful upper-limb work. Participants were asked about lateral elbow pain, duration of symptoms, radiation of pain, aggravating activities, functional difficulty, treatment history, and work absenteeism.

Each participant underwent a standardized examination of both elbows. Inspection was followed by palpation for localized tenderness over the lateral epicondyle and common extensor tendon. Cozen's and Mill's tests were then performed.

For **Cozen's test**, the participant was seated with the elbow flexed, forearm pronated, and wrist extended and radially deviated. The examiner stabilized the elbow and applied resistance while the participant attempted wrist extension. Reproduction of pain over the lateral epicondyle was considered a positive test.

For **Mill's test**, the examiner palpated the lateral epicondyle and passively pronated the forearm, flexed the wrist, and extended the elbow. Reproduction of

localized pain over the lateral epicondyle was considered a positive result.

For this study, tennis elbow was diagnosed when the participant had lateral epicondylar pain or tenderness associated with at least one positive provocative test Cozen's test or Mill's test. Participants with positive findings were advised regarding activity modification, ergonomic precautions, and consultation with the Orthopaedics Department when clinically indicated.

Sample Processing

No biological sample was collected or processed because the study was based on questionnaire responses and clinical examination. Each participant was assigned a unique identification number. Completed forms were checked daily for completeness and consistency. Personal identifiers were separated from the analytical dataset, and coded data were entered into a password-protected electronic database.

Data Collection

Data were collected through face-to-face interviews and standardized clinical examination. Housekeeping supervisors assisted only in ensuring staff availability and were not present during individual interviews. Approximately 4-5 participants were assessed per day until the required sample was achieved. The investigator used the same questionnaire and examination technique for all participants to minimize interviewer and observer variation. A small pilot assessment was conducted before the main data collection to evaluate the clarity and feasibility of the questionnaire; pilot participants were excluded from the final analysis when modifications were required.

Statistical Methods

Data were entered into Microsoft Excel and analysed using an appropriate statistical software package. Data cleaning was performed by checking for missing values, outliers, inconsistencies, and duplicate entries. Continuous variables such as age, working hours, body mass index, and duration of employment were presented as mean with standard deviation or median with interquartile range, depending on their distribution. Categorical variables were summarized as frequencies and percentages.

The prevalence of tennis elbow was calculated as:

$$\text{Prevalence} = \frac{\text{Number of participants diagnosed with tennis elbow}}{\text{Total number of participants examined}} \times 100$$

The prevalence estimate was reported with a 95% confidence interval. Associations between tennis elbow and categorical risk factors were assessed using the Pearson chi-square test or Fisher's exact test when expected cell frequencies were less than five. Continuous variables were compared using the independent-samples t-test for normally distributed data or the Mann-Whitney U test for non-normally distributed data.

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Univariable binary logistic regression was performed to estimate crude odds ratios with 95% confidence intervals. Variables with clinical relevance or a univariable p value below 0.20 were considered for multivariable logistic regression to identify independently associated factors. Adjusted odds ratios with 95% confidence intervals were reported. Model fit and multicollinearity were assessed whenever the number of tennis-elbow cases permitted reliable multivariable analysis. A two-sided p value of less than 0.05 was considered statistically significant.

OBSERVATION AND RESULTS

Table 1: Overall prevalence and distribution of associated risk factors among housekeeping staff (N=100)

Parameter	n (%)	95% CI	Test of significance	P value
Tennis elbow	9 (9.0%)	4.2% - 16.4%	Exact binomial test, reference prevalence =3%	0.003*
Male sex	51 (51.0%)	40.8%-61.1%	Exact binomial test, reference=50%	0.920
Female sex	49 (49.0%)	38.9%-59.2%		
Diabetes mellitus	10 (10.0%)	4.9% - 17.6%	Exact binomial test, reference=50%	<0.001*
Working >8 hours/day	74 (74.0%)	64.3%-82.3%	Exact binomial test, reference=50%	<0.001*
Employment duration >5 years	44 (44.0%)	34.1%-54.3%	Exact binomial test, reference=50%	0.271
Current smoker	14 (14.0%)	7.9% - 22.4%	Exact binomial test, reference=50%	<0.001*

Alcohol consumption	12 (12.0%)	6.4% - 20.0%	Exact binomial test, reference=50%	<0.001*
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Table 1 shows that tennis elbow was identified in 9 (9.0%) of the 100 housekeeping workers, with a 95% confidence interval of 4.2%-16.4%. This prevalence was significantly higher than the reference prevalence of 3% reported in the general adult population (exact binomial p=0.003). The study population had an almost equal sex distribution, comprising 51% males and 49% females (p=0.920). Diabetes mellitus was present in 10% of participants. Nearly three-fourths of the workers (74.0%; 95% CI: 64.3%-82.3%) worked for more than eight hours daily, which was significantly greater than the 50% reference proportion (p<0.001). Forty-four percent had been employed for more than five years, although this proportion did not differ significantly from 50% (p=0.271). Current smoking and alcohol consumption were reported by 14% and 12% of participants, respectively. Their distributions were significantly below the 50% descriptive reference proportion (both p<0.001).

Table 2: Prevalence and clinical distribution of tennis elbow among housekeeping staff (N=100)

Outcome	n (%)	95% CI	Test of significance	P value
Tennis elbow present	9 (9.0%)	4.2%-16.4%	Exact binomial test against 3% reference prevalence	0.003*
Tennis elbow absent	91 (91.0%)	83.6% - 95.8%		
Tennis elbow among males	6/51 (11.8%)	4.4%-23.9%	Fisher's exact test†	0.488
Tennis elbow among females	3/49 (6.1%)	1.3%-16.9%		
Tennis elbow among workers with diabetes	1/10 (10.0%)	0.3%-44.5%	Fisher's exact test‡	1.000
Tennis elbow among	8/90 (8.9%)	3.9%-16.8%		

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workers without diabetes				
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†Male versus female prevalence.

‡Diabetes present versus absent.

*Statistically significant at $p < 0.05$.

Table 2 demonstrates that 9 of the 100 housekeeping workers had tennis elbow, giving an overall prevalence of 9.0% (95% CI: 4.2%-16.4%), whereas 91.0% were unaffected. The observed prevalence was significantly higher than the 3% reference prevalence ($p = 0.003$), indicating that approximately one in every eleven housekeeping workers was affected. Tennis elbow was more frequent among males than females, affecting 6 of 51 males (11.8%) and 3 of 49 females (6.1%). However, this difference was not statistically significant (Fisher's exact $p = 0.488$). Among workers with diabetes, 1 of 10 (10.0%) had tennis elbow, compared with 8 of 90 workers without diabetes (8.9%). This difference was also statistically non-significant ($p = 1.000$).

Table 3: Socio-demographic, clinical, and lifestyle factors associated with tennis elbow (N=100)

Risk factor	Tennis elbow present, n (%)	Tennis elbow absent, n (%)	Crude OR (95% CI)	Test of significance	P value
Sex					
Male (n=51)	6 (11.8 %)	45 (88.2 %)	2.04 (0.48-8.68)	Fisher's exact test	0.488
Female (n=49)	3 (6.1 %)	46 (93.9 %)	Reference		
Diabetes mellitus					
Present (n=10)	1 (10.0 %)	9 (90.0 %)	1.14 (0.13-10.18)	Fisher's exact test	1.000
Absent (n=90)	8 (8.9 %)	82 (91.1 %)	Reference		
Smoking					
Smoker (n=14)	1 (7.1 %)	13 (92.9 %)	0.75 (0.09-6.51)	Fisher's exact test	1.000
Non-smoker (n=86)	8 (9.3 %)	78 (90.7 %)	Reference		

Alcohol consumption					
Present (n=12)	1 (8.3 %)	11 (91.7 %)	0.91 (0.10-7.98)	Fisher's exact test	1.000
Absent (n=88)	8 (9.1 %)	80 (90.9 %)	Reference		

OR=odds ratio; CI=confidence interval. Fisher's exact test was used because several expected cell counts were below five.

Table 3 presents the associations of socio-demographic, clinical, and lifestyle factors with tennis elbow. Male workers had approximately twice the crude odds of tennis elbow compared with female workers (OR=2.04; 95% CI: 0.48-8.68), but the association was not statistically significant ($p = 0.488$). Diabetes mellitus was associated with only a slight increase in the odds of tennis elbow (OR=1.14; 95% CI: 0.13-10.18; $p = 1.000$). In contrast, smokers had marginally lower odds than non-smokers (OR=0.75; 95% CI: 0.09-6.51), while workers who consumed alcohol had odds similar to those who did not consume alcohol (OR=0.91; 95% CI: 0.10-7.98); neither association was statistically significant (both $p = 1.000$). Thus, sex, diabetes mellitus, smoking, and alcohol consumption were not significantly associated with tennis elbow in the present study.

Table 4: Association of occupational exposures and selected medical conditions with tennis elbow (N=100)

Exposure/risk factor	Tennis elbow present, n (%)	Tennis elbow absent, n (%)	Crude OR (95% CI)	Test of significance	P value
Daily working hours					
>8 hours/day (n=74)	4 (5.4 %)	70 (94.6 %)	0.24 (0.06-0.98)	Fisher's exact test	0.049*
≤8 hours/day (n=26)	5 (19.2 %)	21 (80.8 %)	Reference		
Duration of employment					

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>5 years (n=44)	7 (15.9 %)	37 (84.1 %)	5.11 (1.01- 25.97)	Fisher's exact test	0.041*
≤5 years (n=56)	2 (3.6 %)	54 (96.4 %)	Refer ence		
Diabetes mellitus					
Present (n=10)	1 (10.0 %)	9 (90.0 %)	1.14 (0.13- 10.18)	Fisher's exact test	1.000
Absent (n=90)	8 (8.9 %)	82 (91.1 %)	Refer ence		
Type of houseke eping work	Not recor ded	Not recor ded	Not estim able		
Repetitiv e upper- limb activity	Not recor ded	Not recor ded	Not estim able		
Forceful gripping/ lifting	Not recor ded	Not recor ded	Not estim able		

*Statistically significant at $p < 0.05$.

Table 4 shows the association of occupational exposures and selected medical conditions with tennis elbow. Among workers employed for more than eight hours daily, 4 of 74 (5.4%) had tennis elbow, compared with 5 of 26 (19.2%) working eight hours or less. Working for more than eight hours was associated with lower crude odds of tennis elbow (OR=0.24; 95% CI: 0.06-0.98; $p=0.049$). This unexpected inverse association should be interpreted cautiously because it may reflect the small number of cases, unequal group sizes, exposure misclassification, or other uncontrolled factors. Conversely, tennis elbow was more frequent among workers employed for more than five years than among those employed for five years or less (15.9% versus 3.6%). Longer employment was associated with approximately five times higher odds of tennis elbow (OR=5.11; 95% CI: 1.01-25.97; $p=0.041$), suggesting a possible cumulative occupational effect. Diabetes mellitus was not significantly associated with the condition (OR=1.14; 95% CI: 0.13-10.18; $p=1.000$).

DISCUSSION

Discussion of Table 1

The present study found that the prevalence of tennis elbow among housekeeping staff was 9.0% (95% CI: 4.2%-16.4%), which was significantly higher than the 3% reference prevalence in the general adult

population ($p=0.003$). This indicates a substantial occupational burden, with approximately one in every eleven housekeeping workers being affected. Sanders et al. (2015)^[1] reported that lateral epicondylitis generally affects approximately 1%-3% of adults and documented an age- and sex-adjusted annual incidence ranging from 2.4 to 4.5 per 1,000 persons. Vaquero-Picado et al. (2016)^[2] similarly described lateral epicondylitis as a common overuse tendinopathy associated with repetitive wrist extension, forceful gripping, and forearm rotation. The higher prevalence in the present study may therefore reflect the repetitive and physically strenuous nature of housekeeping duties.

The present prevalence was also higher than the 5.5% reported among hospital healthcare workers by Yanai et al. (2024)^[3], although it was markedly lower than the 39.3% prevalence reported among housewives by Akbar et al. (2024)^[4] and the 69.1% Cozen-test positivity reported among housemaids by Rasure et al. (2024)^[5]. Differences in prevalence may be explained by variation in diagnostic criteria, occupational tasks, participant age, duration of exposure, sampling methods, and whether diagnosis was based on symptoms, physical examination, or a single provocative test. The very high prevalence in some studies may also reflect recruitment of symptomatic workers or the use of a positive Cozen's test without requiring a complete clinical diagnosis.

The nearly equal representation of males and females in the present study reduced the likelihood that overall prevalence was primarily driven by an unequal sex distribution. Seventy-four percent of workers reported working for more than eight hours per day, while 44% had been employed for more than five years. These findings demonstrate substantial exposure to prolonged occupational activity. Afework et al. (2024)^[6] reported a 57.2% prevalence of work-related musculoskeletal disorders among hospital cleaners and identified repetitive tasks and heavy lifting as important associated factors. Similarly, Zhou et al. (2025)^[7] highlighted the burden of musculoskeletal disorders among hospital cleaners and emphasized the contribution of physical workload and adverse ergonomic conditions.

Diabetes mellitus, smoking, and alcohol consumption were reported by 10%, 14%, and 12% of participants, respectively. Although their proportions were statistically below the descriptive reference of 50%, these tests do not establish whether these characteristics were associated with tennis elbow. Such associations are better evaluated by comparing affected and unaffected workers, as presented in Tables 3 and 4.

Discussion of Table 2

Table 2 confirmed an overall tennis-elbow prevalence of 9.0%, significantly exceeding the 3% reference prevalence. The finding was broadly consistent with the occupational nature of lateral epicondylitis described by Degen et al. (2018)^[8], who observed that disease burden varies according to demographic profile and occupational exposure. The present prevalence was moderately higher than that reported by Yanai et al. (2024)^[3] among hospital healthcare workers, supporting the possibility that housekeeping personnel experience greater mechanical exposure than healthcare workers whose duties are less dependent on repetitive gripping, scrubbing, lifting, or forearm rotation.

The prevalence was higher among males than females (11.8% versus 6.1%), although the difference was not statistically significant ($p=0.488$). Male workers had approximately twice the crude odds of tennis elbow, but the confidence interval was wide and included unity. In contrast, the meta-analysis by Sayampanathan et al. (2020)^[9] found that female sex was associated with increased odds of lateral epicondylitis. Chen et al. (2024)^[10] also identified female sex, manual labour, smoking history, and hypercholesterolaemia as potential risk factors. The discrepancy may be related to differences in task allocation: male housekeeping workers may have been more frequently assigned heavier duties such as lifting waste containers, shifting materials, or operating heavy cleaning equipment. Because the type and intensity of housekeeping work were not recorded, this explanation could not be examined directly.

Tennis elbow was observed in 10.0% of workers with diabetes and 8.9% of those without diabetes, with no significant difference ($p=1.000$). The extremely wide confidence interval among workers with diabetes resulted from the presence of only one affected case among ten diabetic participants. Thus, the absence of statistical significance should not be interpreted as definitive evidence that diabetes has no influence on tendon health. A larger sample with more diabetic participants would be required to estimate this association precisely.

Discussion of Table 3

The socio-demographic, clinical, and lifestyle analysis did not identify sex, diabetes mellitus, smoking, or alcohol consumption as statistically significant risk factors. Male sex produced an OR of 2.04, but the 95% CI ranged from 0.48 to 8.68, indicating considerable uncertainty. The result differs from Sayampanathan et al. (2020)^[9], whose meta-analysis demonstrated increased risk among females. However, variation in work allocation, ergonomic exposure, hand dominance, age, and duration of employment may modify the apparent effect of sex. Sex should therefore

not be interpreted independently of the actual occupational workload.

Smoking was not associated with tennis elbow in the present study ($OR=0.75$; $p=1.000$). This finding contrasts with Sayampanathan et al. (2020)^[9], who reported approximately 1.5 times higher odds among current or former smokers, and Chen et al. (2024)^[10], who also identified smoking history as a risk factor. Yanai et al. (2024)^[3] reported an association between lateral epicondylitis and smoking history among hospital healthcare workers. The absence of an association in the present study may be explained by the small number of smokers, limited information regarding smoking duration and intensity, or inadequate statistical power.

Alcohol consumption was also unrelated to tennis elbow ($OR=0.91$; $p=1.000$). This suggests that occupational mechanical exposure may be more relevant than alcohol consumption in this population. Diabetes mellitus similarly demonstrated no significant association ($OR=1.14$; $p=1.000$). However, the wide confidence intervals for diabetes, smoking, and alcohol consumption indicate that both increased and decreased risks remain statistically plausible. These results should therefore be described as inconclusive rather than as proof of no association.

The use of Fisher's exact test was appropriate because several expected cell counts were below five. Nevertheless, only nine cases were available, limiting the ability to detect modest associations and preventing stable multivariable regression. Consequently, residual confounding by age, body mass index, dominant hand, workload, comorbid upper-limb disorders, and ergonomic conditions could not be excluded.

Discussion of Table 4

Workers employed for more than five years had a significantly higher prevalence of tennis elbow than those employed for five years or less (15.9% versus 3.6%). The corresponding OR of 5.11 (95% CI: 1.01-25.97; $p=0.041$) suggests that cumulative occupational exposure may play an important role. Housekeeping work involves repeated wrist extension, gripping of cleaning implements, wringing, lifting, pushing, pulling, and forearm pronation-supination. Repeated performance of these movements over several years may produce cumulative microtrauma at the common extensor tendon.

This finding is supported by Bretschneider et al. (2022)^[11], whose systematic review found high-quality evidence that a high Strain Index increased the risk of lateral epicondylitis ($OR=1.75$) and moderate-quality evidence that prolonged or high-angle forearm rotation increased the risk ($OR=1.85$). Afework et al. (2024)^[6] similarly found that repetitive activities and heavy lifting were strongly associated with

musculoskeletal disorders among hospital cleaners. Rasura et al. (2024)^[5] attributed the high occurrence of lateral epicondylitis among housemaids to repetitive cleaning, washing, lifting, and prolonged awkward upper-limb postures. These findings support the observed association between longer employment duration and tennis elbow.

In contrast, workers reporting more than eight working hours per day had a lower prevalence than those working eight hours or less (5.4% versus 19.2%), producing an apparent protective association (OR=0.24; $p=0.049$). This result is contrary to the expected exposure-response relationship and should not be interpreted as evidence that longer working hours protect against tennis elbow. Afzal et al. (2021)^[12] reported high exposure to prolonged working hours among restaurant cooks and concluded that long working hours and repetitive workload were important considerations for prevention. The present inverse finding may have resulted from small cell frequencies, incorrect categorisation of working hours, survivor-worker bias, differences in actual task intensity, or the possibility that workers with elbow symptoms were reassigned to shorter duty schedules. It may also reflect the fact that total working hours are a crude measure that does not distinguish active repetitive work from lighter duties or rest periods.

The significant association with employment duration but inverse association with daily working hours suggests that cumulative years of exposure may have been more important than the reported length of a single working day. Nevertheless, both estimates were unadjusted and had wide confidence intervals. They could have been confounded by age, sex, task allocation, hand dominance, previous treatment, or ergonomic modifications.

The type of housekeeping work, frequency of repetitive upper-limb activity, and forceful gripping or lifting were not recorded. This represents an important limitation because these exposures are more biomechanically specific than total working hours. Coombes et al. (2022)^[13] emphasized the importance of evaluating pain-provoking activities, muscle-function impairment, occupational loading, and functional limitations in individuals with lateral elbow tendinopathy. Future studies should therefore incorporate structured ergonomic assessment, task observation, frequency and duration of forearm rotation, forceful exertion, tool weight, grip requirements, rest intervals, and job rotation.

CONCLUSION

The prevalence of tennis elbow among housekeeping staff at the tertiary-care medical college was 9.0%, which was significantly higher than the 3% reference prevalence reported for the general adult population. Employment duration exceeding five years was

significantly associated with higher odds of tennis elbow, suggesting a cumulative effect of prolonged occupational exposure. Although working more than eight hours daily showed an unexpected inverse association, this finding should be interpreted cautiously because of the small number of cases and possible exposure misclassification. Sex, diabetes mellitus, smoking, and alcohol consumption were not significantly associated with tennis elbow. Regular occupational screening, ergonomic modification of cleaning equipment, task rotation, scheduled rest breaks, and education regarding appropriate gripping, lifting, and cleaning techniques may help reduce the burden of tennis elbow among housekeeping workers.

LIMITATIONS

This study had several limitations. Its cross-sectional design could identify associations but could not establish a temporal or causal relationship between occupational exposures and tennis elbow. The study was conducted at a single tertiary-care institution with a relatively small sample of 100 workers, limiting the generalizability and statistical power of the findings. Only nine cases of tennis elbow were identified, resulting in wide confidence intervals and unstable risk estimates. Participant-level variables such as age, body mass index, hand dominance, previous treatment, recreational activities, and other upper-limb disorders were not included in the analysis. Occupational exposures were based primarily on reported working hours and employment duration; objective ergonomic assessments were not performed. The type of housekeeping work, frequency of repetitive movements, forceful gripping, lifting load, forearm rotation, tool design, rest intervals, and job rotation were not recorded. Recall bias and exposure misclassification were therefore possible. Diagnosis was based on clinical provocative tests without ultrasonography or other confirmatory investigations. Finally, the observed inverse association between longer daily working hours and tennis elbow may have resulted from small cell frequencies, unequal groups, healthy-worker bias, task reassignment, residual confounding, or inaccuracies in the recorded exposure categories.

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