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Research Paper

Prevalence of Jumper's Knee (Patellar Tendinopathy) Among Volleyball Players in Kota, Rajasthan: A Cross-Sectional Observational Study

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Abstract
Background: *Jumper's Knee, clinically termed patellar tendinopathy, is a prevalent overuse injury among volleyball players secondary to repetitive high-load jumping and landing. Early identification is critical to prevent performance decline and chronic tendon dysfunction.*
Objective: *To determine the prevalence of Jumper's Knee among volleyball players in Kota, Rajasthan, and to examine its associations with age group and hamstring flexibility.*
Methods: *A cross-sectional observational study was conducted among 61 active volleyball players (aged 18–27 years). The Victorian Institute of Sport Assessment–Patellar Tendon (VISA-p) questionnaire was used as the primary outcome measure, with Jumper's Knee defined as a VISA-p score <50. Hamstring flexibility was assessed with the Sit and Reach Test. Statistical analyses included descriptive statistics, independent samples t-test, one-way ANOVA, Chi-square test, and Pearson and Spearman correlation coefficients ($\alpha = 0.05$).*
Results: *The prevalence of Jumper's Knee was 34.4% (21/61). Overall, 78.7% of participants reported some degree of patellar tendon symptoms (VISA-p <80). The mean VISA-p score was 57.20 ± 23.36. Players with Jumper's Knee had significantly lower VISA-p scores than those without the condition (30.95 ± 12.71 vs. 70.97 ± 13.83; $t = -11.035$, $p < 0.001$). Significant differences in VISA-p scores were observed across age groups ($F = 4.18$, $p = 0.010$), with the highest prevalence in the 22–23-year age group (60.0%) and no cases recorded among players aged ≥24 years. No significant association was found between hamstring flexibility and Jumper's Knee status ($\chi^2 = 0.006$, $p = 0.940$; $r = -0.099$, $p = 0.449$).*
Conclusion: *Jumper's Knee is highly prevalent among volleyball players in Kota, Rajasthan. Significant age-group differences were observed, whereas hamstring flexibility showed no meaningful association with the condition. Routine musculoskeletal screening and targeted preventive rehabilitation programs are recommended.*

Keywords: *Jumper's Knee; patellar tendinopathy; volleyball; VISA-p; hamstring flexibility; prevalence; sports physiotherapy.*

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I. INTRODUCTION

Jumper's Knee, or patellar tendinopathy, is an overuse condition characterised by well-localised anterior knee pain, typically arising at the inferior pole of the patella following physical activity. Although the diagnosis can usually be established through a thorough history and careful physical examination, the condition may be confused with bursitis, meniscal injuries, chondromalacia, or patellofemoral pain syndrome, necessitating a systematic clinical approach [1].

Volleyball demands repetitive high-intensity jumping and explosive knee-extensor loading, creating mechanical conditions strongly predisposing athletes to proximal patellar tendinopathy. Elite-level male volleyball players have been reported to jump 120–140 times per game, with competitive attackers performing more than 200 jumps per match, placing enormous cumulative load on the patellar tendon [4]. The repetitive microtrauma initiated by these high-frequency movements leads to micro-ruptures of tendon fibres, upregulation of inflammatory cytokines, neovascularisation accompanied by neural ingrowth, and ultimately a failed healing response characterised by painful tendinopathy [5].

Epidemiological data indicate a prevalence of 40–50% for Jumper's Knee among elite male volleyball players [10]. However, prevalence data from lower-resource, community-level settings in India remain sparse. Most published investigations originate from European or North American cohorts, limiting generalisability to South Asian athletes who may face different training environments, surface conditions, and healthcare access.

The Victorian Institute of Sport Assessment–Patellar Tendon (VISA-p) questionnaire has emerged as the gold-standard patient-reported outcome measure for patellar tendinopathy, providing a valid and reliable index of symptom severity [11]. Hamstring flexibility, commonly assessed using the Sit and Reach Test, has been proposed as a modifiable risk factor through its potential influence on knee biomechanics; however, empirical evidence for this relationship remains equivocal.

The present study, therefore, aimed to determine the point prevalence of Jumper's Knee among volleyball players in Kota, Rajasthan, and to investigate associations with player age and hamstring flexibility. The findings are intended to inform physiotherapy screening protocols and preventive rehabilitation strategies in community and university-level sport.

II. MATERIALS AND METHODS

Study Design and Setting

A cross-sectional observational study was conducted between February 2025 and May 2025. The study was performed in Kota, Rajasthan, India, and involved active volleyball players from amateur, semi-professional, and collegiate levels. Ethical approval was obtained from the Institutional Ethics Committee of Career Point University, Kota, Rajasthan, prior to data collection. All participants provided informed consent.

Participants

Volleyball players aged 18 years and above who were actively participating in volleyball training or competition at the time of the study were eligible for inclusion. Players were excluded if they had a history of knee surgery or major knee injury unrelated to patellar tendinopathy, were currently receiving treatment for any knee condition, had co-existing chronic musculoskeletal disorders affecting the knee, participated in another sport as their primary activity, or were unable to provide informed consent. A total of 61 participants met the eligibility criteria and were enrolled.

Outcome Measures

Primary outcome — patellar tendon symptom severity — was assessed using the VISA-p questionnaire, a validated eight-item instrument yielding scores from 0 (severe disability) to 100 (asymptomatic). Participants were classified into three categories: Jumper's Knee (VISA-p <50), subclinical/mild-to-moderate symptoms (VISA-p 50–79), and asymptomatic (VISA-p ≥80) [11].

Hamstring flexibility was measured using the standardised Sit and Reach Test. Participants removed their footwear and sat on the floor with legs extended and feet flat against the box. Both knees were maintained in full extension. Participants reached forward with both hands superimposed, held the maximum reach position for two seconds, and the best of three trials was recorded. Results were classified as indicating hamstring tightness (positive test) or normal flexibility (negative test) based on normative values.

Data Collection

The VISA-p questionnaire was administered electronically via a structured Google Form. Sit and Reach Test measurements were conducted by the primary investigator under standardised conditions. Data were entered into Microsoft Excel for cleaning and analysis.

Statistical Analysis

Descriptive statistics (frequency, percentage, mean ± standard deviation, median, minimum, maximum) were computed for all study variables. The prevalence of Jumper's Knee was expressed as a proportion with a 95% confidence interval (95% CI) using the Wilson score method. Group comparisons of VISA-p scores between players with and without Jumper's Knee were performed using the independent samples t-test. One-Way ANOVA examined differences in VISA-p scores across age groups; Tukey post-hoc tests were applied where significance was confirmed. The Chi-square (χ^2) test of independence evaluated the association between categorical hamstring

flexibility outcomes and Jumper's Knee status. Pearson's correlation coefficient (r) assessed the relationship between continuous VISA-p scores and Sit and Reach performance, while Spearman's rank correlation (ρ) was used for the relationship between age and VISA-p score. Statistical significance was set at $\alpha = 0.05$ for all analyses.

III. RESULTS

Sample Characteristics

Sixty-one volleyball players were enrolled (Table 1). The mean age was 21.10 ± 1.92 years (range 18–27 years). The overall mean VISA-p score was 57.20 ± 23.36, indicating moderate patellar tendon symptom burden across the sample.

Table 1. Descriptive statistics of study variables (n = 61)

Variable	n	Mean	SD	Median	Min	Max
Age (years)	61	21.10	1.92	21.0	18	27
VISA-p Score (Total)	61	57.20	23.36	59.0	4	100
VISA-p – JK Group	21	30.95	12.71	31.0	4	49
VISA-p – Non-JK Group	40	70.97	13.83	71.0	50	100
Age – JK Group	21	20.67	1.32	21.0	18	23
Age – Non-JK Group	40	21.32	2.15	21.0	18	27

SD = standard deviation. JK = Jumper's Knee (VISA-p <50).

Prevalence of Jumper's Knee

The prevalence of Jumper's Knee was 34.4% (21/61; 95% CI: 23.0%–47.3%). A further 44.3% of players (27/61) fell into the subclinical category (VISA-p 50–79), and only 21.3% (13/61) were classified as asymptomatic (VISA-p ≥80). Consequently, 78.7% of the sample reported some degree of patellar tendon symptoms (Table 2).

Table 2. Prevalence of Jumper's Knee by VISA-p category (n = 61)

VISA-p Category	Score Range	n	%	Cumulative %	Clinical Status
Jumper's Knee	0–49	21	34.4%	34.4%	Confirmed
Mild to Moderate	50–79	27	44.3%	78.7%	Subclinical / Recovering
Asymptomatic	80–100	13	21.3%	100.0%	Tendon Healthy
Total	0–100	61	100.0%	–	–

95% CI for overall prevalence: 23.0%–47.3% (Wilson score method). Symptomatic (VISA-p <80): 78.7% (48/61).

Age-Group Differences in VISA-p Score and Prevalence

Prevalence and VISA-p scores varied markedly across age groups (Table 3). The 22–23-year group had the highest JK prevalence (60.0%) and the lowest mean VISA-p score (38.9 ± 21.8). Players aged ≥24 years exhibited no cases of Jumper's Knee and the highest mean VISA-p score (73.3 ± 13.4). One-Way ANOVA revealed a statistically significant difference in VISA-p scores among age groups ($F = 4.18$, $df = 3$, $p = 0.010$).

Table 3. VISA-p scores and Jumper's Knee prevalence by age group

Age Group	n	Mean VISA-p	SD	JK Cases	JK Prevalence	Mean Age
18–19 years	10	48.9	19.8	5	50.0%	18.8
20–21 years	34	61.7	22.9	10	29.4%	20.7
22–23 years	10	38.9	21.8	6	60.0% ▲	22.3
≥24 years	7	73.3	13.4	0	0.0% ▼	25.0
Total	61	57.2	23.4	21	34.4%	21.1

One-Way ANOVA: $F = 4.18$, $df = 3$, $p = 0.010$. ▲ = highest prevalence; ▼ = lowest prevalence.

Comparison of VISA-p Scores by Jumper's Knee Status

Players with Jumper's Knee had a significantly lower mean VISA-p score (30.95 ± 12.71) than those without (70.97 ± 13.83). The mean difference was 40.02 points (Table 4). Independent samples t-test confirmed a highly significant between-group difference (t = −11.035, df = 59, p <0.001), validating the discriminative capacity of the VISA-p scale in this population.

Table 4. Independent samples t-test — VISA-p scores by Jumper's Knee status

Group	n	Mean VISA-p	SD	Std. Error	Mean Difference	t	df	p-value
Jumper's Knee	21	30.95	12.71	2.77	–	–	–	–
No Jumper's Knee	40	70.97	13.83	2.19	–	–	–	–
Between Groups	–	Δ = 40.02	–	–	40.02	−11.035	59	<0.001*

** p <0.001, two-tailed independent samples t-test.*

Association Between Hamstring Flexibility and Jumper's Knee

Among participants with positive Sit and Reach results (hamstring tightness), 32.1% had Jumper's Knee; among those with normal flexibility, 36.4% had Jumper's Knee. Chi-square analysis demonstrated no statistically significant association between hamstring tightness and JK status (χ^2 = 0.006, df = 1, p = 0.940). Pearson correlation analysis also showed a negligible, non-significant relationship between Sit and Reach performance and VISA-p score (r = −0.099, p = 0.449) (Table 5).

Table 5. Sit and Reach Test results vs. Jumper's Knee status (Chi-square analysis)

Sit & Reach Result	JK (n)	JK (%)	No JK (n)	No JK (%)	Row Total	Row %
Positive (Tight Hamstrings)	9	32.1%	19	67.9%	28	45.9%
Negative (Normal Flexibility)	12	36.4%	21	63.6%	33	54.1%
Column Total	21	34.4%	40	65.6%	61	100.0%

χ^2 = 0.006, df = 1, p = 0.940; Pearson r = −0.099, p = 0.449. No significant association.

Summary of Correlation Analyses

Table 6. Correlation analysis summary

Variables	Test	Statistic	p-value	Significance	Interpretation
VISA-p vs JK Status	Ind. t-test	t = −11.035	<0.001	Significant ✓	VISA-p strongly discriminates JK
VISA-p vs Age	Spearman ρ	ρ = 0.026	0.840	NS	No linear relationship
VISA-p vs Sit & Reach	Pearson r	r = −0.099	0.449	NS	Negligible correlation
JK vs Sit & Reach	Chi-square	χ^2 = 0.006	0.940	NS	No association
Age Group vs VISA-p	ANOVA	F = 4.18	0.010	Significant ✓	Significant age-group differences

NS = not significant. α = 0.05 (two-tailed). ✓ = statistically significant.

IV. DISCUSSION

The present study investigated the prevalence of Jumper's Knee among volleyball players in Kota, Rajasthan, and examined its associations with age and hamstring flexibility. The headline finding — a point prevalence of 34.4% — is clinically significant and consistent with international data reporting 40–50% prevalence among elite male volleyball players [10] and 14.4–32% in non-elite populations [6]. The somewhat lower prevalence relative to elite-level estimates is plausible given that the present cohort included players across amateur, semi-professional, and collegiate levels with varying training volumes.

The finding that 78.7% of participants had some degree of patellar tendon symptoms (VISA-p <80) is particularly noteworthy. While only 34.4% met the threshold for Jumper's Knee (VISA-p <50), the large proportion with subclinical symptoms suggests that a continuum of tendon pathology exists in this population.

Volleyball players in the subclinical category may be at elevated risk for progression to clinically significant tendinopathy if training load is not carefully managed, underscoring the value of proactive surveillance.

The VISA-p questionnaire effectively differentiated symptomatic from asymptomatic players ($t = -11.035$, $p < 0.001$), corroborating its established validity as a clinical research instrument in patellar tendinopathy [11]. The 40-point mean difference in VISA-p scores between groups reflects the substantial functional impact of the condition on affected athletes, consistent with prior literature [2,6].

Age-group analysis yielded significant differences in VISA-p scores ($F = 4.18$, $p = 0.010$). The highest prevalence was observed in the 22–23-year group (60.0%), a finding that warrants interpretive caution given the small cell size ($n = 10$). Nonetheless, the absence of Jumper's Knee among players aged ≥24 years may reflect several phenomena: survivor bias (severely affected younger athletes ceasing participation), improved load management through experience, superior neuromuscular adaptations, or a natural reduction in training intensity beyond peak competitive years. Prospective longitudinal designs are needed to disentangle these possibilities.

No significant association was identified between hamstring flexibility and Jumper's Knee status ($\chi^2 = 0.006$, $p = 0.940$; $r = -0.099$, $p = 0.449$). This finding aligns with a growing body of evidence suggesting that the pathomechanics of patellar tendinopathy are multifactorial and cannot be attributed to a single kinetic chain variable. Training load and jump volume are currently regarded as the primary modifiable risk factors [5,6], whereas flexibility measures may have limited predictive value in isolation. Future studies incorporating comprehensive biomechanical analyses — including quadriceps and hip muscle strength, ankle dorsiflexion, and landing kinematics — would better characterise the multidimensional risk profile.

Several limitations of the present study should be acknowledged. First, the cross-sectional design precludes causal inference. Second, the sample ($n = 61$) was drawn from a single city, limiting external generalisability. Third, the VISA-p questionnaire, while validated, is self-reported, and objective tendon assessment via ultrasound or MRI was not performed. Fourth, training load data (weekly jump counts, session duration) were not systematically captured. Notwithstanding these limitations, the study provides the first regional prevalence estimate for Jumper's Knee in Indian volleyball players and establishes a baseline for future longitudinal research.

V. CONCLUSION

Jumper's Knee is highly prevalent among volleyball players in Kota, Rajasthan, affecting approximately one in three players and with subclinical patellar tendon symptoms present in nearly four in five. Age-group differences in symptom severity were statistically significant, whereas hamstring flexibility showed no meaningful association with the condition. The VISA-p questionnaire demonstrated robust discriminative validity in this community-level sample.

These findings support the implementation of routine musculoskeletal screening programmes and evidence-based preventive rehabilitation strategies — including progressive tendon loading exercises, jump-volume monitoring, and targeted strength conditioning — in volleyball programmes across similar settings. Future multicentre prospective investigations incorporating objective tendon imaging and training load quantification are recommended to advance understanding of risk factors and preventive interventions for patellar tendinopathy in Indian athletes.

Ethical Approval: Granted by the Institutional Ethics Committee, Career Point University, Kota, Rajasthan.
Informed Consent: Written informed consent was obtained from all participants.
Conflict of Interest: The authors declare no conflict of interest.
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