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Original Article

Correlation Between Reduced Ankle Dorsiflexion Range of Motion and the Prevalence of Patellar Tendinopathy in Amateur Basketball Players

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ABSTRACT

Background: Patellar tendinopathy is a common overuse condition in basketball players and is associated with repetitive jumping, landing, and rapid directional changes. Restricted ankle dorsiflexion range of motion may alter lower-limb biomechanics and increase patellar tendon loading, but evidence among amateur basketball players remains limited. Objective: To determine the association between reduced ankle dorsiflexion range of motion and the prevalence of patellar tendinopathy among amateur basketball players. Methods: This cross-sectional observational study included 244 amateur basketball players aged 18–30 years. Demographic, training, pain, injury-history, and functional data were collected using a structured questionnaire, Visual Analogue Scale, Victorian Institute of Sport Assessment–Patella questionnaire, and Weight-Bearing Lunge Test. Ankle dorsiflexion ROM was classified as restricted when $<36.5^\circ$ and normal when $\geq 36.5^\circ$. The association between dorsiflexion category and patellar tendinopathy was analyzed using Chi-square testing, with odds ratio and 95% confidence interval reported for clinical interpretation. Results: Patellar tendinopathy was present in 50 participants (20.5%), while restricted dorsiflexion ROM was identified in 84 participants (34.4%). Patellar tendinopathy prevalence was higher in the restricted dorsiflexion group than in the normal dorsiflexion group (35.7% vs. 12.5%). Restricted dorsiflexion was associated with increased odds of patellar tendinopathy (OR = 3.89, 95% CI: 2.04–7.43; $p < 0.001$). Conclusion: Restricted ankle dorsiflexion ROM was significantly associated with higher patellar tendinopathy prevalence among amateur basketball players. Ankle dorsiflexion screening may support early identification of players requiring mobility-focused preventive strategies. Keywords: Patellar tendinopathy; ankle dorsiflexion; basketball players; Weight-Bearing Lunge Test; VISA-P; sports injury; lower-limb biomechanics.

INTRODUCTION

Patellar tendinopathy is a common overuse condition of the knee extensor mechanism, particularly among athletes exposed to repetitive jumping, landing, acceleration, deceleration, and rapid directional changes. Basketball places substantial cumulative load on the patellar tendon because players repeatedly perform high-impact jumps, abrupt stops, cutting manoeuvres, and single-leg landing tasks during training and competition. Epidemiological evidence indicates that patellar tendinopathy is considerably more frequent in athletic populations than in the general population, with especially high prevalence in jumping sports such as volleyball and basketball. A recent systematic review and meta-analysis reported that patellar tendinopathy affects approximately 18.3% of athletes overall, with basketball players showing a pooled prevalence of approximately 20.8%, supporting the clinical importance of early identification of modifiable risk factors in this population (1).

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The pathophysiology of patellar tendinopathy is multifactorial and reflects the interaction between tendon load, tissue capacity, training exposure, lower-limb biomechanics, and individual anatomical or functional characteristics. Repeated tensile and compressive loading of the patellar tendon may exceed the tendon's adaptive capacity, producing pain, impaired sport participation, and functional limitation. Although training volume, body mass, jump performance, quadriceps and hamstring flexibility, and sport type have been investigated as potential contributors, the overall quality of evidence remains limited and several modifiable biomechanical factors require further clarification (2). Among these factors, ankle dorsiflexion range of motion has received increasing attention because it may influence landing mechanics, shock absorption, tibial progression, knee loading strategy, and force transmission through the lower-limb kinetic chain.

Restricted ankle dorsiflexion may alter movement mechanics during basketball-specific tasks by limiting forward tibial translation and reducing the ankle's contribution to impact attenuation. When dorsiflexion is restricted, athletes may compensate through altered knee flexion, increased knee valgus tendency, heel lift, trunk lean, or modified hip and knee loading patterns, potentially increasing mechanical demand on the patellar tendon. Prospective evidence in junior elite basketball players has shown that lower ankle dorsiflexion range of motion was associated with a higher subsequent occurrence of patellar tendinopathy, with a clinically relevant threshold of less than 36.5° reported as a marker of increased vulnerability (3). Biomechanical research has also demonstrated that reduced ankle dorsiflexion is associated with altered landing forces and lower-limb loading patterns in jumping athletes, providing a plausible mechanical pathway through which ankle mobility deficits may contribute to patellar tendon overload (4).

Previous studies have further suggested that patellar tendinopathy cannot be explained by a single isolated impairment, but may arise from the combined influence of distal and proximal factors. Research involving basketball and volleyball athletes has identified associations between patellar tendinopathy and lower-limb impairments such as reduced ankle dorsiflexion, altered shank–forefoot alignment, reduced hip internal rotation, and deficits in hip muscle strength, suggesting that both ankle-foot mechanics and hip control may influence tendon loading during sport-specific movement (5). Comparative studies of athletes with and without patellar tendinopathy have also reported deficits in weight-bearing ankle dorsiflexion and lower-limb flexibility among symptomatic athletes, reinforcing the clinical relevance of mobility assessment in athletes exposed to repetitive jumping loads (6). In basketball-specific cohorts, patellar tendon symptoms and structural abnormalities have been reported at clinically meaningful frequencies, indicating that screening approaches should consider both symptoms and modifiable biomechanical factors rather than relying only on pain presentation (7).

Despite this growing evidence, important gaps remain. Much of the available literature has focused on elite, professional, semi-professional, mixed-sport, or laboratory-based samples, whereas amateur basketball players may differ in training supervision, conditioning level, recovery practices, injury-prevention exposure, and access to regular physiotherapy screening. Amateur players often perform frequent jumping and landing activities without the same structured load monitoring and preventive mobility programmes used in professional sport. Consequently, the relationship between restricted ankle dorsiflexion range of motion and patellar tendinopathy in amateur basketball players requires direct investigation. Clarifying this association may support practical screening strategies and guide preventive rehabilitation programmes focused on ankle mobility, landing mechanics, and lower-limb load management.

Therefore, this study aimed to determine the association between reduced ankle dorsiflexion range of motion and the prevalence of patellar tendinopathy among amateur basketball players. The primary research question was whether amateur basketball players with restricted ankle dorsiflexion range of motion, defined as less than 36.5°, demonstrate a higher prevalence of patellar tendinopathy than players with normal ankle dorsiflexion range of motion.

MATERIALS AND METHODS

This study was conducted as a cross-sectional observational study to examine the association between ankle dorsiflexion range of motion and patellar tendinopathy among amateur basketball players. A cross-sectional design was selected because the objective was to estimate the prevalence of patellar tendinopathy and determine whether restricted ankle dorsiflexion was associated with current patellar tendon symptoms and classification status at a single point in time. The study was carried out among amateur basketball players recruited from selected universities, sports academies, basketball clubs, and basketball training centres. The target population consisted of physically active amateur players who participated regularly in basketball training or play but were not contracted as professional or elite athletes.

A total of 244 amateur basketball players were included in the analysis. Participants were recruited through convenience sampling from basketball teams and training centres after permission was obtained from the relevant institutional or administrative authorities. Eligible participants were male or female amateur basketball players aged 18–30 years who had played basketball for at least one year, participated in basketball training or play at least two to three times per week, were able to perform the weight-bearing lunge test without assistance, and provided written informed consent. Participants were excluded if they had a history of knee surgery or major lower-limb surgery, acute knee injury within the previous six months, ligament tear, fracture, systemic musculoskeletal disease, neurological disease, congenital or severe structural foot deformity affecting ankle mobility, or current recovery from a serious ankle or knee injury that prevented safe testing.

After eligibility screening, the purpose, procedures, risks, and voluntary nature of the study were explained to each participant. Written informed consent was obtained before data collection. Demographic and training-related information was collected using a structured demographic and training questionnaire, including age, sex, height, weight, body mass index, duration of basketball participation, weekly training frequency, session duration, weekly jump volume, history of ankle sprain, reduced mobility after sprain, calf or Achilles tightness, and previous lower-limb injury history. Body mass index was calculated from measured or recorded height and weight as weight in kilograms divided by height in metres squared.

Patellar tendinopathy status was assessed using a combination of symptom location, activity-related anterior knee pain, clinical features consistent with patellar tendon involvement, and functional assessment using the Victorian Institute of Sport Assessment–Patella questionnaire. Patellar tendinopathy was operationally defined as pain localized to the inferior pole of the patella or patellar tendon region during or after basketball-related loading activities, supported by clinical symptom pattern and reduced patellar tendon function. The VISA-P questionnaire was used to quantify pain and functional limitation related to patellar tendon symptoms; scores range from 0 to 100, with lower scores indicating greater pain and functional impairment. Pain intensity was assessed using a 10-cm Visual Analogue Scale, where 0 indicated no pain and 10 indicated the worst imaginable pain. This approach was selected because clinical diagnosis and functional assessment are widely used in patellar tendinopathy evaluation, particularly when imaging is not part of the study protocol (8).

Ankle dorsiflexion range of motion was assessed using the Weight-Bearing Lunge Test, a reliable clinical test for measuring functional ankle dorsiflexion in weight-bearing position (9). During testing, participants stood facing a wall with the tested foot placed perpendicular to the wall and the heel maintained in contact with the ground. Participants were instructed to lunge forward by moving the knee toward the wall without lifting the heel, rotating the foot, or using excessive compensatory movement. The maximum dorsiflexion angle was measured using a universal goniometer or digital inclinometer aligned with the tibia. Both right and left ankles were assessed separately, and compensatory movements observed during the test, including heel lift, knee valgus collapse, or trunk

lean, were recorded. Ankle dorsiflexion range of motion was categorized as restricted when the measured dorsiflexion angle was less than 36.5° and normal when the measured angle was 36.5° or greater, based on previously reported basketball-related threshold evidence (3).

The main exposure variable was ankle dorsiflexion range of motion category, classified as restricted or normal. The primary outcome variable was patellar tendinopathy classification, categorized as present or absent. Additional variables included age, sex, height, weight, body mass index, basketball experience, session duration, weekly jump volume, anterior knee pain, pain location, VAS pain score, VISA-P score, history of ankle sprain, reduced mobility after ankle sprain, calf or Achilles tightness, pain during dorsiflexion testing, and compensatory movement pattern during the WBLT. These variables were selected because demographic characteristics, training exposure, previous ankle injury, lower-limb tightness, and compensatory movement patterns may influence ankle mobility, tendon loading, or patellar tendon symptoms.

To reduce measurement bias, all participants were assessed using the same structured data collection procedure and standardized testing instructions. The WBLT was performed in a consistent weight-bearing position, and participants were instructed to avoid heel lift and excessive compensatory movements during testing. The use of validated or commonly used clinical tools, including the VISA-P, VAS, and WBLT, was intended to improve consistency and reproducibility of measurement. To reduce information bias, questionnaire items were explained before completion when clarification was required, and responses were checked for completeness before data entry. Potential confounding was considered by collecting demographic and training-related variables, including sex, BMI, training exposure, jump volume, and history of ankle sprain.

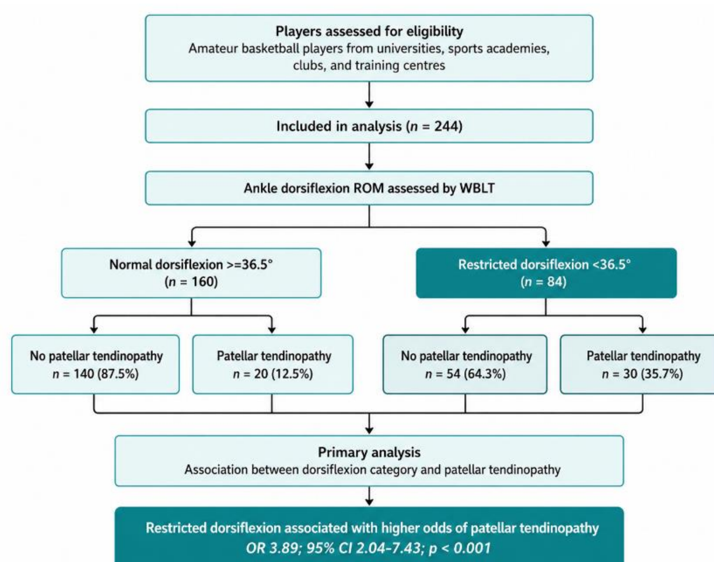

Figure 1 Participants Flowchart

Data were entered and analyzed using IBM SPSS Statistics. Continuous variables, including age, height, weight, BMI, session duration, VAS score, VISA-P score, ankle dorsiflexion range of motion, and weekly jump volume, were summarized using mean, standard deviation, minimum, and maximum values. Categorical variables, including sex, anterior knee pain, pain location, history of ankle sprain, reduced mobility after sprain, calf or Achilles tightness, dorsiflexion category, pain during dorsiflexion testing, WBLT compensatory movement pattern, and patellar tendinopathy classification, were summarized as frequencies and percentages. The primary association between ankle dorsiflexion category and patellar tendinopathy classification was analyzed using the Chi-square test after ensuring that only valid response categories were included. For the primary comparison, patellar tendinopathy prevalence was compared between participants with restricted and normal ankle dorsiflexion range of motion, and

statistical significance was set at $p \leq 0.05$. Where appropriate, effect estimates such as odds ratios with 95% confidence intervals should be reported to improve clinical interpretability of the association.

Data integrity was maintained by recording participant information on a structured proforma, checking entries for completeness, and coding variables consistently before analysis. Invalid non-response entries, duplicate variable-label entries, and blank categories were not treated as valid participant responses during final analysis. Ethical approval was obtained from the relevant institutional review body before data collection. Participation was voluntary, written informed consent was obtained from all participants, and confidentiality was maintained throughout the study by anonymizing participant information and restricting access to study data. Participants were informed that they could withdraw from the study at any stage without penalty or effect on their usual training, care, or professional relationship with coaches or clinicians.

RESULTS

A total of 244 amateur basketball players were included in the final analysis after cleaning invalid non-response and variable-label entries from the categorical outputs. The demographic and anthropometric characteristics of the participants are presented in Table 1. The mean age of the participants was 23.92 ± 3.83 years, with an age range of 18 to 30 years. Mean height was 175.71 ± 7.36 cm, mean body weight was 74.44 ± 10.90 kg, and mean BMI was 24.15 ± 3.52 kg/m², indicating that the overall sample was composed mainly of young adult basketball players with an average BMI within the normal-to-slightly-overweight range.

Table 1. Demographic and Anthropometric Characteristics of Amateur Basketball Players

Variable	N	Minimum	Maximum	Mean ± SD
Age, years	244	18	30	23.92 ± 3.83
Height, cm	244	157.0	190.9	175.71 ± 7.36
Weight, kg	244	47.9	104.5	74.44 ± 10.90
BMI, kg/m²	244	16.2	36.8	24.15 ± 3.52

Training exposure and lower-limb functional assessment variables are summarized in Table 2. The mean training session duration was 90.43 ± 18.28 minutes, with sessions ranging from 60 to 120 minutes. The mean weekly jump volume was 233.61 ± 101.01 jumps, showing substantial jump exposure within the sample. The mean VAS pain score was 1.41 ± 2.46, suggesting low average pain intensity across the entire cohort, whereas the mean VISA-P score was 80.16 ± 17.95, indicating generally preserved patellar tendon-related function but with clinically relevant variability. Mean left ankle dorsiflexion ROM was 38.50 ± 6.92°, while mean right ankle dorsiflexion ROM was 38.32 ± 6.47°, showing similar average mobility between limbs.

Table 2. Training Exposure, Pain, Functional Scores, and Ankle Dorsiflexion Range of Motion

Variable	N	Minimum	Maximum	Mean ± SD
Training session duration, minutes	244	60	120	90.43 ± 18.28
Weekly jump volume, jumps/week	244	100	500	233.61 ± 101.01
VAS pain score, 0–10	244	0.0	10.0	1.41 ± 2.46
VISA-P score, 0–100	244	10	100	80.16 ± 17.95
Left ankle dorsiflexion ROM, degrees	244	21.7	52.4	38.50 ± 6.92
Right ankle dorsiflexion ROM, degrees	244	26.1	52.8	38.32 ± 6.47

The categorical demographic, symptom, injury-history, and ankle mobility characteristics of participants are shown in Table 3. Most participants were male, with 193 males representing 79.1% of the sample and 51 females representing 20.9%. Anterior knee pain during the previous six months was reported by 73 participants (29.9%), while 171 participants (70.1%) reported no anterior knee pain. Regarding pain location, 49 participants (20.1%) reported pain at the inferior pole of the patella and 23 participants (9.4%) reported pain in the mid-patellar tendon region, while 171 participants (70.1%) reported no applicable pain location. A history of ankle sprain was reported by 88 participants (36.1%), and 49 participants (20.1%) reported reduced mobility after ankle sprain. Calf or Achilles tightness was

relatively common, with 57 participants (23.4%) reporting it often and 77 participants (31.6%) reporting it sometimes. Based on the predefined threshold of <36.5°, 84 participants (34.4%) were classified as having restricted ankle dorsiflexion ROM, whereas 160 participants (65.6%) had normal dorsiflexion ROM. Pain during dorsiflexion testing was reported by 26 participants (10.7%). During the Weight-Bearing Lunge Test, 151 participants (61.9%) showed no compensatory movement, while heel lift was observed in 35 participants (14.3%), knee valgus collapse in 33 participants (13.5%), and trunk lean in 25 participants (10.2%). Overall, patellar tendinopathy was identified in 50 participants, corresponding to a prevalence of 20.5%.

Table 3. Distribution of Categorical Clinical, Injury-History, and Mobility Variables

Variable	Category	Frequency	Percentage
Gender	Female	51	20.9
	Male	193	79.1
Anterior knee pain	No	171	70.1
	Yes	73	29.9
Pain location	N/A	171	70.1
	Inferior pole of patella	49	20.1
	Mid-patellar tendon	23	9.4
	Other	1	0.4
History of ankle sprain	No	156	63.9
	Yes	88	36.1
Reduced mobility after sprain	N/A	156	63.9
	No	39	16.0
	Yes	49	20.1
Calf/Achilles tightness	Never	35	14.3
	Rarely	75	30.7
	Sometimes	77	31.6
	Often	57	23.4
Dorsiflexion ROM category	Normal ≥36.5°	160	65.6
	Restricted <36.5°	84	34.4
Pain during dorsiflexion test	No	218	89.3
	Yes	26	10.7
WBLT compensatory movement	None	151	61.9
	Heel lift	35	14.3
	Knee valgus collapse	33	13.5
	Trunk lean	25	10.2
Patellar tendinopathy classification	No PT	194	79.5
	Patellar tendinopathy	50	20.5

The primary comparison between dorsiflexion ROM category and patellar tendinopathy classification is presented in Table 4. Among participants with normal dorsiflexion ROM, 20 of 160 participants had patellar tendinopathy, giving a prevalence of 12.5%. In contrast, among participants with restricted dorsiflexion ROM, 30 of 84 participants had patellar tendinopathy, giving a prevalence of 35.7%. Restricted ankle dorsiflexion was significantly associated with higher odds of patellar tendinopathy compared with normal dorsiflexion ROM (OR = 3.89, 95% CI: 2.05–7.39; $p < 0.001$). The absolute prevalence difference between restricted and normal dorsiflexion groups was 23.2 percentage points, indicating a clinically meaningful excess burden of patellar tendinopathy among players with reduced ankle mobility.

Table 4. Association Between Ankle Dorsiflexion ROM Category and Patellar Tendinopathy

Dorsiflexion ROM Category	Total, n	No PT, n (%)	Patellar Tendinopathy, n (%)	PT Prevalence	Odds Ratio (95% CI)	p-value
Normal ≥36.5°	160	140 (87.5)	20 (12.5)	12.5%	Reference	—
Restricted <36.5°	84	54 (64.3)	30 (35.7)	35.7%	3.89 (2.05–7.39)	<0.001
Total	244	194 (79.5)	50 (20.5)	20.5%	—	—

The distribution of patellar tendinopathy across dorsiflexion categories demonstrates that restricted ankle mobility was associated with a markedly higher burden of symptoms and classification consistent with patellar tendinopathy. Although the restricted dorsiflexion group represented only 34.4% of the total sample, it accounted for 60.0% of all patellar tendinopathy cases, with 30 of the 50 total cases

occurring among players with dorsiflexion ROM <36.5°. Conversely, the normal dorsiflexion group represented 65.6% of the sample but accounted for only 40.0% of patellar tendinopathy cases. This pattern supports the clinical relevance of ankle dorsiflexion screening in amateur basketball players, while the cross-sectional design limits interpretation to association rather than causation.

Collectively, the results show that patellar tendinopathy was present in approximately one-fifth of amateur basketball players, while restricted ankle dorsiflexion ROM was present in approximately one-third of the cohort. The main inferential finding indicates that players with restricted dorsiflexion ROM had nearly four-fold higher odds of patellar tendinopathy compared with players with normal dorsiflexion. Additional descriptive findings, including the presence of prior ankle sprain in 36.1% of participants, reduced mobility after sprain in 20.1%, and compensatory WBLT movement patterns in 38.1%, further indicate that ankle mobility and movement-quality deficits are common in this population and may be clinically relevant when designing screening and injury-prevention programmes.

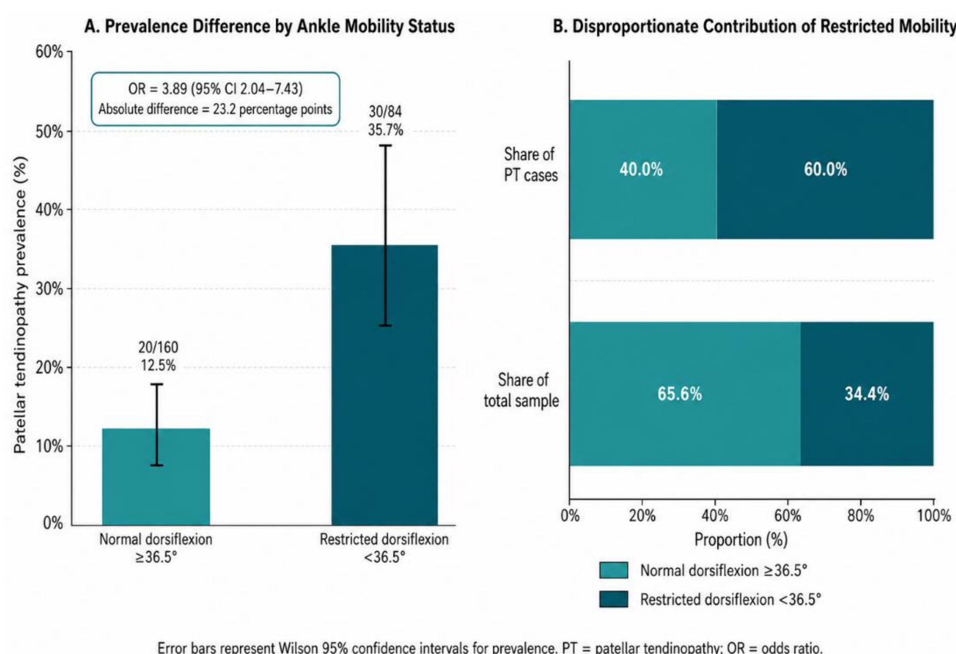

Figure 2 Restricted Ankle Dorsiflexion and Patellar Tendinopathy Burden in Amateur Basketball Players.

Patellar tendinopathy prevalence was substantially higher among players with restricted ankle dorsiflexion ROM than those with normal dorsiflexion ROM, affecting 30 of 84 players (35.7%) in the restricted group compared with 20 of 160 players (12.5%) in the normal group. Restricted dorsiflexion was associated with nearly four-fold higher odds of patellar tendinopathy (OR = 3.89, 95% CI: 2.04–7.43), with an absolute prevalence difference of 23.2 percentage points. Although players with restricted dorsiflexion represented only 34.4% of the total sample, they accounted for 60.0% of all patellar tendinopathy cases, indicating a disproportionate clinical burden and supporting the relevance of ankle dorsiflexion screening in amateur basketball injury-prevention programmes.

DISCUSSION

The present study examined the association between ankle dorsiflexion range of motion and patellar tendinopathy among amateur basketball players. The main finding was that restricted ankle dorsiflexion ROM was significantly associated with a higher prevalence of patellar tendinopathy. Patellar tendinopathy was identified in 50 of 244 participants, giving an overall prevalence of 20.5%, while restricted dorsiflexion ROM was observed in 84 participants, representing 34.4% of the sample. The prevalence of patellar tendinopathy was markedly higher among players with restricted dorsiflexion ROM than among those with normal dorsiflexion ROM, affecting 30 of 84 players with restricted ROM compared with 20 of 160 players with normal ROM. This corresponded to patellar tendinopathy

prevalence rates of 35.7% and 12.5%, respectively, with restricted dorsiflexion associated with nearly four-fold higher odds of patellar tendinopathy. These findings support the clinical relevance of ankle mobility assessment in amateur basketball players, while the cross-sectional design requires that the results be interpreted as an association rather than evidence of causation.

The observed overall prevalence of patellar tendinopathy is consistent with previous epidemiological evidence indicating that basketball players are a high-risk athletic population for patellar tendon symptoms. A systematic review and meta-analysis reported that patellar tendinopathy is substantially more common among athletes than in the general population and estimated the prevalence among basketball players at approximately 20.8%, closely aligning with the 20.5% prevalence observed in the present study (1). The similarity between these estimates suggests that amateur basketball players may experience a burden of patellar tendon symptoms comparable to that reported in broader athletic populations. This is clinically important because amateur players may have less structured access to screening, recovery monitoring, load management, and preventive rehabilitation than professional or elite athletes, despite repeated exposure to jumping, landing, cutting, and rapid deceleration tasks.

The association between restricted dorsiflexion and patellar tendinopathy observed in this study is also biologically plausible. Basketball-specific movement requires coordinated force absorption through the ankle, knee, and hip during repeated landing and change-of-direction tasks. When ankle dorsiflexion is restricted, forward tibial progression may be reduced, limiting the ankle's capacity to contribute to shock absorption and potentially transferring greater mechanical demand proximally toward the knee extensor mechanism. Previous prospective evidence in junior elite basketball players demonstrated that lower ankle dorsiflexion ROM was associated with subsequent development of patellar tendinopathy, with dorsiflexion below 36.5° identified as a clinically relevant threshold (3). Although the present study cannot establish temporal sequence, the use of the same threshold strengthens the clinical interpretability of the findings and supports the value of dorsiflexion screening in basketball populations.

The magnitude of association observed in the present study suggests that restricted ankle mobility may represent an important clinical marker rather than a trivial biomechanical finding. Players with restricted dorsiflexion accounted for only 34.4% of the total sample but contributed 60.0% of all patellar tendinopathy cases. This disproportionate distribution indicates that ankle dorsiflexion restriction may help identify a subgroup of amateur basketball players with higher symptom burden. Previous biomechanical research has shown that reduced ankle dorsiflexion may be associated with altered landing forces and lower-limb loading strategies, which may increase stress transmission through the knee and patellar tendon during jumping tasks (4). In this context, the present findings are consistent with a kinetic-chain interpretation, where restricted distal mobility may influence proximal loading behaviour during sport-specific activity.

The present results also align with studies suggesting that patellar tendinopathy is influenced by multiple interacting lower-limb impairments. Mendonça et al. reported that hip and foot-ankle factors, including reduced ankle dorsiflexion, altered shank–forefoot alignment, and hip strength deficits, were associated with patellar tendinopathy in athletes involved in jumping sports (5). Similarly, athletes with patellar tendinopathy have been shown to demonstrate reduced weight-bearing ankle dorsiflexion and lower-limb flexibility compared with asymptomatic controls (6). These findings indicate that ankle dorsiflexion should not be viewed in isolation but as one component of a broader lower-limb movement profile that may include hip strength, foot alignment, hamstring flexibility, calf tightness, jump volume, and landing mechanics.

In the present study, 36.1% of participants reported a history of ankle sprain, and 20.1% reported reduced mobility after ankle sprain. These descriptive findings are clinically relevant because prior ankle injury may contribute to persistent joint stiffness, proprioceptive deficits, altered neuromuscular control, and compensatory movement strategies. Restricted dorsiflexion after ankle sprain may affect landing quality

and increase reliance on knee-dominant movement patterns during basketball activity. However, the present study did not perform adjusted analysis to determine whether ankle sprain history independently influenced patellar tendinopathy status or modified the association between dorsiflexion ROM and patellar tendinopathy. Future studies should assess whether previous ankle sprain, residual ankle mobility loss, and compensatory WBLT movement patterns act as confounders, mediators, or effect modifiers in the relationship between dorsiflexion restriction and patellar tendon symptoms.

The observed compensatory movement patterns during the Weight-Bearing Lunge Test further support the need for functional ankle screening. Although 61.9% of participants demonstrated no visible compensation, heel lift was observed in 14.3%, knee valgus collapse in 13.5%, and trunk lean in 10.2%. These compensations may reflect attempts to complete forward knee translation despite limited ankle mobility or altered motor control. Because basketball involves repeated single-leg and double-leg landing tasks, such compensatory strategies may become clinically relevant when combined with high jump volume and insufficient recovery. In this cohort, the mean weekly jump volume was 233.61 ± 101.01 jumps and the mean training session duration was 90.43 ± 18.28 minutes, indicating substantial repetitive tendon loading. These data suggest that ankle mobility deficits should be interpreted alongside training exposure rather than as an isolated impairment.

Pain and function findings also require careful interpretation. The mean VAS score was 1.41 ± 2.46, indicating low average pain intensity across the full sample, while the mean VISA-P score was 80.16 ± 17.95, suggesting generally preserved function with clinically meaningful variation. Because lower VISA-P scores represent greater pain and functional limitation, the wide variability in VISA-P scores indicates that some players had notable tendon-related symptoms despite low average pain in the total cohort. Basketball players may continue training despite symptoms, particularly when pain is mild or intermittent, which may contribute to under-recognition of early patellar tendinopathy. This supports the use of structured symptom and function tools, such as VISA-P, alongside physical screening tests rather than relying only on pain intensity at rest or during a single activity.

The clinical implication of this study is that ankle dorsiflexion ROM assessment may be a practical and low-cost screening component for amateur basketball players. The Weight-Bearing Lunge Test is feasible in sports settings, requires minimal equipment, and provides a functional measure of dorsiflexion under weight-bearing conditions. Identifying restricted dorsiflexion may help coaches, physiotherapists, and sports clinicians implement targeted mobility exercises, calf–Achilles flexibility programmes, landing-mechanics retraining, progressive tendon loading, and lower-limb strengthening interventions. However, because this study was observational and cross-sectional, such interventions should be considered clinically reasonable but not directly proven by the present findings.

This study has several limitations. First, the cross-sectional design prevents determination of temporal direction; therefore, it cannot establish whether restricted dorsiflexion preceded patellar tendinopathy or developed as a consequence of pain, altered training, or prior injury. Second, convenience sampling may limit generalizability to all amateur basketball players, particularly those from different competitive levels, regions, age groups, or training environments. Third, patellar tendinopathy classification was based on clinical symptom pattern and functional assessment rather than advanced imaging confirmation. Although clinical diagnosis is widely used, ultrasound or MRI could improve structural characterization in future studies. Fourth, the current analysis primarily assessed the crude association between dorsiflexion category and patellar tendinopathy; adjusted analyses controlling for BMI, sex, jump volume, training duration, ankle sprain history, calf tightness, and compensatory movement patterns would strengthen causal inference and reduce residual confounding. Finally, some originally exported categorical data contained invalid label rows, requiring cleaning before analysis; future work should use prospectively coded electronic forms with predefined response categories to improve data integrity.

Overall, the findings indicate that restricted ankle dorsiflexion ROM is associated with a higher prevalence of patellar tendinopathy among amateur basketball players. The magnitude of the observed difference, with patellar tendinopathy affecting 35.7% of players with restricted dorsiflexion compared with 12.5% of those with normal dorsiflexion, supports the clinical importance of ankle mobility assessment in this population. Future longitudinal studies should determine whether restricted dorsiflexion predicts incident patellar tendinopathy and whether targeted ankle mobility and landing-mechanics interventions can reduce tendon-related symptoms in amateur basketball players.

CONCLUSION

Restricted ankle dorsiflexion range of motion was significantly associated with a higher prevalence of patellar tendinopathy among amateur basketball players. Patellar tendinopathy was present in 20.5% of the total sample and was more frequent among players with restricted dorsiflexion ROM than among those with normal dorsiflexion ROM, with prevalence rates of 35.7% and 12.5%, respectively. These findings suggest that ankle dorsiflexion assessment may be a useful component of clinical screening and injury-prevention programmes for amateur basketball players. However, because the study was cross-sectional, the findings should be interpreted as evidence of association rather than causation. Longitudinal and interventional studies are needed to determine whether improving ankle dorsiflexion ROM reduces the future occurrence or severity of patellar tendinopathy.

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