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Prevalence of Ankle Injuries and its Associated Risk Factors Among Recreational Badminton Players in PESHAWAR: A Cross Sectional Study

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Abstract

Ankle injuries are among the most common musculoskeletal issues in badminton players due to quick directional changes and high lower-limb demand. Despite badminton's popularity in Pakistan, limited research has examined ankle injury prevalence and associated risk factors among recreational players. To determine the prevalence of ankle injuries and identify its associated risk factors among recreational badminton players in Peshawar. A cross-sectional study was conducted among 387 recreational badminton players from three academies in Peshawar. Data was collected using on the Modified Nordic Musculoskeletal Questionnaire (MNMQ), including items on demographics, Prevalence, training characteristics, warm-up practices, previous injuries, footwear, stretching habits, and strength/balance training. The prevalence of ankle injuries was assessed, and chi-square tests were applied to evaluate associations between injuries and potential risk factors. The prevalence of ankle injuries was 45.2%. Significant associations were found between ankle injuries and dominant leg ($p = .000$), playing experience ($p = .000$), warm-up practices ($p = .000$), stretching/ankle mobility exercises ($p = .000$), previous 12-month injury history ($p = .000$), ankle support/taping ($p = .000$), and regular strength/balance training ($p = .000$). No significant association was observed with gender ($p = .260$), footwear ($p = .318$), or fatigue ($p = .148$). Ankle injuries are highly prevalent among recreational badminton players in Peshawar. Insufficient warm-up routines, lack of mobility training, poor neuromuscular conditioning, and previous injuries significantly increased risk. Preventive strategies emphasizing proper warm-up, stretching, and balance/strength training may reduce injury incidence.

Keywords: Ankle Injuries, Badminton, Recreational Athletes, Risk, Sports Epidemiology

Introduction

Badminton is a fast-paced racket sport combining physical skill and strategy. Originating in China and formalized in England, it is now a popular Olympic sport with over 200 million supporters worldwide (1). Badminton originated from ancient shuttlecock games played in China and India, focusing on skill and coordination. The modern rules were formalized in 19th-century England. Today, it is a national sport in several Asian countries and is considered the fastest racket sport,

with shuttlecock speeds reaching up to 565 km/h (2). Badminton is a game full of various abilities and complex movement skills. It requires a unique combination of agility, speed, power, and precision, distinguishing it from other racket sports like tennis or squash (3). Badminton is a racket sport for two or four people, with a temporal structure characterized by actions of short duration and high intensity. This sport has five events: men's and women's singles, men's and women's doubles, and mixed doubles, each requiring specific preparation in terms of technique, control and physical fitness (4). The player must perform a variety of moves such as sprinting, stopping suddenly and immediately moving again, jumping, reaching, turning quickly and making wide steps without ever losing balance (5). Recreation refers to activities done for enjoyment, pleasure, and relaxation. These may be active, such as sports and exercise, or passive, such as reading and arts, and they support physical, mental, and social health. Recreational play helps reduce stress and promotes social interaction without competitive pressure; however, improper technique and lack of control can still lead to injury. (6). Sports such as basketball, volleyball, and badminton require stamina, jumping, running, and good body balance. Badminton, in particular, is an intense racket sport involving rapid jumps, lunges, and directional changes that demand high coordination and power. In competitive play, athletes may perform over 100 shots per match at speeds exceeding 300 km/h, making the sport highly demanding. (7). In badminton, as a high-intensity and fast sport, the transient and explosive nature of its movements makes athletes susceptible to a variety of sports injuries during the game, especially those directly related to footwork movements. Previous studies have shown that ankle sprains and muscle strains are the most common types of injuries in badminton. Preventive measures, such as proper footwear and strength training, are essential to ease these risks (8). Badminton injuries are around 1–5% of all sports injuries. It ranked six after soccer, basketball, volleyball, long-distance running and cycling (9). Existing studies have demonstrated that the risk of injury in badminton to be 0.85 injuries per year (10). An ankle injury refers to any damage or trauma affecting the structures of the ankle joint, including the bones, ligaments, tendons, muscles, or cartilage. It commonly occurs due to twisting, rolling, or impact forces and can vary in severity from mild strains to severe fractures or ligament tears (11). The ankle joint, being the first joint to make contact with the ground, plays a major role in absorbing the impact of landings, The prevalent pattern of single leg landings in badminton matches contributes significantly to the high frequency of ankle injuries, especially ankle sprains (12). Jump smash in badminton is an important part of a player's aggressive strategy and accounts for 53.9% of scoring methods. The majority of landings after a jump smash are on a single foot, with the contra lateral foot touching the ground (12). Lateral ankle sprains are the most common lower limb musculoskeletal injury and re-injury experienced by individuals who participate in sports and recreational physical activities (13) (14). Non-contact trauma occurs frequently in badminton playing (35%) and a higher injury rate was found among athletes competing in badminton tournaments at the London Olympic Games in 2012 (11%) (15). Male badminton players were found to be more frequently injured than females ,In Denmark, over a one-year period, among badminton players treated at a casualty ward**,** 58% were male (mean age 31) and 42% were female (mean age 25), indicating a higher injury occurrence among men**,** Danish hospital-based study: Confirmed a larger share of injuries occurred in male players (58%) versus female players (42%) (16). In Asia (india), and Europe, participation in the sport and interest among spectators have steadily increased over the past few decades. Both men's and women's singles Badminton World Federation (BWF) top rankings have been held by Indian players, and at the moment India holds the most positions in the top thirty men's singles players of any other nation (17). During the London Summer Olympic Games 2012, about 11% and 7% of the athletes were reported as being injured and experiencing discomfort/illness, respectively (18). Lack of awareness relating to proper playing techniques and warm-up activities makes recreational players more prone to injuries. It has been estimated that badminton injuries account for 1–5% of all sports injuries.

Additionally, recreational players continue to play badminton despite minor injuries by ignoring them, leading to worsening and even complications (19). While most injury-related research in badminton has focused on professional athletes, recreational players often lack access to coaching, physiotherapy guidance, or injury prevention programs. This makes them more susceptible to injuries due to poor warm-up routines, lack of training, improper footwear, Playing Surface, over training and identifying modifiable risk factors in this population will provide a foundation for targeted injury prevention strategies, promote safe play, and reduce the socioeconomic burden of sports injuries in the local setting of Peshawar.

Materials and Methods

Study Design:

The study design was cross-sectional survey which determines the Prevalence of Ankle Injuries and its Associated Risk Factors among Recreational Badminton Players in Peshawar: A Cross-Sectional Study.

Study Setting:

This study was conducted in the following sports complex Peshawar.
Qayyum Sports Complex, Hayatabad Sports Complex, Islamia College Peshawar
The study was conducted and completed in approximately six months after the approval, starting from July 2025 till December 2025.

Study Population:

The study population was both male and female (Recreational badminton players) who were registered with the above- mentioned sports complex Peshawar.

Material & Method:

The cross-sectional survey was used to determine the Prevalence of Ankle Injuries and its Associated Risk Factors among Recreational Badminton Players in Peshawar: A Cross-Sectional Study from July 2025 to December 2025.

Sample Size:

The sample size was 387 participants with confidence interval at 95% and keeping the hypothesized 40% proportion of outcome factor in population (p). The sample size was calculated using Open Epi Sample size calculator.

Sample Selection:

The study's inclusion criteria stated that all the registered Recreational players with sports complexes in Peshawar, Both Male and female recreational badmenton players, Age group between 18 - 45 years, Active members actively playing for at least the past 12 months and playing once per week. The following exclusion criteria were used to exclude those: Who Professional or elite-level badminton players (national/international competitors), History of systemic musculoskeletal disorders (rheumatoid arthritis, osteoarthritis), Neurological Disorder, Recent upper and lower limb surgery (within the last 6 months).

Data Collection Procedure:

Following approval from the graduation committee meeting and Departmental Research Board (DRB), further permission from the MD/HOD of Dept. of Rehabilitation Sciences, School of Health Sciences (SHS), Peshawar, was taken for the commencement of data collection. Before data collection permission were taken from sports complexes authorities through official permission letters in order to conduct the study. All the willing participants were briefed about the

purpose and procedure of this study and then an informed consent was taken from them. The agreed participants were screened through inclusion and exclusion criteria.
Data was collected using the following data collection tools;

- A reliable and validated questionnaire was used to collect data modified Nordic Questionnaire (20), (21).

Data Analysis

Data was analyzed using the Statistical Package for Social Sciences (SPSS) version 23. For continuous variables such as age, descriptive statistics including mean and standard deviation were calculated. For categorical variables such as gender, playing frequency, dominant leg, and duration per session frequencies and percentages will be reported. To determine the association between ankle injuries and selected risk factors (e.g., previous injury, use of ankle support, court surface, playing frequency), the Chi-square test was applied. Cross-tabulation was used to display frequency distributions and percentages for these variables. The data was present via tables.

Ethical Considerations

Obtaining ethical approval is crucial for all research involving human subjects. Following the approval of the research proposal, an authorization letter will be issued by the Head of the Department of Rehabilitation Sciences at SHS, Peshawar, allowing the study to proceed. Ethical clearance was secured from the DRB at SHS, Peshawar. Prior to data collection, authorization was sought from the relevant sports complexes to carry out the study. Informed consent was obtained from each participant in the study, with a guarantee of strict confidentiality for their data.

Results and Analysis

Demographic Information:

A descriptive analysis was conducted to determine the age distribution and gender composition of the participants. Among the total sample of 387 badminton players (n = 387), the mean age was 24.16 ± 5.80 years. Regarding gender distribution, participants were recruited from different academies, comprising 354 (91.5%) male and 33 (8.5%) female players (Table 1).

Table 1 : Descriptive analysis of Age and gender of the participants in years

Variable	N	Minimum	Maximum	Mean	S.D
Age in Years	387	18	45	24.16	5.80
Variable	*f*			%	
Male	354			91.1	
Female	33			8.9	
Total	387			100.0	

A descriptive analysis of badminton players from different academies was conducted to determine their dominant leg and playing experience. Among the 387 participants, 74.2% were right-leg dominant and 25.8% were left-leg dominant. Regarding playing experience, 41 (10.6%) had weekly experience, 104 (26.9%) had monthly experience, and 242 (62.5%) had yearly experience (Table 2).

Table 2: descriptive analysis of dominant leg & experience of recreational badminton players.

Dominant Leg of the participant	*f*	%
Right	287	74.2
Left	100	25.8
Total	387	100
Experience of the participant	*f*	%
Week	41	10.6
Month	104	26.9%
Year	242	62.5%
Total	387	100%

A descriptive analysis was conducted to determine the average duration and weekly frequency of badminton sessions among the 387 participants. Regarding session duration, 8 (2.1%) trained for less than 30 minutes, 193 (49.9%) for 30–60 minutes, and 186 (48.1%) for more than 60 minutes. In terms of weekly frequency, 7 (1.8%) had training 1–2 days, 138 (35.7%) had training 3–4 days, and 242 (62.5%) had training more than 5 days per week.

Table 3: Descriptive analysis of average duration per session & playing frequency per week.

Duration per session	*f*	%
<30 minute	8	2.1
30-60 minute	193	49.9
>60 minute	186	48.1
Frequency per week	*f*	%
1-2 days	7	1.8
3-4 days	138	35.7
more than 5 days	242	62.5
Total	387	100.0

The descriptive analysis of ankle injuries of the participants was carried out to find the frequency and percentage of the participants. From a total of 387 participants, 175 (45.2%) Recreational badminton players have ankle injuries and 212 (54.8%) Recreational badminton players have no ankle injuries.

Table 04: Prevalence of ankle injuries.

Prevalence of Ankle Injury	***f***	**%**
Have Ankle Injury (> 50%)	175	45.2
Have no Ankle Injury (< 50%)	212	54.8
Total	387	100

The descriptive analysis of players of the participants was carried out to find the warm-up practices before playing from a total of 387 participants (73.4%), which is positive. Nevertheless, the 26.6% were respected selectively. (Table 8) The descriptive analysis of players of the participants was carried out to find the stretching or ankle mobility exercise from a total of 387 participants 281(71.6%) were selected positive and 106(27.4.%) which is negative selected respectively The descriptive analysis of Players of the participants was carried out to find the uses of proper badminton shoes from a total of 387 participants 343(88.6%) were selected positive and 44(11.4%)

which is negative selected respectively. The descriptive analysis of players of the participants was carried out to find the previous 12- month ankle injury incidence From a total of 387 participants 99(25.6%) were selected positive and 288(74.4%) which is negative selected respectively. The descriptive analysis of players of the participants was carried out to find the use of ankle support or taping during play from a total of 387 participants 70(18.1%) were selected positive and 317(81.9%) which is negative selected respectively. The descriptive analysis of players of the participants was carried out to find the fatigue at end of session. From a total of 387 participants 294(76.0%) were selected positive and 93(24.0%) which is negative selected respectively. The descriptive analysis of players of the participants was carried out to find the regular strength or balance training from a total of 387 participants 226(58.4%) were selected positive and 161(41.6%) which is negative selected respectively (table 9)

Table 5: Descriptive analysis of risk factors of ankle injuries

Associated Risk Factors		***F***	**%**
Warm-up before playing	Yes	284	73.4
	No	103	26.6
Ankle mobility exercise	Yes	281	72.6
	No	106	27.4
Proper badminton shoes	Yes	343	88.6
	No	44	11.4
12 month ankle injury	Yes	99	25.6
	No	288	74.4
Ankle support during play	Yes	70	18.1
	No	317	81.9
Fatigue at the end of session	Yes	294	76.0
	No	93	24.0
Regular balance training	Yes	266	58.4
	No	161	41.6
	Total	387	100

Chi-square test was applied to examine the relationship between ankle injuries and badminton players Out of 284 participants, majority of the right leg players, 287. have Ankle injuries and left leg players 100. The test revealed that there was a statistical significant association observed between ankle injuries and undergraduate PT students ($p<0.05$) (Table 12).

Table 6: Cross tabulation between Dominant legs of the players.

Dominant leg	Ankle injury		Total	P Value
	>50% Have Ankle injury	**<50% Have No ankle injury**		
Right	145	142	287	.000
Left	30	70	100	
Total	175	212	387	

A statistically significant association was found between playing experience and ankle injury ($p = .000$). Players with monthly playing experience showed the highest proportion of ankle injuries (71 out of 104; 68.3%)**,** whereas those who played weekly had the lowest proportion of injuries (14.6%). This indicates that players with moderate experience may be at higher risk, possibly due to increasing exposure without complete skill adaptation or strength developmentA statistically

significant association was observed (p = .000). Players who always performed warm-ups had a much lower injury rate (34.28%) compared to those who did not warm up (65.71**%**). This suggests that warm-up routines are strongly protective against ankle injury**.** The association was statistically significant (p = .000). Players who performed stretching/ankle mobility exercises had fewer injuries (26.85**%**) than those who did not (73.14**%**), suggesting mobility exercises substantially reduce injury risk. The association was not statistically significant (p = .318). Although players wearing proper shoes had a slightly lower injury prevalence (44.3% vs. 52.3%), the difference suggests that footwear alone may not be a strong independent protective factor in this population. The association was highly significant (p = .000). Players with a previous ankle injury had a much higher recurrence rate (79.8%) compared to those without prior injury (33.3%). Thus, previous injury is a major risk factor for future ankle injury**.** A statistically significant relationship was identified (p = .000). Players using ankle support/taping reported higher injury rates (77.1%)**,** likely because those already at higher risk or with past injuries tend to use external support. This indicates support is commonly used as a management or prevention tool among previously injured players**.** The association was not statistically significant (p = .148)**.** Although injury prevalence was slightly higher in fatigued players (47.3%), the relationship was not strong, suggesting fatigue may not be a consistent predictor of ankle injury**.** A statistically significant relationship was found (p = .000). Players performing regular strength/balance training showed a far lower injury prevalence (31.0%) compared to those who did not (70.28**%**). This confirms that neuromuscular strengthening and balance exercises substantially reduce ankle injury risk (Table 14)

Table 7: Cross tabulation of risk factors of ankle injury.

Associated Risk Factors		Ankle Injuries>50%	No Ankle Injuries <50%	Total	P Value
Do you always warm up before playing	**Yes**	60	192	284	.000
	No	115	20	103	
	Total	175	212	387	
Do you perform stretching or ankle mobility exercise before play.	**Yes**	47	194	281	.000
	No	128	18	106	
	Total	175	212	387	
Do you wear proper badminton shoes while playing	**Yes**	152	191	343	.318
	No	23	21	44	
	Total	175	212	387	
Have you had an ankle injuries prior in past 12 month.	**Yes**	79	20	99	.000
	No	96	192	288	
	Total	175	212	387	
Do you use ankle Support or taping during play	**Yes**	54	16	70	.000
	No	121	196	317	
	Total	175	212	387	
Do you feel fatigue at the end of the playing session	**Yes**	139	155	294	.148
	No	36	57	93	
	Total	175	212	387	
Do you Perform regular strength or balance training	**Yes**	52	156	226	.000
	No	123	56	161	
	Total	175	212	387	

Discussion

This study examined the prevalence of ankle injuries and related risk factors among 387 recreational badminton players in Peshawar, most of them were young adult males with regular and frequent exposure to the sport. The majority trained for 30–60 minutes per session and played more than five days per week, indicating a high cumulative physical load. Nearly half of the participants reported ankle-related problems, and one-quarter sustained an ankle injury within the past year, underscoring a substantial injury burden among recreational players. Although most participants reported adopting preventive practices such as warm-up routines, stretching, and appropriate footwear, ankle injuries remained common. While fatigue and footwear use were not independently associated with injury risk, a large proportion of players reported post-training fatigue, suggesting possible shortcomings in recovery or training management. Notably, the low use of ankle support highlights limited reliance on external preventive measures among recreational athletes. Statistical analysis identified several meaningful injury determinants. Leg dominance was significantly associated with injury, with right-leg–dominant players showing higher injury prevalence, likely due to repeated loading during lunges and directional movements inherent to badminton. Playing experience also influenced injury risk; players with moderate (monthly) experience demonstrated higher injury rates than those training weekly, suggesting that partial skill development and conditioning may increase vulnerability.

Preventive strategies showed strong protective effects. Regular warm-up, stretching, ankle-mobility exercises, and strength or balance training were all significantly associated with lower injury prevalence, emphasizing the importance of neuromuscular preparation and joint stability. The strongest predictor of injury was a previous ankle injury, with affected players showing a markedly higher risk of recurrence. Although ankle support and taping were linked to higher injury rates, this likely reflects reactive use by previously injured players rather than a causal effect. The present study found a prevalence of ankle-injury approximately 45% overall survey-based prevalence, indicating that ankle injuries are common among recreational players. This aligns with the 2023 systematic review on musculoskeletal injuries in badminton, which reported that lower-limb injuries dominate injury patterns, with the ankle being one of the most frequently affected regions (Etiology, Epidemiology & Treatment of Musculoskeletal Injuries in Badminton Players 2023 (22). Similarly, Stepper et al. (2025) confirmed that the ankle is consistently among the top injury sites across 19 badminton-injury studies (2). These findings collectively support the high prevalence observed in our sample. Thus, injury-prevention efforts in recreational badminton should focus more on modifiable behaviors rather than gender-specific strategies. Ankle injuries were significantly more common in the dominant (right) leg. This finding is supported by recent biomechanical work showing that badminton players with chronic ankle instability exhibit altered and risk-prone ankle mechanics during landing on the dominant side (23). Dominant-leg movements, especially lunges and directional changes, likely increase localized load, explaining the higher injury rate.

One of the strongest associations in our dataset was between previous ankle injury and recurrent ankle injury. This is consistent with the findings of Liu et al. (2022), who demonstrated that a prior ankle injury more than doubled the risk of subsequent injuries across multiple joints in competitive youth badminton players (24). Additionally, Stepper et al. (2025) identified injury history as one of the most consistent and powerful risk factors for new injuries (2). These similarities highlight the importance of complete rehabilitation and neuromuscular conditioning following initial injury. Players who always performed warm-up exercises had significantly lower ankle-injury rates. This is supported by Rangasamy et al. (2022), who found that inadequate warm-up was a major risk factor in recreational Indian badminton players (25). Given that warm-up improves neuromuscular readiness and dynamic stability, this finding emphasizes the necessity of structured warm-up routines for injury prevention. Regular stretching and ankle-mobility exercises were associated with reduced injury. Although fewer badminton-specific studies have examined mobility, the 2023

systematic review (22). Another study noted that limited flexibility and poor joint range are common contributors to sprain mechanisms. Thus, the protective effect observed in our sample aligns well with broader sports-injury mechanisms. Strength training was a significant protective factor in our study. This finding corresponds with the 2025 systematic review on physical-training programs in badminton, which reported that strength and resistance training enhance neuromuscular stability, potentially reducing sprain risk (26). Strong ankle and lower-limb musculature provide better support during rapid, multidirectional badminton movements.

Conclusion

This study Conclude that, the ankle injuries among recreational badminton players are frequent but not unavoidable. Clear patterns developed previous injury, loading of the dominant leg, and some playing habits increase the risk, while some simple preventive actions, like proper warm-up, mobility work, and strength or balance training, significantly decrease it. Overall, results indicate that with regular preparation and smart training choices, the chances of injury can be drastically reduced to let players enjoy badminton much more safely, confidently, and perform better in the long run.

Limitations

- Cross-sectional Survey, which captures associations at a single point in time.
- Study focuses only on recreational badminton player in Peshawar, limiting generalizability to other regions.
- The study may not account for differences in the type or quality of protective equipment used, which could influence injury rates.
- The study does not separate acute injuries from chronic issues that develop over time.

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