

# Prevalance of Anterior Knee Pain and It's Associated Risk Factors in Professional Badminton Players

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## ABSTRACT

**Background:** Badminton is a sport which need repetitive lunging, squatting and running which causes Patella to move on femur and causing posterior compressive force and causing anterior knee pain .The patellofemoral joint can undergo very high stresses during typical activities .The patellofemoral joint reaction (contact) force is influenced by both the quadriceps force and the knee angle. As the knee flexes and extends, the patella is pulled by the quadriceps tendon superiorly and simultaneously by the patella tendon inferiorly. The combination of these pulls produces a posterior compressive force of the patella on the femur and cause anterior pain

**Methods:** We performed a study with the help of google form,cluster sampling is done. The prevalence of anterior knee pain is studied with kujala questionnaire and ,its associated risk factors are being noted

**Results:** In this study 50 players participated in that 31 are male and 19 are female. 32 players complains of anterior knee pain in that 23 players complains on single knee pain and 8 players complain of both knee pain .increased in number of hours of practice and and years of trainig can cause in over use injury of anterior knee and pain.With the help of Kuajal questionnaire players are being assessed and condition of knee is being determined. Associated risk factors are also being noted in the players in that 8% players were identified with genu valgum,4% with abnormal patellar tracking pattellar ,2%foot misalignment

**Conclusion:** Anterior knee pain is a prevalent issue among badminton players, influenced by various intrinsic and extrinsic factors. Understanding the prevalence and associated risk factors of anterior knee pain in this population is critical for developing targeted prevention strategies and optimizing athlete health and performance. Future research should continue to investigate the complex interplay of biomechanical, training-related, and environmental factors contributing to anterior knee pain in badminton players, with the ultimate goal of reducing injury burden and enhancing athlete well being

**Keywords:** Badminton, Anterior Knee Pain, Kujala Score Questionnaire

## Introduction

Badminton is a racquet sport played using racquet to hit shuttle cock across the net Badminton is a popular competitive and recreational sport . Badminton is a high-paced game and is considered the fastest of the racquet sports. It is Played with predominantly overhead shots. Players of each side of the court has to hit cock .

Badminton is typically played indoors on a rectangular court divided by a net. The objective is to hit the shuttlecock over the net and land it within the opponent's court while preventing them from unning it effectively. This game can be played in singles (with one player each side) and doubles (two players each side). The mechanisms of power generation especially in jump smashes, and analyzed the efficiency of different lunge techniques that are a key to success in repetitive shuttlecock retrieval.

Participation in the sports and spectator interest has progressively improved over the last several decades in India, Asia and Europe. Indian players have occupied the badminton world federation top ranking in both men and women's singles and at present India occupies more players in men singles top thirty ranking than other country.

Badminton is a dynamic and exhilarating sport with a rich history and global appeal. From its humble origins as a leisurely pastime to its status as a highly competitive sport, badminton continues to captivate players and audience alike with its fast-paced action and technical skills. Whether played recreation-ally or professionally, badminton offers a rewarding experience for participants and spectators, making it a beloved sport enjoyed by millions around the world.

Badminton stands as a vibrant and dynamic sport that continues to captivate players and fans around the world. From its humble origins as a leisurely pastime to its status as a global phenomenon, badminton has evolved into a highly competitive and accessible sport enjoyed by people of all ages and backgrounds. With its blend of athleticism, strategy, and camaraderie, badminton offers a unique and exhilarating experience that leaves a lasting impression on players and spectators alike. As the sport continues to grow and evolve, its enduring appeal and inclusive nature ensure that badminton will remain a beloved pastime for generations to come.

Players require aerobic stamina, agility, strength, speed and precision. It is also a technical sport, requiring good motor coordination and the development of sophisticated racquet movements. The game is physically challenging and demands complex movements with constant postural variations in the form of lunges, reaches, and jumps. Badminton also necessitates short bursts of movement with sudden sharp changes in direction, including diving for shuttlecock. Beyond its competitive appeal, badminton offers a multitude of health and fitness benefits for participants of all ages and fitness levels. The fast-paced nature of the game provides an excellent cardiovascular workout, helping to improve heart health, endurance, and stamina and back, promoting strength, flexibility, and coordination. Regular participation in badminton can also contribute to weight management, stress reduction, and mental well-being. The social aspect of the sport fosters a sense of community and camaraderie among players, providing opportunities for social interaction, teamwork, and mutual support. Whether played competitively or recreation-ally, badminton offers a fun and rewarding way to stay active, healthy, and connected with others.

There are different types of technique used in badminton to increase the performance like strokes which requires high level of skill to perform strokes can be played either forehand or backhand. Smash is another technique used to hit the shuttle in fast pace. Moreover, repetitive overhead forehand and backhand strokes executed with a very short hitting action, apply excessive stress on the body. Players are therefore prone to overuse injuries of the upper limb, axial skeleton and lower limb. Repetitive lunges are required in badminton. Higher knee flexion and extension movements were associated with greater quadriceps forces and tibial shear forces, athletes may be exposed to higher risk of overuse injuries and knee injuries and knee pain. Over activity and repetitive lunges, running, jumping may cause knee pain in the badminton players.

These repetitive activity causes patellofemoral joint stress. Patellofemoral joint is made of femur bone, patella bone and tibia bone. The contact between the patella and the femur changes with knee joint motion, the patella simultaneously translates and rotates on the femoral condyles. These movements are influenced by and reflect the patella's relationship to both the femur and the tibia(3)

The contact between the patella and the femur changes throughout the knee ROM. When the patella sits in the femoral sulcus in the extended knee, only the inferior pole of the patella is making contact with the femur. As the knee begins to flex, the patella slides down the femur, increasing the surface contact area.(3)

The patellofemoral joint can undergo very high stresses during typical activities. The patellofemoral joint reaction (contact) force is influenced by both the quadriceps force and the knee angle. As the knee flexes and extends, the patella is pulled by the quadriceps tendon superiorly and simultaneously by the patella tendon inferiorly. The combination of these pulls produces a posterior compressive force of the patella on the femur.

Badminton rackets are typically made from lightweight materials such as carbon fiber, graphite, or aluminum, with varying degrees of stiffness and flexibility to suit different playing styles. Players often customize their rackets with specific string tension and grip sizes to optimize their performance and comfort on the court.(4)

As badminton need repetitive lunging, squatting and running which causes Patella to move on femur and causing posterior compressive force and causing anterior knee pain. The biomechanics of badminton involve repetitive jumping, landing, cutting, and lateral movements, placing significant stress on the knee joint and surrounding structures. Consequently, factors such as lower limb alignment, muscle strength imbalances, foot pronation, and landing mechanics may play a pivotal role in the development of anterior knee pain among badminton players. Furthermore, the prevalence of anterior knee pain may vary depending on the playing level, with elite players potentially facing different risk profiles compared to recreational or amateur players. Therefore, investigating the association between various risk factors and anterior knee pain in badminton players is essential for developing targeted preventive measures and optimizing player performance and longevity(3,4)

The major complaint of patients with patellofemoral pain syndrome is retropatellar pain during activities such as running, squatting, going up and down stairs, cycling, and jumping. Once started, the patellofemoral pain syndrome frequently becomes a chronic problem, forcing the patient to stop sports and other similar activities.

## Methods

### Research design

This study was epidemiological in nature, with the aim of finding the prevalence of anterior knee pain and its associated risk factor in professional badminton players. The study was therefore survey based, observational and quantitative, in the form of a questionnaire and Numerical Pain Rating Scale.

### Participants

The research questionnaire was hand delivered to the participants. The informed consent requested the Players participation as well as explained the purpose and procedure of the study. The benefits of the study, confidentiality and remuneration were addressed. The participants were included according to the inclusion and exclusion criteria. A population of 75 professional badminton players were targeted, out of

which 60 professional badminton players willingly filled the questionnaire. Out of 50 professional badminton players fulfilled the inclusion criteria.

**Research tool**

The questionnaire used along with the Numerical Pain Rating Scale (NPRS).

**Ethics, consent and permissions**

Participants in this study received a consent form which introduced the research project by including the title of the study, the aims of the study and reassuring the participants their information confidentiality as well as of their responses. Consent was given by each participant.

**Data analysis**

The data was analyzed with SPSS version. The results present the descriptive statistics in the form of tabulations, graphs and figures, using qualitative data. A significant data was indicated with “p <

**Results**

75 population professional badminton players were targeted for the survey. Out of which 60 willingly participated and completed the questionnaire. A response rate of 80% (60/75) was calculated. One response was not used as the participant fell under the exclusion criteria for the study. Therefore, the final sample size of n =50. The survey shows that many of professional badminton players have anterior knee pain.

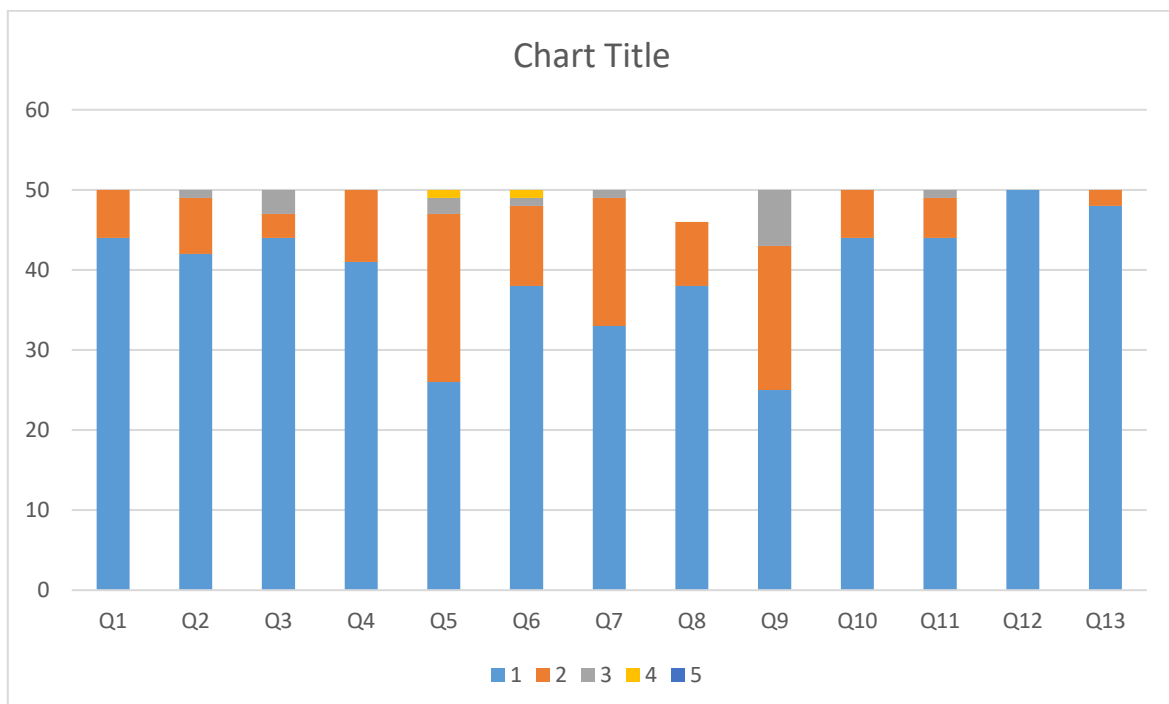
DO YOU HAVE KNEE PAIN		NUMBER OF PLAYERS	PERCENTAGE
YES (32)	1 KNEE	23	44%
	BOTH KNEE	9	18%
NO		18	38%

QUESTIONS		NUMBER OF PLAYERS
1) DO YOU LIMP WHEN YOU WALK	NO	44
	SLIGHT	6
	CONSTANT	0
2) TAKING WEIGHT ON ONE LEG	FULL WEIGHT ON 1 LEG WITHOUT PAIN	42
	PAINFUL ON WEIGHT BEARING LEG	7
	UNABLE TO FULLY WEIGHT BEAR ON LEG	1
3) WALKING	UNLIMITED	44
	MORE THAN 1 MILE	3
	BETWEEN 1- 1 1/2 MILE	3

	UNABLE TO WALK	0
4)STAIRS	NO PROBLEM	41
	SLIGHT PAIN WITH GOING UP	9
	PAIN GOING UP AND DOWN	0
	UNABLE TO CLIMB	0
5)SQUATTING	NO PROBLEM	26
	REPATED SQAUTTING PAINFUL	21
	PAINFUL EACH TIME	2
	POSSIBLE BUT NOT TAKING FULL WEIGHT	1
	UNABLE TO SQUAT	0
6)RUNNING	NO DIFFICULTY	38
	PAINFUL AFTER 1 MILE	10
	SLIGHT PAIN FROM THE START BUT ABLE TO RUN	1
	PAINFUL TO RUN	1
	UNABLE TO RUN	0
7)JUMPING		
	NO PROBLEM	33
	SLIGHT PROBLEM	16
	CONSTANT PROBLEM	1
8)PROLONGED SITTING WITH KNEE BEND	UNABLE TO JUMP	0
	NO PROBLEM	38
	PAIN AFTER EXERCISE	8
	CONSTANTLY PAINFUL	0
	PAIN FORCES YOU TO STRAIGHTEN YOUR KNEE	4
9)PAIN IN KNEE	UNABLE TO SIT WITH KNEE BEND	0
	NO	25
	SLIGHT	18
	OCCASIONALLY SEVERE	7
	INTERFERES WITH SLEEP	0
10) SWHEELING	CONSTANT AND SEVERE	0
	NONE	44
	AFTER SEVERE EXERTION	6
	AFTER DAIY ACTIVITES	0
	EVERY EVENING	0
	CONSTANTLY	0

11) FELLING OF INSTABILITY GIVING WAY IN THE KNEE CAP	NONE	44
	OCCASIONALLY SPORTING OR WITH HIGH LOAD ACTIVITES	5
	OCCASINALLY IN DAILY ACTIVITES	1
	ATLEAST ONE DISLOCATION OF KNEE CAP	0
	MORW THAN 1 DISLOCATION	0
12)WASTING OF THIGH MUSCLE	NONE	50
	NOTICEABLE COMPAERED TO THE OTHER LEG	0
	GREAT REDUCED HTIGH MUCLW SIZE COMPARED TO OTHER LEG	0
13)LOSS OF KNEE BEND	NONE	48
	SLIGHT AT THE END OF THE MOTION	2
	SEVERE LIMITATION OF MOVEMENTS	0

ASSOCIATED RISK FACTORS	NUMBER OF PLAYERS	PERCENTAGE
GENU VALGUM	4	8%
ABNORMAL PATELLAR TRACKING	2	4%
FOOT MALALIGENMENT	1	2%



Total 32 players complain of knee pain and i.e 62% from 32 players 23(44%) players complain of single knee pain and 9(18%) players complain of both knee pain .Knee pain in badminton (Single knee pain  $p= 0.09$ , both knee pain  $p=0.02$ ) no knee pain  $p=0.02$ . associated risk factors which were found in this study are genu valgum 4(8%) players have that, 2(4%) players have abnormal patellar tracking, 1(2%) players have foot misalignment.

## Discussion

This study thought to determine the prevalence of anterior knee pain and associated risk factors and extent to which knee pain affects the performance of badminton players.

Total 50 players participated in this study there were 32 players complained of anterior knee pain and 18 player had no such complain. Some players complained of single knee pain(23 players) some complained of both knee pain(9 players). Players after a shot lands on there dominant knee which leads to increase in shear forces and lead to anterior knee pain and during overhead shots and smash players lands on both knees which cause stress on the tibia and knee which leads to knee pain.

Her were 31 male players and 19 female players, in that 21 male players had knee pain and 11 female players had knee pain .

In general, the results showed that there is anterior knee pain in players.. This study provided unique findings as with increased training hours, there is a significant association with knee pain, training time over 90 minutes per day. There is a significant association between increased training hours and knee pain .Players who practice for 60 minutes daily are total 19 and in that 10 players complain of knee pain, players who practice for 90 minutes daily are 6 and in that 5 players complains of knee pain, player who practice for 120 minutes daily are 25 and 17 of them complains of knee pain. As the number of time of daily practice increases the force and stress duration on knee, due to increase in repetitive load on knee there is increase in stress forces and which also causes knee pain in the players. (3)

With increased years of experience there are increased chances of anterior knee pain. Anterior knee pain is connected to overuse disorder. This happens due to when the the same activity is being repeated in badminton players lunges ,jumping squatting is repeated.

The most affected part of lower limb is the knee followed by the ankle. In the knee, ligament sprains were reported as the most common injury, while anterior knee pain and patellar tendinopathy was reported as the most common injury. (4)

In this study 18 to 25 age group of players were taken. The majority of badminton injuries are secondary to overuse and are a result of excessive cumulative loads, Younger aged badminton players are more prone to acute traumatic injuries .as younger player are more active and moves very fast which leads increased of injury in the players.

Kujala scale questionnaire is self-reported outcome measure that was targeted specifically towards anterior knee pain and recommended the tool measure both pain and disability during the key activities of running, walking, ascending or descending stairs, squatting, jumping, kneeling and prolonged sitting. kujala scale tells the score of the knee joint 29 players have excellent knee joint ,16 players have good knee and 5 players have fair knee joint.

Incorrect technique or biomechanics during movements such as lunging, jumping, or pivoting can place excessive stress on the knees, predisposing players to injuries and pain. Improper footwork or landing mechanics can also contribute to anterior knee pain and limping. In the result 44 players limp while walking and 6 players limp periodic after over exertion with cause pain(12)

Badminton players often train and practice specific movements predominantly on their dominant side, leading to asymmetries in strength, flexibility, and coordination between the legs. This lack of symmetry can contribute to uneven loading of the knees during play, potentially resulting in pain and discomfort in the knee joints. Which unable them to take weight on leg 42 players can take full weight on single leg , 7 players complains of pain while weight bearing and 1 players is unable to weight bear.(9)

Previous studies have demonstrated that increased anterior shear forces which is caused by squatting ,running ,jumping stair climbing are associated with increased loading . quadriceps is connected to the anterior aspect of the proximal tibia through the patellar ligament, the patellar tendon tibial axis angle and the ACL elevation angle (the angle between the ACL and the tibial plateau) increase simultaneously at smaller knee angles, which implies an increase in the horizontal component of the knee extension force generated by quadriceps contraction, i.e., an increase in the proximal tibial anterior shear force(18). Therefore, the greater the quadriceps activation associated with greater a interior shear forces, the higher the loading on the Anterior knee joint (7,8)

Prolonged knee bending places excessive pressure on the patellofemoral joint, where the kneecap (patella) articulates with the thigh bone (femur). This can lead to irritation and inflammation of the cartilage under the patella, causing anterior knee pain. Activities that involve squatting, lunging, or prolonged crouching positions, common in badminton, can exacerbate this pressure. If the player has anterior knee pain they will not be able to sit with knee bend in this study 38 players reported no problem 8 player had pain after heavy exercise and 4 players complained of pain which forced them to straighten there knee.(15)

Knee pain often accompanies inflammation of the joint, which can result from injuries, overuse, or underlying medical conditions. When tissues in the knee become inflamed, the body's natural response is to increase blood flow to the area, leading to swelling in this study 44 players had no such complain and 6 player had swelling after severe exertion

Badminton involves rapid changes in direction, sudden stops, jumps, and lunges, all of which can place significant stress on the knee joint. During these movements, if the forces acting on the knee are not properly controlled or if there's weakness in the supporting structures, it can lead to instability of the patella (6)

**Muscular Imbalance:** Weakness or imbalance in the muscles surrounding the knee, particularly the quadriceps and hip abductors, can contribute to patellar instability. These muscles play a crucial role in stabilizing the kneecap and maintaining proper tracking within the femoral groove. If certain muscles are weaker or tighter than others, it can lead to abnormal patellar movement and increased risk of subluxation or dislocation.(13)

**Genu valgum** alters the alignment of the lower extremities, leading to abnormal tracking of the patella (kneecap) within the femoral groove. This misalignment can cause increased pressure and stress on the lateral (outer) aspect of the patellofemoral joint, potentially leading to anterior knee pain.

**Abnormal Biomechanics:** Genu valgum can result in altered lower limb biomechanics during movement, including walking, running, and jumping. This abnormal gait pattern can lead to increased strain on the knee joint The patella serves as a fulcrum for the quadriceps muscle, enhancing its mechanical advantage during activities like walking, running, and jumping.(17) Abnormal patellar tracking can lead to uneven distribution of forces across the patellofemoral joint, resulting in increased pressure on specific areas of the joint surface. This increased pressure can cause irritation, inflammation, and cartilage damage, leading to anterior knee pain, particularly the patellofemoral joint, predisposing



individuals to anterior knee pain. Foot malalignment can influence the alignment of the knee joint indirectly by affecting the Q-angle, which is the angle formed by the line from the anterior superior iliac spine (ASIS) to the center of the patella and the line from the center of the patella to the tibial tubercle. Certain foot malalignments, such as excessive pronation, can lead to an increased Q-angle, which may predispose individuals to patellar maltracking and anterior knee pain.(15)

The alignment of the foot plays a significant role in the overall alignment of the lower extremity during weight-bearing activities. Malalignment of the foot, such as overpronation (excessive inward rolling of the foot) or supination (excessive outward rolling of the foot), can lead to altered biomechanics of the lower limb. This can result in abnormal forces being transmitted up the kinetic chain, potentially affecting the alignment and function of the knee joint.(16)

### Limitations

While studying the prevalence of anterior knee pain and its associated risk factors in professional badminton players is valuable, there are some limitations that researchers may encounter.

1. Selection bias: Professional badminton players may not be representative of the general population of badminton players. They are likely to have different training regimens, access to healthcare, and injury management strategies compared to amateur players. This could limit the generalization of study findings to the broader badminton-playing population.
2. Limited Sample Size: Professional badminton players represent a relatively small and specialized population. Recruiting a sufficient sample size for prevalence studies may be challenging, particularly when considering subgroups based on factors such as age, playing position, or skill level.
3. Difficulty in Assessing Risk Factors: Identifying and quantifying risk factors for anterior knee pain in badminton players can be complex. Factors such as biomechanics, training intensity, footwear, and playing surface may interact in nuanced ways, making it difficult to isolate the effects of individual risk factors.

### Conclusion

This study is to identify risk factors for anterior knee pain and associated risk factors of anterior knee pain in professional badminton players, aged 18-25 years. Moreover, the findings stated that anterior knee pain was significantly associated with overuse of knee joint by the movements of lunges, jumping and squatting. For preventing badminton pains, appropriate training programme should be implemented and the complaints of the knee pain should be noticed, so that the early intervention can be implemented.

### Acknowledgement

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