

PREVALENCE OF ACTIVITY RELATED PATELLOFEMORAL PAIN SYNDROME AMONG UNIVERSITY STUDENTS: A CROSS SECTIONAL STUDY.

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Abstract

Background: Patellofemoral Pain Syndrome (PFPS) is a very frequent cause of anterior knee pain in young adults and is often linked with physical activities like running, squatting, climbing and sitting for extended periods. The effect on daily functioning and quality of life despite being a major problem, little data exists on its prevalence among university students in Pakistan.

Objective: To determine the prevalence of activity-related Patellofemoral Pain Syndrome (PFPS) among university students.

Methods: A descriptive cross-sectional study was conducted among 376 university students using a nonprobability convenience sampling technique. Participants aged 19–30 years from both genders were included. Data were collected using a demographic questionnaire and the Kujala Anterior Knee Pain Scale (AKPS). Data were analyzed using IBM SPSS version 22. Descriptive statistics, including frequencies, percentages, means, and standard deviations, were used to summarize the findings.

Results: A total of 376 students participated in the study, including 265 (70.5%) males and 111 (29.5%) females. The majority of participants (40.7%) were aged 23–26 years. Based on the Kujala AKPS, 150 (39.9%) participants had excellent knee function, 36 (9.6%) had good knee function, 65 (17.3%) had fair knee function, and 125 (33.2%) had poor knee function, indicating a substantial burden of activity-related PFPS. Regarding symptom duration, 156 (41.5%) participants reported symptoms for more than three months, 118 (31.4%) for 1–3 months, and 102 (27.1%) for less than one month. The mean duration score was 2.14 ± 0.817 .

Conclusion: The study clearly showed a prevalence of activity-related PFPS among university students at KUST. Many participants had difficulties with their knees and symptoms that lasted longer than 3 months. The results highlight the need for early screening, awareness campaigns, preventive

measures, and timely physiotherapy treatment to mitigate the impact of PFPS and enhance the functional health of students.

INTRODUCTION

The American Academy of Orthopaedic Surgeons (AAOS) estimates that there are several different types of knee pain, which can be grouped under the umbrella of patellofemoral pain syndrome (PFPS). Patellofemoral pain syndrome (PFPS) is a wide term used to describe pain in the anterior of the knee and around the patella or kneecap(1). Young adults are highly susceptible to PFPS. It results in generalized pain around and beneath the patella and can be in one knee or both(2). The pain around or behind the kneecap is due to PFPS(3). PFPS is a common complaint of diffuse anterior knee pain, often associated with running, squatting or stair climbing ascending and descending (4). It usually develops gradually from biomechanical issues like patellar malalignment, muscle imbalances, and excess joint loading, which can limit daily and work activities(5). PFPS is a common MSK disorder with a lifespan incidence of 23% to 29%, mostly affecting young, active adults(6).

MSDs cause a significant global health problem. The second most common knee problem is PFP, which occurs in 15-45% of people and manifests as pain in the front of the knee while running, squatting and climbing the stairs(7). A 2.5-year study of 1,319 healthy young adults found that 3% developed patellofemoral pain syndrome (PFPS). PFPS occurred more frequently in females, had regional prevalence and affected some 1.75 million patients, or 6%(8). PFPS is more common in females than males, is associated with obesity, high BMI, and athletic participation, accounting for 28.9% of adolescents and 22.7% of adults(9). The prevalence of PFP is 22–24% globally, ranging from 3% to 85%. It is highest in adolescent, more common in females than males and there is no national data on its prevalence in Pakistan(10).

Muscular imbalance, poor patellar coordination, abnormalities of the lower limb biomechanics, exercise movement, dynamic valgus, limited

midfoot motion and restricted ankle mobility are frequent causes of patellofemoral pain syndrome(11). PFPS is primarily caused due to repetitive stress to the knee, activity, sitting for extended periods, and biomechanics and is more common in females(12). The weak quadriceps and hip muscles, tightness of surrounding muscles and biomechanical imbalance leads to abnormal patellar tracking, misalignment of the knee and increased joint stress, which contributes to patellofemoral pain syndrome(13). Most cases of patellofemoral pain in runners are due to muscle imbalances, biomechanical dysfunction, and repetitive knee loading, which can result in poor patellar tracking, excessive joint loading and overuse injuries(14). The exact cause of patellofemoral pain is unclear, but is multifactorial and includes joint tissue overload, repetitive loading of the knee, overuse, muscular imbalances and abnormal physical activity(15).

Risk factors for patellofemoral pain syndrome include weakness of the quadriceps and hip muscles, dynamic genu valgus, foot malalignment, repetitive knee stress and structural hip deformities which affect the biomechanics(16). Common risk factors for patellofemoral pain syndrome are the weakness of knee and hip musculature, lack of knee flexion, increased femoral rotation, high Q angle, excessive foot pronation and limited dorsiflexion(17). Muscle imbalance, hip and core weakness, proximal instability, myofascial trigger points, overuse, injury and poor posture are all major risk factors for PFPS(18). Knee and hip muscles, altered lower-limb movement, increased femoral internal rotation, decreased ankle dorsiflexion and foot deformities flat feet or high arches(19).

A 2023 USA review by Marissa McCay and Wali Omar et al., PFP is a frequent condition among young, particularly females and sports participants. It is associated with overuse, malalignment and muscle weakness and

strengthening exercises of the hip and knees is the best treatment(20). Callahan, Chin, et al. reported that the occurrence of patellofemoral pain syndrome is prevalent in young and active people, particularly among women. Conservative measures are effective for decreasing pain and improving function, while biomechanical abnormalities, muscle weakness, overtraining, excess loading and psychological factors all play a role(21). Pereira et al. found that patellofemoral pain syndrome causes anterior knee pain while squatting. Excessive forward knee motion, deep knee flexion and quadriceps and hip muscle imbalances cause an increased stress at the patellofemoral joint and are potential contributors to PFPS(22). Gilgallon et al. found that those with higher pain self-efficacy had higher levels of physical activity despite PFPS. There was no significant difference in activity levels among the pain catastrophizing groups, suggesting that psychological factors are of importance and that a biopsychosocial approach to PFP rehabilitation is important(23).

1.1 Rational

There is limited literature on this topic, only few studies focused on prevalence of patellofemoral pain syndrome in university students, some studies focused but their sample size was very less, and they just targeted female students. Mostly studies focused on patellofemoral pain syndrome in sports especially in runners. Our Aim of study is that to address this gap by investigating PFPS prevalence and activity-related factors and to determine the prevalence of patellofemoral pain syndrome (PFPS) in university students engaged in daily life and physical activities.

1.2 Aim and Objective

1. To determine the prevalence of activity-related Patellofemoral Pain Syndrome (PFPS) among university students.

Material And Methods

2.1 Research Design: This study was Descriptive Cross-Sectional Study.

2.2 Study Settings: The research was conducted at main campus in kohat university of science technology.

2.3 Sample Size: Sample size was calculated using OpenEPI. A total of 376 sample size will be required with margin of error 5%, confidence level 95 % and response distribution of 50%. Total population is 15910.

2.4 Sampling Technique: Non probability convenient sampling will be used.

2.5 Study Duration: The duration of study will be 06 months.

2.6 Selection Criteria

2.6.1 Inclusion Criteria:

- Age Between 19 and 30year old.
- Currently Registered as a university student □ Both male and female students.

2.6.2 Exclusion Criteria

- Age is less than 19 and more then 30 year
- Previous Major Knee Injury or Surgery History of fractures, ligament reconstruction (ACL, PCL), meniscal surgery, patellar dislocation, etc.
- Other Knee Pathologies are Diagnosed knee conditions such as:
- Osteoarthritis
- Rheumatoid arthritis or other inflammatory disorders
- Tendon ruptures
- Bursitis
- Neurological Disorders Conditions affecting movement or pain perception, e.g., cerebral palsy, MS, peripheral neuropathy.

Ethical Considerations: Written informed consent was obtained from all participants. Participation was voluntary, confidentiality and anonymity were maintained, and participants had the right to withdraw from the study at any stage without any penalty.

Ethical Approval: Ethical approval for this study was obtained from the Ethical Review Committee of the Kohat University of Science and Technology (KUST) before data collection.

Data Collection Procedure: Data for this study was be collected using a structured questionnaire.

Data analysis procedure: Data will be entered and analyzed using a SPSS Version (22) software. Descriptive statistics will be used to summarize demographic. Categorical variables (e.g., gender and presence of activity related patellofemoral pain syndrome) will be presented as frequencies and percentages, while continuous variables (e.g., age and duration of patellofemoral pain syndrome) will be reported as mean $\pm$ standard deviation. Graphical representations, such as histograms and pie charts, will be used where appropriate.

Results

This study was conducted on 376 students studying at universities. Most respondents (70.5%) were males while 29.5% were females. The largest age group was 23–26 years (40.7%), followed by 19–22 years (36.4%) and 27–30 years (22.9%). Kujala Anterior Knee Pain Scale (AKPS) was used to assess the prevalence of activity related patellofemoral pain syndrome (PFPS). The results indicated that 39.9% of the participants had excellent knee function, 33.2% had poor knee function, 17.3% had fair knee function, and 9.6% had good knee function. These findings suggest

that while the majority of students had excellent knee function, there is still a high burden of activity related PFPS among the university students as a third of them experienced poor knee function. When asked about the duration of participants PFPS symptoms, 41.5% reported symptoms lasting for more than 3 months, 31.4% reported symptoms lasting for 1–3 months, and 27.1% reported symptoms lasting for less than 1 month. The mean score for the duration of symptoms was 2.14 ± 0.817 ; many students who were affected were affected for more than three months. Finally, these findings suggest that activity-related PFPS is common in university students and a significant proportion of students with the diagnosis had a knee dysfunction and ongoing symptoms, emphasising the need to identify and treat activity-related PFPS early.

3.1 Demographic Information:

GENDER: A total of 376 number of participants were included in the study. Out of the total 376 participants, there are 265 (70.5%) participants were males while 111 (29.5%) are females. Which shows majority of male participants.

Table 3.1: Demographic characteristics Demographic characteristics of participants (n)=376

Demographic characteristics		Frequency	percentage (n) %
Gender	MALE	265	70.5%
	FEMALE	111	29.5%
	OTHER	0	0.0%
Age in year	19-22	137	36.4%
	23-26	153	40.7%
	27-30	86	22.9%

AGE:

The age distribution indicated that, age group of 23-26 years old had the highest number of participants (153, 40.7%) while the 19-22 age group had the second highest number (137, 36.4%). 27-30 years (86, 22.9%) had the least numbers of participants. The age group of most of the respondents was from 23-26 years.

3.2 Presence of activity related PFPS:

Presence of activity related PFPS was calculated by using a Kujala anterior knee scale. The kujala anterior knee score cutoff values as:

- 95-100: Excellent
- 85-94: Good
- 65-84: Fair
- <65: Poor

TABLE 3.2: Presence Of Activity Related Pfps By Kujala (Akps)

kujala_score_category		Frequency	Percent
Valid	Poor	125	33.2
	Fair	65	17.3
	Good	36	9.6
	Excellent	150	39.9
	Total	376	100.0

Table 3.2 showed that A total of 376 participants were included in the study. Out of total 376 participants, there are 150 (39.9%) participants had excellent knee function (kujala score was 95-100), 125 (33.2%) had poor knee function (kujala score was <65), its indicating a considerable number of students marked with impairment knee function. 65 (17.3%) had fare knee functions

(kujala score was 65-84) and while 36 (9.6%) participants had good knee function (kujala score was 85-94) which was the smallest category. Overall, the results show that while the biggest number of students had excellent knee function, about onethird (33.2%) of the participants had poor knee function, indicating that a considerable number of university students had poor knee function according to kujala function score.

Figure 3.1 Histogram Representation The Presence Ofactivity Related Pfps By Kujala (Akps)

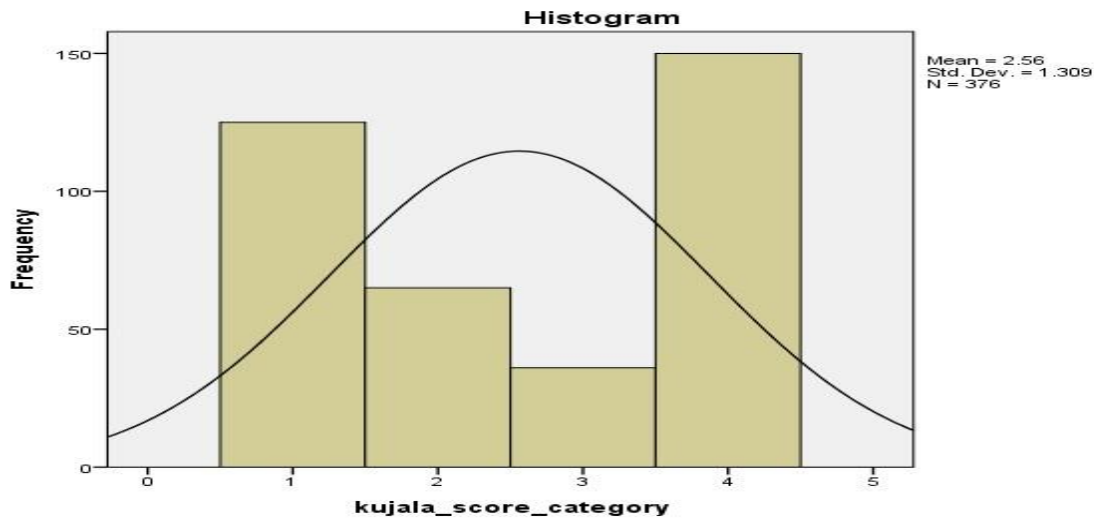


FIGURE 3.1 shows that, The categories of the Kujala (AKPS) score were presented in the histogram, which indicated that the majority of

participants had excellent knee function, while the least number of participants had the fair knee function score.

Figure 3.2 Pie Chart Representation The Presence Of Activity Related Pfps By Kujala (Akps)

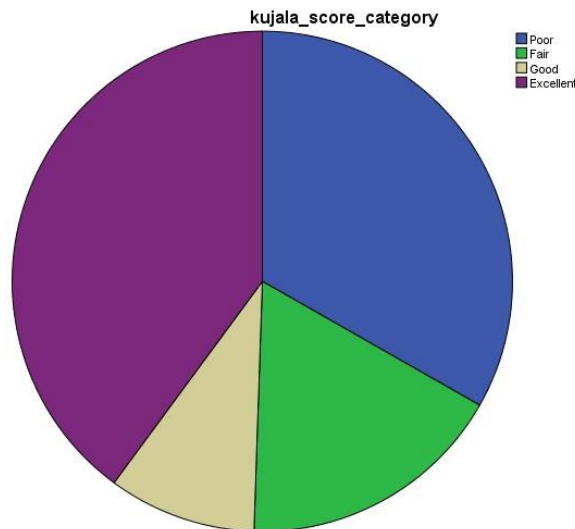


Figure 3.2 shows the distribution of participants according to the Kujala (AKPS) score categories. The pie chart indicates that the largest

proportion of participants had excellent knee function, followed by poor and good knee function, while the smallest proportion had fair knee function.

3.3 Duration Of Patellofemoral Pain Syndrom:

Table 3.3: Distribution Of The Participants According To The Duration Of Pfps

Duration of PFPS			
Duration of PFPS		Frequency	Percent
Valid	< 1 month	102	27.1
	1-3 months	118	31.4
	> 3 months	156	41.5
	Total	376	100.0

Table 3.4: shows that The distribution of participants according to duration of patellofemoral pain syndrome (PFPS). The most common duration was for 376 participants (41.5%) to have had PFPS for over 3 months.

Next, there were 118 (31.4%) participants who had symptoms for 1-3 months, and 102 (27.1%) participants who had symptoms for less than 1 month. There were no missing data and the mean score for the duration of PFPS.

Figure 3.3: Histogram Representation Represent The Distribution Of The Participants According To The Duration Of Pfps.

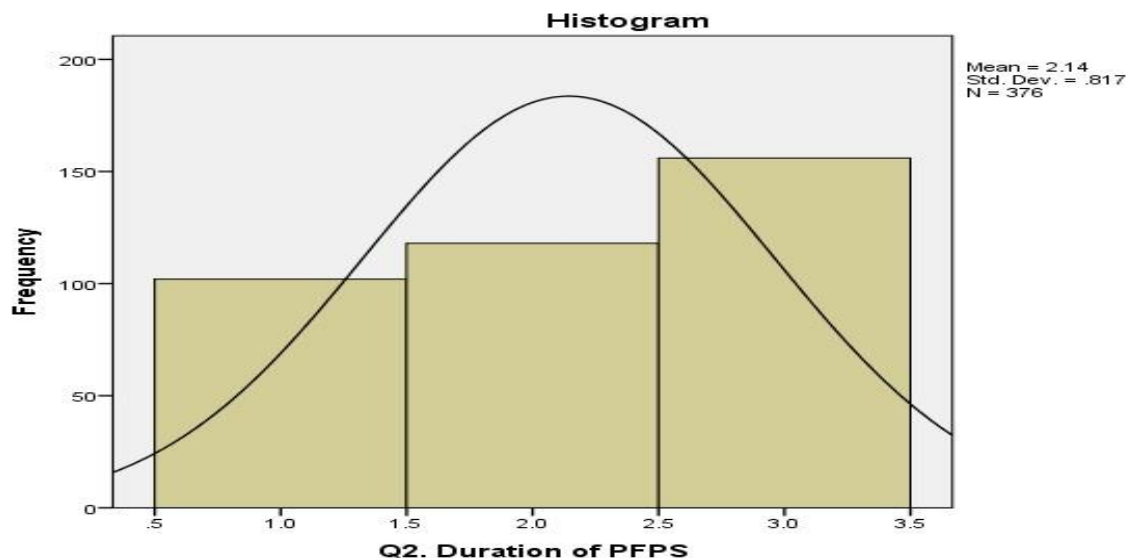


Figure 3.3 Histogram shows that the most common time the participants had been suffering from PFPS was for more than 3 months.

Figure 3.4: Pie Chart Representation Represent The Distribution Of The Participants According To The Duration Of Pfps.

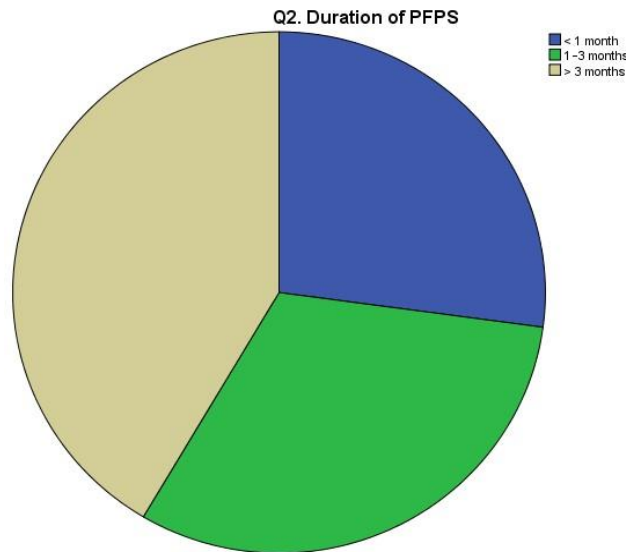


Figure 3.4: Pie Chart confirms that a large proportion of participants had had PFPS for more than 3 months, with 1-3 months and less than 1 month coming next. In conclusion, these results suggest that a significant number of participants continued to experience PFPS symptoms for more than three months.

Table 3.2: Mean And Std. Deviation Of The Duration Of The Pfps.

Duration of Patellofemoral Pain Syndrome (PFPS)		
NO Of participants	Valid	376
	Missing	0
Mean		2.14
Std. Deviation		0.817

Table 3.2 shows the mean and standard deviation of the duration of Patellofemoral Pain Syndrome (PFPS) among the participants. A total of 376 participants were included in the analysis, with no missing data. The mean duration score was 2.14,

and the standard deviation was 0.817, indicating moderate variability in the duration categories of PFPS.

Discussion

A total of 376 university students were included in the present study, 265 (70.5%) of which were males and 111 (29.5%) females. Males were more than females because the present study is special to the determined prevalence of Male and female we found in the whole university students. Males and females unfortunately we collected more data from Males, females had not data give him maximum data. The majority of participants were aged 23–26 years (40.7%), followed by 19–22 years (36.4%) and 27–30 years (22.9%). The results suggest that the study population comprised primarily young adults which was a group typically more active and thus more prone to activity-related patellofemoral pain syndrome (PFPS). The study “Prevalence of Patellofemoral Pain Syndrome Among Sports Sciences Students in Lahore” also included predominantly young university students and concerned with the study of PFPS in an active student population and had similar demographic characteristics. The two studies are comparable in terms of the ages of the participants and the type of university. But the gender differences could be linked with variation in the recruitment of participants and the male and female students enrolment in the institutions(24).

The present study results agreed with recent evidence which shows that PFPS is one of the most common knee disorders among physically active adolescents and young adults. Callahan et al. claimed that patellofemoral pain frequently occurs in young people and is linked with repetitive loading of the patellofemoral joint (PFJ) during functional activities. They highlighted that weakness of the quadriceps, weakness of the hip muscles and abnormal movement patterns were key factors in causing pain and functional restriction(7, 21, 25).

Presences of activity related PFPS was calculated by using a Kujala anterior knee scale. Total of 376 participants, knee function based on Kujala scores was distributed as follows: 150 (39.9%) excellent, 36 (9.6%) good, 65 (17.3%) fair, and 125 (33.2%) poor. While most students had excellent knee

function, about one-third showed poor knee function – indicating a considerable burden of impaired knee function among university students.

The Kujala Anterior Knee Pain Scale has been used in similarly aged young adult groups in both studies, the Saudi study with the majority of participants aged 18-25 years, similar to the age of the university students in this study. The key differences are in how the patients were classified for having PFPS, with the Saudi study utilizing a single cut-off score (83 or below for presence, above for absence), whereas the present study used a more detailed four-tiered classification (Excellent 95-100, Good 85-94, Fair 65-84, Poor <65). Prevalence also was different significantly, with it being lower in the Saudi sample than the present one and lower than most of the reported studies. The Saudi study also revealed that other factors such as age, sex, or BMI were not significant factors, but unemployment and existing knee pain were. Such differences may be due to differences in samples, activity and the classification system used in the Saudi study. There were some differences in the study: The Saudi study classified PFPS as present or absent based on a single cutoff score of 83, while the present study classified the PFPS using four scores (Excellent, Good, Fair, Poor). There were significant differences in prevalence too; the prevalence of PFPS was much lower in the Saudi sample than what was seen in the present study. In addition, the Saudi study investigated factors associated with PFPS, and identified unemployment and pre-existing knee pain as factors that significantly related to PFPS, while age, sex and BMI did not (not measured in the present study)(3, 26).

The present study revealed that 41.5% (n = 156) of respondents had experienced patellofemoral pain syndrome (PFPS) for more than 3 months, 31.4% (n = 118) for 1-3 months and 27.1% (n = 102) for less than 1 month. The findings indicate that a large majority of those involved had experienced PFPS for over three months, which indicates that the condition is long lasting and not short-term. This could be because people still

continue to engage in physical activity, delay treatment, do not get the appropriate rehab or have a lack of awareness of PFPS. Persistent knee pain may interfere with university life, sports and quality of life for university students. In recent years, the results obtained in the present study have been confirmed by other studies. Many people with PFPS experience persistent pain for over one year, indicating that PFPS can be a chronic condition (Lyng et al. 2026)(27). Similarly, Callahan et al. (2025) found that PFPS is prevalent in physically active patients and noted the significance of early diagnosis, patient education, and exercise-based rehabilitation to minimize long-term symptoms. Thus, the high prevalence of the participants who had knee pain symptoms for more than three months in this study draws attention to the need for early screening and appropriate physiotherapy care to avoid chronic knee pain in university students. The difference may be due to variations in the study population, level of physical activity, access to healthcare, rehabilitation practices, or differences in the methods used to collect data(27).

The results of this study suggest that PFPS is a common condition among university students. While the majority of the participants had excellent knee function based on the Kujala (AKPS) score, a considerable number continued to suffer with symptoms for a longer period more than three months. The findings highlight the need for prevention, early assessment and management, and greater awareness of PFPS.

4.1 Limitations

- The study was done in one university so the results are not generalizable to other university students.
- A cross-sectional study design was used, which does not establish cause-and-effect relationships.
- less female than male participation, which could have affected gender comparisons.
- Knee function was only evaluated with the Kujala Anterior Knee Pain Scale and the diagnosis of

PFPS was not confirmed with clinical examination or imaging.

- The present study did not assess such factors as muscle strength, previous injuries, physical activity intensity, and BMI as potential risk factors.

4.2 Recommendation

- Universities need to establish awareness programs related to patellofemoral pain syndrome prevention to patients and early detection.
- Knee pain that is persistent should be encouraged to get an early assessment and physiotherapy management.
- It is recommended to screen the physically active student regularly by using a validated tool, for example the Kujala Anterior Knee Pain Scale.
- Exercise programs focusing on strengthening the quadriceps, hip muscles, and improving lowerlimb biomechanics should be promoted.
- Longitudinal and multicenter studies with larger and more diverse samples are recommended to better understand the long-term outcomes and risk factors of PFPS.

Conclusion

The present study revealed that university students at Kohat University of Science and Technology (KUST) has a high prevalence of activity-related patellofemoral pain syndrome (PFPS). A high proportion of students had excellent knee function, but about one-third had poor knee function, suggesting that PFPS is a health problem in this population. Furthermore, a significant proportion of participants suffered from symptoms of PFPS for over three months indicating that PFPS is a long-term problem among university students.

These results highlight the importance of increased awareness of PFPS, early recognition of symptoms and prompt physiotherapy treatment to avoid chronic knee pain and dysfunction. Preventative measures such as education on correct physical activity, reinforcing exercises and rehabilitation programs could help lower the incidence and/or long-term effects of PFPS. The study contributes to the body of evidence

concerning the incidence of PFPS in university students, and emphasizes the need for preventive and rehabilitative measures to enhance students' musculoskeletal health and quality of life.

REFERENCES:

- Jocelyn Ross Witstein M, FAAOS, Mary K. Mulcahey, MD, FAAOS, Carolyn M. Hettrich, MD, MPH, FAAOS, Daniel Liechti, MD. Patellofemoral pain syndrome (PFPS) by AAOS OrthoInfo. AAOS OrthoInfo. 2021.
- Zamani S, Abbaszadeh-Amirdehi M, Talebi G, Tavassoli M, Esmailnejadganji SM, Gholinia H. Prevalence of femoral nerve neurodynamic disorder in patients with patellofemoral pain syndrome: a crosssectional study. BMC Musculoskeletal Disorders. 2025;26(1):700.
- Sikandar MS, Noor TU, Noor J, Nawaz Q, Rehman Z, Khan HY. Prevalence of Patellofemoral Pain Syndrome and Its Impact on Quality of Life Among Recreational Athletes at Private Universities in Peshawar. The Healer Journal of Physiotherapy and Rehabilitation Sciences. 2025;5(2):343–8.
- Darabseh MZ, Aburub A, Altaim TA, Al Abbad B, Bashareh K. Validity and reliability of an Arabic version of the survey instrument for natural history, aetiology and prevalence of patellofemoral pain studies: a cross-sectional study. International Journal of Environmental Research and Public Health. 2024;21(6):732.
- Khalid A, Hussain Z, Zahid H, Shafi A, Aslam S, Imtiaz R. The Prevalence of Patellofemoral Pain Syndrome in Working Female Physiotherapists. Journal of Health, Wellness and Community Research. 2025:e504–e.
- Sannasi R, Kandakurti PK, Stephan T. Interpretable wrapper-based machine learning framework for predicting patellofemoral pain syndrome using minimal clinical tests: R. Sannasi et al. Scientific Reports. 2025.
- Smith BE, Selfe J, Thacker D, Hendrick P, Bateman M, Moffatt F, et al. Incidence and prevalence of patellofemoral pain: a systematic review and meta-analysis. PloS one. 2018;13(1):e0190892.
- Hussain G, Rasheed BF, Rashid HH, Ashraf M, Manzoor M, Naeem Z, et al. Prevalence of Patellofemoral Pain Syndrome and Its association with Knee Stiffness in Sanitary Workers: Prevalence of Patellofemoral Pain Syndrome. Pakistan Journal of Health Sciences. 2023:44–8.
- Sarwar A, Naz S, Tariq L, Furqan Z, Mehmood Z. Prevalence of patellofemoral pain syndrome and its effect on lower extremity function in young females. The Rehabilitation Journal. 2026;10(01):03–9.
- Aslam M, Amjad H, Saddique I, Khan U. PREVALENCE OF PATELLOFEMORAL PAIN SYNDROME AND ITS ASSOCIATION WITH PROLONGED SITTING, GENDER AND BMI AMONG UNIVERSITY STUDENTS. Journal of Medical & Health Sciences Review. 2025;2(3).
- Sanchis GJB, Nascimento J, Santana RC, Santos VMD, Cunha VLD, Assis SJC, et al. Biomechanical factors associated with patellofemoral pain in children and adolescents. Sci Rep. 2024;14(1):15490.
- Boling M, Padua D, Marshall S, Guskiewicz K, Pyne S, Beutler A. Gender differences in the incidence and prevalence of patellofemoral pain syndrome. Scand J Med Sci Sports. 2010;20(5):725–30.
- Abdo N, Youssef EF, Ibrahim MM. Efficacy of adding manual therapy to hip and knee exercises in patients with patellofemoral pain syndrome: a double-blinded randomized controlled clinical trial. Sci Rep. 2025;15(1):32655.

- Cho SC, Kim YK. The Immediate Effects of Instrument-Assisted Soft Tissue Mobilization on Pain and Function in Female Runners with Patellofemoral Pain. *Medicina (Kaunas)*. 2025;61(11).
- Sánchez MB, Selfe J, Callaghan MJ. The prevalence of patellofemoral pain in the Rugby League World Cup (RLWC) 2021 spectators: A protocol of a cross-sectional study. *PLoS One*. 2021;16(11):e0260541.
- Arslan T, Gültekin MZ. Is Cam Pincer Deformity a Predisposing Factor for Patellofemoral Pain Syndrome? *Indian J Orthop*. 2023;57(7):1139-46.
- Szybist S, Houser A, Corletto J, Maloy W. Patellofemoral Biomechanics Considerations: Analysis of Factors Contributing to Patellofemoral Pain. *Curr Sports Med Rep*. 2025;24(9):275-80.
- Samani M, Ghaffarinejad F, Abolahrari-Shirazi S, Khodadadi T, Roshan F. Prevalence and sensitivity of trigger points in lumbo-pelvic-hip muscles in patients with patellofemoral pain syndrome. *Journal of Bodywork and Movement Therapies*. 2020;24(1):126-30.
- Szybist S, Houser A, Corletto J, Maloy W. Patellofemoral Biomechanics Considerations: Analysis of Factors Contributing to Patellofemoral Pain. *Current Sports Medicine Reports*. 2025;24(9):275-80.
- Walli O, McCay M, Tiu T. Patellofemoral syndrome: a review of diagnosis and treatment. *Current Physical Medicine and Rehabilitation Reports*. 2023;11(2):139-43.
- Callahan EA, Chin KE, Chu SK. Current evidence of evaluation and management of the athlete with patellofemoral pain syndrome. *Current Physical Medicine and Rehabilitation Reports*. 2025;13(1):30. 22.
- Pereira PM, Baptista JS, Conceicao F, Duarte J, Ferraz J, Costa JT. Patellofemoral pain syndrome risk associated with squats: a systematic review. *International Journal of Environmental Research and Public Health*. 2022;19(15):9241.
- Gilgallon TJ, Kim S, Glaviano NR. The influence of psychological factors on physical activity in individuals with patellofemoral pain. *Journal of Sport Rehabilitation*. 2024;33(6):461-6.
- Ali S, Sajjad SA, Niaz M, Rana AA, Waseem M. Prevalence of patellofemoral pain syndrome among sports sciences students in Lahore. *Pakistan Biomedical Journal*. 2022:154-9.
- Lankhorst N, van Middelkoop M, Crossley K, Bierma-Zeinstra S, Oei E, Vicenzino B, et al. Factors that predict a poor outcome 5-8 years after the diagnosis of patellofemoral pain: a multicentre observational analysis. *British journal of sports medicine*. 2016;50(14):881-6.
- Aljuhani W, Aloufi L, Alhafi ME, Alquraiqari AA, Alqahtani R, Alamr A, et al. Prevalence of patellofemoral pain among adults in Saudi Arabia. *Cureus*. 2024;16(11).
- Lyng K, Machado E, Blumenfeld MB, Gürühan S, Andreucci A, Sørensen LB, et al. Long-term prognosis of patellofemoral pain in adolescents and adults: A systematic review with meta-analysis and meta-regression. *medRxiv*. 2026:2026.04. 27.26351023.