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PREVALENCE OF PATELLOFEMORAL PAIN AMONG YOUNG ADULTS WITH QUADRICEPS TIGHTNESS

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Abstract:
Objective: The purpose of this research was to find out the prevalence of patellofemoral pain (PFP) among young adults with quadriceps tightness
Methods: An observational research was carried out on a total of 160 participants in Sargodha, Punjab in Pakistan with a focus on individuals aged 16 to 35 years. Participants from diverse backgrounds were included, and PFP diagnosis was established through clinical examination during specific functional activities. The Pain Numerical Scale and a questionnaire on personal and medical history as well as lifestyle choices were used to compile the data. The SPSS 26 statistical software was used for the analysis.
Results: The research found almost balanced gender distribution, with 51.9% men and 48.1% females. Participants aged 23 and 24 showed the greatest frequency of PFP with quadriceps tightness. Physical activity was prevalent among 74.4% of participants. 33.8% experienced discomfort in their left knee, 36.9% in their right knee, and 29.4% in both knees. 37.5% of participants reported experiencing pain for more than three months. Some activities, like jogging or climbing stairs, were linked to an increased risk of discomfort. Thigh pain during activities varied, with 41.9% during bending the knee and 26.9% during running. According to the Pain Numerical Scale, 26.3% of people expressed having no pain at all, 70.0 % felt moderate pain, and 3.8 % felt extreme pain.
Conclusion: The results of this research highlight valuable insight into the frequency and causes of quadriceps tightness among adults. The results demonstrated the necessity for individualized therapies targeting particular activities and risk factors to reduce pain and improve the quality of life for people with PFP. More research is needed to better understand the causes of PFP and develop effective interventions for a wide range of people.

Keywords: patellofemoral, quadriceps tightness, knee pain, Runner's knee.

1 Introduction

Individuals who are physically active, especially young adults, often have patellofemoral pain (PFP). Women are more likely than men to have PFP (1). Doing squats, going up and down hills or stairs, or sitting with your knees bent for a long time may cause pain in the PFP (1) (2) (3). It's

possible that young people' reduced physical activity involvement results in pain felt at the patellofemoral joint during those specific postures or activities (4).

Lower extremity alignment may have an important role to understand the pathogenesis of PFP (5). An abnormal appearance of the feet is the primary symptom, particularly pes planus (PP), which results from a lack of a medial longitudinal arch and excessive inward rolling of the rear foot (hindfoot valgus) (6) . These bones might not have as much surface area to press on if the tibia doesn't spin and push the knee into a valgus position to fix the problem of abnormal pronation. Where knee movement changes the Q angle, which is also known as the "quadriceps angle", the lateral patella facets may be severely compressed and the patella may not track properly, which can lead to PFP (5) (7).

People with Patellofemoral Pain Syndrome (PFPS) typically report feeling tightness of the muscles around their knees; this is an objective indicator that may be used to guide therapy. In reality, the purpose of a massage is to relieve tightness in the muscles. Although a lack of flexibility in the hamstrings is often blamed for knee discomfort, (8) , for a specific set of muscles, the effect of length on PFPS has been studied in the literature (9) , for example the quads, hamstrings, and tensor fascia lata. Different studies showed that hamstring tightness can affect knee pain in different ways (10) (11) .

Doctors rely heavily on epidemiology data for making decisions and allocating healthcare resources, particularly when it comes to disease prevention and control. The prevalence of PFPS in adolescence has been shown by several studies (12) (13) (14) (15) (16) (17) elite athletes (18) (19) (20) (1) and military recruits (17). It has been estimated that women have a higher risk of developing PFPS than males do (17) . Previous research has mostly focused on the incidence of PFPS in young adults (4) (12) (13) (14) (15) (16) (17) and elite athletes [(18) (19) (20)]. The incidence of PFPS among young people as a whole has only been studied in a few number of studies (21) (22) (23) . The PFPS was studied in one group of recreational long-distance cyclists (21) Physical Activity (PA) levels among the examined individuals were not determined in the other two investigations (24).

The purpose of this research was to investigate the prevalence of patellofemoral pain in association with tight quadriceps. People with patellofemoral pain syndrome were formerly considered to have increased pain in the patellofemoral region and quad tightness.

2 Material and method:

2.1 Study design

This research used an observational methodology to analyze a demographic sample of residents of Sargodha city, stratified by age and gender. The margin of error was 5%, and there were 160 people in the study. The research took place over a period of four months.

2.2 Inclusion criteria

Male and female participants, between the ages of 16 and 35, were screened for this investigation. Different people, including athletes and others who don't often engage in sports, participated. Patellofemoral pain (PFP) was the main focus of the research, and participants had to be able to do two functional activities with discomfort. Exercises including squatting, leaping, jogging, bending, descending or ascending stairs, sitting for extended periods of time, and standing for long periods of time were all included. It was via clinical testing that a diagnosis of PFP was established, allowing for a thorough and comprehensive description of research subjects.

2.3 Exclusion criteria

Participation in the study was restricted to individuals who met certain health and social criteria. There was exclusion of individuals below the age of 16 and above the age of 35. Individuals who had pre-existing knee problems were also excluded from the study, along with instances of surgery or injury. The study did not specifically target individuals with multiple illnesses, thus they were not included in the sample. The resulting subset became more specialized and limited in scope.

2.3 Data collection tool

The primary tools of data collection in this research were the Pain Numerical Scale and a questionnaire. We employed the Pain Numerical Scale to quantify the participants' reports of pain in the patellofemoral region. By assigning numbers to experiences of pain on a standard scale often ranging from 0 to 10, we can more accurately assess their intensity.

Moreover, a questionnaire was used to elicit specific data for several aspects of the research. Those who participated in the research were likely questioned about demographic details, health history, lifestyle habits, and experiences with patellofemoral discomfort. The purpose of employing all of these data gathering techniques together was to gain a thorough picture of the participants' pain experiences and intensity of pain.

2.4 Statistical analysis

In order to conduct statistical analysis on the data collected for this research, we turned to SPSS, version 26. Afterwards, charts and graphs were made to illustrate the findings visually. SPSS 26 ensured that the statistical procedures utilized would be consistent, enhancing the reliability and interpretability of the study's findings.

3 Results

3.1 Percentage and Frequency of different genders

Table 1 shows that the study's 160 participants were uniformly distributed between males and females, with 83 males (51.9% of the total) and 77 women (48.1% of the total). Table 1 displays baseline data.

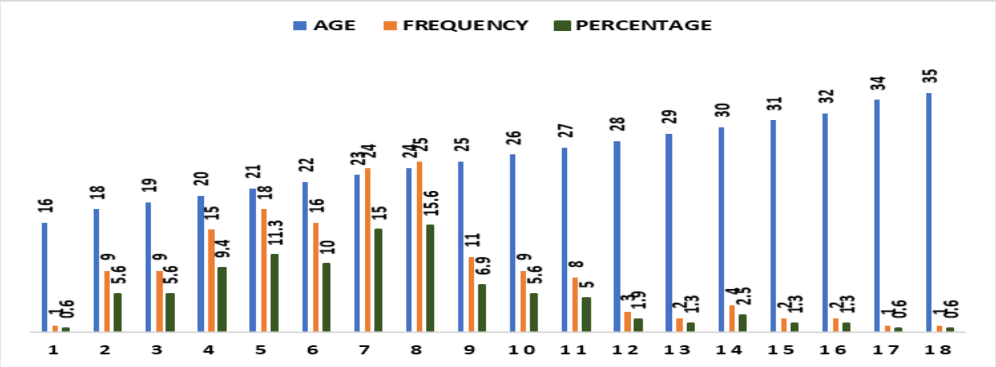
Table- 1 Percentage and Frequency of different genders.

Gender	Frequency	Percentage
Male	83	51.9
Female	77	48.1
Total	160	100

3.2 Ratios of PFP in a different age

Figure 1 shows the age distribution frequency. Participants are most likely to be between the ages of 23 (15%) and 24 (15.6%). Patellofemoral pain (PFP) and tight quadriceps are common complaints among persons of all ages, and the numbers suffering from these conditions are shown in the frequency column. For instance, 18 participants from 21-year-category who took part (11.3% of the sample) experienced PFP with quad discomfort. Meanwhile, the percentages in each age bracket reflect their representation in the overall survey population. This allows us to examine the prevalence of PFP and quad pain across age groups. In this study we noticed trends, such as an increase or decrease in PFP incidence with age. One study found that the peak incidence of PFP occurred between the ages of 23 and 24, suggesting a substantial increase in cases in the early 20s. There are additional instances in the chart where PFP is not particularly prevalent, as between the ages of 16 and 34 and 35. In conclusion, we may learn more about the age-specific distributions of PFP and tight quads from this table. It also sets the platform for subsequent study and discourse regarding potential age-related patterns or links.

Figure 1: The ratio of PFP with Quad tightness in a different age.



3.3 Participants ratio in Physical Activity

Table 2 displays the distribution of individuals according to their level of activity. A total of 160 participants were surveyed, with 119 (74.4%) reporting regular exercise and 41 (25.6%) reporting no such habit. How persons in the research group vary in their levels of physical activity reveals a great deal about their lifestyle preferences. The findings reveal that the majority of participants engaged in regular physical activity, providing valuable insight on the nature of the study's participants. To identify patterns and interpret them in light of the aims of the study, researchers may examine associations with confounding variables such as age and gender. The data also aids in determining the generalizability of the study's findings by providing context on the participants' exercise habits.

Table-2 Participants ratio in Physical Activity

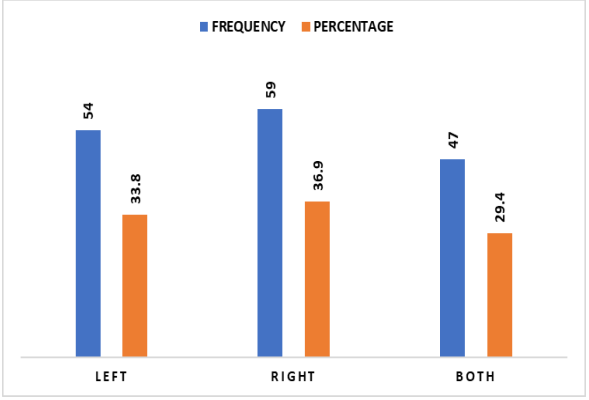
Physical Activity	Frequency	Percentage
No	41	25.6
Yes	119	74.4
Total	160	100

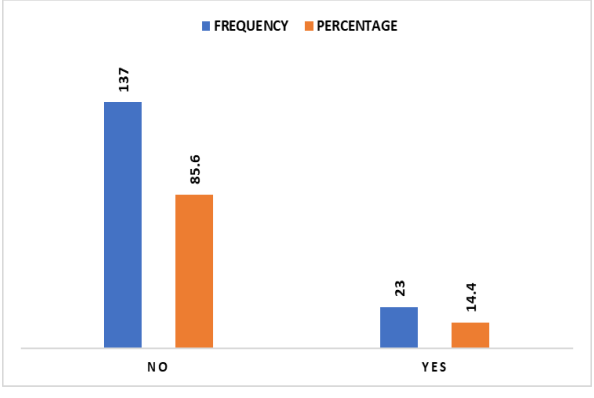
3.4 Percentage and Frequency of knee pain and swelling

Figure 2 (A) provides a statistical breakdown of the rate and percentage of knee discomfort among the participants. The findings revealed that knee discomfort might originate in several spots for different people: Pain was reported in 33.8% of respondents' left knees, 36.9% of their right knees, and 29.4% of both knees.

Figure 2(B) shows how often and how many people in the study group had knees that were swollen. Out of the people who were asked, 85.6% said their knees were not swollen and 14.4% said they were. It's important to know this in order to figure out how common knee swelling is in people with quadriceps tightness and patellofemoral pain (PFP).

Figure 2: (A) Percentage and Frequency of knee pain (B) Frequency of knee swelling.





3.5 The Ratio of Discomfort for More Than Three Months

Table 3 shows that a total of 100 participants (62.5%) reported no discomfort lasting more than three months, whereas 37.5 percent (60) reported experiencing such pain. This information helps us highlight the prevalence of persistent discomfort within the sample population. Scientists may investigate factors like age, gender, and activity level to find the root of chronic pain. It is helpful to get a sense of the prevalence of chronic pain in order to identify recurrent patterns, such as those associated with patellofemoral pain (PFP) and quadriceps tightness.

Table 3: The ratio of discomfort for more than three months

Discomfort	Frequency	Percentage
No	100	62.5
Yes	60	37.5
Total	160	100

3.6 Percentage of Cracking Sound During Any Activity

Table 4 shows that 56.9% (91 individuals) of participants reported hearing a cracking sound when engaging in various activities, whereas 43.1% (69 people) reported no cracking sound.

Table 4: Percentage of cracking sound during any activity

Cracking Sound	Frequency	Percentage
No	69	43.1
Yes	91	56.9
Total	160	100

Difficulties Aggravating Knee Problems

Knee discomfort was reported by a significant percentage of persons (20%) while sitting for extended periods of time, which may have a correlation with inactivity. Two percent of the persons who participated reported that moving downstairs injured their knees, which implies that it has a lesser impact than other jobs. Even though squatting is a common place activity, 11.9% of participants reported feeling uneasy while doing it.

However, just 2.5% of respondents mentioned kneeling as an issue. This indicates that it probably doesn't cause a lot of discomfort for most individuals. For 19% of the study participants, standing for extended durations became a serious issue. Table 4 shows that out of the total number of participants polled (91), 56.9% reported hearing a cracking sound when engaging in various activities, whereas 43.1% reported not hearing any such noise.

If you want healthy knees, you should realize how often popping noises are. For instance, researchers may try to determine whether prolonged knee discomfort is related to the presence of sounds like popping. Running and other activities requiring movement up and down, such as climbing stairs, may significantly impact knee health.

15.6% of participants reported feeling uneasy about ascending the stairs, while 24.4% said the same about jogging. These findings highlight the dangers of engaging in high-impact sports for one's knees. Jumping is another high-impact activity that has been shown to cause knee pain in 3.8% of jumpers, albeit this is still higher than the impact of running. The chart paints a clear picture of the factors that aggravate knee pain, which may be used to tailor therapy and advice related to the individual's specific complaints.

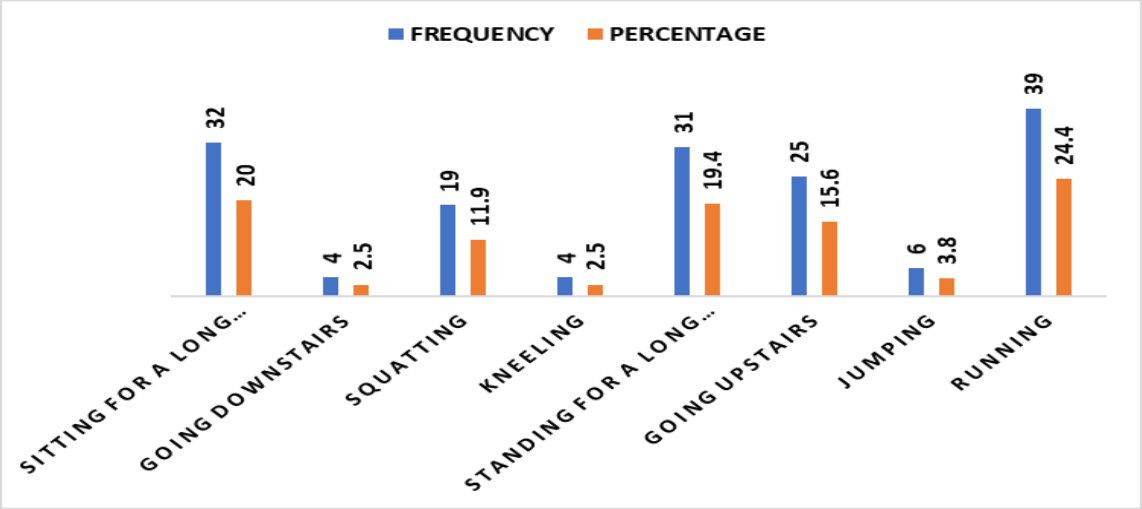


Figure 3: The ratio of different difficulties aggravates the knee problem

The ratio of thigh pain during different activities

Figure 5 showed distribution of participants who reported their hip discomfort levels while doing various exercises. It is clear that flexion movement have an effect on humans since the majority (41%) reported discomfort while bending their knee. A significant but less frequent cause of leg discomfort was reported by 21.9% of participants when they straightened their knee. Running was shown to be strongly associated to hip discomfort in 26.9% of individuals. While 4.4% of those who reported thigh pain when leaping, another 5% reported similar discomfort while kicking. These statistics provided us additional information about the exact actions that make thigh pain worse, which may help us think of techniques to aid patients who have patellofemoral pain and tight quads.

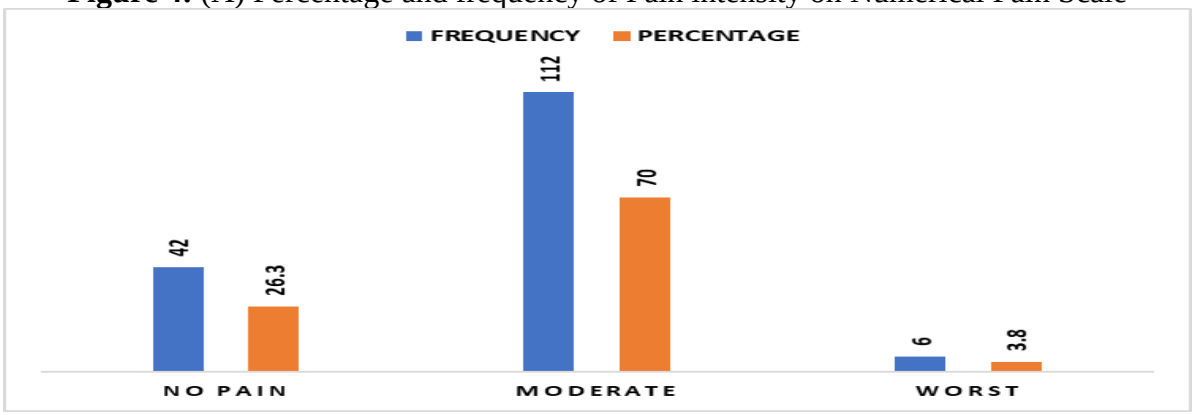
Table 5: The ratio of thigh pain during different activities

Thigh Pain	Frequency	Percentage
bending the knee	67	41.9
straightening the knee	35	21.9
Running	43	26.9
Jumping	7	4.4
Kicking	8	5
Total	160	100

Numerical Pain Scale

Using the Pain Numerical Scale, a large portion (26.3%) reported no pain. Based on these results, a large number of the subjects had an experience that was mostly pain-free. 70% of the people responded with mild to moderate pain. In terms of numbers, this means that a lot of the people in the study group are in the middle of the pain scale. A smaller percentage, 3.8%, said they were in severe pain. A smaller group of people in this group were feeling worse pain than others in the group. All of the individuals' pain experiences, from complete absence to varying degrees of discomfort, are represented. The majority of participants in the research reported experiencing minor discomfort at some point throughout the trial. Conversely, some participants were in the severe pain, indicating that there was a wide range of pain severity within the sample. Patellofemoral pain and tight quadriceps are characterized by varying degrees of discomfort, which may be quantified using the Pain Numerical Scale.

Figure 4: (A) Percentage and frequency of Pain intensity on Numerical Pain Scale



Discussion:

Certainly, by focusing on the main variables, the study revealed a significant association between physical activity and knee pain. The results of this study provided valuable insights into the characteristics and experiences of individuals with patellofemoral pain (PFP) and quadriceps tightness. The gender distribution demonstrated a nearly equal representation of males and females within the study cohort, laying a balanced foundation for exploring potential gender-based differences or similarities in the variables under investigation. The age distribution revealed peaks in PFP cases in the early twenties, particularly at ages 23 and 24, suggesting a potential age-related pattern in the incidence of PFP with quadriceps tightness. According to Harrison, & Magee, (2001), the etiology of PFPS is multifaceted; it is present most commonly in adolescents and young adults. Its incidence varies from 10–40%, with higher rates reported in athletic populations. Evidence does support that in active individuals, patellar mobility, quadriceps muscle activation, and quadriceps muscle tightness are common PFPS precursors (25).

The prevalence of physical activity among participants is substantial, with 74.4% engaging in such activities. This information is crucial for understanding the lifestyle choices of the study population and provides context for interpreting the study's findings. The distribution of knee pain indicated varying configurations, with a notable proportion experiencing pain in both knees. Additionally, the majority of participants report no knee swelling, emphasizing the need to explore potential correlations with other variables such as specific knees experiencing pain or engagement in physical activity. Previous results confirmed that PFP is a common pathology among adolescents, the general population, and those with high levels of activity, such as elite athletes and military populations. Point prevalence within military populations is reported as 13.5% (26); female general populations 12% to 13% (22); multi-day amateur cyclists 35% (21); and female elite sports 16.7% to 29.3% (18). From the previous literature it was calculated through meta-analysis to be 7.2% in mixed sex adolescents, and 22.7% in female amateur athletes. Annual prevalence in the general population is reported as 22.7% (27); in professional cyclists it is reported as 35.7% (26); and in general adolescent population it is reported as 28.9% (13).

The ratio of discomfort lasting for more than three months' highlighted that a significant portion of the participants, 37.5%, experienced persistent discomfort. This finding underscores the importance of investigating factors contributing to sustained discomfort, such as age, gender, or specific physical activities. The prevalence of cracking sounds during activities, reported by 56.9% of participants, prompt further exploration into potential associations with knee pain, swelling or prolonged discomfort. Previously Collins et al., (2016), studied two hundred forty-nine (54.4% of the study sample) participants reporting problems with prolonged sitting, and 121 (26.4%) reporting sitting pain after exercise. Compared to those with no difficulty sitting (n = 88), participants classified as having problems with prolonged sitting were significantly younger (P = .038), more likely to be female (P = .033), had a lower body mass index (P = .027), reported higher pain severity (P<.001) and lower Anterior Knee Pain Scale scores (P<.001), and more frequently reported problems with squatting (P<.001) (28). Selhorst et al., (2015) reported on a pilot study of

21 pediatric patients with PFP, mean age 14 years, where they defined a new PFP classification algorithm that contains four subgroups; elevated fear avoidance, decreased muscle flexibility, functional misalignment, decreased muscle strength (29). Keays et al., (2018) also described four clinical PFP; hypermobility, hypomobility, faulty movement pattern, osteoarthritis. Interestingly they had a very wide age range in their sample from 13 to 82 years (30).

The breakdown of activities associated with knee discomfort provides nuanced information, revealing that prolonged standing, going upstairs, and running are notable challenges for a substantial proportion of participants. This detailed characterization of difficulties contributes to tailoring interventions based on reported challenges. Knee pain during different activities is also explored, with bending the knee and running emerging as significant contributors, offering insights for targeted interventions. Selhorst et al., (2015), highlight the necessity of addressing psychosocial factors in PFP and there is some evidence to suggest a relationship exists between patients with PFP and activity levels, (31) weight (32) and pain mechanisms, (33). These factors may be of relevance to subgroup approaches in the management of patients suffering from PFP (29).

The Pain Numerical Scale results demonstrate a spectrum of pain experiences, with a notable proportion reporting moderate pain. This information is critical for understanding the intensity of pain associated with PFP and quadriceps tightness within the study population.

Conclusion

In conclusion, the comprehensive analysis of the study's results provides a comprehensive understanding of the demographic and experiential landscape of individuals grappling with patellofemoral pain (PFP) and quadriceps tightness. The balanced gender representation among the 160 participants sets a solid foundation for exploring potential gender-based variations in the studied variables. The distribution of PFP across different age groups revealed a notable peak in incidence during the early twenties, particularly at ages 23 and 24, suggesting a potential age-related pattern in PFP occurrence. Furthermore, the high prevalence of physical activity, reported by 74.4% of participants, offers valuable insights into the lifestyle choices of the study population and forms a contextual backdrop for interpreting the study's outcomes. The detailed examination of knee pain and swelling distributions unveils the nuanced experiences of participants, emphasizing the lateralization of knee pain and providing valuable information for potential correlations with age, gender, or physical activity levels. Additionally, the investigation into discomfort lasting more than three months and the prevalence of cracking sounds during activities contributes to a better understanding of persistent issues associated with PFP and quadriceps tightness. The exploration of specific activities aggravating knee problems and thigh pain during different activities further refines our understanding, offering insights for tailored interventions and recommendations. The Pain Numerical Scale results showcase a spectrum of pain experiences, with a substantial proportion reporting moderate pain and a smaller group experiencing the worst pain. This distribution underscores the diversity of pain severity within the cohort. The study's depth of analysis contribute valuable knowledge to the field, offering a holistic perspective on the multifaceted nature of patellofemoral pain and its associated factors.

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