
ORIGINAL RESEARCH

PREVALENCE OF ANTERIOR KNEE PAIN IN 18-35 YEAR-OLD FEMALES

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ABSTRACT

Purpose/Background: Anterior knee pain (AKP), also known as patellofemoral pain syndrome (PFPS), is believed to be common in young, active females. A prevalence rate of 25% has been commonly cited in the literature. However, this rate may be more anecdotal than empirical. The purpose of this study was to estimate the prevalence of AKP in females 18 to 35 years of age.

Methods: Three cohorts of females, totaling 724 participants between 18 and 35 years of age participated in this study. The mean age of participants was 24.17 years (SD: 2.34), mean height was 165.10 cm (SD: 7.26), mean weight was 65.46 kg (SD: 14.10), and mean BMI was 23.95 kg/m² (SD: 4.86). Participants completed the Anterior Knee Pain Questionnaire (AKPQ), a functional outcome tool developed to document symptoms of AKP and progress in patients during rehabilitation.

Results: The mean score on the AKPQ for the left lower extremity was 93.38 (SD: 10.00) and 93.16 (SD: 11.37) for the right lower extremity. Using a cutoff score of 83 on the AKPQ, 85 of 724 subjects were classified as having AKP in the left lower extremity for a prevalence of 12% (95% CI = 9%-14%) while 94 subjects were classified with AKP in the right lower extremity for a prevalence of 13% (95% CI = 11%-15%).

Conclusion: The estimated prevalence of AKP in this sample of 18-35 year old females of 12-13% is much less than the commonly cited value of 25%. The results may provide a better representation of subjects with AKP.

Key Words: Anterior knee pain, Anterior Knee Pain Questionnaire (AKPQ), functional limitations, prevalence

Level of Evidence: 3

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INTRODUCTION

Anterior knee pain (AKP) or patellofemoral pain syndrome (PFPS) has been described as a common diagnosis among young, active females.^{1,2} The terms AKP and PFPS are often used synonymously to describe a syndrome, that includes pain in the anterior part of the knee that can result from patellar dislocation, patellar subluxation or, on occasion, no trauma.^{3,4,5} The diagnosis of AKP is usually determined by the patient's report of symptoms, rather than any combination of clinical or functional tests.

Prevalence is defined as the number of cases of a condition existing in a population at a given time divided by the number of individuals in a given population.⁶ The prevalence of AKP has been reported as between 15-45% of the population.⁷ Callaghan and Selfe,³ in a review article, noted that there is a wide variation in the reported prevalence of AKP, and that these estimates are based primarily on patients in the military or patients consulting practitioners at sports medicine facilities. They concluded that existing estimates of the AKP prevalence are inadequate, and that "the incidence of patellofemoral pain syndrome in the general population has not been evaluated and there clearly is a need for a study on the incidence of patellofemoral pain syndrome."^(3, p. 41)

There are no known valid clinical tests for AKP or PFPS at this time.^{7,8} Individuals with the condition are most typically identified by ruling out other conditions,⁹ by their history, as well as reporting the functional abilities as assessed by the Anterior Knee Pain Questionnaire (AKPQ).¹⁰ The AKPQ is a functional outcome tool developed to document symptoms of AKP and chart progress in patients during their rehabilitation.¹⁰ It includes thirteen questions that query the patient about their ability to perform a number of different activities, as well as a question about pain. It is considered a valid and reliable tool that is easy for patients or subjects to complete.^{11,12} The purpose of this study was to estimate the prevalence of AKP in females 18 to 35 years of age.

METHODS

Sample

This study was approved by the Institutional Review Board (IRB) of Arizona State University and A. T. Still University-Mesa. All subjects participating in

this study were required to sign an informed consent agreement prior to participation. The sampling plan was designed to yield data from a wide variety of female participants aged 18 to 35. Data were collected from three cohorts. The first cohort included 310 female subjects between the ages of 18 and 23 years of age; the second, 165 females between 25 and 35 years of age; and the third, 249 females between 25 and 35. Subjects in the first and third cohorts were nulliparous and not currently pregnant. Subjects in the second cohort had delivered between 1 and 3 children, were not currently pregnant and were at least 1-year post-partum. The total sample for the study included 724 females between 18 and 35 years of age.

Data Collection and Analysis Procedures

Participants' age, height, and weight were measured and recorded. They then completed the AKPQ, based on their current symptoms and functional abilities. A cutoff of 83 on the AKPQ was chosen to identify those individuals with anterior knee pain, following the recommendations made in the study by Kujala et al.¹⁰ To substantiate the cutoff point further, the authors of the current study analyzed the Receiver Operating Characteristic (ROC) curve for AKPQ reported in a therapeutic intervention program conducted by Crossley et al¹¹ using the NIH Image J software program (NIMH, NIH, Bethesda, Md) to determine the area under the curve for the plotted data. The cutoff point chosen by Crossley et al did not appear to optimally balance the sensitivity and specificity of the AKPQ.¹¹ The area under the curve for the AKPQ, based on the current re-analysis, was approximately .88. The authors used formulas derived from Akobeng¹³ and determined that the cutoff point for the AKPQ approximated 83.

Descriptive statistics for age, height, weight and body mass index (BMI) for the different cohorts were calculated. Means and standard deviations for the reported scores on the AKPQ were also calculated for the cohorts. The number of subjects who were considered to be positive for AKP as determined by the AKPQ was counted. The prevalence was then calculated as the number of cases divided by the total number of subjects in the various samples and the total population in the study. A 95% Confidence Interval of the prevalence was calculated for each cohort as well as for the sample as a whole.

RESULTS

The descriptive statistics for each cohort and the sample as a whole can be found in Table 1. The first cohort consisted of 376 subjects with a mean age of 20.41 years (SD: 1.88), mean height of 164.99 cm (SD: 6.98), mean weight 64.25 kg (SD: 13.33), and mean BMI of 23.58 kg/m² (SD: 4.55). The mean score on the AKPQ for the left lower extremity (LE) was 93.80 (SD: 8.93), mean score for the right LE was 93.72 (SD: 11.61), and mean score for both LE's was 93.76 (SD: 10.35).

The second cohort consisted of 165 subjects with a mean age of 30.40 years (SD: 2.98), mean height of 164.06 cm (SD: 6.73), mean weight 67.69 kg (SD: 15.15), and mean BMI of 25.21 kg/m² (SD: 5.00). The mean score on the AKPQ for the left LE was 93.24 (SD: 10.64), mean score for the right LE was 93.45 (SD: 10.06), and mean score for both LE's was 93.34 (SD: 10.34).

The third cohort consisted of 228 subjects with a mean age of 27.78 years (SD: 4.03), mean height of 164.97 cm (SD: 7.50), mean weight 65.84 kg (SD: 13.75) and mean BMI of 24.18 kg/m² (SD: 4.73). The mean score on the AKPQ for the left LE was 92.29 (SD: 11.26), mean score for the right LE was 90.92 (SD: 12.69), and mean score for both LE's was 91.60 (SD: 11.99).

For the entire sample of 769 subjects, the mean age was 24.74 years (SD: 1.89); mean height was 164.78 cm (SD: 7.09), mean weight was 65.46 kg (SD: 12.36) and mean BMI of 24.11 kg/m² (SD: 4.70). The mean score on the AKPQ for the left LE was 93.38 (SD: 10.00) mean score for the right LE was 93.16 (SD: 11.37), and mean score for both LE's was 93.27 (SD: 10.63). Most of the subjects had some sort of mild dysfunction although not at the threshold to be classified with AKP.

For the first cohort, 32 subjects reported positive scores for AKP on the left LE, 37 on the right LE, and 69 on both LE's. For the second cohort, 26 subjects reported positive scores for AKP on the left LE, 25 on the right, and 51 on both LE's. For the third cohort, 27 subjects reported positive scores for AKP on the left LE, 32 on the right, and 59 on both LE's. For all subjects, 85 subjects reported positive scores for AKP on the left LE, 94 on the right, and 179 on both LE's. A count of the subjects who were classified as positive and negative as well as the calculated prevalence and the 95% confidence intervals can be found in Table 2.

DISCUSSION

Baquie and Brukner¹⁵ stated that PFPS was the most common complaint in physically active patients consulting their physicians. Fredericson et al noted that PFPS is one of the most common disorders of the knee, accounting for 25% of all knee injuries treated in sports medicine clinics.¹⁶ Many authors have reported prevalence rates of around 25%.¹⁶⁻²⁰ Callaghan and Selfe³ conducted a literature review in order to describe the different prevalence and incidence rates for patellofemoral pain syndrome or anterior knee pain that have been reported in numerous articles. For the most part, Callaghan and Selfe found that the reported prevalence was often anecdotal. Many authors have simply reported that PFPS is "common," "frequent," or "prevalent".³

Devereaux and Lachman²¹ reported that 25% of the patients in their sports injury clinic had patellofemoral arthralgia. Boling et al²² reported a prevalence of 15% for AKP among female cadets at the United States Naval Academy, and an incidence of 33/1000 person-years. Wills et al²³ reported an incidence rate of 8.75% for AKP among military trainees; whereas,

Table 1. Means (standard deviations) for the three samples and combined sample.

	<u>Group 1</u>	<u>Group 2</u>	<u>Group 3</u>	<u>All Subjects</u>
Count	310	165	249	724
Age (yrs)	20.05 (1.73)	30.40 (2.98)	25.18 (2.53)	24.17 (2.34)
Height (cm)	165.18 (6.93)	164.06 (6.73)	165.10 (7.99)	165.10 (7.26)
Weight (kg)	64.60 (13.71)	67.69 (15.15)	65.05 (13.92)	65.46 (14.10)
BMI (kg/m ²)	23.67 (4.75)	25.21 (5.00)	23.46 (4.38)	23.95 (4.86)

Table 2. Mean scores (standard deviations) for the AKPQ, counts of positive and negative scores and prevalence with 95% confidence intervals.

		Mean (SD) score for AKPQ	Number of positives for AKP	Number of negatives for AKP	Prevalence	95% CI*
Group 1	Left	93.80 (8.93)	32	278	.10	.07 - .14
	Right	93.72 (11.61)	37	273	.12	.10 - .14
	Both	93.76 (10.35)	69	551	.11	.10 - .12
Group 2	Left	93.24 (10.64)	26	139	.16	.10 - .21
	Right	93.45 (10.06)	25	140	.15	.10 - .21
	Both	93.34 (10.34)	51	279	.15	.12 - .19
Group 3	Left	92.29 (11.26)	27	222	.11	.07 - .15
	Right	90.92 (12.69)	32	217	.13	.09 - .17
	Both	91.60 (11.99)	59	439	.12	.09 - .15
All Subjects	Left	93.38 (10.00)	85	639	.12	.09 - .14
	Right	93.16 (11.37)	94	630	.13	.11 - .15
	Both	93.27 (10.63)	179	1269	.12	.11 - .14

* 95% confidence interval

Harrison and Magee²⁴ reported incidence rates between 10-40% for AKP. Studies conducted with sequestered samples such as individuals participating in military service may not be reflective of the actual demographics of the larger population.

AKP is differentially distributed across genders, with greater prevalence in females than males. Dehaven and Linter²⁵ reported that 33% of females complained of patellofemoral pain syndrome. Fairbank et al²⁶ determined that 69 of 219 (32%) of girls between 13 and 17 years presented with anterior knee pain. Witvrouw et al²⁷ found that 13 of 131 (10%) of female, physical education students had patellofemoral pain syndrome, with 11 subjects exhibiting symptoms bilaterally. Tauton et al²⁸ noted that 62 of 207 (30%) of female runners reported symptoms of AKP that required consultation with their physician. Boling et al²² found that females were 2.23 times more likely to develop AKP than males. The authors of the current study chose to limit the current investigation to only females. Studies of functional limitations in males due to AKP are needed.

The medical diagnosis of AKP has historically included many different conditions, ranging from non-traumatic anterior knee pain with a duration of greater than 6 weeks²⁴ to chondromalacia patellae.^{19,27,33} Perhaps a functional diagnosis as offered by the AKPQ would be better than a medical diagnosis when treating patients with AKP. Several authors have found little to no validity for the common clinical tools used to assess individuals with AKP.^{7,8,9,31} Furthermore, the diagnosis is usually made by ruling out other conditions.⁹ Therefore, outcome tools such as the AKPQ may be better suited to document symptoms and chart progress in patients during their rehabilitation.^{10,11,29} To do so would require that the outcome tools receive better scrutiny for validity, with defensible receiver-operating characteristics (ROC) curves. Justifiable cutoff points for any tool developed then need to be established to truly discriminate between those patients with the condition and patients without.

A delimitation of this study is the fact that the sample was recruited from a large metropolitan area in the Southwestern United States. A limitation of the study

was the AKPQ was used as the functional outcome tool. The AKPS was chosen because the reported validity and reliability for the test were deemed adequate.^{11,12,29} The AKPQ has been criticized because it does not address the patient's ability to kneel,²⁹ which is a commonly impaired functional activity in those with AKP.^{11,30,31} However, it is easy to administer and subjects have reported that it was easy to complete.²⁹ Crossley et al recommended that a Visual Analog Scale be administered to individuals when screening for AKP.¹¹ However, the AKPQ includes a section on pain; therefore, the authors of the current study deemed it unnecessary to use either the Visual Analog Scale³² or the Numeric Rating Scale³² for pain during data collection.

CONCLUSION

The overall prevalence rate of anterior knee pain for females in the general population was .12. It appears the reported prevalence of AKP in many studies may have been overestimated or anecdotal. The results of the current study may provide better representation of subjects who exhibit functional limitations or disabilities associated with AKP. As there are no valid clinical tools for diagnosing AKP, and a diagnosis of AKP is usually made by ruling out other conditions, clinicians use functional outcome tools for identifying individuals with AKP.

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