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Research Article / Araştırma Makalesi

The effect of patellofemoral pain on functional mobility, activity level, quality of life, and kinesiophobia in elite football players

Elit futbolcularda patellofemoral ağrının fonksiyonel hareketlilik, aktivite düzeyi, yaşam kalitesi ve kinezyofobi üzerine etkisi

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ABSTRACT

Background: This study was planned to determine the effect of patellofemoral pain (PFP) on functional mobility, quality of life, and kinesiophobia in elite soccer players.

Methods: Screening was conducted among 125 football players aged 14-19 in the U14-U18 infrastructure football team of professional Tümosan Konyaspor club in Konya province, and 30 football players who had PFP between February-April 2024 were included in the study. Pain symptom severity at rest and during performance-based functional mobility tests was assessed with Patellofemoral Syndrome Pain Severity Scale (PSS), functional evaluation with Kujala Patellofemoral score (KPS), activity level with Tegner Activity Level (TAS), functional disability status with Lysholm Knee Scoring Scale (LDSS), daily life activity with Knee Test for Daily Living Activities (KOS-ADL), kinesiophobia was evaluated using the Tampa Kinesiophobia Scale (TSK).

Results: PFP was evaluated with PSS. There was a weak negative correlation between PSS and KPS (r=-0.442, p=0.014), a moderate negative correlation between PSS and TAS (r=-0.503, p=0.005), a weak negative correlation between PSS and LDSS (r=-0.465, p=0.010), a moderately negative significant correlation between PSS and KOS-ADL (r=-0.532, p=0.003) were found. No relationship could be determined between PSS and TSK or complaint duration. Multiple regression analysis determined that activity level (β=-0.484, p=0.011) and daily living activity (β=-0.516, p=0.007) affected patellofemoral pain.

Discussion: It has been determined that PFP affects functional mobility, activity level, and quality of life in elite football players and has no effect on kinesiophobia. The lack of a relationship with kinesiophobia is thought to be because the pain intensity of the athletes participating in our study was not high.

Keywords: *Football, patellofemoral pain, kinesiophobia, life quality, activity level*

ÖZ

Amaç: Elit futbolcularda patellofemoral ağrının (PFP) fonksiyonel mobilite, yaşam kalitesi ve kinezyofobi üzerindeki etkisini belirlemek amacıyla planlanmıştır.

Gereç ve Yöntem: Bu çalışmada Konya ilinde Tümosan Konyaspor kulübü futbol takımının profesyonel altyapı U14-U18 takımında yer alan 14-19 yaş arası 125 futbolcu arasında tarama yapıldı ve Şubat-Nisan 2024 tarihleri arasında PFP saptanan 30 futbolcu çalışmaya alındı. İstirahat ve performansa dayalı fonksiyonel mobilite testleri sırasında ağrı şiddeti Patellofemoral Sendrom Ağrı Şiddeti Ölçeği (PSS) ile, fonksiyonel değerlendirme Kujala Patellofemoral skoru (KPS) ile, aktivite düzeyi Tegner Aktivite Düzeyi (TAS) ile, fonksiyonel engellilik durumu Lysholm Diz Skorlama Ölçeği (LDSS) ile, günlük yaşam aktivitesi Günlük Yaşam Aktiviteleri için Diz testi (KOS-ADL) ile, kinezyofobi ise Tampa Kinezyofobi Ölçeği (TSK) kullanılarak değerlendirildi.

Bulgular: PFP, PSS ile birlikte değerlendirildi. PSS ile: KPS arasında zayıf negatif (r=-0.442, p=0.014), TAS arasında orta negatif (r=-0.503, p=0.005), LDSS arasında zayıf negatif (r=-0.465, p=0.010), KOS-ADL arasında orta negatif (r=-0.532, p=0.003) anlamlı korrelasyonlar saptandı. TSK'nın PSS'si ile yakınma süresi arasında bir ilişki saptanmadı. Çoklu regresyon analizinde aktivite düzeyi (β=-0.484, p=0.011) ve günlük yaşam aktivitesinin (β=-0.516, p=0.007) patellofemoral ağrıyı etkilediği belirlendi.

Sonuç: Elit futbolcularda PFP'nin fonksiyonel mobilite, aktivite düzeyi ve yaşam kalitesini etkilediği ve kinezyofobi üzerinde bir etkisi olmadığı belirlendi. Kinezyofobi ile ilişkisinin olmaması çalışmamıza katılan sporcuların ağrı şiddetlerinin yüksek olmaması kaynaklı olabilir.

Anahtar Sözcükler: *Futbol, patellofemoral ağrı, kinezyofobi, yaşam kalitesi, aktivite düzeyi*

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INTRODUCTION

Patellofemoral pain (PFP) is a common musculoskeletal condition characterized by insidious onset, poorly defined pain localized in the anterior retro patellar or peripatellar region of the knee (1). Symptoms usually present as pain from the anterior aspect of the patella and commonly along the medial aspect of the knee (2). Pain limits daily activities that require loading on a flexed knee (3). PFP accounts for 29% of active adolescents in the general population and 11-17% of all cases of knee pain presenting to the hospital (4). The prognosis of PFP is bad, with more than 50% of patients reporting persistent pain for five years after treatment. Clinicians and researchers need to do more to optimally manage PFP (3).

More than half of adolescent athletes have been reported to experience knee pain every year, and non-traumatic PFP is one of the most common complaints. Adolescents participating in team or individual sports involving repetitive jumping and changing direction tasks are more vulnerable to PFP. Tasks such as repetitive sprinting and deceleration, changing direction, and jumping place high amount of stress on the patellofemoral joint and surrounding musculotendinous units, leading to the onset of pain and dysfunction (5). PFP is most common in adolescents and young adults, especially recreational or professional athletes who regularly participate in sports activities, especially high-activity sports such as running, basketball, and football. This condition occurs especially in activities that require a large amount of knee flexion and generate increased compressive forces on the PFP, as in some sports activities (6). One of these sports is football. PFP in footballers begins in adolescence following the growth phases (7).

Football is the most widely played sport in many countries at both elite and amateur levels. A study conducted by the German Olympic Sports Confederation reveals that football is by far the most popular sport among boys (7-14 years) and teenagers (15-18 years) (8). Football is a sport that involves interval walking, jogging, running and sprinting. Football players are at high risk for lower extremity injuries because they rotate on the axis of rotation, rotate while slowing down, and jump and land repeatedly. One of the most common injury sites is the knee (9). The knee is one of the most important and the largest joint of the body. It plays an important role in movements related to carrying body weight in horizontal (running and walking) and vertical (jumping) directions (10). As the knee is the center of the limb, it is particularly susceptible to injury as it withstands greater forces transmitted through the ankle and foot from the ground and from the trunk to the hip (9). Problems with the knee are primarily characterized by pain. Pain affects functionality and quality of life. In the long term, kinesiophobia may occur due to pain.

There is no research in the literature on PFP in elite football players. Additionally, no study has been found investigating the effect of kinesiophobia on PFP in elite football players. It is important to determine the impact of PFP, which has a high prevalence in elite soccer players, on the athlete. For this reason, this research was planned to examine the effect of PFP on functional mobility, quality of life, and kinesiophobia in elite football players.

MATERIAL and METHODS

Study Design

The methodological model of this study is descriptive. Ethical permission was obtained from Necmettin Erbakan University Health Sciences Scientific Research Ethics Committee (Decision No. 2024/675) (Application ID: 19066). In addition, permission was obtained from Tümosan Konyaspor football club in the Konya Province. After verbal and written information about the study was given, signed informed consent was obtained from all participants or their parents before starting the data collection process (10). This study complies with the STROBE guideline and the REPORT-PFP checklist, and the necessary information has been reported accordingly (11).

Participants

In this study, 30 football players with PFP pain were included in the study between February-April 2024 by screening 125 players aged 14-19 years in the professional substructure U14-U18 football team of Tümosan Konyaspor sports club team in Konya province, a Turkish Football Federation Trendyol super league team. Participants who met the inclusion criteria were determined voluntarily. Data were collected from participants who met the inclusion criteria of the Helsinki Declaration voluntarily and by face-to-face interview technique (12).

PFP eligibility criteria were based on previous studies. PFP diagnoses were made by a physiotherapist with more than ten years of clinical experience (13). The inclusion criteria were: anterior knee pain or retro-patellar pain; pain caused by at least two of the following activities: prolonged sitting knee flexion, bilateral squatting, climbing and descending stairs, kneeling, running, and jumping; presence of one of the following symptoms: patellar tenderness, friction pain, positive single leg squat test or positive knee extension resistance test; knee pain score >3/10 on a visual pain scale, and unilateral pain and symptoms (14). Exclusion criteria for PFP was assessed by a physiotherapist: signs or

subluxation or clinical evidence of meniscal damage or ligament instability, symptomatic osteoarthritis in any lower limb joint. Athletes with patellar tendon pathology, pain from the lumbar spine, hips, ankles or feet, presence of medical conditions, physiotherapy treatment for PFP up to six months before the clinical assessment were excluded (14).

With the G*Power 3.1.9.2 program, it was determined that the calculation using the t-test dependent groups with an effect size of 0.5, a standard error of 0.05, and 80% power should be performed with 27 participants. Considering the drop-out rate of 10% in similar studies in the literature, it was planned to include at least 30 participants in this study (15).

Outcome Measures

The data of this study were collected from U14-U18 footballers in the Tümosan Konyaspor sports club in the Turkcell Superliga, and footballers with PFP were evaluated. Self-report scales were used.

Participants' physical (age, height, gender, body mass index, dominant side and affected side) and sociodemographic (gender, marital status, income-expense balance, education level) data were recorded. Duration of PFP complaints (weeks), and time since PFP diagnosis (weeks), were noted. Pain symptom severity at rest and during performance-based functional mobility tests was determined using the Patellofemoral Syndrome Pain Severity Scale (PSS). Functional evaluation was assessed using the self-reported Kujala Patellofemoral score (KPS), activity level using the Tegner Activity Level (TAS), functional disability using the Lysholm Knee Scoring Scale (LDSS), daily living activity using the Knee Test of Daily Living (KOS-ADL), and kinesiophobia using the Tampa Scale for Kinesiophobia (TSK).

PSS is a 10-parameter scale that assesses the pain of the patients during activities performed during the past week using a visual analog scale. These activities include climbing stairs, squatting, walking, slow jogging, fast jogging, participating in a sport, sitting with knees bent, kneeling, resting and sleeping, and resting after activity. Individuals also marked the activities they did not do last week as 'did not do'. The maximum score was 100 and the evaluation results were recorded as % (16,17). It was revealed by Laprade and Culham (16) and Turkish validity and reliability were performed by Çankaya et al. (17).

KPS is also called the Anterior Knee Pain Scale (18). It was developed by Kujala et al. The validity and reliability of the KPS have been demonstrated in 10 different languages and cultural adaptations have been made. Turkish validity and reliability study was conducted. KPS includes questions about patellar alignment and patella position and consists of 13 items that assess subjective responses to specific activities and symptoms thought to be associated with PFAS. It is scored from a minimum of 0 to a maximum of 100 points. A clinical variability of 8-10 points constitutes the minimum significant difference. Lower scores indicate more pain and disability, while higher scores indicate less disability (19). In the guidelines published by the American Physical Therapy Association and the Academy of Orthopaedic Physical Therapy, it is stated that the use of the KPS form in PFP patients yields high-quality data (1).

TAD is scored between 0-10 according to activities in daily life and sports (20). There are 11 activity levels on this scale. It determines the activity levels of the patients by questioning the activities of daily living, leisure time activities, or competitive sports. Higher scores indicate that the patient performs sports that challenge more knee stability (21).

LDSS consists of eight differently scored sub-headings. Limping and the support used are scored 5 points, locking 15 points, instability and pain 25 points, swelling 10 points, climbing stairs 10 points, and squatting 5 points. LDSS score ranges from 0-100, with higher values indicating better results. Out of 100 points, 95-100 points are considered excellent, 84-94 points are considered good, 65-83 points are considered moderate, and <65 points are considered poor. LDSS was culturally adapted to Turkish by Çelik et al. (22) and was reported to be reliable and valid.

KOS-ADL is a scale that measures symptoms and functional limitations in the activities of daily living of individuals, and the Turkish version of which has been validated and found reliable (23). The test includes six questions related to symptoms: pain, stiffness, swelling, loosening/knee bending, weakness, and limping. It also includes eight questions about functional limitations including walking, climbing stairs, descending stairs, standing, kneeling, squatting, sitting with bent knees, and getting up from a chair. The test is scored between 0-5. The patient's scores from each question are summed, and the total score is divided by 70 and multiplied by 100 (24).

TSK is a 17-item scale measuring fear of movement and re-injury due to movement and physical activity from 0-68 (14). It indicates more fear of re-injury due to movement. The scale uses a 4-point Likert scale (1: strongly disagree, 4: strongly agree). After reversing items 4, 8, 12 and 16; a total score is calculated. The person receives a total score between 17 and 68. A high score on the scale indicates a high level of kinesiophobia. It is recommended to use the total score in studies (25).

Statistical Analysis

SPSS for Windows 29.00 computer package program was used for all statistical analyses. Data were checked for accuracy and normal distribution. Used to report best practices with 95% confidence interval and standard error. Descriptive statistical information was given as mean and standard deviation (X±SD) for measured values, and number (n) and percentage (%) for non-measured values. Cronbach's coefficient and item-total correlation were used to analyze the measurement tools. The conformity of the data to normal distribution was determined by the Kolmogrov-Smirnov Test, Skewness, and Kurtosis tests (as +2) (26). Pearson correlation analysis was performed to determine the relationship between PSS, KPS, TAS, LDSS, KOS-ADL, and TSK. In addition, multiple regression analysis was performed to determine the effects of PSS on the scales used (27).

RESULTS

All participants were aged between 14-19 years, were male, marital status was single. Dominant side was right (n=23, 73.3%) and the affected side was right (n=16, 53.7%). Physical (Table 1) and socio-demographic characteristics (Table 2) of the participants are given. It was observed that the parameters evaluated in our study followed normal distribution. In addition, only the skewness values of the KOS-ADL and LDSS values were found to be greater than 2. The results of the Kolmogorov-Simirnov test were p=0.102 and p=0.155, respectively, and it was decided that there was normal distribution.

Table 1. Participants' (n=30) physical characteristics

Characteristic	Mean±SD	Min	Max	Skewness		Kurtosis	
				Statistic	Std. error	Statistic	Std. error
Age (yr)	16.5±1.6	14.0	19.0	-0.357	0.427	-0.809	0.833
Height (m)	1.77±0.08	1.62	1.93	-0.167	0.427	-0.640	0.833
Weight (kg)	67.1±9.1	49.0	80.0	-0.392	0.427	-0.884	0.833
BMI (kg/m^2)	21.3±1.8	18.0	24.6	-0.119	0.427	-0.763	0.833
PSS	42.9±15.3	11.0	70.0	-0.112	0.427	-0.265	0.833
KPS	66.9±16.2	20.0	93.0	-0.939	0.427	1.097	0.833
TAS	9.1±0.7	8.0	10.0	-0.147	0.427	-0.912	0.833
KOS-ADL	54.0±12.6	23.0	91.4	-0.019	0.427	**3.089**	0.833
LDSS	77.8±13.8	31.0	95.0	-1.530	0.427	**3.391**	0.833
TSK	36.4±5.9	22.0	46.0	-0.446	0.427	-0.018	0.833
Complaint duration (wk)	7.3±3.1	3.0	15.0	0.329	0.427	-0.286	0.833
Time since diagnosis (wk)	5.0±2.6	2.0	12.0	0.938	0.427	0.363	0.833
R-dominant	22 (73.3)			1.112	0.427	-0.824	0.833
L-dominant	08 (26.7)						
R-side patient	16 (53.7)			0.141	0.427	-2.127	0.833
L-side patient	14 (46.7)						

BMI: body mass index, PSS: patellofemoral pain severity scale, KPS: Kujala patellofemoral score, TAS: Tegner activity scale, LDSS: Lysholm knee scoring scale, KOS-ADL: knee outcome survey activities of daily living scale, TSK: Tampa scale for kinesiophobia; R: right, L: left.

Table 2. Participants' (n=30) sociodemographic characteristics

Characteristic	n (%)	Skewness		Kurtosis	
		Statistic	Std. error	Statistic	Std. error
Education level		-0.003	0.427	0.229	0.833
Primary school	0 (0)				
Secondary school	6 (20.0)				
High school	20 (66.7)				
University	4 (13.3)				
Income-expense balance		-0.037	0.427	-0.589	0.833
Income>expense	6 (20.0)				
Equal	17 (56.7)				
Income<expense	7 (23.3)				

In this study, PFP was evaluated with PSS. There was a weak negative correlation between PSS: and KPS (r=-0.442, p=0.014), a moderate negative correlation with TAS (r=-0.503, p=0.005), a weak negative correlation with LDSS (r=-0.465, p=0.010), and a moderate negative correlation with KOS-ADL (r=-0.532, p=0.003) (Table 3, Figure 1). No correlation was found between PSS and TSK or duration of complaint (p=0.353 and p=0.280, respectively). Correlations between other scales are also given (Table 3).

Table 3. The effect of patellofemoral pain on functionality, activity levels, daily living activities, functional disability, and kinesiophobia

N=30	95% CI		Patellofemoral Pain Severity Scale	
Scale	**Lower**	**Upper**	**r**	**(p)**
Kujala Patellofemoral Score	-0.703	-0.044	0.442*	**0.014**
Tegner Activity Scale	-0.735	-0.211	-0.503**	**0.005**
Lysholm Knee Scoring Scale	-0.718	-0.137	-0.465**	**0.010**
KOS-ADL Scale	-0.747	-0.244	-0.532**	**0.003**
Tampa Scale for Kinesiophobia	-0.263	0.545	0.176	0.353
Complaint duration	-0.112	0.504	0.204	0.280
			Kujala Patellofemoral Score	
Tegner Activity Scale	-0.650	0.662	0.372*	**0.043**
Lysholm Knee Scoring Scale	0.109	0.827	0.563**	**0.001**
KOS-ADL Scale	-0.059	0.825	0.492**	**0.006**
Tampa Scale for Kinesiophobia	-0.533	0.170	-0.221	0.241
Complaint duration	-0.411	0.232	-0.065	0.735
			Tegner Activity Scale	
Lysholm Knee Scoring Scale	-0.157	0.572	0.276	0.140
KOS-ADL Scale	-0.010	0.958	-0.529	0.530
Tampa Scale for Kinesiophobia	-0.366	0.269	-0.043	0.821
Complaint duration	-0.697	-0.153	-0.465**	**0.010**
			Lysholm Knee Scoring Scale	
KOS-ADL Scale	0.041	0.766	**0.462***	**0.010**
Tampa Scale for Kinesiophobia	-0.230	-0.160	**-0.498****	**0.005**
Complaint duration	-0.544	0.124	-0.160	0.398
			KOS-ADL Scale	
Tampa Scale for Kinesiophobia	-0.538	-0.071	-0.288	0.123
Complaint duration	0.104	0.583	-0.143	0.363
			Tampa Scale for Kinesiophobia	
Complaint duration	-0.278	0.591	0.099	0.604

N: number of participants, CI: confidence interval, r: Pearson correlation coefficient, *: correlation is significant at the 0.05 level, **: correlation is significant at the 0.01 level.

As can be seen in Table 3 and Figure 1, in this study, a weak positive correlation was found between KPS and: TAS (r=-0.372, p=0.043), a moderate positive correlation with LDSS (r=-0.563, p=0.001), a low positive correlation with KOS-ADL (r=-0.492, p=0.006). No significant correlation was found between the TSK or duration of complaint (p=0.241, p=0.735, respectively). No significant correlation was found between TAS and: LDSS, KOS-ADL and TAF in PFP footballers (p=0.140, p=0.530, and p=0.821, respectively). A low-level negative correlation was determined between KPS and complaint duration (r=-0.465, p=0.010) (). It was determined that there was a low level negative significant correlation between LDSS and; KOS-ADL and TAF (r=-0.462, p=0.010; r=-0.498, p=0.005, respectively), but there was no significant correlation with the duration of complaint (p=0.398) (Table 3, Figure 1). It was also determined that there was no significant relationship between PFP footballers' KOS-ADL and duration of TAF complaints (p=0.123 and p=0.363, respectively). There was no significant relationship between TSK and complaint duration (p=0.604).

In the conducted multiple regression analysis, the effect of PSS of PFP footballers on KPS, TAS, KOS-ADL, LDSS, TAF, and complaint duration was determined. Thus, the ANOVA test results were found to be significant in Model 1 (F=4.761, p=0.003) (Table 4). The adjusted R^2 in the model summary shows the generalizability of the model. The model explains 55.4% of the total variance in the effect of PSS on other outcome measures (R^2=0.554). Activity level (β=-0.484, p=0.011), activity of daily living (β=-0.516, p=0.007) were found to affect PFP. It was determined that PFP was associated with functionality, activity level, activities of daily living, functional disability, but not with kinesiophobia and duration of complaint.

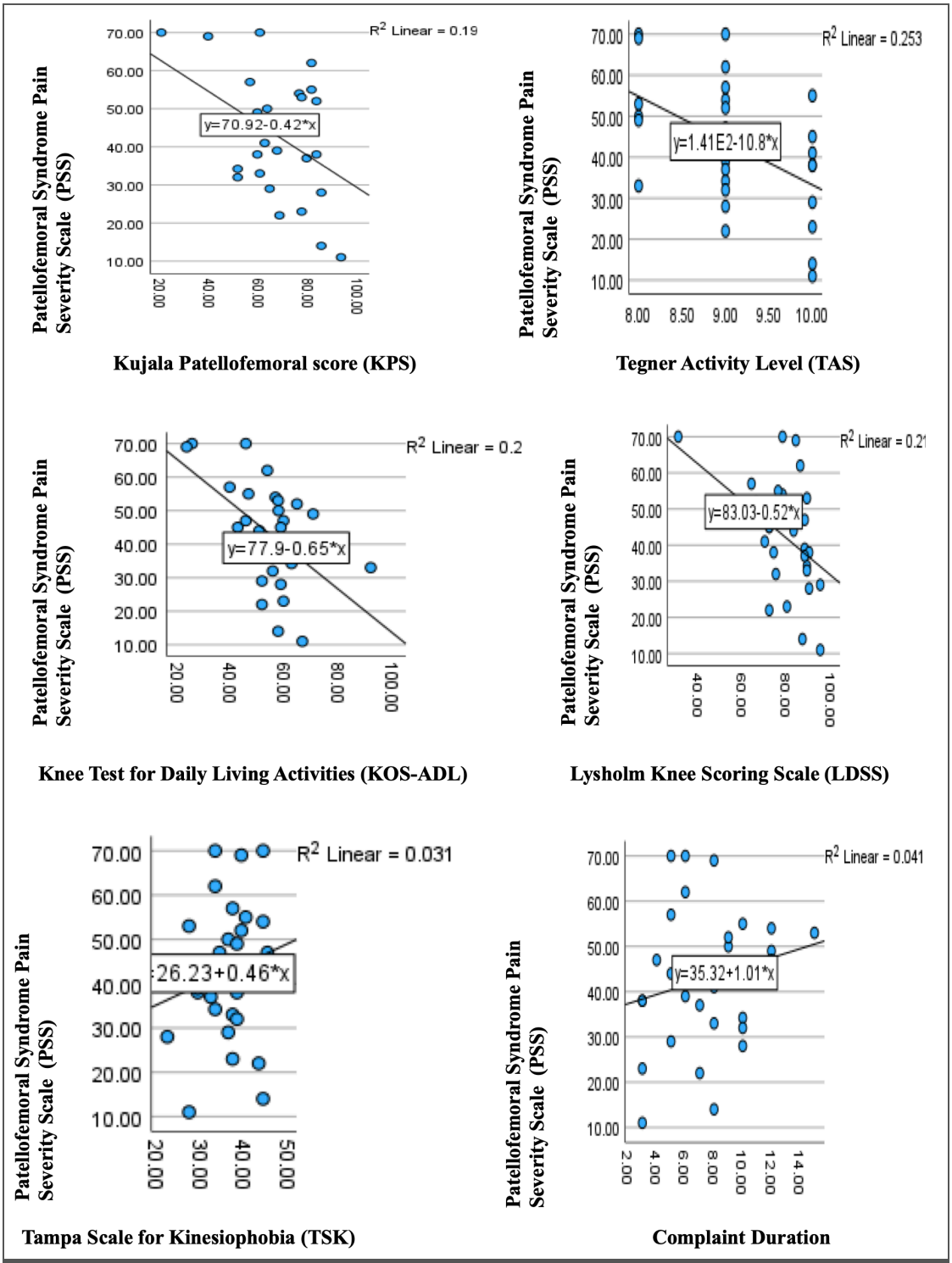

Figure 1. The effect of patellofemoral pain on functionality, activity levels, daily living activities, functional disability, and kinesiophobia

Table 4. Determination of the effect of patellofemoral pain on functionality, activity levels, daily living activities, functional disability, and kinesiophobia by multiple regression analysis.

Model 1	R	R Square	Adjusted R square	Std. error of the estimate	Durbin-Watson
	0.744[a]	0.554	0.438	11.479	1.914
ANOVA[a]	**Sum of squares**	**df**	**Mean square**	**F**	**p**
Regresyon	3763.715	6	627.286	4.761	**0.003[b]**
Residual	3030.442	23	131.758		
Total	6794.157	29			
Model	**Unstandardized β**	**Coefficients Std. error**	**Standardized coefficients β**	**t**	**p**
Constant	185.931	41.179		4.515	**<0.001**
KPS	0.066	0.181	0.069	0.362	**0.024**
TAS	-10.414	3.764	-0.484	-2.767	**0.011**
KOS-ADL	-0.628	0.211	-0.516	-2.976	**0.007**
LDSS	-0.176	0.219	-0.159	-0.805	**0.029**
TSK	-0.155	0.426	-0.059	-0.363	0.720
Complaint duration	0.085	0.800	0.017	0.106	0.916

[a] Depentdent variable: PSS; predictors: (Constant), KPS, LDSS, TAS, KOS-ADL, TSK, complaint duration. PSS: patellofemoral syndrome pain severity scale, KPS: Kujala patellofemoral score, TAS: Tegner activity level, LDSS: Lysholm knee scoring scale, KOS-ADL: knee outcome survey activities of daily living scale, TSK: Tampa scale for kinesiophobia.

DISCUSSION

This is the first descriptive study in the literature investigating the effect of PFP on function, activity level, activities of daily living, and kinesiophobia in elite football players. Results revealed that PFP influenced functionality, activity level, functional disability, and activities of daily living, but not kinesiophobia and duration of complaints in elite football players. The functional status of the knee joint is extremely important for footballers. Some injuries in the knee joint may affect functionality and even career length. It was determined that PFP affected functionality and functional disability in elite football players. It was observed that as PFP increased, functionality decreased, and functional disability increased.

Rathleff et al. (28) found that physical function was significantly affected in adolescents with PFP and there was no clinically significant difference between Osgood-Schlatter disease and PFP. They also have shown that adolescents with PFP or Osgood-Schlatter disease had high levels of physical activity despite long-standing knee pain that affected their quality of life (29). They found that although the participants were in early adolescence, the effect of pain on sports and physical function was like that in middle and late adolescents (15-19 years) with PFP (29). Ferreira et al. (30) reported that adolescent athletes exhibited higher levels of pain and lower physical function status compared to physically active non-athletes. In addition, functional status is associated with poor prognosis in patients with PFP, giving important information regarding the management of PFP in adolescent athletes. In this context, our study parallels the results of Ferreira et al. in terms of the effect of PFP on functional status.

Our findings reveal that there is a negative relationship between pain intensity and activity level in elite football players with PFP. Glaviano et al. (31) also showed that PFP reduced activity levels in their study. Participants in this study stated that they developed various approaches to stay active while experiencing knee pain in elite footballers with PFP, including reducing sets/repetitions, and reducing the distance of cardiovascular activities.

In this study, it was determined that PFP was associated with activities of daily living in elite football players. In line with our study, a systematic review of the effect of PFP on quality of life, Reijnders et al. (32) evaluated quality of life with the Short Form Health Survey (SF-36) and KOSS scales. Based on fifteen studies, it was concluded that quality of life was worse in patients with PFP comparing to healthy individuals. It was also reported that PFP affected the quality of life of adolescents. Pazzinatto et al. (33) found a significant relationship between pain and quality of life in women with PFP ($r=-0.38$, $p<0.001$).

Pain-related kinesiophobia is a negative emotional response to painful stimuli that causes avoidance of painful activity. Pain-related kinesiophobia has been suggested to be more inhibitory than pain itself. Previous studies have indicated that pain-related kinesiophobia is most associated with reduced self-reported function, while pain-related fear is more commonly associated with high pain levels (34). Selhorst et al. (35) reported that pain and kinesiophobia were significantly related in their study in adolescents with PFP ($r=0.22$, $p=0.04$). Pazzinatto et al. (33) found a significant relationship between pain and kinesiophobia in women with PFP ($r=0.21$, $p=0.045$). Priore et al. (14) determined that knee brace support improved

kinesiophobia compared with minimal intervention in patients with PFP after 2-6 weeks follow-up evaluations.

Ercan et al. (36) found that although elite male football players with lower extremity musculoskeletal injuries that did not require surgery developed inadequacy in physical activity after injury, this did not make a difference in the context of exercise self-efficacy and kinesiophobia (p>0.05). In the only prospective study in the literature, Pazzinatto et al. (37) stated in their two year research that physical function and fear of movement were not risk factors for PFP in young women. Shallan et al. (38) found that PFPS patients with more kinesiophobia displayed poorer dynamic balance. It has also been reported that addressing psychological factors such as kinesiophobia during examination and treatment of PFP patients, is important to improve dynamic balance. In our study, it was determined that PFP was not associated with kinesiophobia in elite football players (r=0.176, p=0.353). This is thought to be linked to pain severity not being high in our study.

Pain severity and duration of complaint may affect the prognosis in patients with PFP (11). In our study, no relationship was found between pain severity and complaint duration. This is thought to be because the elite football players included in the study were in adolescence, and their pain history was shorter. In their systematic review of factors associated with PFP, Lankhorst et al. (39) found the sulcus angle to be 1.6° greater in the PFP group. It is also important to determine whether this small difference is of clinical significance, considering measurement errors in research. The same is probably true for muscle strength findings.

Limitations

Keeping gender, age, activity level and sport discipline homogenous in our study is one of our strengths. Our limitations are that the study is single-centred and the statements given by elite football players to the survey questions are taken as basis. The single center of the study makes it difficult to generalize our results. The lack of follow-up of the athletes included in the study is one of the limitations of our study.

To conclude; it was determined that PFP in elite football players affected functional mobility, activity level, quality of life, and had no effect on kinesiophobia. New research could investigate the possibility of pain levels. There may also be new research on the long-term impact on the careers of athletes with PFP.

Data availability

Data supporting the findings of this study can be obtained from Mendeley Data. (Mendeley Data, V1, doi: 10.17632/mbkxxkx8y9.1.

Ethics Committee Approval / Etik Komite Onayı

The approval for this study was obtained from Necmettin Erbakan University Health Sciences Scientific Research Ethics Committee (Decision No. 2024/675) (Application ID: 19066).

Conflict of Interest / Çıkar Çatışması

The authors declared no conflicts of interest with respect to authorship and/or publication of the article.

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Author Contributions / Yazar Katkıları

Concept – MC, MTD; Design – MC, MTD; Supervision – MC, MTD; Materials – Data Collection and/or Processing – MC, MTD; Analysis and Interpretation – MC, MTD; Literature Review – MC; Writing manuscript – MC; Critical Reviews – MC, MTD. All authors contributed to the final version of the manuscript and discussed the results and contributed to the final manuscript.

REFERENCES

1. Willy RW, Hoglund LT, Barton CJ, Bolgla LA, Scalzitti DA, Logerstedt DS, et al. Patellofemoral Pain. *J Orthop Sports Phys Ther.* 2019;49(9):91-5.
2. Xie P, István B, Liang M. The relationship between patellofemoral pain syndrome and hip biomechanics: a systematic review with meta-analysis. Healthcare (Basel). 2022;11(1):99.
3. Davis IS, Tenforde AS, Neal BS, Roper JL, Willy RW. Gait retraining as an intervention for patellofemoral pain. *Curr Rev Musculoskelet Med.* 2020;13(1):103-14.
4. Culvenor AG, van Middelkoop M, Macri EM, Crossley KM. Is patellofemoral pain preventable? A systematic review and meta-analysis of randomised controlled trials. *Br J Sports Med.* 2020;55(7): 378-84.
5. Harris M, Edwards S, Rio E, Cook J, Cencini S, Hannington MC, et al. Nearly 40% of adolescent athletes report anterior knee pain regardless of maturation status, age, sex or sport played. *Phys Ther Sport.* 2021;51:29-35.
6. Schenatto Ferreira A, Mentiplay BF, Taborda B, Ferraz Pazzinatto M, de Azevedo FM, de Oliveira Silva D. Overweight and obesity in young adults with patellofemoral pain: impact on functional capacity and strength. *J Sport Health Sci.* 2023;12(2):202-11.
7. You S, Shen Y, Liu Q, Cicchella A. Patellofemoral pain, Q-angle, and performance in female Chinese collegiate soccer players. *Medicina (Kaunas).* 2023;59(3):589.
8. Thaller PH, Fürmetz J, Chen F, Degen N, Manz KM, Wolf F. Bowlegs and intensive football training in children and adolescents. *Dtsch Arztebl Int.* 2018;115(24):401-8.
9. Naik BM, Akre M, Kumar A. Prevalence of knee pain in football players of various age group. *Int J Health Sci Res.* 2021;11(4):299-305.
10. Xu A, Baysari MT, Stocker SL, Leow LJ, Day RO, Carland JE. Researchers' views on, and experiences with, the requirement to obtain informed consent in research involving human participants: a qualitative study. *BMC Med Ethics.* 2020;21(1):93-5.
11. Barton CJ, de Oliveira Silva D, Morton S, Collins NJ, Rathleff MS, Vicenzino B, et al. REPORT-PFP: a consensus from the International Patellofemoral Research Network to improve REPORTing of quantitative PatelloFemoral Pain studies. *Br J Sports Med.* 2021;55(20):1135-43.
12. Sommers R, Bohns VK. The voluntariness of voluntary consent: Consent searches and the psychology of compliance. *Yale LJ.* 2019;128(7):1962-5.
13. Crossley KM, van Middelkoop M, Callaghan MJ, Collins NJ, Rathleff MS, Barton CJ. Patellofemoral pain consensus statement from the 4th International Patellofemoral Pain Research Retreat, Manchester. Part 2: recommended physical interventions (exercise, taping, bracing, foot orthoses and combined interventions). *Br J Sports Med.* 2016;50(14):844-52.
14. Priore LB, Azevedo FM, Pazzinatto MF, Ferreira AS, Hart HF, Barton C, et al. Influence of kinesiophobia and pain catastrophism on objective function in women with patellofemoral pain. *Phys Ther Sport.* 2019;35:116-21.
15. Scholes MJ, Crossley KM, King MG, Schache AG, Kemp JL, Semciw AI, et al. Running biomechanics in football players with and without hip and groin pain. A cross-sectional analysis of 116 sub-elite players. *Phys Ther Sport.* 2021;52:312-21.
16. Laprade JA, Culham EG. A self-administered pain severity scale for patellofemoral pain syndrome. *Clin Rehabil.* 2002;16(7):780-8.
17. Çankaya M, Karakaya İÇ, Yargıç PM. Reliability and validity of the Turkish version of the patellofemoral pain severity scale in patients with patellofemoral pain syndrome. *Disabil Rehabil.* 2024;46(24):5936-43.

1. Alshehri A, Lohman E, Daher NS, Bahijri K, Alghamdi A, Altorairi N, et al. Cross-cultural adaptation and psychometric properties testing of the Arabic anterior knee pain scale. *Med Sci Monit*. 2017; 23:1559-82.
2. Kujala UM, Jaakkola LH, Koskinen SK, Taimela S, Hurme M, Nelimarkka O. Scoring of patellofemoral disorders. *Arthroscopy.* 1993;9(2):159-63.
3. Briggs KK, Kocher MS, Rodkey WG, Steadman JR. Reliability, validity, and responsiveness of the Lysholm knee score and Tegner activity scale for patients with meniscal injury of the knee. *J Bone Joint Surg Am*. 2006;88(4):698-705.
4. Tegner Y, Lysholm J. Rating systems in the evaluation of knee ligament injuries. *Clin Orthop Relat Res*. 1985;198:43-9.
5. Celik D, Coşkunsu D, Kiliçoğlu O. Translation and cultural adaptation of the Turkish Lysholm knee scale: ease of use, validity, and reliability. *Clin Orthop Relat Res*. 2013;471(8):2602-10.
6. Evcik D, Ay S, Ege A, Turel A, Kavuncu V. Adaptation and validation of Turkish version of the Knee Outcome Survey-Activities for Daily Living Scale. *Clin Orthop Relat Res*. 2009;467(8):2077-82.
7. Kapreli E, Panelli G, Strimpakos N, Billis E, Zacharopoulos A, Athanasopoulos S. Cross-cultural adaptation of the Greek version of the Knee Outcome Survey-activities of Daily Living Scale (KOS-ADLS). *Knee*. 2011;18(6):424-7.
8. Yilmaz ÖT, Yakut Y, Uygur, F, Uluğ N. Turkish version of the Tampa Scale for Kinesiophobia and its test-retest reliability. *Physioyher Rehabil*. 2011;22(1):44-9.
9. Tabachnick BG, Fidell LS, Ullman JB. *Using Multivariate Statistics*. 6th ed. Boston, MA: Pearson; 2013; pp. 497-516.
10. Davison ML, Davenport EC, Jia H. Linear equality constraints: reformulations of criterion related profile analysis with extensions to moderated regression for multiple groups. *Psychol Methods*. 2023;28(3):600-12.
11. Rathleff MS, Winiarski L, Krommes K, Graven-Nielsen T, Hölmich P, Olesen JL, et al. Pain, sports participation, and physical function in adolescents with patellofemoral pain and Osgood-Schlatter disease: a matched cross-sectional study. *J Orthop Sports Phys Ther*. 2020;50(3):149-57.
12. Rathleff MS, Roos EM, Olesen JL, Rasmussen S. Exercise during school hours when added to patient education improves outcome for 2 years in adolescent patellofemoral pain: a cluster randomised trial. *Br J Sports Med*. 2015;49(6):406-12.
13. Ferreira AS, de Oliveira Silva D, Priore LBD, Garcia CLG, Ducatti MHM, Botta AFB, et al. Differences in pain and function between adolescent athletes and physically active non-athletes with patellofemoral pain. *Phys Ther Spor*t. 2018;33:70-5.
14. Glaviano NR, Baellow A, Saliba S. Physical activity levels in individuals with and without patellofemoral pain. *Phys Ther Sport*. 2017;27:12-6.
15. Reijnders L, van de Groes SA. The quality of life of patients with patellofemoral pain - a systematic review. *Acta Orthop Belg*. 2020;86(4):678-87.
16. Pazzinatto MF, de Oliveira Silva D, Willy RW, Azevedo FM, Barton CJ. Fear of movement and (re)injury is associated with condition specific outcomes and health-related quality of life in women with patellofemoral pain. *Physiother Theory Pract*. 2022;38(9):1254-63.
17. Fischerauer SF, Talaei-Khoei M, Bexkens R, Ring DC, Oh LS, Vranceanu AM. What is the relationship of fear avoidance to physical function and pain intensity in injured athletes? *Clin Orthop Relat Res*. 2018;476(4):754-63.
18. Selhorst M, Fernandez-Fernandez A, Schmitt L, Hoehn J. Adolescent psychological beliefs, but not parent beliefs, associated with pain and function in adolescents with patellofemoral pain. *Phys Ther Sport*. 2020;45:155-60.
19. Ercan S, Başkurt Z, Başkurt F, Büyükdemir M, Kolcu G, Çetin C. Fear of movement and exercise self-efficacy after lower extremity injury in elite soccer players. *J Exerc Ther Rehabil*. 2021;8(2): 160-7.
20. Pazzinatto MF, Barton CJ, Willy RW, Ferreira AS, Azevedo FM, de Oliveira Silva D. Are physical function and fear of movement risk factors for patellofemoral pain? A 2-year prospective study. *J Sport Rehabil*. 2022;32(1):24-30.
21. Shallan A, Hawamdeh M, Gaowgzeh RAM, Obaidat SM, Jastania R, Muhsen A, et al. The association between kinesiophobia and dynamic balance in patients with patellofemoral pain syndrome. *Eur Rev Med Pharmacol Sci*. 2023;27(6):2216-21.
22. Lankhorst NE, Bierma-Zeinstra SM, van Middelkoop M. Factors associated with patellofemoral pain syndrome: a systematic review. *Br J Sports Med.* 2013;47(4):193-206.