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Investigation of exercise-related leg pain, fear of pain, kinesiophobia, and injury anxiety in athletes



Erkan Bingöl¹, Kadir Tiryaki^{2*}, İsmet Tümtürk³ and Fatih Özden⁴

Abstract

Background This study aimed to investigate the relationship between exercise-induced leg pain, fear of pain, kinesiophobia and injury anxiety in amateur and professional athletes. Secondarily, the present study also aimed to investigate the relationship between women or men athletes and individual or team sports.

Methods A cross-sectional study was conducted with a total of 304 athletes. Participants were categorized as amateur and professional athletes, male and female athletes, individual and team athletes. Participants were evaluated with Exercise Induced Leg Pain Questionnaire (EILP), Fear of Pain Questionnaire (FOPQ), Sports Injury Anxiety Scale (SIAS), and Tampa Scale of Kinesiophobia (TSK). Parametric tests were used for statistical analysis. A statistical significance level of 0.05 was chosen.

Results Fear of pain and anxiety about sports injury were significantly less in men (p < 0.05). Loss of social support for sports injury anxiety was less in women (p < 0.05). Anxiety about sports re-injury was less in professional athletes (p < 0.05). Anxiety about letting down important Others and loss of social support were greater in team sports (p < 0.05). Besides, there was a positive, moderate, and significant correlation between the Fear of Pain Questionnaire-III Total and Tampa scale for kinesiophobia (r = 0.411, p < 0.01). Finally, a positive, moderate and significant correlation was found between Sport Injury Anxiety Scale Total and Tampa scale for kinesiophobia (r = 0.579, p < 0.01).

Conclusion Exercise and movement were associated with psychological parameters related to injury and pain in athletes. Female athletes were found to have more injury anxiety and fear of pain. In addition, amateur athletes have more injury anxiety. Besides, injury anxiety was found to be higher in individuals in team sports. Future studies may further investigate these groups who are more disadvantaged in terms of anxiety, fear of pain and kinesiophobia. In addition, clinicians should pay attention to the criteria for a biopsychosocial approach by choosing appropriate descriptive phrases to avoid exacerbating athletes' anxiety.

Keywords Pain, Sports, Kinesiophobia, Anxiety

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Background

Pain management is an essential issue of exercise and sport [1]. Athletes experience various psychological barriers arising from the nature of their profession [2]. Psychological conditions such as kinesiophobia and pain-related fear are common in athletes and have consequences on pain intensity, physical and psychological well-being in athletic populations [3]. The impact of kinesiophobia, fear of pain, anxiety can be seen in athletic performance [2]. Recent studies have demonstrated that athletes' pain threshold and sensitivity or intensity are lower compared to healthy peers. However, some studies have reported opposite results [4, 5]. "Exerciseinduced leg pain" is a frequent condition among "competitive and recreational athletes" called as "shin splints". It is addressed in a broad spectrum that includes different tissues. "Exercise-induced leg pain" is considered to be related to bones, muscles, blood vessels, nerves, tendons. As a result of exercise-related pain, fear of pain and injury anxiety occur in athletes. The fear of not being able to participate in sports activities predominates in these athletes [6].

Some studies reported that athletes with high injury anxiety levels were more likely to be exposed to more intense injuries than athletes with low anxiety levels, while some studies reported that they did not find a significant difference or a relationship between anxiety and injuries [7, 8]. For this reason, it is comprehended that a relationship between sports injuries and anxiety should be investigated and analyzed in more detail [9].

Exercise-induced leg pain is a problem in athletes with a wide range of etiologies. Based on the current literature, the proportion of syndromes that account for exercise-induced leg pain is unclear [10]. However, the relationship between exercise-induced leg pain and psychological factors such as kinesiophobia and fear of pain has not been sufficiently investigated. The fear of reinjury among athletes is characterized by kinesiophobia [11]. Kinesiophobia is described as an "excessive and irrational fear of physical movement" to avoid harm or reinjury [12]. An individual can believe in improving pain and sidestep the move in pain conditions. As the status of fear advances, activity avoidance also rises [13]. Behind concussion and strains, interventions may be insufficient because the individual bypasses moving the traumatic area. Increased kinesiophobia after sports injury may lead to decreased physical activity levels and decreased self-reported function [14, 15]. Kinesiophobia may negatively affect both the performance and technical development of the athlete, as well as the treatment process. Addressing psychological factors during physical rehabilitation is crucial for an athlete to rebuild confidence and overcome the fear of re-injury [16]. Professional sports are associated with injuries, which are the most common reason for ending a career. Sports injury is a threat to a sports career. Some researchers report that professional athletes are more focused on injury, while other researchers report that amateur athletes have more difficulty coping with factors such as kinesiophobia. High competition in sports also increases the likelihood of injury and anxiety. Team or individual sport categories are an influencing factor here. An additional factor is the difference in beliefs between male and female athletes [17, 18].

For all these reasons, as well as the need to identify new relationships and the lack of research on this topic, we planned the present study. This study aimed to investigate the relationship between exercise-induced leg pain, fear of pain, kinesiophobia and injury anxiety in amateur and professional athletes. Secondarily, the present study also aimed to investigate the relationship between women or men athletes and individual or team sports. We hypothesized to demonstrate a linear correlation between exercise-induced leg pain, fear of pain, kinesiophobia and injury anxiety. In addition, we hypothesized that beliefs such as anxiety and kinesiophobia are more common in female gender, team sports and amateur athletes.

Methods

Participants and setting

This cross-sectional prospective study was completed with 304 athletes in Muğla Sıtkı Koçman University and related sports teams. This manuscript was prepared based on the STROBE Checklist guidelines. Considering the \mathbb{R}^2 value obtained from the correlation coefficient in a similar study [19] (0.15), it was determined that the sample size of the study (effect size 0.38, power 0.99 and margin of error 0.05) should be at least 95 [20].

Inclusion criteria were defined as; (a) being over 18 years old, (b) licensed athletes with a professional certificate or amateur athletes without a professional certificate. The exclusion criteria were determined as; (a) athletes who did not want to be included in the study, (b) a history of injury in the last three months, (c) the presence of a disability that may affect function, and conditions that would prevent the performance of evaluations or communication.

Ethical approval and informed consent

The study protocol was approved by the ethics committee of Muğla Sıtkı Koçman University (No: 47)." The study was conducted in adherence to the Declaration of Helsinki. Participants understood and signed a comprehensive informed consent. Informed consent includes essential information such as the aims, requirements, potential benefits/harms of the current study and that the final decision to participate in the study rests with the participant.

Data collection

All evaluations were completed on an online platform. The entire population was evaluated with a demographic data collection form, Exercise Induced Leg Pain Questionnaire, Fear of Pain Scale, Sports Injury Anxiety Questionnaire, and Tampa Scale of Kinesiophobia (TSK). To eliminate the risk of potential bias, inclusion criteria were rigorously determined, and the appropriate dataset was created. All assessments were self-reported outcome measures and were answered appropriately by participants.

Exercise induced leg pain questionnaire (EILP-Q)

Patient-reported outcome measures optimize rehabilitation protocols by providing valid qualitative information. The EILP-Q is also reported to be a valid alternative method for assessing leg pain [21]. The EILP-Q is a 10-item scale to assess the exercise induced leg pain in various activities. Minimum and maximum possible scores are 0 and 40, respectively. A higher questionnaire score indicates a higher functionality [10, 22].

Fear of pain questionnaire (FOPQ)

FOPQ is a 30-item 5-point Likert-type scale. Participants mark the option that best describes the severity of their fear according to their pain experiences related to the items listed on the scale. In this respect, the scale allows to measure the fear of pain in individuals with and without pain [23, 24].

Sports injury anxiety scale (SIAS)

The Sports Injury Anxiety Scale consists of 6 subscales. The sub-dimensions of the scale are as follows: loss of athleticism (3 items), being perceived as weak (3 items), experiencing pain (3 items), letting down important others (3 items), loss of social support (3 items) and reinjury (4 items). The 5-point Likert-type inventory is scored as 1 "Strongly Disagree" and 5 "Strongly Agree" [25, 26].

Tampa scale of kinesiophobia

The questionnaire is a 17-item scale to measure fear of movement/reinjury [27]. The level of kinesiophobia in

daily life is evaluated on a Likert-type scale. The score range is between 17 and 68 [28].

Statistical analysis

SPSS software (Statistical Package for Social Sciences) for Windows v25.0 (SPSS Inc, IBM Corp, Armonk, New York)" was used for the statistical analysis. The data of the study were provided as mean, standard deviation (SD), and percent (%). Normality and homogeneity of data was checked by One-Sample Kolmogorov–Smirnov test. The "Independent samples t-test" was used to analyze between-group differences. The relationship between the body mass index, EILPQ, FOPQ, SIAS, and TSK were analyzed with the "Pearson correlation coefficient". In addition, Cohen's d based effect sizes were calculated. Cohen's d effect size cut-off values are categorized as small (0.2), medium (0.5) and large (0.8) [29]. A statistical significance level of 0.05 was chosen.

Results

The mean age of the participants was 22.25 ± 3.63 years, and the minimum and maximum ages were 18 and 42 years, respectively. In addition, data such as gender, body mass index (BMI), injury history, and sport type are also presented in Table 1.

Comparison of outcome measures between gender

A comparison between gender is given in Tables 2 and 3. All scores of the Fear of Pain Questionnaire- III (FPQ-III) were significantly lower in men (p < 0.05). Experiencing Pain score, one of the subscores of the Sports Injury Anxiety Scale (SIAS), was significantly lower in men (p < 0.05). SIAS Loss of Social Support subscore was significantly lower in women (p < 0.05). There was no significant difference between genders in other parameters (p > 0.05).

Comparison of outcome measures between injury history

A comparison between injury history is presented in Tables 2 and 3. There was no significant difference between participants with and without a history of injury on any outcome measure (p > 0.05).

Table 1 The baseline physical and demographic characteristics of the participants

	Athletes (n=304)
Age (years, mean±SD)	22.25±3.63
Gender (women/men, %)	37.8 / 62.2
BMI (kg/m ² , mean±SD)	22.60±3.16
BMI WHO classification (underweight/normal weight/overweight/obesity, %)	6.6 / 73.7 / 17.8 / 2.0
Injury history (yes/no, %)	63.5 / 36.5
Classification of sports (combat/individual aesthetic/ individual aiming/racing/net/invasion/target, %)	16.1 / 9.5 / 0.7 / 14.1 / 18.1 / 40.8 / 0.7
Sport type (professional/amateur, n (%))	22.0 / 78.0
Sport category (individual/team, n (%))	51.6 / 48.4

SD: standard deviation, n: number of participants, BMI: Body Mass Index, WHO: World Health Organization

	EILPQ**		FPQ-III Seve	re Pain*	FPQ-III Mino	r Pain*	FPQ-III Medi	cal Pain [*]	FPQ-III Total *		TSK [*]	
	(Mean±SD)	p (Cohen's d)	(Mean±SD)	p (Cohen's d)	(Mean±SD)	p (Cohen's d)	(Mean±SD)	p (Cohen's d)	(Mean±SD)	p (Cohen's d)	(Mean±SD)	p (Cohen's d)
Gender												
Nomen (<i>n</i> = 115)	77.32±17.75	0.125 (0.181)	32.83±8.78	0.004 (0.349)	22.8±7.79	0.009 (0.307)	26.81±10.38	0.001 (0.395)	82.46±23.2	0.001 (0.409)	39.88±6.48	0.490 (0.08)
Men (<i>n</i> = 189)	80.48±17.17		29.62±9.58		20.51±7.12		23.2±7.71		73.34±21.34		39.38±5.99	
njury History												
Yes (n = 193)	78.25±18.77	0.144 (0.169)	30.68±9.96	0.709 (0.046)	20.75±7.27	0.052 (0.23)	23.84±8.64	0.065 (0.218)	75.29±22.49	0.124 (0.184)	39.59±6.29	0.946 (0.008)
Vo (<i>n</i> = 111)	81.1±14.73		31.1±8.37		22.47±7.67		25.81±9.43		79.4±22.29		39.54±6	
Sport Type												
Professional ($n = 67$)	78.88±19.99	0.827 (0.03)	29.41±9.79	0.161 (0.192)	21.53±8.89	0.866 (0.025)	24.61±10.11	0.965 (0.006)	75.56±25.48	0.614 (0.066)	39.5±7.51	0.933 (0.013)
4mateur (<i>n</i> = 237)	79.4±16.68		31.24±9.27		21.33±7.02		24.55±8.65		77.13±21.59		39.59±5.76	
Sport Category												
ndividual ($n = 157$)	78.93±16.12	0.711 (0.042)	30.64±9.47	0.704 (0.044)	21.05±7.54	0.434 (0.09)	24.31±9.16	0.607 (0.059)	76.01±22.43	0.533 (0.072)	39.29±6.04	0.416 (0.094)
Team (<i>n</i> = 147)	79.67±18.78		31.05±9.35		21.72±7.37		24.84±8.79		77.62±22.55		39.87±6.32	
SD: standard deviatio *: Higher values = Bet	n, n: number of ξ ter. Summary: Fε	oarticipants, BMI: ear of pain is mor-	: Body Mass Inde e common in th	x, EILPQ: Exercise- e female gender	-Induced Leg Pa	ain Questionnaire,	FPQ-III: The Fea	r of Pain Questior	nnaire-III, TSK: Ta	mpa Kinesiopho	bia Scale, [*] : Low	er values=Better,

Comparison of outcome measures between sport type

A comparison between sport type is demonstrated in Tables 2 and 3. SIAS Reinjury subscore was significantly lower in professional athletes than amateur athletes (p < 0.05). There was no significant difference between sport types in other parameters (p > 0.05).

Comparison of outcome measures between sports categories

A comparison between sport category is demonstrated in Tables 2 and 3. SIAS Letting Down Important Others and SIAS Loss of Social Support subscores showed significantly lower scores in the individual sports category (p < 0.05). There was no significant difference between sports categories in other variables (p > 0.05).

Relationship between parameters

The results of the analyses conducted with the Pearson correlation test are presented in Table 4. There was weak correlation between BMI and EILPQ (r=-0.209, p < 0.01). There was no significant correlation between BMI and other parameters (FPQ-III Total, SIAS Total, TSK) (p > 0.05). There were weak correlations between EILPQ and BMI, FPQ-III Total, SIAS Total, and TSK, respectively (r_1 =-0.209, r_2 =-0.213, r_3 =-0.3, r_4 =-0.323, p < 0.01). A weak correlation was obtained between FPQ-III Total and SIAS Total (r=0.384, p < 0.01). Besides, a moderate correlation was found between FPQ-III Total and TSK (r=0.411, p <0.01). Finally, moderate correlation was found between SIAS Total and TSK (r=0.579, p < 0.01).

Discussion

The aim of this study was to investigate the relationship between exercise-induced leg pain, fear of pain, kinesiophobia and injury anxiety in amateur and professional, male and female athletes and in individual and team sports. The results of the present study verified the initial hypothesis. Our results revealed a high level of correlation between kinesiophobia and injury anxiety. Exercise and movement were associated with psychological parameters related to injury and pain in athletes. Female athletes were found to have more injury anxiety and fear of pain. In addition, it can be declared that amateur athletes have more injury anxiety. Finally, injury anxiety was found to be higher in individuals in team sports.

Our sample included amateur (78%) and professional (22%) athletes with an average age of 22 years. It can be expressed that the gender distribution is homogeneous due to the large population with a slightly higher proportion of male participants. On the other hand, a heterogeneous sample was included in our study, which included individuals from different sports branches. It is noticed that the individuals are primarily from combat sports. The fact that there are more individuals from a sport

	SIAS		SIAS		SIAS		SIAS		SIAS Loss of	Social	SIAS Reinjury	* SIAS Tot	a_*
	Loss of Ath	leticism [*]	Being Percei	ived as Weak	*Experiencin	g Pain*	Letting Dow Others [*]	n Important	Support*				
	(Mean±SD)	d	(Mean±SD)	d	(Mean±SD)	d	(Mean±SD)	d	(Mean±SD)	d	(Mean±SD)	<i>p</i> (Mean±	ß
		(Cohen's d)		(Cohen's d)		(Cohen's d)		(Cohen's d)		(Cohen's d)		(Cohen's d)	
ender													
Vomen (<i>n</i> = 115)	6.93±2.74	0.465	5.65±2.85	0.68	10.38±2.46	0.001	7.49±3.12	0.703	5.4±2.66	0.03	13.03±3.72	0.229 (0.143) 48.9±12.	16
∆en (<i>n</i> = 189)	7.17±2.87	(0.085)	5.79±2.92	(0.048)	9.32±2.93	(0.392)	7.35±3.13	(0.045)	6.17±3.14	(0.265)	12.48±3.97	48.3±13.	64
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Table 3

	(Mean±SD)	d	(Mean±SD)	d	(Mean±SD)	d	(Mean±SD)	d	(Mean±SD)	d	(Mean±SD)	p (Mear	n±SD) p	
		(Cohen's d	6	(Cohen's d)		(Cohen's d)		(Cohen's d)		(Cohen's d)		(Cohen's d)	Ů	hen's d)
Gender														
Women (<i>n</i> = 115)	6.93±2.74	0.465	5.65±2.85	0.68	10.38±2.46	0.001	7.49±3.12	0.703	5.4±2.66	0.03	13.03±3.72	0.229 (0.143) 48.9±	12.16 0.7	
Men (<i>n</i> = 189)	7.17±2.87	(0.085)	5.79±2.92	(0.048)	9.32±2.93	(0.392)	7.35±3.13	(0.045)	6.17±3.14	(0.265)	12.48±3.97	48.3土	13.64 (0.0)46)
Injury History														
Yes (n = 193)	7.19±2.73	0.351	5.77±2.77	0.801	9.68±2.92	0.757	7.48±3.08	0.587	5.94±2.96	0.628 (0.057)	12.86±3.94	0.302 (0.124) 48.95	=12.82 0.46	51
No (n=111)	6.88±2.96	(0.109)	5.68±3.1	(0.031)	9.79±2.61	(0.04)	7.27±3.2	(0.067)	5.77±3.05		12.38±3.77	47.8土	13.54 (0.0	J87)
Sport Type														
Professional ($n = 67$)	7.05±3.02	0.941	5.77±3.06	0.908	9.35±3.11	0.224	7.52±3.49	0.755	6.07±3.1	0.558	11.7±4.1	0.018 47.49	-15.67 0.5	22
Amateur (<i>n</i> =237)	7.08±2.76	(0.01)	5.73±2.85	(0.013)	9.83±2.71	(0.165)	7.37±3.01	(0.046)	5.83±2.96	(0.079)	12.97±3.77	(0.322) 48.82:	=12.27 (0.0	94)
Sport Category														
Individual ($n = 157$)	7.15±2.65	0.653	5.63±2.82	0.522	9.67±2.84	0.74	7.04±2.92	0.037	5.54±2.7	0.04	12.73±3.78	0.847 47.78	=12.35 0.30	03
Team (<i>n</i> = 147)	7±2.99	(0.053)	5.85±2.96	(0.076)	9.78±2.77	(0.039)	7.79±3.28	(0.241)	6.25±3.24	(0.238)	12.64±3.99	(0.023) 49.33:	=13.82 (0.1	18)
SD: standard deviatic sports	on, n: number (of participan	ts, BMI: Body Mē	ass Index, SIAS	5: Sport Injury	Anxiety Scale	e, *: Lower valu	ies=Better. Su	immary: Sport	s injury anxiet	y is higher in	female gender, ama	eur athletes	and team

 Table 4
 The relationship between outcome measure scores

n: 304	BMI	EILPQ	FPQ-III Total	SIAS Total	TSK
BMI	1	-0.209*	-0.04	-0.014	-0.023
EILPQ	-0.209*	1	-0.213 [*]	-0.3*	-0.323*
FPQ-III Total	-0.04	-0.213*	1	0.384*	0.411*
SIAS Total	-0.014	-0.3*	0.384 [*]	1	0.579*
TSK	-0.023	-0.323*	0.411*	0.579 [*]	1

n: number of patients, BMI: Body Mass Index, EILPQ: Exercise-Induced Leg Pain Questionnaire, FPQ-III: The Fear of Pain Questionnaire- III, SIAS: Sport Injury Anxiety Scale, TSK: Tampa Kinesiophobia Scale, *: p < 0.01; Pearson Correlation Test was used in all analyses. Summary: Increasing body mass index is associated with increased exercise-induced leg pain. Increased exercise-induced leg pain is associated with increased fear of pain, sports injury anxiety and kinesiophobia

branch where the pain after injury and injury is high shows that it is a suitable universe for testing the study's hypothesis. In addition, the fact that more than half of the individuals have a history of injury also supports this conclusion.

Our correlational analysis results show that fear of movement is associated with injury anxiety. Especially in the post-injury period, it takes time for athletes to return to training [30]. In this process, individuals live a less active life and especially in post-operative periods; the fact that they attribute their increased pain to movement makes this situation even more complex [31]. According to the biopsychosocial model, overcoming kinesiophobia in athletes will reduce the risk of anxiety and possible depression [32, 33]. On the other hand, kinesiophobia was also associated with fear of pain and leg pain with exercise in our study. There is a fear of pain and a concern that it will increase, particularly after exercise. Therefore, it was clearly demonstrated that the parameters associated with kinesiophobia are integrated.

Pain with exercise is a phenomenon often experienced by athletes after some injuries or sometimes after heavy training [34, 35]. Leg pain with exercise has been shown to be associated with fear of pain and injury anxiety. Even non-injury pain due to a physiological reaction can sometimes lead to fear of pain and injury anxiety [36]. In addition to this, a relationship was found between BMI and exercise-induced leg pain in participants. Increasing BMI is known to increase the risk of injury [37]. In addition, knee valgus angles may increase with increasing BMI. Increased valgus angle is also a risk factor for sports injuries. The relationship between knee injuries and BMI has been reported in the literature [38]. Conditions such as increased joint load and physical stress during exercise may trigger leg pain after exercise [39, 40]. This hypothesis was confirmed in our study.

Injury anxiety and fear of pain have been shown to be related to each other as expected. The extent to which anxiety affects the individual at the level of fear should be investigated in detail. This fear and anxiety may affect the individual's sports performance and interfere with the postoperative rehabilitation process after injury. Further studies may address the concepts of anxiety and fear with a focus on rehabilitation after specific sports injuries.

We concluded that amateur athletes experience more injury anxiety. Some inferences can be made based on this result. Having more injury experience and returning to sports may reduce injury anxiety [41]. Therefore, it may have been possible that professional athletes had less injury anxiety for this reason. On the other hand, the fact that amateur athletes can perform more risky activities carelessly during the performance may increase their anxiety about injury.

Another result obtained in our study was that fear of pain and injury anxiety were higher in female athletes. The difference between male and female gender in terms of pain threshold and anxiety has been demonstrated in previous studies. Our study is valuable in terms of revealing this situation, especially in amateur and professional athletes. In this respect, it should be emphasized that team physiotherapists and psychologists from male and female sports branches should address more specific therapy solutions by considering this situation. It was observed that individuals practicing team sports had more injury anxiety. Especially in sports such as soccer and basketball, individuals should coordinate more [42]. Measures to be taken as a team rather than as an individual are essential to reduce the risk of injury.

Our study examines the relationship between exerciseinduced leg pain, fear of pain, kinesiophobia and injury anxiety in amateur and professional athletes. Especially the high sample size makes the results of the study valuable. In addition to correlational analysis, the sample demographics in terms of parameters deepen the integrity of our results. All these implications suggest that the psychological understanding of athletes can lead to negative outcomes such as pain and anxiety. A study looking at this from psychological perspective reports on how to choose terms and words when talking to athletes about rehabilitation strategies. For example, sports therapists should use the term "sports-related knee pain" instead of "knee injury" in the absence of a pathology [43]. Clinical implementations: In the absence of trauma in athletes do not assume that pain is due to previous or existing tissue damage, understand biopsychosocial factors that may contribute to pain, explain that radiological findings are not always the cause of pain, give positive messages about pain, improve tissue tolerance to sports loading, involve athletes in decision-making. In addition, rehabilitation approaches such as graded exercise exposure can also be considered as coping methods. Future studies could investigate these aspects of pain and fear in athletes through further clinical research.

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Limitations

Some limitations should be mentioned. First, the fact that individuals from many sports branches and amateurprofessional individuals were subjected to correlational analysis in a single sample may have prevented specific inferences from being made. On the other hand, leg pain after training was not evaluated with objective measurement tools is another limitation. Unfortunately, we did not control mental disorders such as post-traumatic stress disorder, which may affect anxiety outcomes. The correlation analysis in the present study does not provide causality. The regression analysis did not provide a causal analysis of the related parameters of the individuals. The biggest reason for this situation is that the sample was not homogeneous, so specific results and inferences may not be provided. Finally, conducting assessments online may present some difficulties and reliability concerns compared to face-to-face assessment. Future studies can produce more comprehensive results by including the interactions of parameters such as gender, sport category and sport type in the data analysis.

Conclusions

Our results revealed a high level of association between kinesiophobia and injury anxiety. On the other hand, the relationship between kinesiophobia and fear of pain and leg pain with exercise was statistically significant, albeit of moderate and weak severity, respectively. On the other hand, there was a moderate and weak correlation between injury anxiety and fear of pain and leg pain with exercise, respectively. The relationship between fear of pain and leg pain with exercise was weak. In summary, exercise and movement were associated with psychological parameters related to injury and pain in athletes. Female athletes were found to have more injury anxiety and fear of pain. In addition, it can be declared that amateur athletes have more injury anxiety. Finally, injury anxiety was found to be higher in individuals in team sports. Future studies should consider sports branches specifically and more homogeneously and investigate pain-movement-training and injury anxiety. In addition, appropriate descriptive sentences should be chosen to avoid aggravating the anxiety of the athletes.

Abbreviations

BMI Body Mass Index

- EILPQ Exercise-Induced Leg Pain Questionnaire
- FPQ-III The Fear of Pain Questionnaire-III
- TSK Tampa Kinesiophobia Scale
- SIAS Sport Injury Anxiety Scale
- WHO World Health Organization

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Author contributions

EB: Investigation, Methodology, Writing-review&editing; KT: Writing- Original draft; IT: Writing- review & editing; FÖ: Conceptualization, Writing- review & editing.

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Data availability

All data generated or analyzed during this study are included in this published article.

Declarations

Ethical approval and consent to participate

The study was carried out in accordance with the ethical principles and the Helsinki Declaration. The study protocol was approved by the ethics committee of Muğla Sıtkı Koçman University (No: 47). Written informed consent was obtained from the participants.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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