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RESEARCH

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Intermediary role of mental toughness beliefs on the relationship between pain self-efficacy and fear avoidance in Elite injured athletes

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Abstract

Introduction Athletes adopt different coping mechanisms with injury. Differences and links between fear avoidance (FA), pain self-efficacy (PSE), and mental toughness (MT) might affect injury outcomes.

Aim To examine the relationship between Fear Avoidance, Pain Self-Efficacy and Mental Toughness in injured elite and competitive athletes in Lebanon.

Methods This is a cross-sectional study that included 172 athletes. Different questionnaires were used to determine the three pre-mentioned concepts. FA, PSE, and MT were measured using AFAQ—Athletic Fear Avoidance Questionnaire, PSEQ—Pain Self-Efficacy Questionnaire, and SMTQ—Sports Mental Toughness Questionnaire respectively. The data was collected and analyzed using IBM SPSS software.

Results Athletes who practiced boxing reported the highest SMTQ score. Age and training hours predicted higher scores in mental toughness while athletes returning to practice within the last month showed higher PSEQ scores. A negative relationship was found between SMTQ and AFAQ ($r = -0.47$, $p < 0.001$) as well as between PSEQ and AFAQ ($r = -0.44$, $p < 0.001$). However, a positive relationship was seen between SMTQ and PSEQ ($r = 0.36$, $p < 0.001$).

Conclusion By incorporating insight into FA, PSE, and MT, sports professionals may enhance their ability to assess both physical and psychological predicaments of injured athletes.

Keywords Injured, Athletes, Elite, Pain efficacy, Mental toughness, Fear avoidance

Introduction

During their athletic career, athletes tend to face a lot of injuries, very painful sometimes, where their ability to bounce back from a certain injury depends on the physical therapist and themselves [1]. Injuries are an integral aspect of sports participation, whether due to incorrect sports technique, poor nutrition, or sports overuse [1, 2]. More than 3.5 million sports related injury occur each year in the United States alone [3]. The ability to recover from certain injuries requires addressing possible challenges arising along the way. One of these challenges is

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fear avoidance behavior, which is elicited through negative coping behaviors and pain catastrophizing [4]. In a previous study, Dover et al. (2015) stated that some athletes, especially the competitive ones, fully recover after the occurrence of injury while others, who showed higher levels of fear avoidance, required more time to recover [4]. With evolving research, it is known that various elements affect pain like tissue loading, cognitive functions, emotions, and lifestyle behaviors [5].

Recovering from an injury does not simply depend on physiological healing, but involves psychological factors too [6]. Mood disturbance, self-esteem, and mental toughness showed an important role in the recovery process [7]. Mental toughness (MT) is described as an individual's capacity to consistently deliver the highest possible performance, regardless of situational demands [8]. Previous studies have shown a positive association between mental toughness and athletic performance [9]. Furthermore, pain self-efficacy (PSE), an additional psychological variable, has been associated with positive outcomes in sports and ameliorated athletic coping strategies, especially among Elite athletes [10]. Pain is defined as "an unpleasant sensory and emotional experience associated with, or resembling that associated with, actual or potential tissue damage" [11]. Pain self-efficacy is shown to be a major contributing and predicting factor of the attitude of a person and can alter the course of injury and outcomes [12].

Multiple studies have demonstrated that an athlete's mental toughness is influenced by their level of competition. Athletes competing at higher levels tend to exhibit greater mental toughness [13]. Moreover, Fischerauer et al. (2018) found that higher levels of fear avoidance (FA) in competitive athletes were associated with decreased physical function [14]. Additionally, in terms of coping, higher pain self-efficacy was linked to less avoidance coping and lower levels of catastrophizing [15].

Within the existing literature, no prior research particularly examined the relation between fear avoidance, pain self-efficacy and mental toughness in injured competitive and Elite athletes, thus creating a gap in the literature. Thus, this relationship has yet to be examined. The differences in responses between genders on injuries and the difference in how athletes perceive pain during their normal daily activities remains to be examined. Hence, it is expected that this study could enlighten athletes about the importance of mental toughness and pain self-efficacy in mitigating the effects of fear avoidance, aiding healthcare professionals in managing injuries. Therefore, we expect that there is a significant relationship between fear avoidance, pain self-efficacy, and mental toughness in injured Elite and/or competitive athletes. Consequently, the following research questions were addressed:

- What is the relationship between fear avoidance behavior and recovery outcomes in injured Elite and/or competitive athletes?
- How does pain self-efficacy impact fear avoidance behavior and recovery from injury in Elite and/or competitive athletes?
- To what extent does mental toughness influence the recovery process and the experience of fear avoidance in injured athletes?
- How do mental toughness and pain self-efficacy interact to influence coping strategies in athletes recovering from injury?

Materials and methods

Study design and population

This is a cross-sectional study that was carried out from February 2024 to June 2024. A sample of Elite and/or competitive athletes who still haven't returned to their sports due to injury or have returned less than a month ago after injury were recruited. These were reached out through the "Fédération Sportive Universitaire du Liban" (FSUL). The selection of athletes' "type" was based on the classification of McKinney et al., 2019 (Table 1) where Elite athletes were chosen if they exercised for more than 10 h per week and competitive athletes who exercised for more than 6 h per week [16]. The participants in this study consisted of both male and female players

Table 1 Classification of athletes and exercisers [16]

Subcategory	Intent to compete	Volume of exercise (hours per week)	Level of competition
Elite Athlete	+	≥ 10	Regional or national team, Olympian professionals and some college athletes
Competitive Athlete	+	≥ 6	Official competitions (high school and most college athletes)
Recreational Athlete	+	≥ 4	Registered recreational league, open events
Exerciser	0	≥ 2.5	Professional fitness
Physically inactive	0	< 2.5	Do not meet recommended minimums of low intensity physical activity

aged between 18 and 30 years old. Participants who usually train less than 6 h/week or who never suffered from an injury during practice were excluded from the study.

Sample size calculation

Using Epi-Info TM 7 for population survey, the estimated sample size was calculated to be 140 (taking into account a confidence interval of 95%, a precision measure of 8% and an expected frequency of 50% due to the absence of prior data regarding the percentage of injuries among Lebanese athletes. A proportion of 50% represents the maximum possible variability in a population and ensures that the sample size will be large enough to accommodate the maximum variability, which results in a more robust and conservative estimate.The total number of participants who actually participated in the study was 172, accounting for missing values.

Data collection tool

Athletes were provided with an online questionnaire, administered in English, via Google Forms, with an estimated completion time of approximately 8–10 min. Each participant gave his/her consent before taking part in the study. They were briefed on the study's objectives, the confidentiality of their responses, and the duration for which their data would be stored before deletion, set at two years.

The study questionnaire consisted of two parts: sociodemographic characteristics and main outcome measures. The sociodemographic questions included: age, gender, the type of sport, and the number of hours devoted to training per week for their respective exercise. The second part of the questionnaire was divided into three sub-parts: 1) The Sports Mental Toughness Questionnaire (SMTQ) which is a 14-item survey specifically crafted to gauge the concept of mental toughness. Participants responded to the survey using a 4-point Likert Scale, ranging from 1 (not at all true) to 4 (very true). Scores on the scale vary from 14 to 56, computed by summing the points of the responses. Notably, items 2, 4, 7, 8, 9, and 10 necessitate reverse coding. Higher scores indicate elevated levels of mental toughness [13, 17]. Each of its components have shown acceptable internal consistency in previous research, with Cronbach's alpha values of 0.8, 0.74, and 0.71 for Confidence, Consistency, and Control, respectively. 2) The Athletic Fear-avoidance Questionnaire (AFAQ), developed by Dover & Amar in 2015, which comprises 10 items aimed at evaluating athletes' fear avoidance concerning injury-related fears [4]. AFAQ showed a Cronbach's alpha coefficient of 0.805, indicating good internal consistency. Participants provided responses on a 5-point Likert Scale, with options ranging from 1 (not at all) to 5 (completely agree). The total score ranges from 10 to 50, with higher scores indicating a higher degree of sport-specific fear and avoidance. 3) The Pain Self-Efficacy Questionnaire (PSEQ), developed in 1989, which is a tool that is utilized to gauge the impact of pain on an individual's confidence level (self-efficacy) in carrying out tasks. Comprising 10 items, respondents rate their responses on a 7-point Likert scale, ranging from 0 (Not at all confident) to 6 (Completely confident). Scores on this scale range from 0 to 60, with higher scores indicating heightened levels of pain self-efficacy. The PSEQ has demonstrated satisfactory reliability and validity. The entire scale yielded a Cronbach's alpha coefficient of 0.92 [18].

Ethical approval

The study was completed in accordance with the Ethics Code set and approved by the Research and Ethics committee of the Antonine University on 24/11/2023 and was assigned the serial number #1905–2023. Participation was voluntary and informed consents were obtained from each study participant. This study was performed in accordance with the ethics standards as laid down in the 1964 Declaration of Helsinki and its later amendments.

Statistical analysis

Two independent observers conducted a thorough quality check of the questionnaire, and an additional audit was conducted on a randomly selected 5% of the questionnaires. The collected data were analyzed using the Statistical Package for Social Sciences (SPSS, IBM Corporation, Somers, NY) version 23.0. Before entry, all data underwent meticulous examination for accuracy. Descriptive statistics were computed using different measures depending on the distribution of the variables. For normally distributed continuous variables, mean and standard deviation (SD) were utilized. For continuous variables without a normal distribution, median and interquartile range were employed. Counts and percentages were used for categorical variables. Prior to analysis, continuous data underwent normality testing via the Shapiro–Wilk test. Bivariate analysis was conducted to assess the relationship between participants' characteristics and the different scales included. For normally distributed numerical variables, Student's t-test and Analysis of Variance (ANOVA) were employed to compare means between two groups and more than two groups, respectively.. Bonferroni Post-hoc analysis was utilized to compare mean differences between each pair of educational setting categories. For categorical variables, the analysis employed the Pearson chi-square test. In instances where the expected values within cells were less than 5, the Fisher exact test served as a substitute. To explore the association between two quantitative variables, such as

the various total scores derived from the questionnaire, either Pearson or Spearman correlation coefficients were calculated. In all cases, a significance level of $p \leq 0.05$ was adopted.

Results

Participants recruitment and baseline characteristics

As shown in Fig. 1, a total of 308 responses were obtained. Of them, 172 (55.8%) patients met the inclusion criteria and completed the questionnaire. The most common reason for exclusion was that some participants have returned to their normal sports activity for more than one month ($n = 91$) and some of them didn't complain of any injury during their practice.

One hundred and seventy-two eligible responses were recorded, of which 59.9% were males ($n = 103$). The mean age was 22.87 ± 2.96. The majority of participants were involved in "track and field sports" (22.7%, $n = 39$), followed by "basketball" (21.5%, $n = 37$), "football" (16.3%, $n = 28$), and "volleyball" (10.5%, $n = 18$). An equal percentage of athletes participated in "boxing" and "futsal" (9.9% each)0.9.3% of all participants practiced other types of sports, (i.e., gymnastics, handball, weightlifting, wakeboarding). The majority of the participating athletes (57.6%) returned to sprots less than one month ago. The average training hours per week was 10.28 ± 4.26. More details on the baseline characteristics are found in Table 2.

Description of the outcome measures scales

The mean AFAQ score was 25.55 ± 7.51 indicating a moderate fear avoidance. As for the PSEQ scale, a mean score of 37.95 ± 12.59 with a median of 38.0 indicative of a moderate to good pain self-efficacy while SMTQ mean score was 41.48 ± 6.55 with a median of 42 indicating moderate to high mental toughness score. Each of the three scales used showed a very good to excellent internal consistency underlined by Cronbach alpha values > 0.8. More details about each scales' description are found in Table 3.

Sports Mental Toughness Questionnaire (SMTQ)

Figure 2 presents an overview of the distribution of responses of the 14 questions of SMTQ questionnaire. As shown in the figure, the majority of the participants voted "not true at all" for the statements "I give up in difficult situations" and "I get distracted easily and lose my concentration" whereas the majority totally agreed that they "have what it takes to perform well under pressure" and that they "are committed to completing the tasks they have to do".

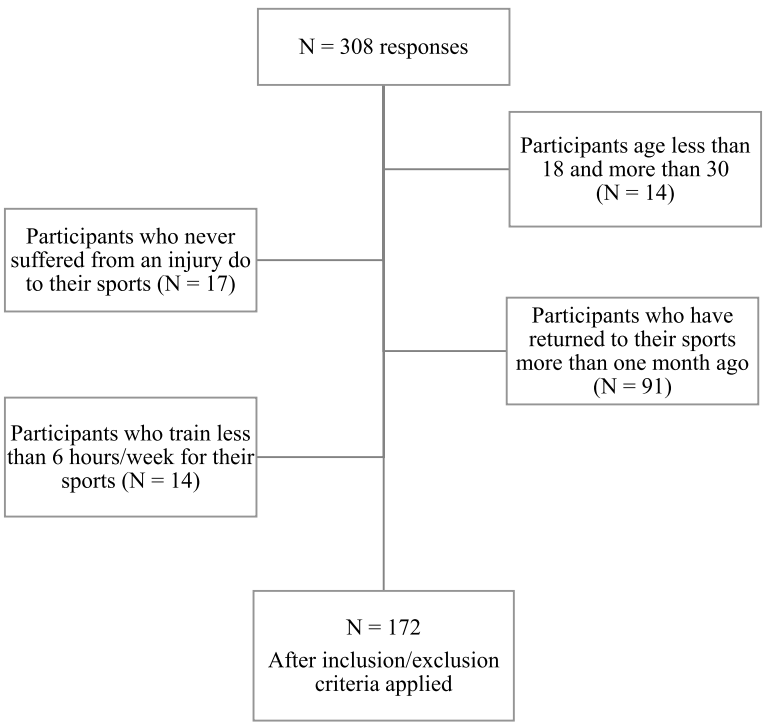

Fig. 1 Recruitment Flow Diagram. Citation 1: Flow Diagram of the recruitment phase

Table 2 Socio-demographic characteristics

	N	Percentage (%)
Gender		
Male	103	59.9
Female	69	40.1
Sport type		
Basketball	37	21.5
Boxing	17	9.9
Football	28	16.3
Futsal	17	9.9
Track and Field	39	22.7
Volleyball	18	10.5
Other	16	9.3
Time of return to sports		
I still haven't returned	73	42.4
Less than one month ago	99	57.6
Age categories		
18–21	65	38.0
22–29	101	59.1
≥ 30[a]	5	2.9
Training hours/week		
6–9	91	52.9
≥ 10	81	47.1

[a] *Missing values: n = 1*

Athletic Fear Avoidance Questionnaire (AFAQ)

Figure 3 offers a comprehensive overview of the responses' distribution for the athletic fear avoidance questionnaire. It was shown that the majority of the athletes had positive attitudes towards fear where they answered "not at all" for the statements "I will never be able to play as I did before my injury", I am not sure what my injury is", and "I believe that my current injury has jeopardized my future athletic abilities" while 21.5% completely agreed that, "when the pain is intense, they worry that the injury is a very serious one".

Pain Self-Efficacy Questionnaire (PSEQ)

Figure 4 provides a visual representation of the percentages of responses to each item of the PSEQ. As shown, the majority of the participants specified that they are either "completely confident" or "very confident" towards most of the items of this questionnaire whereas the minority were "not confident at all" or "confident to small degree" towards the same items, which indicates a positive attitude towards pain and better self-efficacy.

Relationship between different socio-demographic characteristics and the different scales

As shown in Table 4, there was no significant difference in any of the total scores of the three scales between males and females. On the contrary of the AFAQ and the PSEQ scores, a significant difference was seen in SMTQ total scores among the three age groups where the highest score (38.81 ± 4.1) was obtained by the youngest group (i.e. 18–21 year old) ($p = 0.023$; $\eta 2 \approx 0.044$) in addition to those who train more 10 h or more per week (38.48 ± 3.79; $p = 0.019$; $d = 0.36$). Moreover, both SMTQ and PSEQ total scores differed significantly among the different types of sports where athletes who practice boxing demonstrated the highest SMTQ total score of 43.52 ± 6.55 ($p = 0.002$; $\eta 2 \approx 0.062$) while other types of sports (gymnastics, handball, wakeboarding…) reported the highest PSEQ total score 46.31 ± 8.90; $p = 0.001$; $\eta 2 \approx 0.012$). To add, those who returned to practice less than 1 month ago had a higher SMTQ score compared to those who still didn't return yet (42.37 ± 6.45 vs. 40.27 ± 6.52; $p = 0.037$; $d = 0.37$). The same was also noticed for the PSEQ total score where those who returned to sport less than 1 month ago scored a higher PSEQ score than those who still haven't returned yet (39.92 ± 12.81 vs. 35.28 ± 12.8; $p = 0.016$; $d = 0.37$). On the contrary, those who still didn't return to sports scored a higher AFAQ total score than those who have returned back less than one month ago (27.28 ± 6.99, vs. 24.28 ± 7.67; p = 0.009; $d = 0.407$).

Relationship between the different used scales

Correlation analysis showed that there was a significant weak to moderate negative relationship between SMTQ and AFAQ scores ($r = -0.47$) and between PSEQ and AFAQ scores ($r = -0.44$). However, a weak positive relationship was detected between SMTQ and PSEQ scores ($r = 0.37$). More details on the correlation between the scales are found in Fig. 5.

Table 3 Description of outcome measures scales

	Min	Max	Median	Mean	SD	Cronbach alpha
AFAQ	10	48	25.5	25.55	7.51	0.946
PSEQ	10	60	38	37.95	12.59	0.815
SMTQ	26	56	42	41.48	6.55	0.916

SD standard deviation

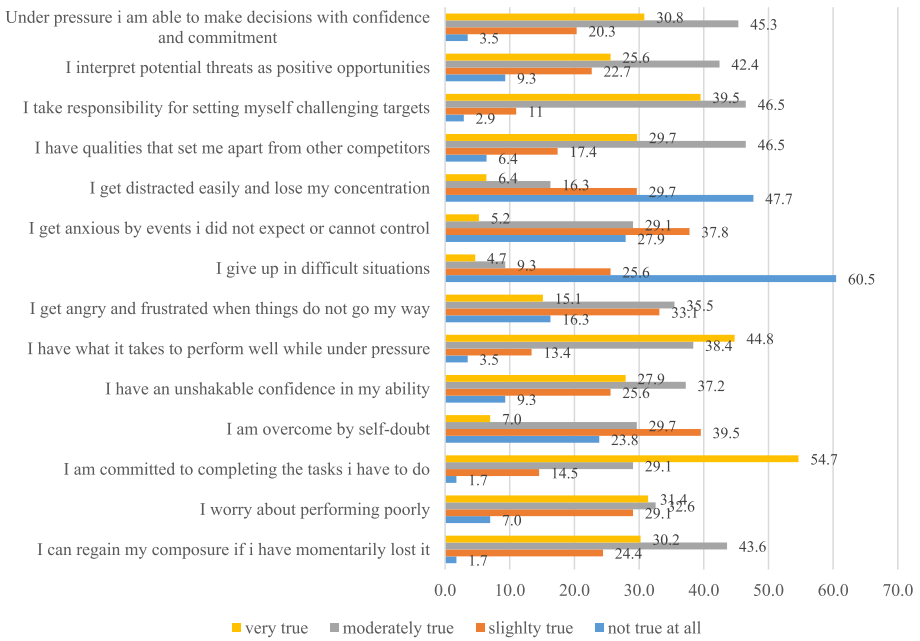

Fig. 2 Distribution of answers to SMTQ items. Citation 2: Distribution of the individual answers of SMTQ questionnaire

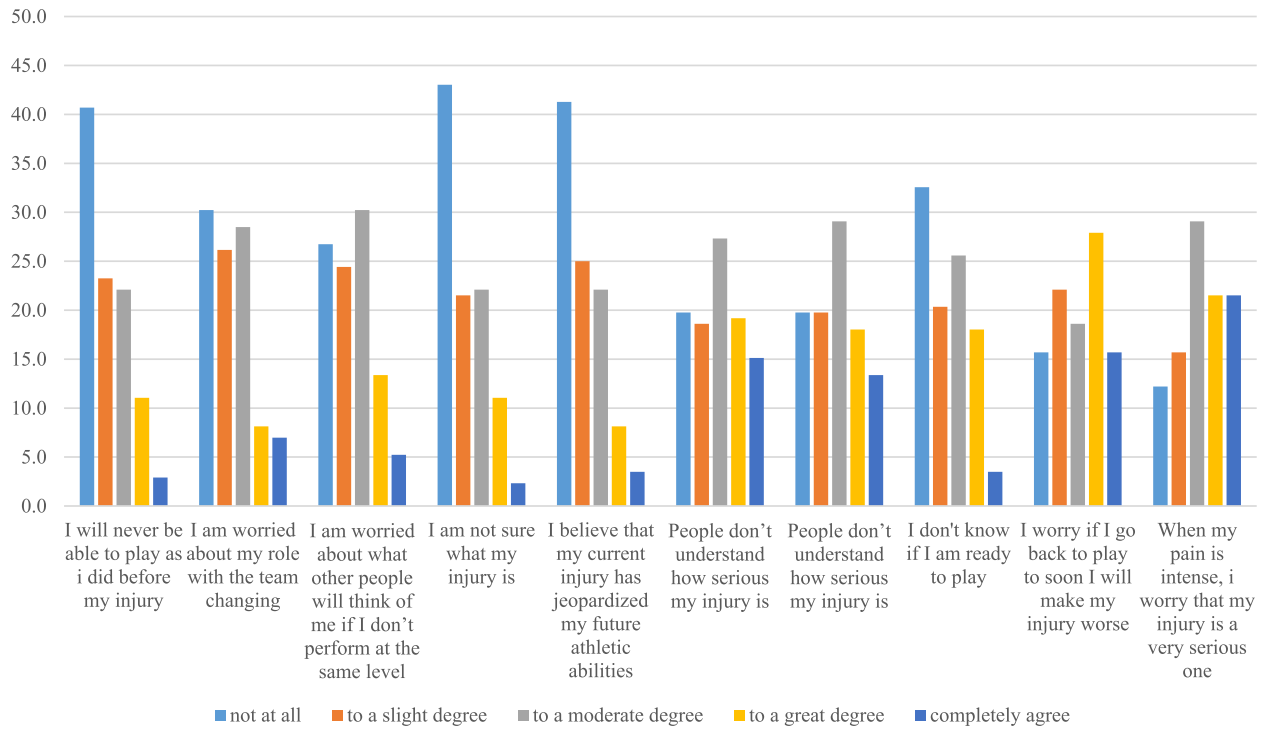

Fig. 3 Distribution of answers to AFAQ questionnaire. Citation 3: Distribution of the individual answers of AFAQ questionnaire

Post hoc analysis of the different scales

After multiple comparisons analysis, the Bonferroni correction method detected a significant difference in SMTQ score between athletes who practice "futsal" and each of the following: "Basketball" (mean difference of 6.68; $p = 0.008$), "boxing" (mean difference of 7.58; $p = 0.011$), and "track and field" (mean difference of 6.93; $p = 0.004$). As for PSEQ, the post hoc analysis detected

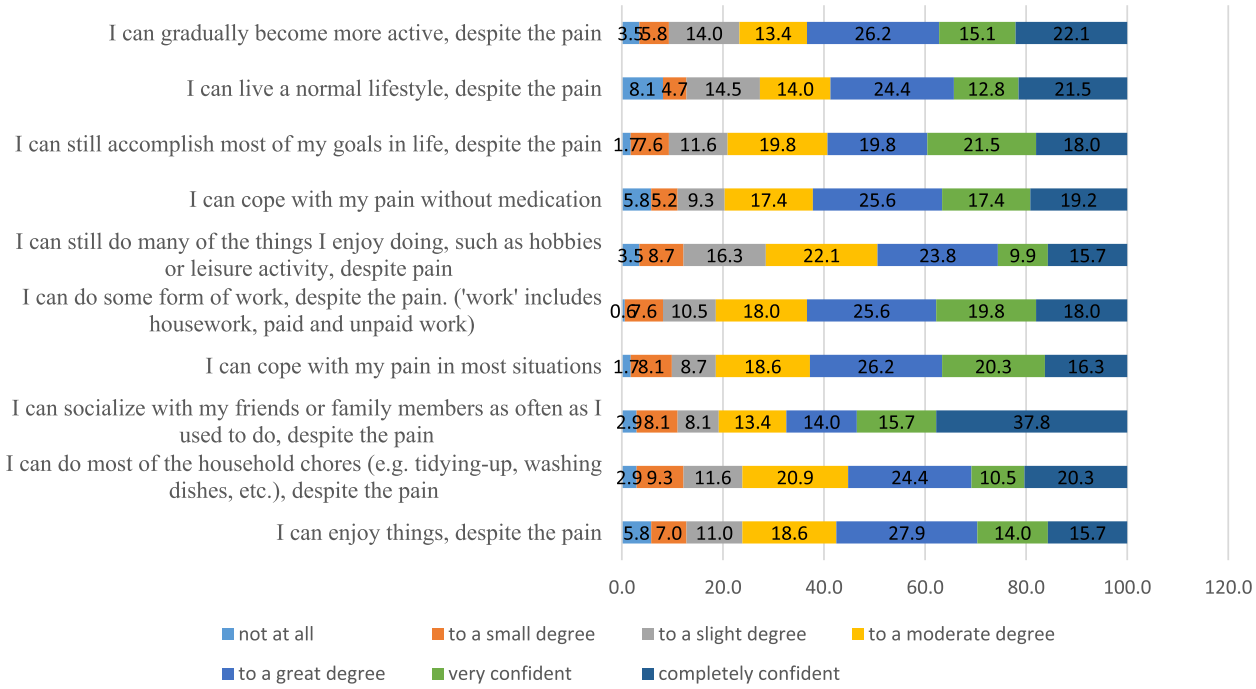

Fig. 4 Distribution of answers to PSEQ questionnaire. Citation 4: Distribution of the individual answers of PSEQ questionnaire

Table 4 Difference of mean scores of the different scales depending on socio-demographic characteristics

	SMTQ (mean ± SD)	*p*-value	AFAQ (mean ± SD)	*P*-value	PSEQ (mean ± SD)	*P*-value
Gender						
Male	41.64 ± 6.42	0.7*	24.99 ± 7.31	0.359*	36.52 ± 13.02	0.068*
Female	41.25 ± 6.77		24.91 ± 7.81		40.101 ± 11.67	
Age categories						
18–21	38.81 ± 4.1	**0.023†**	27.13 ± 7.34	0.085†	37.32 ± 14.24	0.83†
22–29	36.90 ± 4.53		24.67 ± 7.66		38.50 ± 11.7	
≥ 30	37.2 ± 2.77		22.8 ± 3.76		37.2 ± 8.01	
Sports type						
Basketball	42.62 ± 6.59	**0.002†**	24.75 ± 7.12	0.474†	41.18 ± 14.76	**0.001†**
Boxing	43.52 ± 6.55		24.88 ± 6.16		38.05 ± 12.26	
Football	41.35 ± 4.60		27.35 ± 6.00		32.67 ± 11.12	
Futsal	35.94 ± 7.39		24.76 ± 10.24		26.23 ± 10.81	
Track and Field	42.87 ± 5.88		26.02 ± 8.13		41.35 ± 9.16	
Volleyball	38.77 ± 6.68		27.11 ± 7.41		35.72 ± 11.12	
Other	42.43 ± 6.82		22.93 ± 7.45		46.31 ± 8.90	
Time of return to sports						
I still haven't returned	40.27 ± 6.52	**0.037***	27.28 ± 6.99	**0.009***	35.28 ± 12.81	**0.016***
< 1 month	42.37 ± 6.45		24.28 ± 7.67		39.92 ± 12.11	
Training hours/week						
6–9	36.92 ± 4.78	**0.019***	36.92 ± 7.57	0.126*	36.36 ± 12.81	0.077*
≥ 10	38.48 ± 3.79		38.48 ± 7.39		39.75 ± 12.16	

* Statistical comparison using t-test

† Statistical comparison using ANOVA

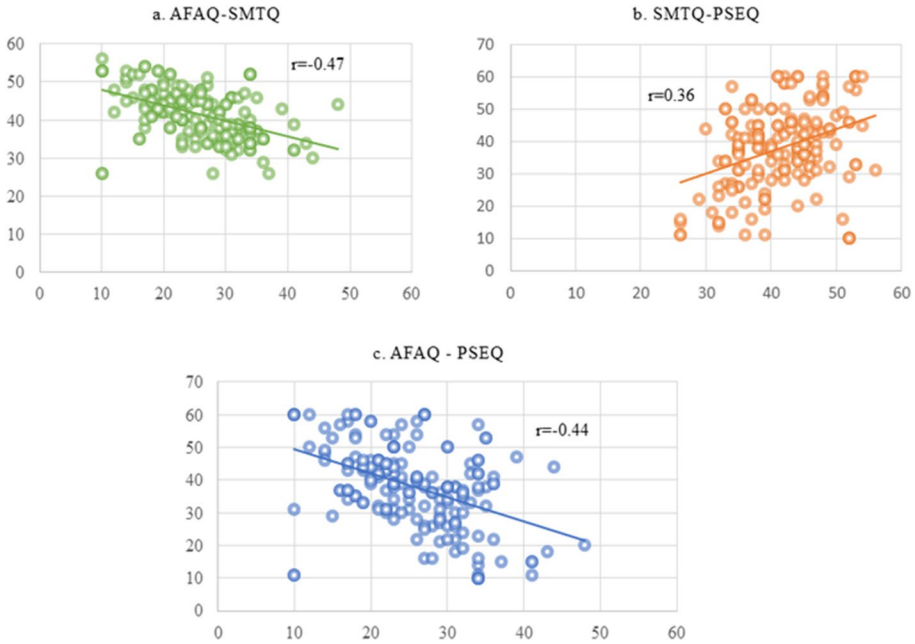

Fig. 5 **a** Correlation analysis between the AFAQ and SMTQ scales; $R^2 = 0.22$; $p < 0.001$. **b** Correlation analysis between the PSEQ and SMTQ scales; $R^2 = 0.13$; $p < 0.001$. **c** Correlation analysis between the PSEQ and AFAQ scales; $R^2 = 0.2$; $p < 0.001$. Citation 5: Correlation analysis between AFAQ, SMTQ, and PSEQ total scores

a significant difference in its score between "Futsal" and each of: "Basketball" (mean difference of 14.95; $p < 0.001$), "track and field" (mean difference of −15.123; $p < 0.001$) and "other sports" (mean difference of −20.077; $p < 0.001$) in addition to significant difference between "football" and "other sports" (mean difference: −13.633; $p = 0.005$). More details on the post hoc analysis can be found in Table 5.

Discussion

The objective of this study was to examine the correlation between fear avoidance, pain self-efficacy, and mental toughness among elite and/or competitive athletes. Injuries frequently occur in sports, and when elite athletes are affected, they face considerable challenges due to heightened expectations that come with higher competition levels. Such injuries can lead to negative psychological impact, including depression, especially when athletes are unable to meet these elevated expectations.

Injury-related pain is also considered a stressor. By viewing pain as a challenge, perceived stress in sports decreases, indicating that pain can be reduced through high self-efficacy. Our findings proved that pain self-efficacy is seen as an essential cognitive predictor of how well athletes pushed past pain and exerted more, and strongly related PSE to sports performance. These results were consistent with previous data in many metrics [19]. A recent study on ultra-marathon runners underlined the importance of PSE as a key predictor of positive performance outcomes, increased capabilities, and sustained effort in elite athletes. This is particularly significant in endurance sports, where resilience and pain tolerance are essential [20].

In this study, the Athlete Fear Avoidance Questionnaire (AFAQ) was used to extend previous research on psychosocial factors, specifically targeting elite and competitive athletes. Our findings revealed a negative correlation between AFAQ and PSEQ, which can be attributed to the opposing relationship between fear avoidance and pain self-efficacy. This finding is also underlined by the study conducted by Karkkola et al., emphasizing the fact that pain catastrophizing can be a predicting factor in fear avoidance, which might also correlate negatively fear avoidance and mental toughness, as proven in our study [15]. Moreover, a notable negative correlation was highlighted between SMTQ and AFAQ scores, which may clarify the current conceptual understanding of mental toughness (MT). The findings suggest that mentally tough individuals demonstrate strong control, commitment, and consistency, especially in challenging situations. They tend to perceive problems as opportunities for growth rather than as obstacles [21]. Athletes with high mental toughness often report lower levels of fear, avoidance, and anxiety. This may be due to the cognitive and motivational strategies they employ, which help them manage challenges and emotions effectively [22]. Mentally tough

Table 5 Post hoc analysis of the SMTQ and PSEQ scales according to sports type

Group 1	Group 2	SMTQ (Mean difference)	p-value	PSEQ (Mean difference)	p-value
Basketball	Boxing	−0.907	1.000	3.130	1.000
	Football	1.264	1.000	8.510	0.077
	Futsal	**6.680**	**0.008**	**14.953**	**< 0.001**
	Track and Field	−0.250	1.000	−0.169	1.000
	Volleyball	3.843	0.719	5.466	1.000
	Others	0.184	1.000	−5.123	1.000
Boxing	Football	2.172	1.000	5.380	1.000
	Futsal	**7.588**	**0.011**	11.823	0.068
	Track and Field	0.657	1.000	−3.300	1.000
	Volleyball	4.751	0.551	2.336	1.000
	Others	1.091	1.000	−8.253	0.871
Football	Futsal	5.415	0.116	6.443	1.000
	Track and Field	−1.514	1.000	−8.680	0.058
	Volleyball	2.579	1.000	−3.043	1.000
	Others	−1.080	1.000	**−13.633**	**0.005**
Futsal	Track and Field	**−6.930**	**0.004**	**−15.123**	**< 0.001**
	Volleyball	−2.836	1.000	−9.486	0.338
	Others	−6.496	0.070	**−20.077**	**< 0.001**
Track and Field	Volleyball	4.094	0.485	5.636	1.000
	Others	0.434	1.000	−4.953	1.000
Volleyball	Others	−3.659	1.000	−10.590	0.174

athletes are less likely to perceive ambiguous information or high-pressure competitive scenarios as threatening, and less prone to reacting with dysfunctional thoughts [23]. This would suggest that mastering emotional control could help athletes better manage and reduce fear during competitions [24].

Regarding the return to practice, overall PSEQ scores had a significant influence on resuming physical activity. Athletes who resumed their training within the past month displayed higher PSEQ scores, indicating that elite athletes may have higher pain self-efficacy, likely due to their intense training, extensive experience, and increased pain tolerance [6]. Moreover, increasing age and number of training hours were shown to be associated with higher scores of MT. Such findings could validate the conceptualization of MT and imply that MT functions may be similar to other personality traits [25]. Mental toughness appears to be a characteristic, which can be acquired among athletes with experience and training over years. Therefore, the minor adjustments in the attributes of mental toughness could be attributed to learning experiences and/or biological changes. In particular, it appears that when athletes get older, MT augments in addition to commitment and emotional control. The findings of the present study are similar to those of Nicholls et al. (2009) who also found further enhancement in commitment, life and emotional control with increasing age of athletes [9]. Furthermore, many previous studies have examined the variation in the levels of mental toughness based on the level of the athletes' competitiveness status in sports, where higher levels of mental toughness were seen when the athlete had better rank based on achievement level. These studies indicated that MT was able to discriminate between two or more groups of athletes participating at various competitive standards and/or training capacities [13, 26]. This was underlined in the post-hoc analysis that emphasized that athletes who practice boxing reported the highest overall SMTQ scores, followed by basketball. Boxing, known for being one of the most physically demanding sports, also requires exceptional psychological resilience. Fighters must remain composed and continue to perform under immense pressure, facing constant challenges, as noted by Brito and his colleagues [27]. Moreover, Elite Track and Field or Basketball athletes consider all adversities and obstacles in this way, which differentiated them from the competitors at an average sports skill level like Futsal [28]. Understanding the mechanisms that connect mental resilience to sports performance necessitates additional research and theoretical exploration.

So far, only few studies explained the mechanism responsible for the MT and PSE in relationship to performance or type of sport [29]. Undoubtedly, one of the important elements is how athletes perceive their own

effort and fatigue. This perspective is crucial for understanding the link between mental toughness and pain, as they often occur together [30]. This might explain why sports with higher SMTQ scores often also show higher PSEQ scores. The results of this study are consistent with the results of Karami et al. in 2022 which also showed the significant and direct effect of pain self-efficacy on psychosocial adjustment and mental fatigue [31]. Therefore, the mediating role of mental toughness in pain self-efficacy and psychosocial adjustment might explain why some types of sports may differ from others.

Limitations

Despite being the first study in the Middle East to assess the relationship between fear, pain and mental toughness among Elite or competitive athletes, some limitations are to be mentioned. First, a small, non-random sample of athletes was selected because it was challenging to find a sufficient number of eligible elite or competitive athletes due to their limited availability. To add, this study was performed only on Elite or competitive athletes. Consequently, generalizing the results should be done cautiously. In this regard, it is recommended to conduct similar studies other comparative groups using random sampling method so that the obtained samples will be more evenly distributed, which is conducive to improving sample representativeness, reducing sampling error, and improving the accuracy of sample results. Moreover, due to study time constraints and difficulty in engaging willing respondents, the surveys yielded incomplete or partial responses which might implicate recall bias. Respondents may have also provided inaccurate or overestimated information denoted as social desirability bias. A major limitation of the present study was its cross-sectional nature. Such an approach does not allow establishing future actions or decisions of athletes with different levels of mental toughness, pain self-efficacy and fear avoidance. A longitudinal approach is best employed to assess the direct impact of significant life events on mental toughness, and how athletes cope in such situations.

Future recommendations and implications

As practice implications, we recommend that this study can be used by sports psychologists and coaches to implement mental training programs into their regular schedules. By developing good habits for their athletes, coaches can set end goals and keep athletes motivated through commitment. The importance of mental training can be the difference in an elite-athlete versus a non-elite athlete. By implementing mental training programs in youth sports, athletes will be prepared to persist in the face of adversity. Moreover, we recommended to recruit larger sample and different types of athletes in future research studies to significantly strengthen the results and offer more generalizability. Furthermore, categorizing sports types into contact vs. non-contact and individual vs. team sports would further help narrow our scope of focus and regulate results.

Conclusion

In conclusion, the current data on fear avoidance, pain self-efficacy, and mental toughness validates their importance as psychological variables in the sporting field. Incorporating MT and PSE training yields benefits that outweigh any associated risk. In essence, this study could enlighten sports professionals on the significance of these three variables (FA, PSE and MT) in sports activity. Educating individuals about these concepts' benefits athletes, coaches, and physical therapists alike by enhancing mental health, improving performance, aiding rehabilitation, bolstering injury coping mechanisms, and reducing medical costs.

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Authors' contributions

ST, VK: conceptualization, methodology, analysis, writing- Original draft preparation. TB, KF, EH, LM: data collection, data analysis, writing-original draft. CN: Validation, Supervision, Writing- Reviewing and Editing.

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Data availability

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate

The study received ethical approval from the Antonine University Ethics Committee on 24/11/2023. Informed consent to participate was obtained from all participants.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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