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Factors associated with persistent pain in college athletes with a history of lateral ankle sprain

ABSTRACT

Objectives: To examine factors associated with persistent pain after lateral ankle sprain (LAS) in college athletes.

Design: Cross-Sectional Study.

Setting: University.

Participants: Of the 385 participants, 140 were identified through an online survey as having a history of at least one LAS.

Main Outcome Measures: Regression analyses were performed to identify the factors associated with the presence of pain during activities of daily living (ADL) and sports. Independent variables were sex, body mass index, bilateral/unilateral LAS, number of LASs and giving way episodes, the Identification of Functional Ankle Instability (IdFAI) questionnaire score, the Foot and Ankle Ability Measure ADL (FAAM-ADL) and Sport (FAAM-Sport) subscales, and the Tampa Scale for Kinesiophobia-11 score.

Results: In univariate regression analysis, sex, IdFAI score, FAAM-ADL and FAAM-Sport were significantly associated with the pain during ADL and sports activity. The number of LASs was only associated with pain during sports activity. Multivariate regression analysis revealed that sex (odd ratio: 0.332) and IdFAI score (odd ratio: 1.077) were associated with pain during ADL and sports, respectively.

Conclusions: Lower self-reported function, higher number of LASs, and, in particular, male sex and greater perceived ankle instability may be important factors to consider for pain management after LAS.

Keywords: ankle injury; ankle instability; sport injury; psychological factor

Introduction

Lateral ankle sprains (LASs) are the most common ankle injuries in the general population as well as in athletes (Hiller et al., 2012; Hootman, Dick, & Agel, 2007). LASs result in sequelae such as pain, dysfunction, and joint instability, and increase the risk of recurrence (Gribble et al., 2016). The risk of ankle osteoarthritis is also increased after LAS, which can lead to long-term health problems (Lee, Song, & Lee, 2022). In addition, a history of LAS is associated with poorer health-related quality of life (QOL) (Gribble, Kleis, Simon, Vela, & Thomas, 2022). Identifying the factors that contribute to the sequelae of LAS is important in developing solutions to the long-term effects of LAS on physical health and QOL.

Persistent pain is one of the main sequelae of LAS. Self-reported pain was present in 58% of the population with chronic ankle instability (CAI) following LAS (Al Adal, Pourkazemi, Mackey, & Hiller, 2019). Recent studies have shown that self-reported pain is associated with lower function, higher injury-related fear, and lower health-related QOL in individuals with CAI (Kosik, Hoch, Slone, Bain, & Gribble, 2022; Suttmiller, Cavallario, Baez, Martinez, & McCann, 2022; Wikstrom & Song, 2019). Pain assessment and management are important because pain after LAS has negative physical and psychological effects. However, the factors contributing to residual pain after LAS are not well understood.

Greater perceived ankle instability, older age, and unilateral ankle sprain are associated with pain during physical or daily activities in the CAI population (Adal, Mackey, Pourkazemi, & Hiller, 2020). Previous studies examining pain after LAS have included only the CAI population (Adal et al., 2020; Kosik et al., 2022; Suttmiller et al., 2022; Wikstrom & Song, 2019). Although these studies have been useful in understanding the pathogenesis of CAI (Adal et al., 2020; Kosik et al., 2022; Suttmiller et al., 2022; Wikstrom & Song, 2019), not all patients develop CAI after LAS. Injury-related fear, which has been suggested to be associated with pain, is higher with a history of a single LAS (Houston, Hoch, & Hoch, 2018). It is also important to note that ankle osteoarthritis, a potential source of post-LAS pain, can result from a single LAS (Gribble et al., 2016). Therefore, it would be beneficial to include a population with a history of LAS to

explore the factors that contribute to pain as a sequela of LAS. In addition, to the best of our knowledge, no studies have examined pain after LAS in a population that regularly participates in sports. Identifying the factors involved in pain after LAS would provide information that would assist in pain management as well as improving physical and psychological factors after LAS.

The purpose of this study was to examine factors associated with persistent pain after LAS in college athletes based on demographics, injury profiles, perceived ankle instability, function, and psychological factors. We hypothesized that pain after LAS would be associated with perceived ankle instability, self-reported foot and ankle function, and injury-related fear.

Materials and Methods

To identify individuals with a history of LAS, students from 22 university sports clubs completed an online questionnaire. A total of 385 individuals agreed to participate in this study. LAS was defined as a sprain that resulted in 1) symptoms on the lateral side of the ankle and 2) ankle swelling, pain, or interruption of physical activity for at least one day. The exclusion criteria were as follows: 1) no history of LAS; 2) first LAS within 12 months; 3) musculoskeletal injury including LAS within 3 months; and 4) history of lower extremity fracture or surgery. These inclusion and exclusion criteria were based on the recommendations of the International Ankle Consortium (IAC) (Gribble et al., 2014). All participants gave informed consent to participate in this study. This study was approved by our university's ethics committee.

An online survey using Google Form (Google LLC, Mountain View, CA, USA) was requested for each sport club at meetings and practices or through representatives. Participants were asked to complete an electronically distributed questionnaire. The questionnaire consisted first of questions on demographics, injury characteristics, and pain, then the Cumberland Ankle Instability Tool (CAIT) and the Identification of Functional Ankle Instability (IdFAI) for perceived ankle instability, then the Foot and Ankle Ability Measure (FAAM) Activities of Daily Living (ADL) and Sports subscales for foot and ankle function, and finally the Tampa Scale for

Kinesiophobia 11-item version (TSK-11) for injury-related fear.

Demographic data were collected for sex, age, height, weight, and hours per week of sports activity. Injury characteristic data were collected on the presence or absence of a previous ankle sprain, the injured area and symptoms that occurred as a result of the LAS, the timing of the most recent LAS, the number of episodes of giving way at the ankle within 6 months, and a history of lower extremity injury. The number of previous LASs was extracted from question 1 of the IdFAI questionnaire (the maximum number was set to 10). Pain data were obtained using the Numerical Rating Scale (NRS) on an 11-point scale from 0 (no pain) to 10 (worst pain imaginable) for pain during ADL and sports activities, respectively. Pain data were used for binary outcomes, as in previous studies, and the NRS of 1 or greater was defined as having pain (0 = no pain, 1 = pain) (Suttmiller et al., 2022).

The CAIT and IdFAI were used to assess perceived ankle instability. However, the CAIT includes questions about pain, so it was not used in the analysis of this study. The IdFAI has established validity and reliability for the assessment of CAI and is the recommended assessment by the IAC (Donahue, Simon, & Docherty, 2013; Gribble et al., 2016; Mineta et al., 2019). Participants were asked a total of 10 questions regarding their history of ankle sprain, history of ankle instability, and feeling of ankle instability during activities. The total IdFAI score ranges from 0 to 37 points, with a higher score indicating greater perceived ankle instability.

Self-reported foot and ankle function was assessed using the FAAM ADL (21-item) and Sport (8-item) subscales. These have established reliability and validity as assessments for individuals with foot and ankle conditions (Eechaute, Vaes, Van Aerschot, Asman, & Duquet, 2007; Uematsu et al., 2015). Participants were asked how much difficulty they have with the activity because of the foot and ankle. For each item, four points indicates *no difficulty*, and zero indicates *unable to do*. The total score of the questionnaire is converted to a percentage, with higher scores indicating better foot and ankle functions (100% indicates no dysfunction).

Injury-related fear was assessed using the TSK-11, which has also been reported to have good reliability and validity (Kikuchi, Matsudaira, Sawada, & Oka, 2015; Woby, Roach, Urmston,

& Watson, 2005). The TSK is a commonly used in studies examining injury-related fears associated with CAI, suggesting that it is a useful assessment tool after LAS (Suttmiller & McCann, 2021), with a total of 11 items, with each item scored from 4 (*strongly agree*) to 1 (*strongly disagree*). Higher TSK-11 scores indicate greater fear of re-injury and movement.

Univariate logistic regression analysis was performed to identify the factors significantly associated with pain during ADL and sports activity after LAS. The dependent variables were the presence or absence of pain during ADL and sports activity. The independent variables were sex (female: 1, male: 0), BMI, bilateral/unilateral LAS (bilateral: 1, unilateral: 0), number of LASs, number of giving way episodes in the past 6 months, IdFAI score, FAAM ADL and Sport scores, and TSK-11 score. We also selected unilateral or bilateral history of LAS as an independent variable based on the previous study (Adal et al., 2020). In addition, these associations were assessed by multivariate logistic regression analysis to adjust for potential confounders. Independent variables that showed a statistically significant association ($p < 0.05$) with pain during ADL and sports activity in the univariate analysis were included in the multivariate analysis. Odds ratios (ORs) and 95% confidence intervals (CIs) were calculated. The statistical significance level was set at $p < 0.05$. All analyses were performed with IBM SPSS Statistics 26 (IBM Corp., Armonk, NY, USA).

Results

Of the 385 participants, 15 were excluded due to incomplete responses. After excluding those who met the exclusion criteria, 140 individuals with a history of LAS were identified. The results of the questionnaire are shown in Table 1. Of those with a history of LAS, 49 (35.0%) reported pain during ADLs and 66 (47.1%) reported pain during sports activities.

In univariate regression analysis, male sex, higher IdFAI score, lower FAAM ADL and Sport subscale scores significantly increased the odds of the presence of pain during ADL (Table 2). Differences in the distribution of these variables by presence/absence of pain during ADLs were shown in Figure 1. In addition, male sex, higher number of LASs, higher IdFAI score, lower

FAAM ADL and Sport subscale scores significantly increased the odds of the presence of pain during sports activities (Table 2). Differences in the distribution of these variables according to the presence/absence of pain during sports were shown in Figure 2.

Multivariate logistic regression analysis showed that male sex increased the odds of the presence of pain during ADL (Table 3). For pain during sports, a higher IdFAI score increased the odds of the presence of pain (Table 3).

Table 1. Demographics, injury characteristics, pain data, and all patient-reported outcome measures individuals with a history of LAS (n = 140)

	Mean (SD)
Female/male (n)	28/112
Age, years	20.2 (1.3)
BMI, kg/m^2	22.2 (2.6)
Hours/week of sports activity	11.4 (4.9)
No. of LASs	2.0 (2.8)
No. of ankle giving way within 6 months	1.6 (2.5)
Bilateral/unilateral LAS (n)	77/63
NRS during ADL	1.1 (1.8)
Presence/absence of pain during ADL (n)	49/91
NRS during sports activity	2.0 (2.8)
Presence/absence of pain during sports (n)	66/74
IdFAI score	11.9 (6.6)
FAAM ADL subscale	98.5 (4.7)
FAAM Sports subscale	97.0 (7.9)
TSK-11 score	21.6 (5.4)

BMI: body mass index, No: number, LAS: lateral ankle sprain, NRS: Numerical Rating Scale, ADL: activities of daily living, IdFAI: Identification of Functional Ankle Instability, FAAM: Foot and Ankle Ability Measure, TSK-11: Tampa Scale for Kinesiophobia 11-item version

Table 2. Univariate logistic regression analysis for the presence of pain during ADL and sports activity.

	Presence of pain during ADL				Presence of pain during sports			
	B	*OR*	*95% CI*	*P*	*B*	*OR*	*95% CI*	*P*
Sex (female: 1/male: 0)	**−1.091**	**0.336**	**0.119–0.949**	**0.040**	**−0.400**	**0.671**	**0.827–0.972**	**0.008**
BMI, kg/m^2	0.057	1.058	0.928–1.207	0.399	−0.027	0.973	0.857–1.105	0.677
Hours/week of sports activity	0.016	1.016	0.947–1.016	0.655	0.039	1.040	0.971–1.113	0.268
No. of LASs	0.110	1.117	0.966–1.291	0.136	**0.162**	**1.176**	**1.007–1.372**	**0.040**
No. of giving way within 6 months	0.015	1.015	0.883–1.167	0.832	0.037	1.038	0.907–1.187	0.590
Bilateral/unilateral LAS (n)	0.391	1.478	0.729–2.996	0.278	0.081	1.084	0.559–2.114	0.812
IdFAI score	**0.057**	**1.059**	**1.003–1.117**	**0.038**	**0.099**	**1.104**	**1.043–1.169**	**0.001**
FAAM ADL subscale	**−0.132**	**0.876**	**0.777–0.988**	**0.031**	**−0.148**	**0.862**	**0.746–0.996**	**0.045**
FAAM Sports subscale	**−0.077**	**0.926**	**0.870–0.986**	**0.016**	**−0.109**	**0.897**	**0.827–0.972**	**0.008**
TSK-11 score	−0.001	0.999	0.936–1.066	0.981	0.028	1.028	0.966–1.094	0.388

ADL: activities of daily living, OR: odd ratio, CI: confidential interval, BMI: body mass index, No: number, LAS: lateral ankle sprain, IdFAI: Identification of Functional Ankle Instability, FAAM: Foot and Ankle Ability Measure, TSK-11: Tampa Scale for Kinesiophobia 11-item version

Bold font indicates statistical significance ($p < 0.05$).

Table 3. Multivariate logistic regression model for the prediction of pain during ADL and sports activity

	B	*OR*	*95% CI*	*P*
Pain during ADL				
Sex (female: 1/male: 0)	**−1.033**	**0.332**	**0.114–0.963**	**0.042**
IdFAI score	0.039	1.040	0.979–1.104	0.205
FAAM ADL score	−0.069	0.933	0.816–1.068	0.315
FAAM Sport score	−0.037	0.964	0.889–1.045	0.367
Pain during sports activity				
Sex (female: 1/male: 0)	−0.458	0.632	0.255–1.568	0.322
No. of LASs	0.028	1.028	0.852–1.241	0.772
IdFAI score	**0.074**	**1.077**	**1.003–1.157**	**0.042**
FAAM ADL score	−0.038	0.963	0.843–1.100	0.579
FAAM Sport score	−0.066	0.937	0.855–1.026	0.159

ADL: activities of daily living, OR: odd ratio, CI: confidential interval, FAAM: Foot and Ankle Ability Measure, IdFAI: Identification of Functional Ankle Instability, No: number, LAS: lateral ankle sprain

Bold font indicates statistical significance ($p < 0.05$).

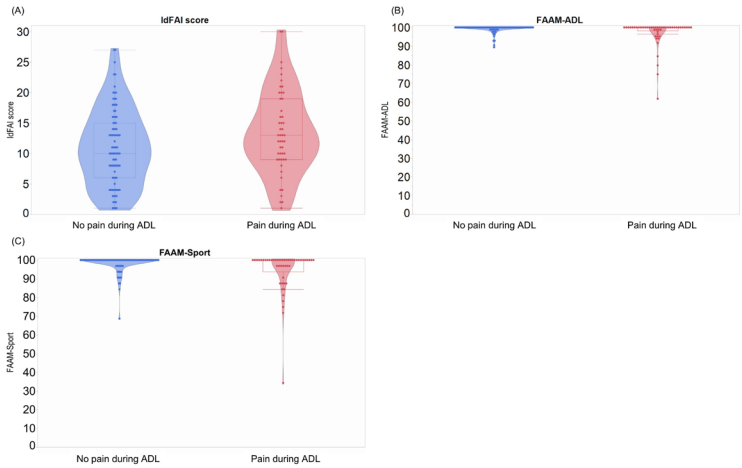


Figure 1. Violin and box plots show data distribution for the pain (red) and no pain (blue) groups during ADL. Data are shown for the IdFAI (A), the FAAM ADL score (B), and the FAAM Sport score (C).

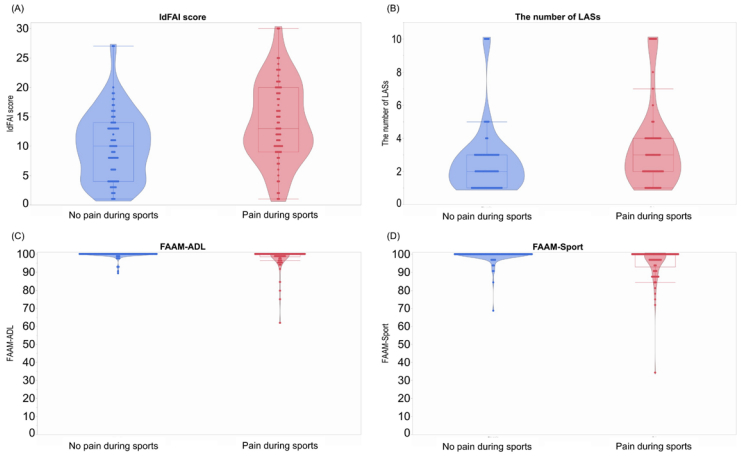


Figure 2. Violin and box plots show data distribution for the pain (red) and no pain (blue) groups during sports activity. Data are shown for the IdFAI (A), the number of LASs (B), the FAAM ADL score (C), and the FAAM Sport score (D).

Discussion

The present study examined the association between persistent pain after LAS and demographics, injury profile, perceived ankle instability, self-reported foot and ankle function, and injury-related fear in college athletes. Male sex, higher perceived ankle instability, and lower self-reported foot and ankle function during ADL and sports were associated with the presence of pain during ADL and sports activity. The number of previous LAS was only associated with pain during sports activity. On the other hand, multivariate logistic regression analysis revealed that male sex was associated with the presence of pain during ADL, and higher perceived ankle instability was associated with the presence of pain during sports.

The present study found that perceived ankle instability was associated with the presence of pain in ADL and sports in a group with a history of LAS, as determined by univariate regression analyses. These findings supported our hypothesis. Some studies reported that perceived instability has no significant effect on pain in CAI populations (Kosik et al., 2022; Wikstrom & Song, 2019), while another study reported a strong relationship with pain (Adal et al., 2020). Our study partially supported this (Adal et al., 2020), and showed this association in the group with a history of LAS. In addition, our multivariate logistic regression analyses showed that perceived ankle instability, as a single factor, was significantly associated with increased odds of the presence of pain during sports activity. Greater perceived instability can lead to changes in kinematics and loading at the ankle joint (Jang & Wikstrom, 2023), which can cause pain. The present findings suggest that assessing and improving perceived ankle instability may be important for managing pain during sports activities following LASs in athletes.

The present univariate regression analysis showed that male sex was significantly associated with pain in both ADLs and sports activities. Additionally, sex was included in a multivariate logistic regression model for the presence of pain during ADL. A previous review suggested that reports of musculoskeletal pain are more common in women than in men (Rollman & Lautenbacher, 2001). However, sex was not associated with pain in the CAI population (Adal et al., 2020). Further research is needed to clarify the mechanism underlying

the relationship between male sex and the presence or absence of pain after LAS.

Lower self-reported foot and ankle functions, as indicated by lower FAAM ADL and Sports subscale scores, were associated with the presence of pain in ADL and sports activity, which supports our hypothesis. Previous studies in the CAI group have shown that pain is associated with self-reported ankle function (Kosik et al., 2022; Suttmiller et al., 2022; Wikstrom & Song, 2019). The present study in the group with a history of LAS supports these findings. Assessment of self-reported function in may be important for pain management in athletes with a history of LAS. However, we did not find a significant association between pain and the FAAM scores in the multivariate analysis that adjusted for potential confounders in the group of athletes with a history of LAS. This suggests that the FAAM score may not be independently associated with the presence or absence of pain in the present participants. In the CAI population with a lower FAAM score, the score was also associated with the presence of pain in multivariate analysis (Suttmiller et al., 2022). The FAAM scores of the present participants tended to be higher, and their distribution was skewed (Table 1 and Figure 1 and 2). It should be noted that these results were found in a population with relatively high self-reported ankle function.

Adal et al. indicated no association between the number of ankle sprains and pain in the CAI population with a wide age range (Adal et al., 2020). In the present study of college athletes with a history of LAS, the number of previous LASs increased the odds of the presence of pain during sports activity in the univariate regression analysis, although it was not included as one of the associated factors in the multivariate analysis. The frequency of sprains increases the likelihood of cartilage damage in the ankle, which may have contributed to the pain. Preventing recurrent sprains may be important in managing pain after LAS.

The injury-related fear assessed by the TSK has been shown to be associated with chronic musculoskeletal pain lasting more than three months (Luque-Suarez, Martinez-Calderon, & Falla, 2019). Our participants had a mean TSK-11 score of 21.6, which was comparable to or higher than the mean scores of 18 and 21.4 for the CAI group (Houston, Van Lunen, & Hoch, 2014; Suttmiller et al., 2022). However, contrary to our hypothesis, the TSK-11 score was not

associated with the presence or absence of pain in the present study. In CAI populations, injury-related fear has been reported to differ significantly between those with and without pain (Kosik et al., 2022), but not with pain intensity (Watanabe et al., 2023). More research would be needed to determine how psychological factors affects sequelae after a LAS, as there is still little research on this topic.

Regarding clinical significance, assessments of perceived ankle instability, self-reported function, and the number of LASs would be important in athletes with persistent pain after LAS. To our knowledge, no intervention studies have been found that use persistent pain as the primary outcome after LASs, but perceived instability and function have been shown to improve with rehabilitation such as balance training (Molla-Casanova, Ingles, & Serra-Ano, 2021; Tsikopoulos, Mavridis, Georgiannos, & Vasiliadis, 2018). Since such rehabilitation has the potential to improve pain, it will also be important to assess pain before and after the intervention. In particular, interventions that address perceived instability, which is independently associated with pain during sports, may be useful in improving pain. Additionally, interventions may need to consider that males may be at higher risk of pain.

The present study had several limitations. Firstly, the causal relationship between the obtained results was unclear as this was a cross-sectional study. Secondly, we did not obtain data on ankle cartilage damage, which could be related to pain. Thirdly, the unbalanced male/female ratio may have influenced the results. Finally, the present study relied solely on self-reported data only, so it was not possible to comprehensively investigate factors that may be related to pain. Future studies should include clinician-oriented outcomes such as mechanical instability and joint range of motion to address these limitations.

Conclusions

The present study showed that male sex, higher perceived ankle instability, and lower self-reported foot and ankle function during ADL and sports were associated with the presence of pain during ADL and sports activity, in college athletes with a history of LAS. The number of

LAS was only associated with pain during sports activities. Multivariate logistic regression analysis showed that male sex and perceived ankle instability were independently associated with pain during ADL and sports, respectively. Considerations for pain management after LAS in college athletes may include lower self-reported foot and ankle function, a higher number of LASs, and especially male sex and greater perceived ankle instability.

REFERENCES

Adal, S. A., Mackey, M., Pourkazemi, F., & Hiller, C. E. (2020). The relationship between pain and associated characteristics of chronic ankle instability: A retrospective study. *J Sport Health Sci, 9*, 96-101.

Al Adal, S., Pourkazemi, F., Mackey, M., & Hiller, C. E. (2019). The Prevalence of Pain in People With Chronic Ankle Instability: A Systematic Review. *J Athl Train, 54*, 662-670.

Donahue, M., Simon, J., & Docherty, C. L. (2013). Reliability and Validity of a New Questionnaire Created to Establish the Presence of Functional Ankle Instability: The IdFAI. *Athletic Training & Sports Health Care, 5*, 38-43.

Eechaute, C., Vaes, P., Van Aerschot, L., Asman, S., & Duquet, W. (2007). The clinimetric qualities of patient-assessed instruments for measuring chronic ankle instability: A systematic review. *BMC Musculoskeletal Disorders, 8*.

Gribble, P. A., Bleakley, C. M., Caulfield, B. M., Docherty, C. L., Fourchet, F., Fong, D. T., Hertel, J., Hiller, C. E., Kaminski, T. W., McKeon, P. O., Refshauge, K. M., Verhagen, E. A., Vicenzino, B. T., Wikstrom, E. A., & Delahunt, E. (2016). Evidence review for the 2016 International Ankle Consortium consensus statement on the prevalence, impact and long-term consequences of lateral ankle sprains. *Br J Sports Med, 50*, 1496-1505.

Gribble, P. A., Delahunt, E., Bleakley, C., Caulfield, B., Docherty, C., Fourchet, F., Fong, D. T., Hertel, J., Hiller, C., Kaminski, T., McKeon, P., Refshauge, K., van der Wees, P., Vicenzino, B., & Wikstrom, E. (2014). Selection criteria for patients with chronic ankle instability in controlled research: a position statement of the International Ankle Consortium. *Br J Sports Med, 48*, 1014-1018.

Gribble, P. A., Kleis, R. E., Simon, J. E., Vela, L. I., & Thomas, A. C. (2022). Differences in health-related quality of life among patients after ankle injury. *Front Sports Act Living, 4*, 909921.

Hiller, C. E., Nightingale, E. J., Raymond, J., Kilbreath, S. L., Burns, J., Black, D. A., & Refshauge, K. M. (2012). Prevalence and impact of chronic musculoskeletal ankle

disorders in the community. *Arch Phys Med Rehabil, 93*, 1801-1807.

Hootman, J. M., Dick, R., & Agel, J. (2007). Epidemiology of collegiate injuries for 15 sports: summary and recommendations for injury prevention initiatives. *J Athl Train, 42*, 311-319.

Houston, M. N., Hoch, J. M., & Hoch, M. C. (2018). College Athletes With Ankle Sprain History Exhibit Greater Fear-Avoidance Beliefs. *J Sport Rehabil, 27*, 419-423.

Houston, M. N., Van Lunen, B. L., & Hoch, M. C. (2014). Health-related quality of life in individuals with chronic ankle instability. *J Athl Train, 49*, 758-763.

Jang, J., & Wikstrom, E. A. (2023). Ankle joint contact force profiles differ between those with and without chronic ankle instability during walking. *Gait & Posture, 100*, 1-7.

Kikuchi, N., Matsudaira, K., Sawada, T., & Oka, H. (2015). Psychometric properties of the Japanese version of the Tampa Scale for Kinesiophobia (TSK-J) in patients with whiplash neck injury pain and/or low back pain. *J Orthop Sci, 20*, 985-992.

Kosik, K. B., Hoch, M. C., Slone, S., Bain, K. A., & Gribble, P. A. (2022). Health-Related Quality of Life Among Patients With Painful Chronic Ankle Instability. *International Journal of Athletic Therapy and Training*, 1-6.

Lee, S., Song, K., & Lee, S. Y. (2022). Epidemiological study of post-traumatic ankle osteoarthritis after ankle sprain in 195,393 individuals over middle age using the National Health Insurance Database: A retrospective design. *J Sci Med Sport, 25*, 129-133.

Luque-Suarez, A., Martinez-Calderon, J., & Falla, D. (2019). Role of kinesiophobia on pain, disability and quality of life in people suffering from chronic musculoskeletal pain: a systematic review. *Br J Sports Med, 53*, 554-559.

Mineta, S., Inami, T., Fukano, M., Hoshiba, T., Masuda, Y., Yoshimura, A., Kumai, T., & Hirose, N. (2019). The reliability, and discriminative ability of the identification of functional ankle instability questionnaire, Japanese version. *Phys Ther Sport, 35*, 1-6.

Molla-Casanova, S., Ingles, M., & Serra-Ano, P. (2021). Effects of balance training on

functionality, ankle instability, and dynamic balance outcomes in people with chronic ankle instability: Systematic review and meta-analysis. *Clin Rehabil, 35*, 1694-1709.

Rollman, G. B., & Lautenbacher, S. (2001). Sex differences in musculoskeletal pain. *Clin J Pain, 17*, 20-24.

Suttmiller, A. M. B., Cavallario, J. M., Baez, S. E., Martinez, J. C., & McCann, R. S. (2022). Perceived Instability, Pain, and Psychological Factors for Prediction of Function and Disability in Individuals With Chronic Ankle Instability. *J Athl Train, 57*, 1048-1054.

Suttmiller, A. M. B., & McCann, R. S. (2021). Injury-Related Fear in Individuals With and Without Chronic Ankle Instability: A Systematic Review. *J Sport Rehabil, 30*, 1203-1212.

Tsikopoulos, K., Mavridis, D., Georgiannos, D., & Vasiliadis, H. S. (2018). Does Multimodal Rehabilitation for Ankle Instability Improve Patients' Self-assessed Functional Outcomes? A Network Meta-analysis. *Clin Orthop Relat Res, 476*, 1295-1310.

Uematsu, D., Suzuki, H., Sasaki, S., Nagano, Y., Shinozuka, N., Sunagawa, N., & Fukubayashi, T. (2015). Evidence of validity for the Japanese version of the foot and ankle ability measure. *J Athl Train, 50*, 65-70.

Watanabe, K., Koshino, Y., Kawahara, D., Akimoto, M., Mishina, M., Nakagawa, K., Ishida, T., Kasahara, S., Samukawa, M., & Tohyama, H. (2023). Kinesiophobia, self-reported ankle function, and sex are associated with perceived ankle instability in college club sports athletes with chronic ankle instability. *Phys Ther Sport, 61*, 45-50.

Wikstrom, E. A., & Song, K. (2019). Generic and psychological patient-reported deficits in those with chronic ankle instability: A cross sectional study. *Phys Ther Sport, 40*, 137-142.

Woby, S. R., Roach, N. K., Urmston, M., & Watson, P. J. (2005). Psychometric properties of the TSK-11: a shortened version of the Tampa Scale for Kinesiophobia. *Pain, 117*, 137-144.

Figure Legends

Figure 1. Violin and box plots show data distribution for the pain (red) and no pain (blue) groups during ADL. Data are shown for the IdFAI (A), the FAAM ADL score (B), and the FAAM Sport score (C).

Figure 2. Violin and box plots show data distribution for the pain (red) and no pain (blue) groups during sports activity. Data are shown for the IdFAI (A), the number of LASs (B), the FAAM ADL score (C), and the FAAM Sport score (D).

Highlights

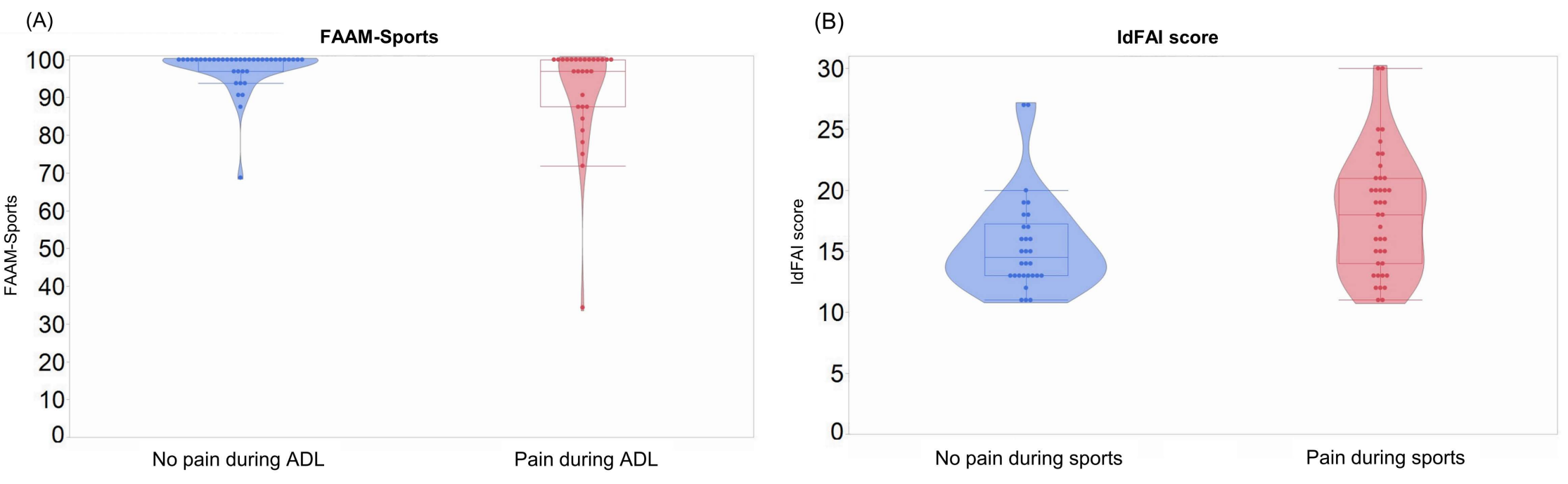
1. In athletes with CAI, 42% had pain during ADL and 57% had pain during sports.

2. In coper group, 17% had pain during ADL and 33% had pain during sports.

3. In ankle sprain group without CAI, 34% had ADL pain and 40% had sports pain.

4. Perceived ankle instability was associated with pain during sports in CAI group.

5. Lower foot/ankle function was associated with pain during ADL in CAI group.


(A)
FAAM-Sports
FAAM-Sports
100
90
80
70
60
50
40
30
20
10
0
No pain during ADL
Pain during ADL
(B)
IdFAI score
IdFAI score
30
25
20
15
10
5
0
No pain during sports
Pain during sports