ORIGINAL ARTICLE

Comparison of psychological factors between healthy athletes and those suffering from chronic ankle instability

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ABSTRACT

Background: Ankle sprain is the most common traumatic injury among handball players, which usually leads to the development of Chronic Ankle Instability (CAI). There is much evidence regarding the mechanical component about this condition; however, the psychological component has been little studied in previous research. The aim of this study was to compare anxiety, personality traits, depression, and kinesiophobia between young handball players with and without CAI. Methods: Case-control study. A sample of 100 young handball players was recruited and divided into athletes with CAI (case group, n = 50) and healthy athletes (control group, n = 50). Main outcome measures were anxiety, personality traits, depression and kinesiophobia levels, which were assessed by self-reported questionnaires (State-Trait Anxiety Inventory, Eysenck Personality Questionnaire, Beck Depression Inventory-II and Tampa Scale for Kinesiophobia-11). Results: Statistically significant differences were found between groups for anxiety, personality traits, depression and kinesiophobia. Case group showed higher levels of state anxiety (Δ-2.50; $p < .05$), trait-anxiety (Δ-3.80; $p < .05$), neuroticism (Δ-0.92; $p < .05$), depression (Δ-4.10; $p < .05$), and kinesiophobia (Δ6.82; $p < .05$) compared to the control group. Conclusions: Young handball players with CAI present significant greater levels of anxiety, neuroticism, depression and kinesiophobia compared to healthy young handball players.

Keywords: Handball, Adolescent, Biopsychosocial, Anxiety, Depression, Kinesiophobia.

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INTRODUCTION

Handball is one of the most popular sports in the world in all age groups. The game is characterized by physical contact, sudden acceleration, jumps with hard landings, and twisting actions, which are related with a high risk of injury (Aman et al., 2016; Engebretsen et al., 2013; Junge et al., 2009). Young handball players aged between 15 to 19 years have shown the highest injury prevalence (41%) among all the age groups (Aman et al., 2016). The lower limbs registered the highest injury rates, and the ankle sprain is the most common traumatic pathology with a prevalence between 24.9 to 40% (Y de J, Nielsen AB, 1990) of the total injuries in young handball players generating a high sporting and economic burden (Asai et al., 2020; Bere et al., 2015; Giroto et al., 2017; Goes et al., 2020; Moller et al., 2012; Rafnsson et al., 2019).

Lateral ankle sprain is defined as an acute traumatic injury of the lateral ligament complex after an excessive inversion of the rear foot or a combined plantar flexion and adduction of the foot (Gribble et al., 2013). Around 40% of the young athletes with lateral ankle sprain developed CAI. CAI is characterized by multiple mechanical and sensorimotor dysfunctions such as plantar flexor, inversion, and eversion muscles weakness (Feger et al., 2016; Fraser et al., 2020; Gribble PA, Robinson RH, 2009; Ryman Augustsson S, Sjöstedt E, 2023), restricted ankle joint dorsiflexion (Fraser et al., 2020; Jamsandekar et al., 2022; Li et al., 2017), joint position sense (Alghadir et al., 2020; Nakasa et al., 2008; Witchalls et al., 2012) and force sense impairments (Simon et al., 2014; Sousa et al., 2017; Yen et al., 2019), static (Ryman Augustsson S, Sjöstedt E, 2023; Mitchell et al., 2008) and dynamic (Alghadir et al., 2020; Hoch et al., 2012) balance alterations, and kinetic and kinematic changes (Drewes et al., 2009; Koldenhoven et al., 2016; Ty Hopkins et al., 2012; Wright et al., 2016).

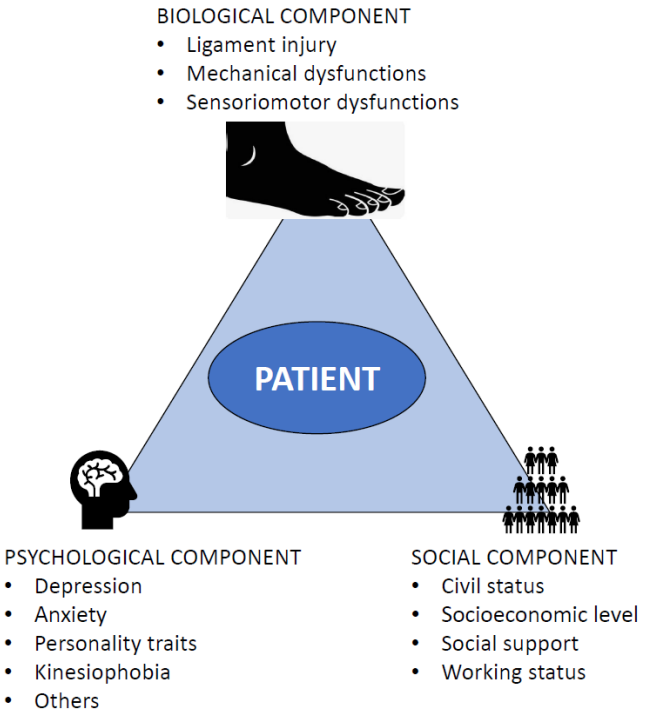

Figure 1. Biopsychosocial approach.

Despite of mechanical dysfunctions in patients with CAI are widely investigated, a high proportion of young athletes do not fully recover after an ankle sprain and have residual and chronic symptoms such as pain,

swelling, ankle joint giving-way or recurrent injury (Ryman Augustsson S, Sjöstedt E, 2023; Baldwin et al., 2017; Hiller et al., 2012). Hertel et al. (2019) proposed a biopsychosocial model for patients with CAI in which not only biological factors but also personal, and environmental factors are involved (Figure 1). There is a lack of evidence on the role that the psychological component may play in the development and evolution of CAI, and research into this seems necessary. Conventional physical therapy modalities usually only address the biological component of CAI. It is likely that if the psychological and social components of the patient are not addressed as well, the therapeutic success will not be complete; this is what can lead to the chronification of the injury. In this sense, several authors have found differences between adults with musculoskeletal injuries and healthy matched controls in some psychological variables such as anxiety, personality traits, depression, and kinesiophobia (Kilic et al., 2017; San-Antolín et al., 2020).

Anxiety is defined as a mental disorder associated with psychological discomfort and which presents symptoms such as irritability, fear, avoidance, muscle pain, lack of memory, concentration difficulties and fatigue. Li et al. (2017) showed that athletes presented a higher incidence of anxiety having a two-fold increase in risk of suffering different types of injuries. Depression is one of the most common mental disorders in professional handball players with a prevalence of 26% and is characterized by the presence of symptoms such as y sadness, fatigue, sleep difficulties, feelings of tiredness and worthlessness, loss of interest and pleasure or appetite changes (Kilic et al., 2017). The same authors found that depression can have a negative impact on sport performance and injury recovery and that a higher number of severe sport injuries was related to the presence of symptoms of depression. Some personality traits, like adventurous spirit and lack of caution, have shown to be related with the risk of sport injuries (Junge A, 2000). In this regard, San Antolín et al. (2020) found that athletes suffering from myofascial pain syndrome exhibited higher neuroticism level compared with healthy athletes. Some authors have described that neuroticism is associated with higher levels of anxiety and injury risk and with states of hypervigilance to pain, which may be related to the development of chronic pathologies (San Antolín et al., 2020; Xu et al., 2024). Kinesiophobia is defined as an irrational fear of movement or physical activity that results in physical limitation and is due to feelings of vulnerability to pain or re-injury. Several authors concluded that athletes with higher levels of kinesiophobia showed a poorer physical condition because of the avoidance of activities (Fraser et al., 2020; San-Antolín et al., 2020; Houston et al., 2014).

Despite of the knowledge about the key role of psychological factors in adults with musculoskeletal injuries, there is a lack of evidence about the psychological profile of young handball players with CAI, which is the population group that has the highest incidence and prevalence rate of ankle sprains and CAI. Thus, the aim of this study was to compare the anxiety, personality traits, depression, and kinesiophobia between young handball players with and without CAI.

MATERIAL AND METHODS

Design

A case-control study was conducted between January 2022 and March 2023. The study was designed following the *Strengthening the Reporting of Observational Studies in Epidemiology* (STROBE) Statement Guide (Von Elm et al., 2008). Before patients´ enrolment, the Ethical Committee of the Hospital Clínico San Carlos (20/478-E) and the Ethical Committee of the European University of Madrid (CIPI/20/139) approved the study. The study was carried out following the Declaration of Helsinki (2013) and all the participants read the informant consent, agreed to participate, and signed the informed consent by themselves or by their parents or guardians depending on the age of the participant.

Sample size calculation

The sample size calculation analysis was performed for the difference between two independent means (two groups including case and control participants) using G*Power version 3.1.9.2 (G*Power©, University of Dusseldorf, Germany), considering a large effect size (Cohen d = 0.80) (Cohen et al., 1988) for a two-tailed hypothesis, a between group proportion of N/n = 1, and a power (1-β error probability) of 0.80 with an α level of .05, the minimum sample size required was 52 participants to achieve an actual power of 0.807.

Participants

Patients´ recruitment was carried out between January 2022 and March 2023 in the Hospital IMSKE (Valencia, Spain) following a sex-matched consecutive sampling method. A hundred young handball players participated in the study (50 athletes with CAI and 50 age-matched athletes without CAI).

Inclusion criteria

The sample consisted of handball players aged between 13 to 17 years, who practiced handball at least six hours per week. Participants were divided into two groups: the case group, which included young handball players with CAI, and the control group that included age-matched athletes without CAI.

- Case group: Young handball players were included in the case group if they met the inclusion criteria stated by the International Ankle Consortium (Gribble et al., 2013): 1) history of at least one significant LAS in the previous 12 months or more prior to the study and resulted in inflammation and impaired physical activity; 2) the most recent LAS must have occurred more than three months prior to the study enrolment; 3) two or more episodes of ankle giving-way, or recurrent LAS or feelings of instability at the injured ankle in the previous six months; 4) a score of 24 or less in the Cumberland Ankle Instability Tool (CAIT).
- Control group: Young handball players were included in the control group if they: 1) had no history of LAS or ankle instability; 2) were considered as coper (individual who is more than 12 months removed from the index ankle sprain, reports no or very minimal symptoms or deficit in self-reported function and perceives fully recovery) (Hertel J, Corbett RO, 2019); 3) had a score higher than 24 in the CAIT.

Exclusion criteria

The exclusion criteria were: 1) young handball players with history of previous surgeries in the foot, ankle or other regions of the lower limb; 2) any acute injury of other musculoskeletal structures of the lower extremity (such as sprains, strains and/or fractures) in the previous three months; 3) or young handball players with visual, vestibular or neurological impairments that could influence their balance. Although it was not considered an exclusion criteria, none of the participants were undergoing psychological treatment at the time of the study.

Socio-demographic and descriptive data

Descriptive data comprised sex (male or female), age, body mass index (BMI), playing position (goalkeeper, wing, back or line), use of foot insoles, use of ankle bandage or ankle brace and CAIT score.

Outcome measures

Psychological variables consisted of anxiety, personality traits, depression, and kinesiophobia and were measured using the Spanish adaptations of self-reported questionnaires. The questionnaires used in this study are chosen because they have adequate psychometric properties, are validated in Spanish, have been widely used in the literature and are easy for patients to complete.

Anxiety

Anxiety was measured using the Spanish State-Trait Anxiety Inventory (STAI). This questionnaire presented excellent internal consistency (Cronbach α: 0.90-0.93) and good test-retest reliability (ICC: 0.73-0.86) (Guillén-Riquelme, Buela-Casal, 2011). STAI measure two dimensions of anxiety: trait-anxiety, which determine the permanent anxiety level; and state-anxiety, which measure how the person feels at the moment. Each dimension has 20 items on a Likert-type scale of 0 (not at all) to 3 (very much), with higher scores indicating greater presence of anxiogenic symptoms.

Personality traits

Personality traits were measured using the Spanish abbreviated Eysenck Personality Questionnaire (EPQ-RA). This scale was used to determine four personality traits: neuroticism (level of emotional instability), psychoticism (level of hardness), extraversion (level of sociability) and sincerity (level of compliance) scores. This questionnaire has 24 items that evaluate these four dimensions using six items per scale and two YES/NO response alternatives. The greater the number of affirmative answers, the greater presence of each dimension in the subject's personality. This questionnaire presented an internal consistency ranging from 0.363 to 0.552 and a moderate-good reliability (ICC = 0.53-0.83) (Sandín et al., 2020).

Depression

Depression was assessed using the Spanish version of the Beck Depression Inventory-II (BDI-II) (Sanz et al., 2003), which had very good internal consistency (Cronbach α: 0.87) and retest reliability ranged from 0.73 to 0.96. BDI-II presents 21 Linkert-type items that measure different symptoms of depression, such as sadness, pessimism, feelings of failure, loss of pleasure, feelings of guilt, feelings of punishment, among others. Each item has a four-point scale (0,1,2,3), except items 16 and 18, which each have seven categories. The total score is categorized into minimal, mild, moderate, or severe depression, with a higher score linked to greater severity.

Kinesiophobia

Kinesiophobia was measured using the Spanish validated translation of the Tampa Scale for Kinesiophobia (TSK-11) (Gómez-Pérez et al., 2011). Acceptable psychometric properties have been shown with good internal consistency (Cronbach α: 0.79), and excellent test-retest reliability (ICC: 0.81) (Woby et al., 2005).). TSK-11 consists of 11 Lykert-type items from 1 (strongly disagree) to 4 (strongly agree). TSK-11 is divided into two subscales: activity avoidance and harm. Higher scores mean greater fear of pain and avoidance of movement.

Statistical analysis

Statistical Package for the Social Sciences (SPSS) version 25.0 for Windows was used for statistical analysis. Qualitative variables were presented as frequencies and percentages while quantitative variables were presented as minimum, maximum, mean and standard deviation. Before between-group comparisons, the normality and variances homogeneity were evaluated using the Kolmogorov-Smirnov and Levene test, respectively. Differences between young handball players with and without CAI were analysed using the Students´ t-test or the Mann-Whitney U test following the normal or non-normal distribution of the variables respectively. A *p*-value < .05 was considered statistically significant. To determine the effect size, the value of η^2 is obtained.

RESULTS

Socio-demographic and descriptive data

One hundred and seven participants were initially recruited for the study. After the elegibility criteria screening, seven participants were excluded. Four presented lower limb surgeries and three had acute musculoskeletal injury in the ankle or foot regions in the previous three months. Finally, one hundred young handball players met all the elegibility criteria (CAI group, n = 50; control group, n = 50).

No statistically significant differences were found for any demographic or clinical variables except for the use of bandages and the CAIT total score. In the CAI group, 34% (n = 12) of the young handball players reported using ankle bandages for training and/or matches, and the total CAIT score was 19.82 ± 4.26; while the control group used no bandages, and the total CAIT score was 28.64 ± 1.54 (p < .05). The detailed description of the demographic and clinical variables are shown in the Table 1.

Table 1. Demographic and clinical variables at baseline.

Demographic and clinical variables	Control group	CAI group	Statistical test	Significance (p-value)
Sex				
-Men	25 (50)	25 (50)		
-Women	25 (50)	25 (50)		1
Age (years)	14.02 (1.91)	14.16 (1.77)	$t(98) = -0.93$	.7
BMI[1] (Kg/cm^2)	21.24 (3.93)	21,76 (2.84)	$t(98) = -0.76$	.45
Position			X^2 (3) = 1.72	.63
-Goalkeeper	3 (6)	6 (12)		
-Wing	16 (32)	12 (24)		
-Pivoter	10 (20)	9 (18)		
-Backcourt	21 (42)	23 (46)		
Use of foot insoles			X^2 (2) = 0.45	.8
-Never	42 (84)	40 (80)		
-Only for sport	4 (8)	4 (8)		
-Sport and daily live	4 (8)	6 (12)		
Bandage			X^2 (2) = 13.64	**<.01**
-Never	50 (100)	38 (76)		
-For matches	0 (0)	8 (16)		
-Training and matches	0 (0)	4 (8)		
CAIT[2]	28.64 (1.54)	19.82 (4.26)	t(98) = 13.79	**<.01**

Note. [1]BMI: Body Mass Index; [2]CAIT: Cumberland Ankle Instability Tool.

Outcomes

Table 2 shows the between-groups comparison for all the outcome variables. Statistically significant differences were found between the CAI and control group for anxiety, personality traits, depression and kinesiophobia. Young athletes with CAI showed higher levels of state-anxiety (Δ 2.50; p < .01), trait-anxiety (Δ 3.80; p < .01), neuroticism (Δ 0.92; p < .01), depression (Δ 4.10; p < .01) and kinesiophobia (Δ 6.82; p < .01), compared to the control group. Considering the η^2 values, the effect size is medium for the variables state-anxiety, neuroticism, depression and harm (kinesiophobia). The effect size is large ($\eta^2 > 0.14$) for the variables trait-anxiety, avoidance activity (kinesiophobia) and total kinesiophobia. On the contrary, the effect size is small ($\eta^2 < 0.06$) for the variables psychoticism, extraversion and sincerity.

Table 2. Psychological outcomes (between-groups differences).

Outcome variable	Control group Mean (SD)	CAI group Mean (SD)	Between-group differences	Significance (*p*-value)	Effect size (η^2)
State-anxiety (STAI)	26.80 (4.14)	29.30 (4.69)	2.50	**<.01**	0.08
Trait-anxiety (STAI)	25.84 (4.91)	29.64 (4.77)	3.80	**<.01**	0.14
Neuroticism (EPQ-RA)	2.06 (1.71)	2.98 (1.70)	0.92	**<.01**	0.07
Psychoticism (EPQ-RA)	1.72 (1.28)	1.90 (1.22)	0.18	.47	0.01
Extraversion (EPQ-RA)	4.52 (1.45)	4.20 (1.53)	-0.32	.28	0.01
Sincerity (EPQ-RA)	3.32 (1.53)	3.80 (1.57)	0.48	.13	0.02
Depression (BDI-II)	8.76 (6.98)	12.86 (7.59)	4.10	**<.01**	0.08
Avoidance activity (TSK-11)	10.34 (4.09)	14.98 (3.12)	4.64	**<.01**	0.3
Harm (TSK-11)	9.22 (3.60)	11.40 (3.09)	2.18	**<.01**	0.1
Total kinesiophobia (TSK-11)	19.56 (7.21)	26.38 (5.53)	6.82	**<.01**	0.23

Note. SD: standard deviation; CAI: chronic ankle instability; STAI: state-trait anxiety inventory; EPQ-RA: Eysenck personality questionnaire revised abbreviated; BDI: Beck depression inventory; TSK: Tampa scale for kinesiophobia.

DISCUSSION

The aim of this cross-sectional study was to compare the psychological status between young handball athletes with and without CAI. Athletes with CAI showed statistically significant higher levels of anxiety, personality traits such as neuroticism, depression, and kinesiophobia than the age-matched controls.

Due to the results achieved in this study, psychological status may be an important factor in young handball players with CAI. To the best of our knowledge, there is a lack of evidence assessing the anxiety, personality traits and depression in young athletes with CAI. However, due to the design of the study it is not possible to determine the cause-effect relationship between CAI and psychological disorders; i.e., the results of the present study do not allow to conclude whether athletes with CAI present these psychological disorders as a consequence of the injury; or whether, on the contrary, athletes with certain psychological characteristics could be predisposed to the development of CAI after an initial ankle sprain. It might be interesting to carry out longitudinal studies in order to determine this causal relationship between CAI and the psychological disorders described in the present study.

Previous studies considered certain aspects of psychological status but did not include young athletes or did not carry out a specific evaluation. Kosik et al. (2020) concluded that in sample size of 59 adult athletes, the participants included in the CAI group presented higher levels of depression but not anxiety compared to a Copers group and a control group. Johnson et al. (2011) and Ivarsson et al. (2010) reported a higher anxiety level in injured athletes than in healthy ones. San Antolín et al. (2020), concluded that athletes with myofascial pain syndrome presented statistically significant higher levels of anxiety, neuroticism, and depression compared to healthy athletes. Cohen et al. (2018) found significant differences in neuroticism between professional and amateur athletes. Galambos et al. (2005) found higher levels of depression in injured athletes compared to healthy or asymptomatic athletes in a cohort of 845 young athletes. These studies showed similar results to the data reported in our study. However, all the studies included adult athletes, Kosik et al. (2020) used the Patient Reported Outcomes Measurement Information System to assessed physical, social and mental functioning, which cannot be considered a specific instrument to evaluate psychological status. Johnson et al. (2011), Ivarson et al. (2010) and San Antolín et al. (2020), did not consider the presence of CAI among the athletes. Galambos et al. (2005) used the Brunel Mood Scale to assess depressive symptoms, considering depression as a mood instead of a clinical entity by itself.

In general, anxiety, personality traits and depression have shown to be important factors practicing sports because may influence sport performance, injury risk and injury recovery. Some authors pointed out that athletes with higher levels of anxiety presented a two-fold risk of injury (Lobo et al., 2016), the presence of some personality traits were considered injury predictive factors (Ivarsson 2010) and can influence in the risk of injuries and in the outcome of the rehabilitation (Cohen et al., 2018), negative association between neuroticism and athleticism has also been showed in adolescents (Klein et al., 2016) and lower levels of positive reframing were related to higher levels of depression and an increased risk of traumatic injuries (Tranaeus et al., 2021; Yang et al., 2014). Thus, the psychological status understanding of the athletes may optimize the rehabilitation process and promote a faster and safer return to play (Truong et al., 2020). In this sense, Ramaligan et al. (2023) suggested that the inclusion of a psychological intervention to decrease anxiety improved pain intensity and ankle instability perception in adult athletes with CAI. On the other hand, no between-group differences were found on the variables psychoticism, sincerity and extroversion. Therefore, these personality traits did not seem to be related to injury risk in athletes. This is in line with findings found by other authors (San Antolín et al., 2020; Xu et al., 2024).

Kineshiophobia is the most investigated symptom in recreative and professional athletes with musculoskeletal injuries, including CAI. Our study found that young handball athletes with CAI presented higher levels of kinesiophobia, in the activity avoidance and in the harm subscales, compared to the control group. Several studies (Fraser et al., 2020; Houston et al., 2014; DeJong et al., 2019; Hadadi et al., 2020; Koldenhoven et al., 2019; Suttmiller et al., 2022; Terada et al., 2017) concluded that athletes with CAI presented higher levels of kinesiophobia compared to Copers or to healthy-matched controls using the short or the long version of the TKS questionnaire. In this sense, the presence of kinesiophobia in athletes leads to fear of movement and avoidance of activity behaviours. In addition, a negative association between kinesiophobia and foot and ankle function has been reported (Suttmiller et al., 2022). All of this may negatively affect the athletic performance. Kinesiophobia is a characteristic symptom also in other sport injuries such as anterior cruciate ligament rupture or Achilles tendon injury (Kvist et al., 2022). Clinical evolution of patients with these pathologies can also be improved by including a psychological approach.

All these findings described in the present study are in agreement with the results of the review by Tranaeus et al. (Tranaeus et al., 2024) in which the psychosocial component is reported to be a risk factor for overuse injuries and it is concluded that intervention programs based on acceptance practices, cognitive behavioural approach and social support can reduce negative reactions.

Clinical Recommendations: From a clinical perspective, considering the higher levels of anxiety, neuroticism, depression and kinesiophobia found in young handball players with CAI, it may be necessary to change the treatment approach for this pathology. The mechanical and local model should be changed for the biopsychosocial model proposed by Hertel and Corbett (2019). Patients suffering from CAI should be treated with multimodal psychological interventions such as mental imagery, coping strategies and cognitive restructuring educational techniques (Banatao et al., 2024), as well as deep breathing exercises (Ramalingan et al., 2023) to improve psychological deficits presented in these patients. Therefore, it seems interesting for sports clubs to include a psychologist within the medical staff; in this way, it will be possible to make a comprehensive approach to injured athletes, allowing their full recovery and their return to play. Future interventional studies should combine some physical therapy modalities and psychological interventions for the treatment of athletes with CAI.

Limitations: This study presents several limitations. First, only young handball players were included, so the results cannot be extrapolated to other groups. Second, the cross-sectional design does not allow associating

the cause-effect of the differences achieved. Third, a random selection may be more appropriate than a consecutive sampling method for the recruitment process. Fourth, the inclusion of a Copers group was not considered. Fifth, confounding variables such as civil status, socioeconomic level, social support, working status or previous psychological diagnostics were no collected. Finally, despite our statistical analysis was performed using the Students´ t-test or the Mann Whitney U test following the normal or non-normal distribution, according to the calculated sample size based on the difference between two independent means (case and control groups), future investigations should perform longitudinal studies such as cohorts to apply analysis of variance and Bonferroni corrections to determine the differences among different measurement moments. Moreover, future studies should assess the psychological status in different age groups with CAI from different sports. In addition, gender differences should be considered in future analysis.

CONCLUSIONS

Young handball players with CAI present significant greater levels of anxiety, neuroticism, depression and kinesiophobia compared to healthy athletes. Therefore, it seems necessary to include psychological approaches in the treatment of athletes with CAI.

AUTHOR CONTRIBUTIONS

Daniel García García, César Calvo Lobo and David Rodríguez Sanz participated in data collection and execution of the field study. Marta San Antolín Gil, Rocío Llamas Ramos and Inés Llamas Ramos designed the study´s protocol and carried out the data processing. Luis Ceballos Laita and Sandra Jiménez del Barrio drafted the manuscript that subsequently was commented, revised and approved by all authors.

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DISCLOSURE STATEMENT

No potential conflict of interest was reported by the authors.

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