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ORIGINAL RESEARCH

Fear-Avoidance Beliefs Associated with Non-Specific Chronic Low Back Pain in College Athletes

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Purpose: This study aimed to determine the psychosocial factors associated with non-specific chronic low back pain (NS-CLBP) among college athletes.

Material and Methods: A cross-sectional study was performed at one university. A non-anonymous, self-administered online questionnaire was collected from each athlete. Participants with a history of orthopaedic spine disease or surgery were excluded. Online responses from 368 college athletes belonging to 18 clubs were collected, among which 263 were included in the analysis. In the 263 responses, 41 individuals were identified as having NS-CLBP. Multivariate logistic regression analyses were performed to determine factors associated with presence of NS-CLBP. Independent variables included the Fear-Avoidance Beliefs Questionnaire physical activity subscale (FABQ-PA) score, Tampa Scale for Kinesiophobia-11 (TSK-11) score, Roland-Morris Disability Questionnaire (RDQ) score, and body mass index (BMI). Additionally, the Mann–Whitney *U*-test was utilized to compare FABQ-PA, TSK-11, RDQ scores, and BMI between the NS-CLBP and non-NS-CLBP groups.

Results: The FABQ-PA (odd ratio = 1.096, $P = 0.003$) was significantly associated with NS-CLBP. No significant association was observed between NS-CLBP and TSK-11 ($P = 0.776$), RDQ ($P = 0.074$), and BMI ($P = 0.296$). The scores for FABQ-PA, TSK-11, RDQ, and BMI in the group with NS-CLBP were found to be significantly higher compared to the group without NS-CLBP ($P < 0.001$, $P = 0.034$, $P < 0.001$, and $P = 0.022$, respectively).

Conclusion: The present study revealed a significant relationship between higher FABQ-PA scores and NS-CLBP among college athletes. Conversely, TSK-11 and BMI values showed no significant association with NS-CLBP presence. The findings suggest that addressing fear-avoidance beliefs may be crucial in managing NS-CLBP among college athletes.

Keywords: questionnaire, psychosocial factors, multivariate logistic regression analyses, sports

Introduction

Low back pain (LBP) is a musculoskeletal disorder that is common in the general population, with a lifetime incidence rate of more than 80%.[1] Similar to the majority of the general population, a substantial proportion of athletes also experience LBP. Trompeter et al reported that athletes in several disciplines have an increased risk for LBP than the general population.[2] Several cross-sectional studies have suggested an inverse relationship between health-related quality of life and LBP.[3–5] Further, LBP may contribute to reduced performance and early retirements in athletes.

Non-specific LBP refers to LBP that cannot be attributed to an identifiable and known specific underlying condition.[6,7] Individuals experiencing non-specific acute LBP often exhibit positive improvement rates during the initial six-week period.[8] Nevertheless, approximately 40% of patients experience chronic LBP (CLBP).[9] The chronicity of non-specific LBP has been suggested to be due in part to psychosocial factors.[10,11] Previous studies have shown that fear-avoidance beliefs and kinesiophobia, as assessed by the physical activity subscale of the Fear-Avoidance Beliefs Questionnaire (FABQ-PA) and the Tampa Scale for Kinesiophobia (TSK)-11 scores, are significantly associated with

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presence of CLBP.[12,13] Although several investigations have shown an association CLBP and psychosocial factors in workers,[12,13] few similar studies have been conducted in athletes. In a 1-year prospective study, Nakao et al reported that kinesiophobia is associated with CLBP in high school baseball players.[14] However, this has not been clarified for athletes in other sports. Determining which psychosocial factors are associated with non-specific chronic low back pain (NS-CLBP) in athletes may be useful for the management of NS-CLBP in athletes.

In examining the association between psychosocial factors and NS-CLBP, it is noteworthy that NS-CLBP arises from many factors. The Roland-Morris Disability Questionnaire (RDQ), a patient-reported outcome that assesses disability due to LBP, has been shown to be correlated with psychological factors in NS-CLBP.[15] Additionally, a significant association has been reported between NS-CLBP and increased body mass index (BMI).[16] Hence, these potential confounding variables should be considered simultaneously when examining the association between NS-CLBP and psychosocial factors. Previous studies have used multivariate logistic regression analysis to examine psychosocial factors for CLBP.[12,13] Using multivariate logistic regression analysis, the association between specific factors and the dependent variable can be explored while accounting for their relationships with other variables. This approach allows the assessment of the relative impact of psychosocial factors on NS-CLBP compared to RDQ and BMI.

The aim of this study was to investigate the association between NS-CLBP, psychosocial factors, RDQ score, and BMI among college athletes using multivariate logistic regression analysis. We hypothesized that both FABQ-PA and TSK-11 scores are associated with NS-CLBP, alongside RDQ score and BMI value.

Materials and Methods

Participants

This study was a cross-sectional investigation, and the survey was conducted from April 1 to July 31, 2023. This study complied with the Declaration of Helsinki. All study procedures were approved by the ethics committee of the Faculty of Health Sciences, Hokkaido University (No: 22–77). All participants were informed of the study objectives and procedures, and all provided informed consent to participate. Eligible participants include athletes belonging to 18 clubs within our university (n = 368). Each athlete completed a self-administered, non-anonymous online questionnaire. Participants with a history of orthopaedic spine disease or surgery were excluded. Subsequently, the participants were then divided into NS-CLBP and non-NS-CLBP groups. Those experiencing localized pain from the lower margin of the twelfth rib to the lower gluteal folds for more than three months were included in the NS-CLBP group.[17]

Online Questionnaire Survey

A web-based questionnaire survey was conducted using Google Form (Google LLC, Mountain View, CA, United States). The survey was distributed to each sports club during meetings, practices, or via representatives. Participants were asked to complete the survey, which comprised inquiries regarding their demographic information, the presence or absence of LBP, and any history of orthopaedic conditions or surgeries; followed by sections covering the FABQ-PA, Athlete Fear Avoidance Questionnaire (AFAQ), TSK-11, Pain Catastrophizing Scale (PCS), and RDQ.

Demographic data, including age, height, weight, gender, club affiliations, and weekly hours of sports activity of each participant, were obtained. The presence or absence of NS-CLBP was determined by locating the pain site with the assistance of an anatomical diagram depicting the lumbar region, spanning from the lower margin of the ribs to the gluteal folds. Additionally, they were also queried on the duration of their condition.

Fear-avoidance beliefs were evaluated by the use of the FABQ-PA and the AFAQ. The Fear-Avoidance Beliefs Questionnaire consists of 16 questions that individuals self-report, which are further divided into two subscales: fear-avoidance beliefs related to physical activity and work.[18] The present study used a previously established and verified Japanese adaptation of the Fear-Avoidance Beliefs Questionnaire.[19] Because the present study was conducted on athletes, we utilized a physical activity subscale consisting of four items. Participants responded using a 7-point Likert scale, where 0 corresponded to "completely disagree", and 6 denoted "completely agree". The total scores spanned from 0 to 24, with higher scores meaning heightened fear-avoidance beliefs. Meanwhile, fear avoidance related to sports injuries was evaluated using the 10-item AFAQ.[20] Every question was assessed using a 5-point scale, where 5 and 1 indicated "completely agree" and "not at all", respectively. The total score ranged from 10 to 50 points, with higher scores indicating a greater degree of fear avoidance. The questionnaire exhibited strong internal consistency and demonstrated concurrent validity, as established through correlations with the PCS and FABQ-PA.[20]

The TSK was originally created as a self-assessment questionnaire consisting of 17 items to distinguish between rational fear and phobia in individuals with chronic pain. The assessment of kinesiophobia or fear of movement and potential re-injury associated with pain is commonly employed in patients with musculoskeletal conditions. The TSK employs a 4-point Likert scale, with response options spanning from 1 (strongly disagree) to 4 (strongly agree). We utilized a shorter version known as the TSK-11,[21] which has been translated into Japanese and undergone linguistic validation.[22]

The PCS is a self-report questionnaire consisting of 13 items that is used to evaluate the level of pain catastrophizing experienced by individuals with chronic pain.[23] Participants are instructed to evaluate the degree to which they encounter any of the ideas described in the questionnaire using a 5-point Likert scale, which spans from 0 (not at all) to 4 (all the time). The total score is computed by summing the scores for each individual item and can range from 0 to 52. Higher scores are indicative of more severe catastrophic thoughts. The reliability and validity of this scale in its Japanese version have been shown.[24]

The RDQ is a health assessment tool specifically intended to evaluate the extent of disability caused by LBP in individuals.[25] Participants gave a score of one point for each of the 24 items on the questionnaire that they marked with a tick. An individual participant's score ranges from 0, indicating no disability, to 24, indicating significant disability.[26]

Statistical Analyses

IBM SPSS Statistics 29 (IBM, Chicago, IL, USA) was used for the statistical analyses. The Shapiro–Wilk test was performed to confirm normality. The Mann–Whitney *U*-test and chi-squared test were utilized to compare demographic data and questionnaires between the NS-CLBP and non-NS-CLBP groups. Additionally, post-hoc power analyses were conducted using G*Power 3.1.9.7 to determine the effect sizes of group differences (University of Dusseldorf, Dusseldorf, Germany). Cohen's d and w were used to examine effect sizes in the Mann–Whitney U and chi-square tests, which were interpreted on three levels: large (d = 0.8 or w = 0.5), moderate (d = 0.5 or w = 0.3), and small (d = 0.2 or w =0.1).[27] We also calculated the statistical power from these calculated effect sizes. Multivariate logistic regression analysis was conducted using the forced entry method to find the factors that are associated with NS-CLBP. Briefly, the number of independent variables that could be incorporated was approximately one-tenth of the number of events; in this specific scenario, approximately four confounding factors were available for use in the model. Prior to conducting the multivariate logistic regression analysis, the Spearman's rank correlation coefficient was utilized to assess the correlation between independent variables. This was performed to minimize the potential issue of multicollinearity. If any variables were discovered to have a Spearman's rank correlation coefficient of ≥ 0.5,[28] we opted for the variable that was considered more pertinent to this study and incorporated it into the regression model, while omitting the other variable. Since TSK-11 had a significant correlation with AFAQ (P < 0.001, r = 0.690) and PCS (P < 0.001, r = 0.714), the latter variables were excluded. Following the criteria mentioned earlier, the final regression model included the following variables: FABQ-PA, TSK-11, RDQ scores, and BMI. In order to evaluate the presence of multicollinearity in the model, the variance inflation factor was utilized. The level of statistical significance was established at α = 0.05.

Results

In the Shapiro–Wilk test, it was confirmed that all outcomes did not adhere to a normal distribution. Online responses from 368 college athletes were collected, among which 92 were excluded due to incomplete responses. Of the 276 complete responses obtained, 13 reported a history of spinal orthopaedic or surgical procedures and thus were excluded (Figure 1). Hence, a total of 263 athletes completed the questionnaire survey, resulting in a response rate of 71.5%. The included athletes from 18 different clubs were further categorized, among them 41 belonged to the NS-CLBP group, while 222 belonged to the non-NS-CLBP group (Table 1). The number of participants with NS-CLBP in the clubs that participated in this study is shown in Table 1.

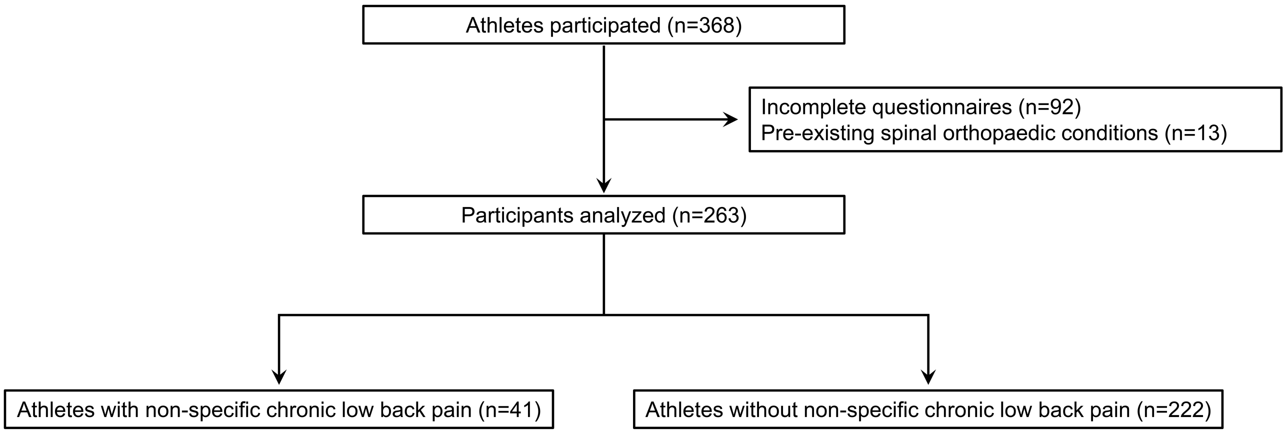

Figure 1 Flow chart of participant recruitment.
Notes: Among the 263 athletes, those with pain from the lower margin of the 12th rib to the lower gluteal folds for more than 3 months were classified as non-specific chronic low back pain group, and thus 41 patients were included.

Age, height, and time per week in sports activity were not significantly different between the two groups ($P = 0.476$, $P = 0.223$, and $P = 0.207$, respectively) (Table 2). The chi-squared test did not reveal a statistically significant difference in the male-to-female ratio between the groups ($P = 0.352$). However, body weight and BMI were significantly higher in the NS-CLBP group than in the non-NS-CLBP group ($P = 0.012$ and $P = 0.022$, respectively) (Table 2). The effect sizes for body weight and BMI were small.

The FABQ-PA, TSK-11, PCS, and RDQ scores in the NS-CLBP group were significantly higher than those of the non-NS-CLBP group ($P < 0.001$, $P = 0.034$, $P = 0.005$, and $P < 0.001$, respectively) (Table 3). No significant difference was found in the AFAQ score ($P = 0.169$). The TSK-11 and RDQ scores showed a small effect size, and the FABQ-PA and PCS scores revealed moderate effect sizes.

Table 1 Participants from Different Clubs with Non-Specific Chronic Low Back Pain

	Total	Athletes with NS-CLBP
Tennis	29	7 (24.1)
Baseball	25	3 (12.0)
Rugby football	24	6 (25.0)
Volleyball	20	6 (30.0)
Track and fields	20	2 (10.0)
Taido	17	1 (5.9)
Badminton	17	0 (0.0)
American football	17	4 (23.5)
Futsal	16	1 (6.3)
Alpine and Nordic ski	16	1 (6.3)
Table tennis	15	2 (13.3)
Softball	12	2 (16.7)
Basketball	8	0 (0.0)
Soccer	8	2 (25.0)
Yachting	7	1 (14.3)
Handball	5	1 (20.0)
Sumo	4	1 (25.0)
Boat	3	1 (33.3)

Notes: The values are given as the number of participants (%).
Abbreviation: NS-CLBP, non-specific chronic low back pain.

Table 2 Demographic Data of Participants with or Without Non-Specific Chronic Low Back Pain

	NS-CLBP Group (n = 41)	Non-NS-CLBP Group (n = 222)	*P* value	Effect Sizes	Power
Age, yrs	20.0 (2.0)	20.0 (2.0)	0.476	0.020	0.052
Height, cm	173.0 (11.0)	170.0 (9.6)	0.223	0.218	0.249
Weight, kg	70.0 (11.5)	64.0 (13.1)	0.012	0.375	0.595
Body mass index, kg/m^2	23.1 (4.4)	21.7 (3.6)	0.022	0.347	0.529
Sex, male/female	37/4	184/38	0.352	0.173	0.801
Time per week in sports activity, hours	12.0 (8.0)	10.0 (7.0)	0.207	0.166	0.164

Notes: The values are given as the median (interquartile range). In the sex section, the number of males and females each is listed.
Abbreviation: NS-CLBP, non-specific chronic low back pain.

Table 3 Questionnaire Data of the Participants with or Without Chronic Low Back Pain

	NS-CLBP Group (n = 41)	Non-NS-CLBP Group (n = 222)	*P* value	Effect Sizes	Power
FABQ-PA	15.0 (6.0)	10.0 (15.0)	<0.001	0.792	0.996
AFAQ	26.0 (11.0)	24.0 (16.0)	0.169	0.249	0.309
TSK-11	25.0 (5.5)	23.0 (9.3)	0.034	0.372	0.588
PCS	22.0 (15.0)	17.5 (21.0)	0.005	0.512	0.851
RDQ	1.00 (4.0)	0.0 (0.0)	<0.001	0.447	0.745

Notes: The values are given as the median (interquartile range).
Abbreviations: NS-CLBP, non-specific chronic low back pain. FABQ-PA, Fear-Avoidance Beliefs Questionnaire physical activity subscale. AFAQ, Athlete Fear Avoidance Questionnaire. TSK-11, Tampa Scale for Kinesiophobia-11. PCS, Pain Catastrophizing Scale. RDQ, Roland-Morris Disability Questionnaire.

Table 4 Multivariate Regression Model Associated with Non-Specific Chronic Low Back Pain

	B	OR	95% CI for OR	*P* value	VIF
BMI	0.053	1.055	0.954–1.165	0.296	1.131
FABQ-PA	0.092	1.096	1.031–1.165	0.003	1.314
TSK-11	0.009	1.009	0.947–1.076	0.776	1.360
RDQ	0.063	1.065	0.994–1.142	0.074	1.079

Abbreviations: BMI, body mass index. FABQ-PA, Fear-Avoidance Beliefs Questionnaire physical activity subscale. TSK-11, Tampa Scale for Kinesiophobia-11. RDQ, Roland-Morris Disability Questionnaire. B, partial regression coefficient. OR, odd ratio. CI, coefficient interval. VIF, variance inflation factor.

Table 4 shows the results of the multivariate logistic regression analysis. NS-CLBP was significantly associated with FABQ-PA (odd ratio [95% confidence intervals] = 1.096 [1.031, 1.165], $P = 0.003$) in athletes (Table 4).

Discussion

This study examined the relationship between NS-CLBP and fear-avoidance beliefs and kinesiophobia among college athletes. Multivariate logistic regression analysis revealed a significant association between a higher FABQ-PA score and NS-CLBP. This study showed that athletes with NS-CLBP had a higher fear of pain and that scores on fear-avoidance beliefs were significantly associated with the presence of NS-CLBP. This study is the first to investigate the association between NS-CLBP and psychosocial factors in college athletes. The findings suggest that it is crucial to prioritize fear-avoidance beliefs when managing NS-CLBP.

Multivariate logistic regression analysis revealed a significant association between the FABQ-PA score and NS-CLBP, whereas TSK-11 and body weight were not significantly associated. Additionally, the FABQ-PA score was significantly higher in the NS-CLBP group than in the non-NS-CLBP group. Fujii et al showed an association between

CLBP and FABQ-PA score in nurses, with an odds ratio of 1.76.[12] Furthermore, a survey of the general public also showed a significant association between CLBP and FABQ-PA score with an odds ratio of 1.97.[29] Apart from physical factors, psychosocial factors are also recognized as important risk factors for the occurrence of NS-CLBP.[30,31] Our results are consistent with these findings, suggesting that fear-avoidance beliefs for physical activity are associated with NS-CLBP in athletes. However, contrary to our hypothesis, TSK-11 score and NS-CLBP were not significantly associated. Therefore, FABQ-PA may be more relevant than TSK-11 for CLBP in college athletes. Yoshimoto et al showed significant association in TSK-11 with occupational CLBP.[13] In the present study, the mean TSK-11 score was 24.5, whereas that of the previous study was 26.1.[13] This difference in results could be because the participants who took part in the previous study were more affected by kinesiophobia. The results of this study suggest that addressing fear-avoidance beliefs may be crucial in managing NS-CLBP among college athletes.

A meta-analysis revealed that obesity and overweight were risk factors for NS-CLBP.[16] In the present study, BMI, which was significantly higher in the NS-CLBP group, was not significantly associated with NS-CLBP. As to the World Health Organization's classification, individuals are considered overweight if their body mass index (BMI) falls between the range of 25 to 29.9 kg/m^2, whereas those with a BMI equal to or over 30 kg/m^2 are classified as obese.[32] In this study, the median BMI value of the NS-CLBP group was 23.1, and many athletes were not overweight. Since most of the NS-CLBP athletes in this study had BMI values within the normal range, the results of this study may not have shown a significant association of BMI with NS-CLBP.

In terms of clinical significance, this study showed the importance of assessing fear-avoidance beliefs in the management of NS-CLBP in athletes. For the treatment of patients with NS-CLBP, a previous guideline recommended psychosocial interventions as well as the use of non-steroidal anti-inflammatory drugs, antidepressants, and exercise therapy.[33] Vibe Fersum et al reported that classification-based cognitive functional therapy improved outcomes for outpatients with NS-CLBP attending medical facilities, compared to conventional manual therapy and exercise interventions.[34] However, the effects of intervention for psychosocial factors on NS-CLBP in athletes have not been determined. The present study suggests that intervention on psychosocial factors, especially fear-avoidance beliefs, is important in the management of NS-CLBP in athletes.

This study had some limitations. Firstly, since this was a cross-sectional study, a causal relationship between NS-CLBP and FABQ-PA score was not established. Secondly, participants in NS-CLBP group were screened through the questionnaire, and participants with orthopaedic and surgical history were excluded. In future studies, it is desirable to obtain a diagnosis by a spine surgeon or radiologists through a medical institution and investigate the relationship with the detailed injury. Thirdly, this study does not include data on the amount of sports activity load being performed at each club. According to the clinical practice guidelines established by the Japanese Orthopaedic Association, engaging in hard labor that involves a significant physical load has been identified as a risk factor for occupational LBP.[35] Therefore, the relationship between NS-CLBP and the load of sports activity should be investigated in future studies. Fourthly, the sample size of 41 athletes with low back pain who participated in this study was small. Besides, in this study, BMI was used as the independent variable in the multivariate logistic regression analysis. However, BMI is considered a confounding variable in athletes as they generally have a musculoskeletal component above the population average, which cannot be quantified using BMI because it utilizes total body mass as the main variable. In future studies, it may be important to consider using the more appropriate Waist Height Ratio as a body mass index for athletes. Finally, although BMI did not show a significant association with NS-CLBP in this study, the use of subcutaneous fat index (SFI) instead of BMI may have shown a significant association. SFI has been demonstrated as a new anthropometric index that is more reliable and correlates well with lumbar spine degeneration.[36] SFI is easily measured on lumbar spine MRI, correlates better with spinal degeneration than BMI, and has cutoff values for women and men.[36]

Conclusion

The present study revealed a significant relationship between higher FABQ-PA scores and NS-CLBP among college athletes. Conversely, TSK-11, RDQ, and BMI values showed no significant association with NS-CLBP presence.

The findings suggest that addressing fear-avoidance beliefs may be crucial in managing NS-CLBP among college athletes.

Data Sharing Statement

The datasets generated and analyzed during the current study are not publicly available, but are available from the corresponding author who was an organizer of the study.

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Disclosure

The authors have no conflict of interest.

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