International Journal of Research in Exercise Physiology

Original Research Article

# Personality Type and Prevalence of Lower Extremity Injury in Novice and Experienced Long-Distance Runners

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**ABSTRACT**

**Purpose:** Purpose of the study was to determine the relationship between Big Five Inventory (BFI)-2 domain scores and lower kinetic chain injury rates for novice and experienced long-distance runners. **Methods:** Thirty-three participants were gathered from the pre-established fitness program at the university. Participants were engaging in a training period for completion of a half or full marathon. Participants completed a BFI-2 questionnaire, and scores were calculated via Microsoft Excel. Injury tracking data was collected on a weekly basis for nine weeks via questionnaires that recorded injury frequency. **Results:** Binomial logistic regression analysis indicated no significant p values ($p > .05$) between cumulative injury frequency and BFI-2 domain scores. Mean BFI scores: neuroticism 3.22 ± 0.77, conscientiousness 2.31 ± 0.70, openness 2.40 ± 0.57, extraversion 2.59 ± 0.67, agreeableness 2.13 ± 0.45. Percentage of participants with less than two injuries across the 15-week training period was 66.7%; subjects with two or more injuries was 33.3%. The largest percentage of participants reporting an injury within one week was week 11 with 27.3% sustaining at least one injury. **Conclusions:** The findings of the study suggest that injury is a multifactorial phenomenon. More research needs to be done to determine other factors and their influences, such as biomechanics, built environment, and other areas relating to psychosocial health.

KEYWORDS: Big Five Inventory, Rehabilitation, Athletic Training, Kinesiology, Running.

## Introduction

The American College of Sports Medicine and American Heart Association recommends adults between ages 18 to 64 years complete 150 minutes of moderate to vigorous physical activity per week[1]. This has been linked to decreases in chronic disease and major health risks, such as cardiovascular disease, type 2 diabetes, certain cancers, and obesity[2]. Long-distance running is an inexpensive and accessible exercise option that provides acute and

long-term health benefits. However, running does come with the risk of physical injury. Between 37% and 56% of recreational runners who consistently train for long-distance running will sustain a running-related injury annually[3]. Previous research has been done on the impact of personality types and PA levels, perceived susceptibility to injury, and injury risk. Multiple studies have viewed populations of high school, college, and professional athletes, but long-distance runners, especially at a novice level (first-time half or full marathon runner), have been underrepresented. There has also been limited literature on what actions can be taken from personality-type findings, and how they can benefit individuals in the pre-habilitation and rehabilitation process.

The lower body, which consists of the hips, knees, ankles, and its adjacent musculoskeletal anatomy, is a great area of concern during long-distance running. This is due to the repetitive use of this area with increased mileage and its biomechanical interactions with various terrain. Poor biomechanics in absolute peak knee moment, knee abduction impulse, peak foot eversion, and foot eversion have been shown to be associated with lower limb injury[4]. Biological markers also play a role in injury prevalence and recovery. Previous studies state that people with increased stress, increased responses to stress, and increased attentional disruption have a higher susceptibility to injuries[5]. There is also a notable increase in c-reactive protein in individuals with higher scores of neuroticism[6]. C-reactive protein is a cytokine found within the circulatory system in the presence of stress and inflammation.

With medicine shifting to take on a holistic approach in treating patients, it is important to know the psychological traits of a runner in addition to the physiological characteristics. The Big Five Inventory-2 (BFI-2) has identified correlations between personality types and physical activity (PA) levels. Personality traits can impact athletes and patients by affecting the perception of injury susceptibility and symptom severity, as well as quality of life (QOL) during injury recovery. In a French study looking at Rugby players, it was found through multiple regression analysis that people with higher scores of neuroticism tended to have increased perceived susceptibility of injury and higher perception of symptoms that may occur[7]. Another study found that patients with higher levels of neuroticism tended to have decreased QOL ratings at 6 months post-total knee replacement surgery[8]. Overall, this tends to lead to negative thought patterns, hypervigilance, and fear-avoidance behavior. Both extraversion and contentiousness have shown positive impacts on PA, whereas neuroticism has shown negative impacts on PA[9].

The BFI-2 has been measured as a reliable personality test and contains 5 individualized outcomes. Previous sports-related studies have used other personality tests with varying durations and personality

type outcomes. The Swedish Universities' Scale of Personality Questionnaire, which has been used in studies with elite athletes, may contain an excess of variables for the rehabilitation setting since there are 13 facet outcomes[10]. The Eysenck Personality Questionnaire, which analyses risk-taking behavior in sports[11], may lead to a lack of individualization since there are only 3 possible outcomes[12].

The BFI-2 allows professionals to easily learn the types and is individualized enough to lead to appropriate intervention. The BFI-2 utilizes a balanced system of short phrases that categorizes the participants' responses into one of the five domains of personality. These domains are extraversion, agreeableness, conscientiousness, neuroticism, and open-mindedness[13]. The following descriptions are stated below[14]:

- Extraversion has a high correlation with increased communication, sociability, dominance, assertiveness, energy levels, and enthusiasm.
- Agreeableness has a high correlation with compassion, helpfulness, respect, politeness, forgiveness, and assuming the best of others.
- Conscientiousness has a high correlation with organization, tidiness, productivity, persistence, reliability, and dependability.
- Neuroticism, also known as negative emotionality, has a high correlation with worry, anxiousness, sadness, depression, emotional instability, and moodiness.
- Open-mindedness has a high correlation with complex thinking, curiosity, artistic interests, values of art and beauty, innovation, and originality.

Each domain is associated with positive and negative features of human behavior, and certain domains can be associated with injury. For example, increased anxiety (which falls under the domain of neuroticism) is a predictor of the intensity of an injury[15]. Perfectionism, which is defined as the concern towards mistakes and negative emotional reactions in the event of mistakes, tends to lead to an increased incidence of injury. According to a 2018 study, if a perfectionist is not able to perform a task well, they tend to strive for that perfectionism, causing an increase in injuries[16]. Increased risk-taking behavior also plays a role in injury; for example, playing football comes with a greater risk than playing golf. People that choose to participate in higher-risk sports are more likely to sustain an injury[11]. It is important to understand that human behavior in relation to personality plays a role in injury incidence, intensity, and recovery. However, stakeholders in the field of rehabilitation science should also recognize that this behavior may carry over into activities of daily living or high-risk activities.

This study aimed to identify a possible relationship and the degree between personality traits and injury rate in novice long distance runners. Prior research has led to the hypothesis that subjects with

increased scores of neuroticism from the BFI-2 will have an increased presence of injury. The results of this study have the potential to allow for individualization of rehabilitation plans, healthcare advocacy at the macro level, and promotion of the Big Five Inventory-2 as an essential clinical tool in rehabilitation settings.

## Methods

### Participants

Subjects consisted of runners enrolled in a long-distance running class at a university. Subjects completed a 15-week training plan followed by completion of a half or full marathon. Inclusion criteria involved participants being at least 18 years of age. Male and female participants were included, and their previous running experience ranged from novice to experienced. Participants were considered experienced runners if they had prior experience completing a half or full marathon prior to the study. Participants who have not done this were considered novice. Exclusion criteria were minimal; participants not enrolled in the distance running course and those who did not complete the Qualtrics survey to determine their BFI-2 domain scores. Study protocol was approved by the International Review Board (IRB) prior to data collection. Participants signed informed consent paperwork and were provided the opportunity to ask questions via text and email communication. This virtual format was utilized so that participants could have ample time to read through the informed consent documentation.

### Instrumentation and Testing

For this study, the following tests were utilized to collect data on personality type and injury:

*Big five Inventory-2 (BFI-2)*: The test utilized a balanced system of 60 short phrases that categorized a score into one of the five dimensions of personality (extraversion, agreeableness, open-mindedness, contentiousness & neuroticism). The test used a Likert scale from 1 “disagree strongly” to 5 “agree strongly” for each question. A combination of standard and reverse questions was used to score the domains and strengthened the internal validity of the BFI-2. This internal validity has been previously documented in multiple test samples from other studies; overall, these studies provided evidence of strong positive correlations (>0.82) in reliability of the BFI-2 with each domain[13].

*Weekly Injury Assessment:* The running course instructor created a weekly assessment that evaluated injury and pain. Participants completed the following questions in the event of injury:

- Did you have any difficulty participating in normal training and competition due to pain over the past week? (Yes, No)
- Please identify where the pain is felt (hips/lower back, knees, ankle, shin or lower leg, feet, other).
- Have you sought treatment? (No revisions to training, saw an athletic trainer, saw a doctor, went to massage

therapist, cross training, added in strength training, reduced in training volume, reduced training pace, self-selected stretches, saw physical therapists or physical therapist PowerPoint)

- How much have you reduced your training volume or intensity due to the pain? (No effect, minor- small adjustment to training, moderate- missed 1 day, major- missed 3 or more days)
- What level of pain do you feel in your problem area? (Minimal, moderate, severe, crippling, could not participate)

Following completion, the results of the questionnaire were collected and paired with each participant's BFI-2 results.

**Protocol and Procedures**

A Qualtrics survey was distributed to participants via email for data collection. This survey consisted of seven demographic questions (name, age, previous injuries, novice or experienced) and sixty additional questions that composed the BFI-2. The self-reported questionnaire took participants approximately 10 minutes to complete. It was taken once by each participant in the study due to a low possibility of drastic score changes over the 9-week data collection period. In addition to the BFI-2 survey, each participant was required to fill out an injury report provided by the instructor at the end of each training week. This injury questionnaire was considered third-party data, thereby eliminating ethical concerns within the research process. Out of the 15 weeks of training, 9 weeks of data was collected and used for statistical analysis.

**Statistical Analyses**

This was an observational study completed over the course of 15 weeks. Participants started training at week 1 and completed the BFI-2 survey at week 9. This survey was completed during week 9 due to timing which involved gaining IRB approval, developing a research design, and completing a successful pilot test. The results of the BFI-2 were scored as a categorical independent variable whereas the results from the injury questionnaires were a dichotomous dependent variable. The independent variables utilized were the BFI-2 domains: extraversion, neuroticism, openness, agreeableness, and conscientiousness. The dependent variable was split into two categories: injured or not injured. Injury was defined as pain that resulted in participants missing out on the opportunity to engage in at least one running activity throughout the week and/or seek medical care. Injury was considered significant if participants had at least 2 injuries occur in the 9-week data collection period.

Results from the BFI-2 were collected in the Qualtrics survey and scores were entered into a Microsoft Excel 2019 version spreadsheet (build 16.0.15207.31876). Scores were verbally stated from the Qualtrics survey by one researcher while another researcher recorded the numbers into Excel. Scores for each question were

verbally restated back to the researcher who was responsible for looking at the Qualtrics survey to reduce the chance of human error in data collection. The questionnaire matched the wording and scoring formulas from the BFI-2 created by Christopher J Soto and Oliver P. John in 2017[13]. Reverse scoring was color coded by its specific domain category and used the Excel IF function to flip the scores. For example, this function flipped a score of "2" to a score of "4" as outlined by the scoring criteria in the BFI-2. These steps acted as safeguards to reduce the chance of data errors.

Scores were added together into their respective domains using the SUM function in Excel. The sum of the scores in non-reverse scoring categories were added together along with the sum of the reverse scores flipped. The sum of these two categories were added together and divided by 12 to achieve each domain score. In addition, the sum of the reverse scores before they were flipped were added in a separate column. Although this was not included in the final domain score, this column was essential for possible troubleshooting if an error occurred in the reverse scoring calculations.

Injury report questionnaires were also tracked through Microsoft Excel. Participant confidentiality was maintained by having the course instructor assign participant IDs to the questionnaires and surveys. Each participant's records were tracked on Excel to track injury history and potential recurrence.

Binomial regression analysis was completed with SPSS V27 software. The highest scoring domain category for each participant along with their injury history throughout the 15-week training period was analyzed using this statistical analysis.

**Results**

Among 45 participants who completed the Qualtrics survey, 12 were excluded for having incomplete injury and/or BFI-2 data. The remaining 33 participants were included in the subsequent analyses. Descriptive statistics for number of injuries prior to study, sex, experience in long distance running, and cumulative injuries are presented in Table 1. Number of participants sustaining at least one injury per week across the 15-week training period is reported in Table 2. Table 3 provides means and standard deviations for BFI-2 scores for the five personality domains. Upon screening of the data spreadsheet, week 7 was eliminated from the dataset due to participants being on academic spring break, week 1 was eliminated for not having data points related to injury, and week 6 was eliminated due to high incompletion rates because of semester midterm exams The three additional weeks that composed the 15-week training period were not accounted for due to lack of injury data acquired from the third-party source. It is suspected that data was not collected by this source since the training period started prior to the academic semester.

*Results of Binomial Logistic Regression Predicting Cumulative Injuries:*

A binomial logistic regression analysis indicated that extraversion personality domain was not significant ($p > .05$), thus it was eliminated from the analysis. A second test of the binomial logistic regression model containing four personality domains (openness, neuroticism, conscientiousness, and agreeableness) and the two control variables (experience and sex) revealed that when compared against a constant-only model, this collective set of variables did not significantly distinguished between participants two or more cumulative injuries and participants with less than two cumulative injuries over the 15-week training period, $\chi 2$ (6, N = 33) = 6.64, p = .356. The Nagelkerke R2 measure of strength of association revealed that 25.3% of the variance in cumulative injuries (less than two vs. two or more total injuries) was explained by this 6-variable regression model. Examination of the classification table from the regression analysis (see Table 4) demonstrated that 86.4% of participants who were categorized as having less than two total injuries and 45.5% of participants who were categorized as having two or more total injuries were classified correctly. Overall, 72.7% of participants were classified correctly with respect to cumulative injuries over the 15-week training period.

Table 5 presents regression coefficients, Wald's statistics (a test of significance of each predictor variable in the model), and odds ratios for the predictor and control variables in the revised logistic regression analysis. According to the Wald criterion (the criterion value to reject the null hypothesis that a particular effect coefficient is zero), none of the personality domains were significant predictors while controlling for the two control variables (sex and experience).

**Table 1.** Results of Frequency Analyses

| | ***N*** | **Percentage** |
|---|---|---|
| ***Number of Previous Injuries*** | | |
| **None** | 13 | 39.4 |
| **One to two** | 13 | 39.4 |
| **Three or more** | 7 | 21.2 |
| ***Sex*** | | |
| **Male** | 14 | 42.4 |
| **Female** | 19 | 57.6 |
| ***Marathon Experience*** | | |
| **Novice** | 25 | 75.8 |
| **Experienced** | 8 | 24.2 |
| ***Cumulative Injuries*** | | |
| **Less than two** | 22 | 66.7 |
| **Two or more** | 11 | 33.3 |

**Table 2.** Number of Participants who Reported Sustaining At Least One Injury

| Week | *n* | Percentage |
|---|---|---|
| **2** | 6 | 18.2 |
| **3** | 6 | 18.2 |
| **4** | 4 | 12.1 |
| **5** | 5 | 15.2 |
| **8** | 4 | 12.1 |
| **9** | 5 | 15.2 |
| **10** | 7 | 21.2 |
| **11** | 9 | 27.3 |
| **12** | 7 | 21.2 |

*Note.* Frequency and valid percentage, number of participants injured during each week of training.

**Table 3.** Descriptive statistics of BFI-2 scores

| | Mean | SD |
|---|---|---|
| BFI-2 Openness | 2.40 | 0.57 |
| BFI-2 Neuroticism | 3.22 | 0.77 |
| BFI-2 Conscientiousness | 2.31 | 0.70 |
| BFI-2 Agreeableness | 2.13 | 0.45 |
| BFI-2 Extraversion | 2.59 | 0.67 |

*Note.* BFI-2 = Big Five Inventory-2. Mean and standard deviation of each BFI-2 domain score. SD = standard deviation.

**Table 4.** Classification Table for Cumulative Injuries

| | Predicted Cumulative Injuries | | |
|---|---|---|---|
| Observed Cumulative Injuries | Less than two | Two or more | Percentage correct |
| Less than two | 19 | 3 | 86.4 |
| Two or more | 6 | 5 | 45.5 |
| Overall | | | 72.7 |

**Table 5.** Results of Binomial Logistic Regression Predicting Overall Injury Rate

| Variable | *B* | *SE* | *Wald* | *OR* | *P value* |
|---|---|---|---|---|---|
| BFI- 2 Openness | -1.60 | 0.85 | 3.54 | 0.20 | .06 |
| BFI- 2 Neuroticism | 0.34 | 0.70 | 0.24 | 1.40 | .62 |
| BFI-2 Conscientiousness | -0.60 | 0.72 | 0.69 | 0.55 | .41 |
| BFI- 2 Agreeableness | 1.57 | 1.31 | 1.44 | 4.79 | .23 |
| Experience | -1.33 | 1.06 | 1.58 | 0.26 | .21 |
| Sex | -0.93 | 1.23 | 0.57 | 0.40 | .45 |
| Constant | 1.31 | 4.38 | 0.09 | 3.72 | .76 |

*Note.* Reference categories = experienced runners for experience variable, female for sex variable. No P values under any BFI-2 variables were significant ($p > 0.05$). *B* = unstandardized logistic regression coefficient; *SE* = standard error; *OR* = odds ratio.

## Discussion

The purpose of this study was to identify the relationship between personality type and prevalence of lower extremity injury in long-distance runners. It was hypothesized that there would be an association between certain personality domains of the Big Five Inventory-2 and the number of injury incidents, and that those runners who scored higher in neuroticism would report a higher incidence of present injuries compared to other subjects.

The study comprised of a university fitness program for both novice and experienced participants. The goal was for participants to complete a 15-week training plan with assistance from an instructor and end the program by running a half or full marathon. All participants were at least 18 years of age. The sample included both male and female participants as well as novice and experienced runners.

This program utilized a self-completed injury report each week that asked about injury location, pain, training alterations, and medical treatment(s). Throughout training there were several athletes that reported having multiple injury locations, and/or injuries that had a continuous trend. Participants also completed the BFI-2 which looked at personality trends within the scoring domains. This study is one of few that has investigated injury rates during training and compared that to the BFI-2.

Participants were excluded from the study under the following circumstances: under 18 years of age, lack of signature stating they consent to participate in the study, an incomplete Qualtrics survey, and/or incompletion of 5 or more weeks of injury report data. Out of the 15-week training program, 9 weeks of training were used for data analysis. Three weeks were not accounted for due to a total absence of third-party data and weeks 1, 6, and 7 were excluded due to limited data from low injury report completion. Since the

program was being provided through a university, some of the gaps were due to periods of high academic demand and university-approved academic breaks.

*Injury Frequency and BFI-2:*

The frequency analysis in table 1 looked at background information and overall injury occurrence prior to and during the study. Most participants reported having 0 injuries (39.4%) or 1-2 injuries (39.4%) before the start of training. When separated by sex, 42.4% of participants were male and 57.6% were female. Training level, which was divided into two categories, was determined by prior completion of a full or half marathon; 75.8% of participants were novice and 24.2% were experienced. The injury reports provided information on the number of injuries each participant experienced throughout the training period; 66.7% reported sustaining an injury for 0-1 of the weeks whereas 33.3% reported sustaining an injury during 2 or more weeks. After reviewing the frequency analysis, it was determined that there were no significant trends or patterns.

Table 2 showed the number of participants who had sustained an injury in that given week of training. Weeks 2 and 3 each had 18.2% of participants reporting an injury, weeks 4 and 8 each had 12.1%, weeks 5 and 9 each had 15.2%, weeks 10 and 12 each had 21.2%, and week 11 had 27.3% reporting an injury. These results showed a higher presence of injury during the beginning and end of training. The highest presence was in the last 3 weeks with over 20% of participants reporting an injury during each week.

The descriptive statistics of the BFI-2 score in table 3 reviewed the average scores of each BFI-2 survey. Neuroticism had the highest average with a score of 3.22. The next closest score was extroversion with 2.59, making neuroticism noticeably larger than the rest of the domains. This comparison found that the participants in the study were most likely to have an increased score of neuroticism when taking the BFI-2.

The classification of cumulative injuries in table 4 investigated the number of injuries that were sustained over 9 weeks of completed injury reports. 19 participants reported less than 2 weeks of injuries and 6 participants reported at least 2 weeks of injuries. It is possible that the number of participants reporting at least 2 injuries would have been higher if there was a more consistent rate of injury reports being completed and more data to review.

Results of the binomial logistic regression predicting injury rate in table 5 analyzed the BFI-2 personality domains along with experience and sex. No domains were significant. Openness had the lowest p-value which was surprising due to the evidence that exists in other literature regarding neuroticism. The extraversion

domain was removed from analysis to improve the Nagelkerke R2 regression model due to its insignificance of correlation.

The present findings do not have a correlation with the themes and findings from other literature. Previous studies have not confirmed a singular personality domain as more likely to experience a running-related injury; however, there have been studies with small correlations relating to increased injury risk. Some of the traits that have been linked to high injury rates are elevated levels of anxiety, high stress susceptibility, and perfectionism. Anxiety and stress are components of neuroticism and high anxiety has been correlated with increased injury rate and intensity[15]. Conscientiousness can also be related to injury rate due to its association with perfectionism. This increased rate of injury is due to negative reactions to imperfection and overtraining to improve at tasks[16].

Past research has also evaluated BFI-2 domains in connection to incidence reporting of pain and injury. Studies regarding the use of pain medication have found an association between increased use and higher scores of neuroticism and extraversion. Patients with neuroticism tend to be aroused easier by pain and need the medication for increased relief. Patients with extraversion tend to talk more freely about their pain, which increases the access to pain medication[17]. With this research, it could be assumed that the participants who score higher in neuroticism and extraversion would be more likely to report an injury, due to the increased likelihood of reporting pain, but the data for both traits were not statistically significant.

*Study Limitations:*

There were many limitations to the study in relation to the lack of consistent information. Participant size, which was already limited by the 60-person program size, further decreased from 45 participants to 33 due to a lack of adherence in filling out the BFI-2 survey and injury reports.

In addition, there was a limitation in data collection due to the data being collected from a third party. Since the injury report questionnaire was pre-established, very little adjustments could be made to what information was being acquired. This also created the potential scenario of participants not completing the injury reports to the best of their knowledge or denying the presence of an injury to decrease the amount of time they spent completing the report. Future studies would benefit from creating their own injury reports and having more defined questions that consider the location(s) of injury, biomechanics, healthcare accessibility, and psychosocial history of the participants.

Even though this study lacked significant data and consistency with the previous literature, this study should prompt individuals to consider the psychological domains and their features in relation to sports injury. Future research should consider conducting this type of study with a methodological system that assures a greater number of participants and consistent data collection. Results may be more comprehensive if participant recruitment is done in a laboratory-based setting rather than a fitness program. Ultimately, this study could serve as a starting point for further research which may improve the individualization of rehabilitation programs by using the BFI-2 as a quick and accessible clinical assessment for patients.

## Conclusion

The possibility of injury is inevitable during exercise and physical activity. Previous data has suggested that personality domains could serve as an identifier for injury rates in individuals participating in these activities. Despite previous research suggesting that traits such as high stress, anxiety, and perfectionism have a higher chance of sustaining an injury during exercise, no correlation between BFI-2 scores and injury rates was found in this study. Therefore, the present data shows that injury is a multifactorial phenomenon. Future research is needed to determine if BFI-2 domain scores can be a predictor of injury trends in long-distance runners and should take other factors into consideration, such as injury location, biomechanics, healthcare accessibility, and psychosocial history.

**Acknowledgements**

The authors acknowledge the study participants for donating their time to the project.

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## References

1. Haskell WL, Lee IM, Pate RR, Powell KE, Blair SN, Franklin BA, Macera CA, Heath GW, Thompson PD, Bauman A. (2007). Physical activity and public health: updated recommendation for adults from the American College of Sports Medicine and the American Heart Association. *Med Sci Sports Exerc,* 39(8), 1423-1434.
2. Durstine L, Gordon B, Wang Z, Luo X. (2013). Chronic disease and the link to physical activity. *J Health Sport Sci,* 2, 3-11.
3. Gallo R, Plakke M, Silvis M. (2012). Common leg injuries of long-distance runners: Anatomical and biomechanical approach. *Sports Health,* 4(6), 489-495.
4. Dunn MD, Claxton DB, Fletcher G, Wheat JS, Binney DM (2018). Effects of running retraining on biomechanical factors associated with lower limb injury. *Hum Mov Sci*, 58, 21-31.
5. Andersen MB, Williams JM (1988). A model of stress and athletic injury: Prediction and prevention. *Int J Sport Exerc Psychol*, 10(3), 294-306.
6. Elliot AJ, Turiano NA, Chapman BP. (2016). Socioeconomic status interacts with conscientiousness and neuroticism to predict circulating concentrations of inflammatory markers. *Ann Behav Med*, 51(2), 240-250.
7. Deroche T, Stephan Y, Brewer BW, Scanff CL. (2007). Predictors of perceived susceptibility to sport-related injury. *Pers Individ Dif*, 43(8), 2218-2228.

8. Qi A, Lin C, Zhou A, Du J, Jia X, Sun L, Zhang G, Zhang L, Liu M. (2016). Negative emotions affect postoperative scores for evaluating functional knee recovery and quality of life after total knee replacement. *Braz J Med Biol Res*, 49(1), e4616-e4616.
9. Rhodes RE, Smith NEI. (2006). Personality correlates of physical activity: A review and meta-analysis. *Br J Sports Med*, 40(12), 958-965.
10. Eckerman M, Svensson K, Edman G, Alricsson M. (2020). The relationship between personality traits and muscle injuries in Swedish elite male football players. *J Sport Rehabil 29*(6), 783-788.
11. Castanier C, Scanff CL, Woodman T. (2010). Who takes risks in high-risk sports? A typological personality approach. *Res Q Exerc Sport*, 81(4), 478-484.
12. Muñiz J, García-Cueto E, Lozano LM. (2005). Item format and the psychometric properties of the Eysenck Personality Questionnaire. *Pers Individ Dif*, 38(1), 61-69.
13. Soto CJ, John OP. (2017). The next Big Five Inventory (BFI-2): Developing and assessing a hierarchical model with 15 facets to enhance bandwidth, fidelity, and predictive power. *J Pers Soc Psychol*, 113(1), 117-143.
14. Denissen JJA, Geenen R, Soto CJ, John OP, Van Aken MAG. (2020). The Big Five Inventory–2: Replication of psychometric properties in a Dutch adaptation and first evidence for the discriminant predictive validity of the facet scales. *J Pers Assess*, 102(3), 309-324.
15. San-Antolín M, Rodríguez-Sanz D, Becerro-de-Bengoa-Vallejo R, Losa-Iglesias ME, Martínez-Jiménez EM, López-López D, Calvo-Lobo C. (2020). Neuroticism traits and anxiety symptoms are exhibited in athletes with chronic gastrocnemius myofascial pain syndrome. *J Strength Cond Res*, 34(12), 3377-3385.
16. Madigan DJ, Stoeber J, Forsdyke D, Dayson M, Passfield L. (218). Perfectionism predicts injury in junior athletes: Preliminary evidence from a prospective study. *J Sports Sci*, 36(5), 545-550.
17. Roome P, Humphrey M. (1992). Personality factors in analgesic usage. *Stress & Health*, 8(4), 237-240.