Turkish Journal of Sport and Exercise /
Türk Spor ve Egzersiz Dergisi
http://dergipark.gov.tr/tsed
Year: 2024 - Volume: 26 – Issue 2- Pages: 182-188
10.15314/tsed.1499080

Turkish Journal of Sport and Exercise
Türk Spor ve Egzersiz Dergisi
ISSN: 2147-5652
https://dergipark.org.tr/tr/pub/tsed

Investigation of the Relationship Between Kinesiophobia, Foot and Ankle Function and Physical Activity of Athletes with Chronic Ankle Instability

Sinan SEYHAN [1A], Görkem AÇAR [2B], Yusuf YAŞASIN [2C], Berkay ÜZÜMCÜ[3D]

[1] *Celal Bayar University, Faculty of Sport Sciences, Manisa, TÜRKİYE*
[2]*Bahçeşehir University, Institute of Graduate Studies, Physiotherapy and Rehabilitation Doctora Program, Istanbul, TÜRKİYE*
[3]*Berton Robotic Technology and Health Inc., Istanbul, TÜRKİYE*

Address Correspondence to Sinan SEYHAN: e-mail: sinanseyhan@gmail.com

Conflicts of Interest: The author(s) has no conflict of interest to declare.

Ethical Statement: It is declared that scientific and ethical principles have been followed while carrying out and writing this study and that all the sources used have been properly cited.

(Date Of Received): 10.06.2024 (Date of Acceptance): 25.07.2024 (Date of Publication): 31.08.2024
A: Orcid ID: 0000-0002-4979-7992, B: Orcid ID: 0000-0002-0970-8625, C: Orcid ID: 0009-0004-7193-7252, D: Orcid ID: 0000-0002-6519-6273

Abstract

Lateral ankle sprains (LAS) are common in athletes and 40% lead to chronic ankle instability (CAI). CAI is characterised by recurrent sprains and limitation of motion. Our study investigated the relationship between kinesiophobia, foot-ankle function, and physical activity in athletes with chronic ankle instability. In our study, 112 individuals with CAI who have been doing regular sports for at least 5 years were included. Tampa kinesiophobia test, Foot and Ankle Ability Measure (FAAM), and International Physical Activity Questionnaire (Short Version) were administered to the included individuals via Google form. IBM Statistical Package for Social Sciences Version 26.0 (SPSS inc, Chicago, IL, USA) was used. Pearson's test analysis was used in the study, and statistical significance was taken as $p \leq 0.05$ for all measurements in two directions. 115 participants (75 males and 40 females) were included in the study. The descriptive characteristics of the participants were 20.43±3.92 (years), 176.14±9.28 (cm) and 67.88±11.57 (kg). In addition, the subjects' International Physical Activity Score (Short Version) showed that 34 were inactive, 54 were minimally active, and 27 were very active. There was a moderate negative correlation between the Tampa Kinesiophobia score and FAAM sport and DLA subscores ($p<.001$). Individuals with increased kinesiophobia scores had decreased Foot and Ankle Ability Measure scores. According to the studies, studies on foot and ankle range of motion, position perception, and balance in individuals with CAI may decrease kinesiophobia.

Keywords: Chronic foot instability, kinesiophobia, foot function.

Kronik Ayak Bileği İnstabilitesi Olan Sporcularda Kinezyofobi, Ayak ve Ayak Bileği Fonksiyonu ve Fiziksel Aktivite Arasındaki İlişkinin İncelenmesi

Özet

Lateral ayak bileği burkulmaları (LAS) sporcularda sık görülmektedir ve %40'ı kronik ayak bileği instabilitesine (KAİ) yol açmaktadır. KAİ, tekrarlayan burkulmalar ve hareket kısıtlılığı ile karakterizedir. Çalışmamızda, kronik ayak bileği instabilitesine sahip sporcularda kinezyofobi, ayak-ayak bileği fonksiyonu ve fiziksel aktivitenin arasındaki ilişkinin incelenmesi hedeflenmiştir. Çalışmamıza en az 5 yıl düzenli spor yapan 112 KAİ'li bireyler dahil edilmiştir. Dahil edilen bireylere Google form aracılığıyla, Tampa kinezyofobi testi, Ayak ve Ayak Bileği Yetenek Ölçüsü (FAAM) ve Uluslararası

Fiziksel Aktivite Anketi (Kısa Versiyon) uygulanmıştır. IBM Statistical Package for Social Sciences Version 26.0 (SPSS inc, Chicago, IL, USA) ile incelenmiştir. Çalışmada Pearson test analizi ile hesaplanmış olup, tüm ölçümlerde istatistiksel anlamlılık p≤0.05 olarak iki yönlü alınmıştır. Çalışmamıza 115 kişi (75 erkek ve 40 kadın) dahil edilmiştir. Çalışmaya katılanların tanımlayıcı özellikleri 20,43±3,92 (yıl), 176,14±9,28 (cm) ve 67,88±11,57 (kg) olarak bulundu. Ayrıca kişilerin Uluslararası Fiziksel Aktivite Skoru (Kısa Versiyon) 34 kişi inaktif, 54 kişi minimal aktif ve 27 kişi çok aktif bulundu. Kişilerin Tampa Kinezyofobi skoru ile FAAM spor ve GYA alt skorları arasında orta derecede negatif korelasyon bulundu (p<.001). Kinezyofobi skoru puanında artış olan kişilerde Ayak ve Ayak Bileği Yetenek Ölçüsü puanında azalma bulunmuştur. Yapılan çalışmalara göre, KAİ'li bireylerde ayak ve ayak bileği eklem hareket açıklığı, pozisyon algısı ve denge üzerine yapılan çalışmaların, kinezyofobi üzerinde azalmaya yol açabileceği düşünülmektedir.

Anahtar Kelimeler: Kronik ayak instabilitesi, kinezyofobi, ayak fonksiyonu.

INTRODUCTION

The foot is a complex structure comprising 26 bones, 33 ligaments, and many joints located in the distal part of the body. It provides contact with the ground and carries body weight during activities such as walking, running, and jumping. It consists of three main arches: medial longitudinal, lateral longitudinal, and transverse (28).

Lateral ankle sprains (LAS) are common musculoskeletal injuries, accounting for 10-30% of sports-related injuries, affecting many physically active individuals (14,15). Complications from LAS include osteoarthritis, sensory limb dysfunction, reduced quality of life, and significant life burdens (34). Around 40-70% of LAS patients develop chronic ankle instability (CAI), characterized by a history of LAS, recurrent sprains, and ankle deficits lasting over a year (19,10). CAI involves impairments in range of motion, muscle strength, postural control, and movement strategies, leading to recurrent sprains, stability issues, frequent ankle injuries, and biomechanical abnormalities (10,36). Frigg et al. identified the bony structures of the ankle joint as a risk factor for CAI. The ankle's biomechanics involve complex movements, with the lateral collateral ligaments of the subtalar joint (STJ) playing a critical role in stability during supination (6-23). The anterior talofibular ligament (ATFL) is a second stabilizer when the ankle reaches varus through plantar flexion (8). The STJ, which includes the talus and calcaneus, connects ligaments commonly damaged in LAS. CT scans revealed that CAI patients have distinct morphological features in the calcaneus and talus, potentially contributing to CAI risk (29). In 2010, ankle sprains in U.S. emergency departments were 3.29 per 1,000 persons yearly (26). A 2016 study on sub-elite Australian football athletes reported an incidence of 3.1 per 1,000 athletes during the season (33).

Kinesiophobia is an irrational and excessive fear of movement that leads to avoidance of physical activity due to perceived risk of injury. This fear can transform acute pain into chronic pain as individuals limit movement to avoid potential pain increase. It has three components: a threatening stimulus, increased sympathetic arousal, and defensive behavior (22). Kinesiophobia negatively impacts athletes by hindering rehabilitation and return to sport (16). It involves a debilitating fear of physical activity due to vulnerability to painful injury or re-injury (27). This condition affects athletes both physically (e.g., decreased muscle strength, impaired proprioception, and reduced range of motion) and psychologically (e.g., anxiety, depression, and lower health-related quality of life) (1,35). Fear of movement increases pain-related fear and is associated with avoidance behaviors (3). Various movements performed using muscles and requiring energy expenditure are called physical activity. Physical activity can be performed in daily life, leisure time, work life, or during active transport (21). Various movements performed using muscles and requiring energy expenditure are called physical activity. Physical activity can be performed in daily life, leisure time, work life or during active transport (21). Given the connection between physical activity and a lower risk of mortality, heart disease, obesity, asthma, and some cancers, it is important to identify factors like musculoskeletal injuries that could lead to long-term reductions in physical activity (24).

In general, CAI is frequently encountered, especially in contact sports. Increasing kinesiophobia in athletes after CAI affects the performance, daily life activities and physical activities of athletes. In athletes with CAI, joint perception, decreased strength, decreased range of motion and impaired balance occur. Although they return to the field after rehabilitation, decreases in performance due to kinesiophobia are also observed. However, there are not many studies in the literature on whether there is a direct relationship between foot and ankle function and kinesiophobia in athletes with CAI.

Our primary hypothesis was to examine the relationship between kinesiophobia and foot and ankle function and our secondary hypothesis was to examine the relationship between kinesiophobia and physical activity.

Therefore, in this study, the relationship between kinesiophobia and foot and ankle and athletes' physical activity in individuals with chronic ankle instability were investigated.

METHOD

Participants

The participants' inclusion criteria were being between the ages of 18 and 35, having had at least one foot and ankle injury in the last year, and having been participating in regular sports activities for at least 5 years. In addition, the participants' exclusion criteria were having undergone any lower extremity surgery in the last year and having any neurological or psychiatric problems.

Data Collection Tools

- Sociodemographic Form: It consists of information such as gender, height, weight, etc.

- Tampa Kinesiophobia Test: The Tampa Kinesiophobia Scale (TSK), developed in 1991 by R. Miller, S. Kopri, and D. Todd, measures an individual's excessive fear of physical movement and activity, known as kinesiophobia (31). This fear stems from a perceived vulnerability to injury. Burak Kese and colleagues validated and found the Turkish version of the TSK reliable. Scores on the self-administered test range from 17 to 68 points, with higher scores indicating higher levels of kinesiophobia (18).

- Foot and Ankle Ability Measure (FAAM): The Foot and Ankle Ability Measure (FAAM) consists of 29 items divided into two subscales: 21 items for 'Activities of Daily Living' (ADL) and 8 items for 'Sports.' Each item is rated from 0 to 4, with 4 representing 'no difficulty' and 0 representing 'unable.' The maximum possible scores are 84 for ADL and 32 for Sports, scaled from 0 to 100, with higher scores indicating better physical function (9). The Turkish version of the FAAM has been validated. It is considered reliable for evaluating physical function in individuals with chronic ankle instability, with intraclass correlation coefficients of 0.97 for ADL and 0.94 for Sports (20).

- International Physical Activity Questionnaire (Short Version): The International Physical Activity Assessment Questionnaire (IFAA) developed by Öztürk was developed to determine individuals' physical activity and sedentary lifestyles. There are two separate designs as short and long form. The short form consists of 7 questions; it provides data on vigorous and moderate vigorous physical activities and time spent walking. Time spent at rest is assessed as a separate question. The total score is calculated in the short form by summing the duration and frequency according to the exercise intensity class. Severe physical activity= 8.0 METs, Moderate physical activity= 4.0 METs, Walking= 3.3 METs. For example, the score of an individual who walks for 40 minutes 2 days a week is calculated as 3.3x40x2= 264 MET-min/week. UFAA categorization: I category: inactive: <600 MET-min/hf II category: minimally active: 600 < 3000 MET-min/hf 42 (25).

Statistical Analysis

Statistical analysis will be conducted using IBM SPSS Statistics for Windows, Version 26.0 (IBM Corp., Armonk, NY, USA). Continuous variables will be expressed as mean ± standard deviation, while categorical variables will be presented as frequencies and percentages. Descriptive statistics for quantitative variables will include measures of central tendency and dispersion, and the distribution of categorical variables will be assessed using frequency analysis. Pearson's correlation test will examine relationships between variables, with a threshold for statistical significance set at $p \leq 0.05$ for all two-tailed tests.

The study's sample size was determined using the G*Power 3.1.9.7 program for a correlation test. Based on an effect size of 0.950, a 5% margin of error, and 95% power, 115 participants were calculated (32).

Ethics Approval and Institutional Permission

Ethical approval was obtained from Çankırı Karatekin University Ethics Committee Institutional Review Board within protocol 2024-13. In addition, this study adhered to the principles outlined in the Declaration of

Helsinki. All participants gave informed consent and written informed consent was obtained from each participant. Evaluations were conducted online via Google Forms.

FINDINGS

As a result of the study, 115 people (75 males and 40 females) out of 177 people with CIA were included. The participants participated in football, athletics, basketball, futsal, handball, gymnastics, judo, karate, kickbox, korfball, taekwondo, tennis, triathlon, volleyball, and swimming. The demographic data of the participants are given in Table 1. The physical activity scores of the participants were found to be 34 people inactive, 54 people minimally active, and 27 people very active. The physical activity scores of the participants are given in Table 2.

As a result of the correlation test, a moderate negative correlation (r= -,37, r= -,36) was found in the Tampa Kinesiophobia test score, FAAM sports, and daily life activity (DLA) sub-parameters (p<,0001). The Pearson correlation results of the parameters are given in Table 3.

Table 1. Demographic data

	n	Means	SD
Age (years)	115	20,43	±3,92
Height (cm)	115	176,14	±9,28
Weight (kg)	115	67,88	±11,57
Tampa Kinesiophobia Test	115	39,03	±8,07
FAAM Sports Subscale (%)	115	74,08	±22,25
FAAM Daily Living Activity (DLA) Subscale (%)	115	70,95	±24,86

FAAM: foot and ankle ability measure.

Table 2. International physical activity test (short version)

	n	**Percentage (%)**
Inactive	34	%29,5
Minimal Active	54	%47
Very Active	27	%23,5
Total	115	%100

Table 3. Pearson's correlation test result

	Tampa Kinesiophobia Test	**Faam Sports Subscale**	**Faam Dla Subscale**
Tampa Kinesiophobia Test	-	-	-
Faam Sports Subscale	**-.37***	-	-
Faam Dla Subscale	**-.36***	**.86***	-

*P<0.05, FAAM: Foot and ankle ability measure; DLA: Daily living activity.

DISCUSSION AND CONCLUSION

Our study found that FAAM sports and DLA scores decreased inversely proportional to the increase in kinesiophobia score. Therefore, athletes with kinesiophobia may experience significant loss of function in the foot and ankle during sports activities or daily life activities.

Studies conducted on athletes have observed in the literature that parallel with the increase in the score of the kinesiophobia test in individuals with CAI, balance with eyes open and closed worsens, foot-ankle joint range of motion decreases, and position perception decreases in foot-ankle joint range of motion (1,32). Watanabe et al. In a study conducted in 2023, 42 college-active athletes with kinesiophobia, ankle instability and ankle and 42 college-active athletes with chronic ankle instability were included. Cumberland Ankle Instability Instrument (CAIT) score and Tampa Kinesiophobia Scale-11 (TSK-11), Foot and Ankle Ability Measurement (FAAM) tests were evaluated between genders. In addition, the numeric pain scale (NPS) was used to assess ankle pain. As a result of the study, an increase in kinesiophobia scores was associated with lower CAIT scores in FAAM sports subscale scores in women. Therefore, it was found that increased kinesiophobia was associated with increased balance problems and decreased foot-ankle function in athletes with CAI (32). A 2024 study examined the effect of kinesiophobia on static and dynamic balance in individuals with chronic ankle instability (CAI). The study included 70 participants divided into three groups based on the Tampa Kinesiophobia Scale results: 25 without kinesiophobia, 25 with kinesiophobia, and 20 without CAI. Participants with CAI performed single-leg balance tests with eyes open and closed and the Y balance test with eyes open. The Romberg ratios for individuals with CAI were also analyzed. The study found no significant differences in static balance tests with eyes open and closed. However, the kinesiophobia group had a higher mediolateral Romberg ratio during static balance assessments compared to both the non-kinesiophobia and non-CAI groups. Additionally, a higher anterior-posterior Romberg ratio was observed in the kinesiophobia group compared to the non-CAI group. In the Y balance test, the kinesiophobia group had less anterior reach than the non-kinesiophobia and non-CAI groups (11).

Another study by Alshahrani and Reddy in 2022 investigated the relationship between kinesiophobia, ankle position sense, and postural control in individuals with CAI. This study included 55 participants with CAI. Kinesiophobia was assessed using the Tampa Kinesiophobia Scale, and ankle range of motion was measured with a digital inclinometer. Postural control was evaluated using the TecnoBody IsoFree system and a stabilometric force platform, which measured the center of pressure oscillations, ellipse area, and sway parameters. Participants were asked to actively reposition their ankles to 10° dorsiflexion and 15° plantar flexion positions, with accuracy measured in degrees. The study found a moderate positive correlation between kinesiophobia scores and ankle repositioning accuracy and postural control parameters. Higher kinesiophobia scores were associated with significant impairments in foot-ankle range of motion and postural control in individuals with CAI (1).

Considering the limitations of the study, the balance of individuals with CAI could not be evaluated with eyes open and closed and static and dynamic. We think that balance assessment of individuals with CAI may better explain the relationship between kinesiophobia and kinesiophobia in the study.

As a result of our study, a negative correlation was found between the FAAM sport and DLA subheadings in athletes with high kinesiophobia scores. It is thought that decreased FAAM scores due to kinesiophobia may improve athletes' fear of injury during competition or training. In addition, in other studies in the literature, we think that performing studies on foot-ankle range of motion, position perception and balance in individuals with CAI may reduce kinesiophobia.

REFERENCES

1. Alshahrani MS, Reddy RS. Relationship between kinesiophobia and ankle joint position sense and postural control in ındividuals with chronic ankle ınstability-A Cross-Sectional Study. International journal of environmental research and public health, 2022; 19(5): 2792.
2. Brown OS, Hu L, Demetriou C, Smith, TO, Hing, CB. The effects of kinesiophobia on outcome following total knee replacement: a systematic review. Archives of orthopaedic and trauma surgery, 2020; 140(12), 2057–2070.
3. Castanho B, Cordeiro N, Pinheira V. The influence of kinesiophobia on clinical practice in physical therapy: an integrative literature review. Int J Med Res Health Sci, 2021; 10, 78-94.

4. Cross SJ, Gill DL, Brown PK, Reifsteck EJ. Prior ınjury, health-related quality of life, disablement, and physical activity in former women's soccer players. Journal of athletic training, 2022; 57(1), 92–98.
5. Donovan L, Hertel JA. New paradigm for rehabilitation of patients with chronic ankle instability. The physician and sportsmedicine, 2012; 40(4), 41–51.
6. Frigg A, Frigg R, Hintermann B, Barg, A, Valderrabano V. The biomechanical influence of tibio-talar containment on stability of the ankle joint. Knee surgery, sports traumatology, arthroscopy: Official journal of the ESSKA, 15(11), 2007; 1355–1362.
7. Frigg A, Magerkurth O, Valderrabano V, Ledermann HP, Hintermann B. The effect of osseous ankle configuration on chronic ankle instability. British journal of sports medicine, 2007; 41(7), 420–424.
8. Golanó P, Vega J, de Leeuw PA., Malagelada F, Manzanares MC, Götzens V, van Dijk CN. Anatomy of the ankle ligaments: a pictorial essay. Knee surgery, sports traumatology, arthroscopy: Official journal of the ESSKA, 2016; 24(4), 944–956.
9. Gonzalez-Sanchez M Li GZ, Ruiz Munoz M, Cuesta-Vargas AI. Foot and ankle ability measure to measure functional limitations in patients with foot and ankle disorders: a Chinese cross-cultural adaptation and validation. Disability and rehabilitation, 2017; 39(21): 2182-2189.
10. Gribble PA, Bleakley CM, Caulfield BM, Docherty CL, Fourchet F, Fong DT, Hertel J, Hiller CE, Kaminski TW, McKeon PO, Refshauge K M, Verhagen EA, Vicenzino BT, Wikstrom EA, Delahunt E. Evidence review for the ınternational ankle consortium consensus statement on the prevalence, impact and long-term consequences of lateral ankle sprains. British journal of sports medicine, 2016; 50(24), 1496–1505.
11. Han S, Oh M, Lee H, Hopkins JT. The effects of kinesiophobia on postural control with chronic ankle instability. Gait & posture, 2024; 107: 269–274.
12. Hertel J. Functional anatomy, pathomechanics, and pathophysiology of lateral ankle ınstability. Journal of athletic training, 2002; 37(4), 364–375.
13. Hoch JM, Druvenga B, Ferguson BA, Houston MN, Hoch MC. Patient-reported outcomes in male and female collegiate soccer players during an athletic season. Journal of athletic training, 2015; 50(9), 930–936.
14. Hølmer P, Søndergaard L, Konradsen L, Nielsen PT, Jørgensen LN. Epidemiology of sprains in the lateral ankle and foot. Foot & ankle international, 1994; 15(2), 72–74.
15. Hootman JM, Dick R, Agel J. Epidemiology of collegiate injuries for 15 sports: summary and recommendations for injury prevention initiatives. J Athl Train. 2007; 42(2): 311–319.
16. Hsu CJ, Meierbachtol A, George SZ, Chmielewski TL. Fear of Reinjury in Athletes. Sports health, 2017; 9(2), 162–167.
17. Hubbard-Turner T, Turner M. J. Physical activity levels in college students with chronic ankle ınstability. Journal of athletic training, 2015; 50(7), 742–747.
18. Kese B, Salcı Y, Yılmaz ÖT. Validity and reliability of the Tampa Kinesiophobia-Fatigue Scale in patients with multiple sclerosis. Irish journal of medical science, 2023; 192(1), 285–290.
19. Konradsen L, Bech L, Ehrenbjerg M, Nickelsen T. Seven years follow-up after ankle inversion trauma. Scandinavian journal of medicine & science in sports, 2002; 12(3), 129–135.
20. Kulunkoglu BA, Celik D. Reliability and validity of the Turkish version of foot and ankle ability measure for patients with chronic ankle disability. The journal of foot and ankle surgery, 2019; 58(1): 38-41.
21. Kusan O. Culture of being healthy and physical activity status in individuals who do and do not do sports. Gümüşhane University journal of health sciences, 2023; 12(1), 192-200.
22. Luque-Suarez A, Martinez-Calderon J, Falla D. Role of kinesiophobia on pain, disability and quality of life in people suffering from chronic musculoskeletal pain: a systematic review. British journal of sports medicine, 2019; 53(9), 554–559.
23. Magerkurth O, Frigg, A, Hintermann B, Dick W, Valderrabano V. Frontal and lateral characteristics of the osseous configuration in chronic ankle instability. British journal of sports medicine, 2010; 44(8), 568–572.
24. McPhie ML, Rawana JS. The effect of physical activity on depression in adolescence and emerging adulthood: a growth-curve analysis. Journal of adolescence, 2015; 40, 83–92.
25. Öztürk M. Validity and reliability of the ınternational physical activity questionnaire and determination of physical activity levels in university students. H.Ü. Institute of Health Sciences, Master's Thesis, 2005. Ankara.
26. Shah S, Thomas AC, Noone JM, Blanchette CM, Wikstrom EA. Incidence and cost of ankle sprains in United States emergency departments. Sports Health. 2016; 8(6): 547–52.
27. Stiller-Ostrowski J, Granquist MD, Flett R. Kinesiophobia. Athletic training & sports health care, 2014; 6(6), 248-251.
28. Towers JD, Deible CT, Golla SK. Foot and ankle biomechanics. Seminars in musculoskeletal radiology, 2003; 7(1), 67–74.
29. Tümer N, Vuurberg G, Blankevoort L, Kerkhoffs GMMJ, Tuijthof GJM, Zadpoor AA. Typical shape differences in the subtalar joint bones between subjects with chronic ankle ınstability and controls. Journal of orthopaedic research : Official publication of the orthopaedic research society, 2019; 37(9), 1892–1902.
30. Verhagen RA, de Keizer G, Van Dijk, CN. Long-term follow-up of inversion trauma of the ankle. Archives of orthopaedic and trauma surgery, 1995; 114(2), 92–96.

31. Vlaeyen JWS, Kole-Snijders AMJ, Boeren RGB, van Eek H. Fear of movement/(re)injury in chronic low back pain and its relation to behavioral performance. Pain, 1995; 62(3), 363–372.
32. Watanabe K, Koshino Y, Kawahara D, Akimoto M, Mishina M, Nakagawa K, Ishida T, Kasahara S, Samukawa M, Tohyama H. Kinesiophobia, self-reported ankle function, and sex are associated with perceived ankle instability in college club sports athletes with chronic ankle instability. Physical therapy in sport : official journal of the association of chartered physiotherapists in sports medicine, 2023; 61, 45–50.
33. Whalan M, Lovell R, McCunn R, Sampson JA. The incidence and burden of time loss injury in Australian men's sub-elite football (soccer): A single season prospective cohort study. Journal of science and medicine in sport, 2019; 22(1), 42–47.
34. Wikstrom EA, Hubbard-Turner T, McKeon PO. Understanding and treating lateral ankle sprains and their consequences: a constraints-based approach. Sports medicine (Auckland, N.Z.), 2013; 43(6), 385–393.
35. Wright SA, Snyder Valier AR. Health-related quality of life in former division ıı collegiate athletes using the disablement of the physically active scale. Athletic Training & Sports Health Care, 2021; 13(2), 85-92.
36. Yu P, Mei Q, Xiang L, Fernandez J, Gu Y. Differences in the locomotion biomechanics and dynamic postural control between individuals with chronic ankle instability and copers: a systematic review. Sports biomechanics, 2022; 21(4), 531–549.