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Effect of Chronic Ankle Instability on Functionality, Mental and Physical Health Among Elite Athletes: A Case-Control Study

Elit Atletlerde Kronik Ayak Bileği İnstabilitesinin Fonksiyonellik, Mental ve Fiziksel Sağlık Üzerine Etkisi: Vaka-Kontrol Çalışması

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ABSTRACT Objective: Chronic ankle instability (CAI) leads to a decrease in physical performance and a delay in return to sportive activities in elite athletes. Approximately 40% of the lateral ankle sprains result in CAI. The purpose of the current study was to compare the functionality of foot and ankle and health-related quality of life in elite athletes with or without CAI. **Material and Methods:** A total of 104 elite athletes 79 men, 25 women with (n=52) and without (n=52) CAI participated in this study. The functionality of the foot and ankle was determined using Foot and Ankle Ability Measure (FAAM) FAAM-activity of daily living and FAAM-sports subscales. Health-related quality of life was assessed using the short form-12 (SF-12) physical and mental subscores. **Results:** FAAM-activity of daily living and FAAM-sport subscale scores of elite athletes with CAI were lower than athletes without CAI ($p<0.05$). The SF-12 physical and mental subscores differed between the 2 groups ($p<0.05$) and the most affected side was the dominant one in chronic ankle insatbility group. **Conclusion:** CAI causes functional performance decline and mental impairment by showing general and regional symptoms in the professional athletic population. During the planning of the treatment and rehabilitation process, priority should be given to increase the perceived quality of life by diminishing the symptoms. In addition, focusing on multidimensional treatment approaches that take into account the level of mental health would be beneficial in increasing athletic performance.

Keywords: Chronic ankle instability; functionality; elite athlete; mental health; quality of life

ÖZET Amaç: Kronik ayak bileği instabilitesi, profesyonel sporcuların spordan uzun süre uzak kalmalarına ve fiziksel performanslarına negatif etki etmektedir. Lateral ayak bileği instabilitelerinin yaklaşık %40'ı kronik ayak bileği instabilitesine dönüşmektedir. Bu çalışmanın amacı, kronik ayak bileği instabilitesi olan ve olmayan profesyonel sporcuların, ayak ve ayak bileği fonksiyonellik ve sağlıkla ilgili yaşam kalitesi etkilenimi açısından karşılaştırmaktır. **Gereç ve Yöntemler:** Bu çalışmaya 25 kadın, 79 erkek olmak üzere toplam 104 katılımcı [kronik ayak bileği stabilitesi olan (n=52) ve olmayan (n=52)] katıldı. Katılımcıların ayak ve ayak bileği fonksiyonellik seviyesi Ayak Bileği Kullanılabilirlik Ölçüsü [Foot and Ankle Ability Measure (FAAM)] Ölçeği'nin FAAM-günlük yaşam aktiviteleri ve FAAM-spor alt ölçekleri ile sağlıkla ilgili yaşam kalitesi kısa form-12'nin [short form-12 (SF-12)] fiziksel ve mental alt skorları ile değerlendirildi. **Bulgular:** Kronik ayak bileği instabilitesi olan sporcuların, FAAM günlük yaşam aktiviteleri ve spor alt ölçekleri skorları bakımından olmayan sporculara göre anlamlı bir azalma gösterdiği görülmüştür ($p<0,05$). Katılımcıların SF-12'nin fiziksel ve mental alt skorları açısından gruplar arasında istatistiksel olarak anlamlı fark bulunmuştur ($p<0,05$) ve kronik ayak bileği instabilitesinin daha fazla dominant taraf ekstremitede görüldüğü saptanmıştır. **Sonuç:** Kronik ayak bileği instabilitesi, profesyonel atletik popülasyonda genel ve bölgesel semptomlar göstererek, fonksiyonel performans düşüşüne ve mental etkilenime neden olmaktadır. Tedavi ve rehabilitasyon sürecinin planlanmasında kişiye özel semptomlar giderilerek, yaşam kalitesinin artırılması hedeflenmelidir. Ayrıca mental sağlık düzeyini dikkate alan çok yönlü tedavi yaklaşımlarına odaklanılması atletik performansın artırılmasında yararlı olacaktır.

Anahtar Kelimeler: Kronik ayak bileği instabilitesi; fonksiyonellik; elit sporcu; mental sağlık; yaşam kalitesi

Lateral ankle sprain is the most frequent musculoskeletal injury among elite athletes and it constitutes approximately 25-30% of all injuries.[1] Up to 40% of lateral ankle sprain recurrences occur in 6-18 months after the first ankle sprain.[2] Approximately 30-40% of that patients experience chronic ankle in-

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stability (CAI). Besides repetitive ankle sprain and ankle giving away, CAI leads to pain, loss of function, decreased neuromuscular control and proprioception.[3] Researchers use the International Ankle Consortium (IAC) criteria to clarify the inclusion criteria for CAI. These criteria include recurrent lateral ankle instability, at least 3 ankle instability and giving away history. However, validated self-reported ankle instability questionnaires should be used to identify or categorize CAI.[2]

People with CAI display region-specific and global deficits compared to individuals without CAI. Generally individuals with CAI report a decrease in global and local health. In particular physical outcomes display worse results than mental outcomes.[4] CAI causes postural control impairments, decrease in strength, giving away sensation and ankle mechanic disability. Findings related to perceived health-related quality of life in CAI is very limited that also focused on elite college-aged athletes.[5] CAI also may consequence other long-term results such as reduced physical activity, ankle osteoarthritis and negative well-being.[6] Furthermore, CAI exacerbates health care costs annual, thus prevention strategies are needed to avoid CAI-related deficits. It is necessary to understand how CAI affects functionality and perceived quality of life before deciding on the appropriate rehabilitation program and prevention strategies.[7]

Traditionally CAI research has focused on the pathophysiology of the condition to identify functional and mechanical disability.[8] Over the past decade, patient-based outcomes have become increasingly accepted in healthcare and researchers start to spend their efforts to include perceptions of patients health status. Evidence has shown that patient-reported outcomes are lower in individuals with CAI but not yet it is not clear what mental health status. Therefore the relationship between CAI and multidimensional outcomes consider in the rehabilitation process.[9] Mental health is included the updated model of CAI and Houston et al. demonstrated a large deficit in mental subscales among patients with CAI.[10] Also, they reported future studies are needed to understand the mental dimension specific to among athletes.[9]

To the best of our knowledge, no study has yet compared the functional level and health-related quality of life especially with the mental health aspect in the elite athlete with CAI and without CAI. Our study aimed to investigate the effects of CAI on functionality, mental health and health-related quality of life in elite athletes.

MATERIAL AND METHODS

PARTICIPANTS

A total of 104 elite athletes (52 with and 52 without CAI) mean age of 20.55 participated in this case-control study. These participants, were recruited from university-level sports teams and different professional club facilities. They have been training 3 or 4 days a week for at least 2 years. All participants completed the Cumberland ankle instability questionnaire that classifies the individuals according to CAI conditions. When 52 patients were reached, 52 non-CAI elite athletes were included in the study as a control group and which non-CAI group. Inclusion criteria stated by IAC were as follows; having a history of unilateral ankle sprain, "giving way" sensation of the ankle, and a feeling of instability.[2] Exclusion criteria were; history of previous surgery of lower extremity, having bone, ligaments and nerve injury or any acute injury and sprain, strain or fracture of both ankles within the last 3 months. All participants read and provided their written informed consent before participation.

The current study was approved by the Acıbadem Mehmet Ali Aydınlar University Medical Research Ethics Committee (date: March 12, 2020; no: 2020-04/14) and our study was completed following the "Declaration of Helsinki".

DATA COLLECTION METHOD

We recorded sociodemographic data including age, height, weight, educational status, smoking and alcohol habits. We determined the CAI status of the athletes with the Cumberland ankle instability tool (CAIT). In addition, the physical functions of the athletes were evaluated with the Foot and Ankle Ability Measure (FAAM), and the health-related quality of life was evaluated with the short form-12 (SF-12) scale.

CAIT

CAIT is a disease-specific questionnaire that is most widely used to diagnose patients with CAI.[2] CAIT consists of 9 items that focus on the severity of functional problems in patients with ankle instability. The questionnaire is structured to report the feelings of instability in different types of activities, such as running, walking, jumping, and staring up and it is scored between 0 and a maximum of 30 points.[11] A higher score indicates a better level of overall function. According to the most recent study about of regarding the revalidation of the CAIT, the optimal cut-off score of the tool is ≤25.[12] Minimal detectable change score of CAIT is 3.08 and minimal clinically important difference score is ≥3 points reported in individuals with CAI.[13]

FAAM

FAAM is a self-reported tool to assess the functional level of individuals with leg, ankle and foot disorders and musculoskeletal injuries. It consists of 2 subscales and 29 items. The "activity of daily living" subscale includes 21 items and the "sport" subscale 8 items.[14] Each item is scored with a 5-point Likert scale. The activity of daily living (ADL) and sports subscales have a maximum score of 84 and 32, respectively. A higher score indicates a higher level of functionality for both subscales.[15]

SF-12

SF-12 is a self-reported generic health-related quality of life measure which consists of 12 items and 8 domains: role physical, physical functioning, bodily pain, vitality, general health, role emotional, social functioning and mental health.[16] The physical and mental component scores are obtained with higher scores representing better health.[17] The Turkish reliability and validation of the SF-12 was conducted by Kocyigit et al.[18]

SAMPLE SIZE

An independent sample t-test was conducted to calculate the sample size according to FAAM-sport values and Cohens d effect size 0.5 (moderate) was excepted.[7] Total sample size required is 88 (44 per group) for this study, whereby we had 52 participants for each group due to the possibility of a 20% missing value.

STATISTICAL ANALYSIS

Statistical analysis was performed using SPSS 21.0 for Windows (IBM Inc., Armonk, NY, USA). Descriptive statistics as the mean, median, standard deviation (SD), skewness and kurtosis were calculated. The normality of data distribution was analyzed with Shapiro-Wilk test. Normally distributed data were presented as a mean±SD, and non-normally distributed data were expressed as median and range. An independent sample t-test was used to compare variables in both groups and the chi-square test to analyze the categorical variables. The Mann-Whitney U test was used for non-parametric distribution and a p-value of <0.05 was considered significant skewness, kurtosis.

RESULTS

The descriptive statistical results of the demographic and physical parameters of the participants are shown in Table 1 and Table 2. In terms of age, height, weight, and body mass index, CAI and non-CAI groups were similar ($p>0.05$). A statistically significant difference was found in terms of gender and injured side ($p<0.05$). Our data showed that 75.96% (n=79) of the participants were men and 24.04% of them were women (n=25). The right dominance was higher in both groups and 69% of the CAI and 76% of the non-CAI group were right dominant.

The distribution of the athletes according to professional sports branches is also shown in Figure 1. The sports branches of the participants were football (n=35), basketball (n=32), American football (n=9), volleyball (n=9), tennis (n=3), indoor sports (n=9) and other sports branches such as (swimming, athleticism, climbing) (n=1).

When we compared the groups in terms of FAAM-ADL and FAAM-sport, both sub-scores of the individuals with CAI were significantly lower than those of the non-CAI ($p<0.05$). Likewise, the physical component and mental component sub-scores of SF-12 in the CAI group were found to be statistically higher than the non-CAI group ($p<0.05$) (Table 3).

TABLE 1: Demographic variables.

Variables	Non-CAI (n=52) $\bar{X}$ (SD)	CAI (n=52) $\bar{X}$ (SD)	p*
Age (years)	19.88±3.63	21.23±3.38	0.053
Height (cm)	1.83±0.10	1.79±0.10	0.072
Body weight (kg)	78.40±15.93	72.84±12.49	0.050
BMI (kg/m^2)	23.20±2.98	22.46±2.29	0.161
Female/male	8/44	17/35	0.039
Dominant side R/L	40/12	36/16	0.377
Effect side R/L	37/15	27/25	0.044

p*: Values obtained from the independent samples test; CAI: Chronic ankle instability; SD: Standard deviation; BMI: Body mass index.

TABLE 2: General information of groups.

Variables	Non-CAI (n=52) Median (IQR)	CAI (n=52) Median (IQR)	p value
Education			
High school/university	24/28	14/38	0.095*
Number of injuries	1 (1-3)	3 (2-5.75)	0.014¥
Time off from sports/day	10 (5-33)	14 (5.50-26.25)	0.817¥
Number of instability in the last 1 year	0 (0-1)	1 (0-7.5)	0.006¥

p*: Values obtained from the chi-square test; p¥: Values obtained from the Mann-Whitney U test; CAI: Chronic ankle instability; IQR: Interquartile rang.

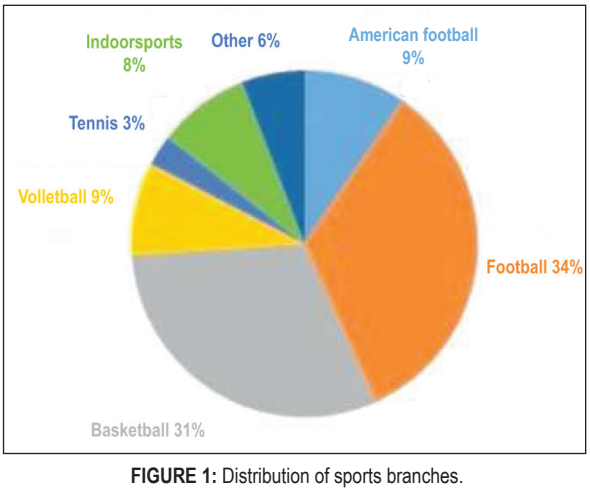

FIGURE 1: Distribution of sports branches.

DISCUSSION

The primary purpose of the current case-control study was to determine the functionality and health-related quality of life of elite athletes with and without CAI. Our study showed that functional ability status and health-related quality of life in both physical and mental aspects were worse in elite athletes with CAI.

The presence of CAI is a problematic condition in adolescents or above 18 years aged population.[19] Donovan et al. reported an overall prevalence of CAI is 20% in 1,002 adolescent athletes in different sports

TABLE 3: Patient reported outcomes between CAI and non CAI.

Outcomes	Non-CAI (n=52) $\bar{X}$±SD	Median (IQR)	Skewness	Kurtosis	CAI (n=52) $\bar{X}$±SD	Median (IQR)	Skewness	Kurtosis	p value
FAAM-ADL	81.07±5.20	83.08 (81-84)	-2.741	8.071	70.66±14.28	75.30 (62-80.75)	-2.178	7.517	0.000
FAAM-sport	27.20±5.33	28 (26.25-32)	-1.255	0.428	22.93±7.61	25.50 (16-29.75)	-0.696	-0.707	0.001
SF-12 (PCS)	52.61±9.07	55.76 (44.64-58.49)	-0.870	-0.364	49.42±8.51	50.88 (42.21-56.56)	-0.360	-0.561	0.035
SF-12 (MCS)	47.84±10.71	51.70 (38.21-55.92)	-0.492	-0.726	42.68±12.70	43.59 (32.02-53.71)	-0.269	-1.114	0.031

p*: Values obtained from the Mann-Whitney U test; CAI: Chronic ankle instability; SD: Standard deviation; IQR: Interquartile rang;
FAAM-ADL: Foot and ankle ability measure-activity of daily living; PCS: Physical component score; MCS: Mental component score.

fields. Also, the prevalence of CAI in female athletes was 23.6% higher than in male athletes (16.3%).[7] In our study, the prevalence of male athletes with CAI was 67.30% which was more than female athletes with CAI (32.69%). Since the number of professional male athletes in our country is higher than female athletes, our results are not in line with the literature.[20]

A lateral ankle sprain is a common injury experienced in a vast majority of athletes in different sports fields. Both lateral ankle sprain and CAI are frequently seen in rugby, volleyball, football, basketball and handball players. Approximately 40% of lateral ankle sprain detected in professional sports players turn into CAI.[21] When we examine the distribution of sports fields in our study, most of our athletes were football, basketball, American football and volleyball players.

CAI can be categorized into functional ankle instability and mechanical ankle instability. Mechanic ankle instability results in synovial and degenerative changes, pathological laxity and kinematic restrictions within the ankle joint. Impaired neuromuscular control and proprioception, reduced strength and postural control cause functional ankle instability.[22] These 2 theories do not fully describe CAI and some symptoms overlap with each other. Therefore, assessment and treatment strategies should be tailored individually.[23]

It has been reported that the psychological effects of individuals with only mechanical instability and with only functional instability are similar. However, it has been observed that having both instabilities causes higher mental impact, more deficits in sportive activities, and lower FAAM scores.[24] In our study, CAI was not differentiated as functional or mechanical instability. Therefore, we think that future studies are needed with more sample sizes and subgroups defined.

In case of no full restoration of mechanical ankle instability or incomplete rehabilitation up to 6-12 weeks after an ankle sprain, the ankle will be more prone to re-injury. As a result of this situation, athletes with CAI present reduced functionality, instability, and increased pain and swelling in long term.[25] In addition, evidence emphasizes the importance of injury-related fear in individuals with CAI.[25] When comparing ankle sprain copers and CAI groups, CAI groups showed a higher level of fear-avoidance behavior.[26] The clinicians should be aware of all appropriate outcome measures before returning to sports activities.[27]

It is recommended that a FAAM-ADL score below 75.6 and FAAM-sports subscale score below 25.6 can be one of the inclusion criteria for CAI studies.[2] Our elite athletes displayed lower scores for both subscales as 70.6 and 22.6 for FAAM-ADL and FAAM-sports, respectively which were lower than the abovementioned cut-off scores. Our results are similar to the literature, thus these values may be considered to determine the functionality of the elite athletes and determine their prognosis.

Younger and older people with CAI have demonstrated deficits in psychological, physical and social domains.[5] There is a strong relationship between the functionality of the ankle joint and the level of quality of life. According to patient-reported outcome measures, physical and mental health are significantly affected in the middle-aged population with CAI.[28] On the contrary, Houston et al. reported that there is no difference in the mental health subscale of the SF-12 between the CAI and non-CAI groups. In addition, they included 40 physically active individuals in their cross-sectional design study and reported the SF-12 physical component score and mental component score as 56.2 and 52.9, respectively in individuals with CAI.[4] In our case-control study, physical and mental subscales of SF-12 were lower in participants with CAI. The athletes in our sample group continued their match and training programs. We think that low mental status scores affect their physical performance. Considering mental health in the return to sports criteria of elite athletes with CAI may be required for maximum performance.

Especially athletes with CAI display reduced general and region-specific function and increased fear-avoidance beliefs. Each new ankle sprain results in a 21-30 days loss of time for elite athletes.[29] These negative consequences predispose the athletes to new

injuries and diseases and affect the mental health of athletes suitable for games.[30,31]

Clinicians should comprehensively evaluate before designing health care interventions and investigate and clearly describe CAI.[32,33] Professional athletes with CAI have a poor quality of life.[7] However, there are not enough studies that determine the mental health status of professional athletes with CAI, and our results may add a valuable contribution to this area.

Our study is not without limitations. Objective clinical evaluation methods can be implemented in our study design. Since we included elite athletes in different sports fields, our results do not reveal the effects of CAI in isolated sports fields. Lastly, the elite athletes may be categorized both according to CAIT scores and the number history of ankle sprains.

CONCLUSION

CAI negatively affects physical performance, quality of life and mental health in elite athletes. To prevent secondary injuries related to CAI and return to sports activities, clinicians should use cost-effective patient-reported outcome measures during their clinical routine. The subjective outcome measures may help to ease the CAI diagnosis, follow the prognosis and diminish individual-specific deficits. Also, they may be useful to guide rehabilitation strategies. Finally, considering the effectiveness of mental health status in athletes with CAI, clinicians should focus on multidisciplinary treatment approaches and the psychological readiness of elite athletes. Re-injury incidence of elite athletes can be reduced with concept treatment approaches that include regional and general dimensions. In addition, the fear of movement and fear avoidance behavior can be prevented from being permanent.

Source of Finance

During this study, no financial or spiritual support was received neither from any pharmaceutical company that has a direct connection with the research subject, nor from a company that provides or produces medical instruments and materials which may negatively affect the evaluation process of this study.

Conflict of Interest

No conflicts of interest between the authors and / or family members of the scientific and medical committee members or members of the potential conflicts of interest, counseling, expertise, working conditions, share holding and similar situations in any firm.

Authorship Contributions

Idea/Concept: *Özgül Öztürk;* ***Design:*** *Özlem Feyzioğlu, Özgül Öztürk;* ***Control/Supervision:*** *Stefanos Gadis, Özlem Feyzioğlu;* ***Data Collection and/or Processing:*** *Stefanos Gadis, Özlem Feyzioğlu, Özgül Öztürk;* ***Analysis and/or Interpretation:*** *Stefanos Gadis, Özlem Feyzioğlu;* ***Literature Review:*** *Stefanos Gadis, Özlem Feyzioğlu;* ***Writing the Article:*** *Özlem Feyzioğlu, Özgül Öztürk;* ***Critical Review:*** *Özlem Feyzioğlu, Özgül Öztürk;* ***Materials:*** *Stefanos Gadis.*

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