

ORIGINAL ARTICLE

Evaluation of Toenail Findings and Ingrown Nails in Athletes

¹Deniz Aksu Arica , ¹Leyla Baykal Selcuk , ²Elif Ates , ³Cahit Yavuz , ¹İbrahim Etem Arica 

¹Karadeniz Technical University, Faculty of Medicine, Department of Dermatology and Venereology, Trabzon, Türkiye

²Karadeniz Technical University, Faculty of Medicine, Department of Family Medicine, Trabzon, Türkiye

³Selcuk University, Faculty of Medicine, Department of Dermatology and Venereology, Konya, Türkiye

Correspondence

Deniz Aksu Arica, Karadeniz Technical University, Faculty of Medicine, Department of Dermatology and Venereology, Trabzon, Türkiye

E-Mail: drdenizaksu@gmail.com

How to cite ?

Aksu Arica D, Baykal Selçuk L, Ateş E, Yavuz C, Arica İE. Evaluation of Toenail Findings and Ingrown Nails in Athletes. Genel Tıp Derg. 2024;34(4):506-12.

ABSTRACT

Background/Aims: Professional athletes often encounter foot nail issues due to the demands of their intensive training and the conditions within their sports footwear. The aim of this study is to assess the prevalence of nail disorders affecting professional athletes, characterize their types, and identify predisposing factors, shedding light on a critical but often neglected area in sports-related health.

Methods: We surveyed 120 professional athletes from football and basketball teams across three major sports clubs. Data on sociodemographic factors and nail issues were collected via a detailed questionnaire and corroborated with dermatological exams.

Results: The research included 108 football players and 12 basketball players, with 13 female athletes among them. The average age of the participants is 22.87, and their average sports career duration is 6.72 years. Ingrown toenails were reported by 81 athletes (67.5%), with 35 cases involving multiple regions and 9 cases a single region. The condition was most frequently found in the first toe, presenting in 41 instances. A significant association was found between ingrown toenails and both age and sports activity duration ($p=0.006$ and $p<0.001$, respectively). Drying between toes was more prevalent among those with ingrown toenails ($p=0.005$). No significant relationship was observed with other factors such as shoe type, nail cutting habits, pedicure history, fungal infections or symptoms like sweating and swelling. Dermatological assessments also identified subungual hematoma in 25 athletes, hyperkeratosis in 5, and nail dystrophy in 23.

Conclusion: In professional athletes, a high incidence of ingrown toenails has been associated with increased duration of sports activity; however, no correlation was found with known predisposing factors such as improper nail cutting or incorrect footwear selection, suggesting that the meticulous foot care practices of athletes may mitigate these risks. Proactive dermatological surveillance and tailored educational interventions are imperative for athletes to preemptively address podiatric ailments and uphold optimal performance.

Keywords: Nails; Athletes; Nails, Ingrown; Football

Introduction

Physical activity is universally acknowledged for its health benefits, enhancing both physical and mental well-being. However, professional athletes, due to the nature of their rigorous training and competitive environments, often face a unique set of health challenges. Among these, foot-related ailments are particularly common owing to the combination of mechanical stress, repeated trauma and the microenvironments created by sports footwear.

The foot is a complex anatomical structure that bears the brunt of repetitive impacts and pressures during athletic activities. This constant stress, coupled with the confined conditions of sports footwear—often under moist and frictional circumstances—increases the risk of developing a range of podiatric conditions, including various nail disorders. Such afflictions can range from common fungal infections to more serious structural nail changes resulting from repeated trauma. Moreover,

the close quarters of locker rooms and communal showers facilitate the spread of infectious agents, compounding the likelihood of dermatological issues.

The implications of neglected foot health extend beyond discomfort; they can adversely affect an athlete's performance, potentially leading to more severe injuries and even impacting team dynamics. Prompt identification, effective management, and preventive strategies are therefore crucial components in the holistic healthcare of athletes.

In the light of these considerations, the aim of this study is to investigate the prevalence and types of foot nail issues among professional athletes. By doing so, we hope to contribute valuable insights to the domain of sports medicine, particularly in the field of preventative dermatological care for athletes.

Material and Methods

Study Population and Data Collection

Between February 2021 and November 2023, we conducted a survey involving 120 professional athletes from the football and basketball teams of three major sports clubs. A questionnaire, designed by our research team, gathered data on the athletes' sociodemographic characteristics and nail-related issues. Alongside the questionnaire, we performed dermatological physical examinations on the participants.

Questionnaire Design

The questionnaire commenced with a preamble explaining the study's goals and the responsible academic department's information. A consent form was presented at the outset, offering options to 'agree to participate' or 'decline participation'. Those who chose 'decline participation' were excluded from further contact. The questionnaire was enhanced with visual aids to help participants, pinpoint the location of their nail problems, specify their shoe type, and describe their nail-cutting practices.

Inclusion and Exclusion Criteria

Eligible participants for this study must provide informed consent and have played basketball or football professionally for at least one year with a valid license. Conversely, individuals will be excluded from the study if they do not provide informed consent or have played basketball or football professionally for less than one year. This approach ensures that all participants have a comparable level of professional experience, crucial for the reliability and validity of the study findings.

Ethical issues and permissions

Ethical permission was obtained from the Karadeniz Technical University, Medical Faculty Clinical / Human Research Ethics Committee for this study with date 2017 and number 44, and Helsinki Declaration rules were followed to conduct this study.

Statistical Analysis

Data analysis was conducted using SPSS version 23.0. Descriptive data were summarized with counts and percentages. For categorical variables, the comparison was made using the Chi-square test. The Kolmogorov-Smirnov test assessed the normality of the distribution. For normally distributed continuous variables, we applied the Student's t-test, while the Mann-Whitney U test was used for variables not normally distributed. Spearman's correlation test facilitated the correlation analysis. We considered a p-value of less than 0.05 as indicative of statistical significance.

Results

Participant Demographics

A total of 120 athletes were assessed, comprising 13 females (10.8%) and 107 males (89.2%). The mean age of participants was 22.87 years (SD \pm 4.68, range 17-35). The majority were football players (108, 90%), while the rest were basketball players (12, 10%). The athletes trained for an average of 1 hour and 15 minutes per day, 5-6 days a week with a mean sports involvement of 6.72 years (SD \pm 4.89, range 1-20 years).

Education and Health

Educational levels among 104 athletes were as follows: primary education (36, 34.6%), secondary education (54, 51.9%), and university graduates (14, 13.5%). One athlete was on adalimumab and azathioprine treatment for a rheumatological condition. Dermatological issues were limited to vitiligo (2 athletes) and contact dermatitis (2 athletes). Reported medication use included vitamin supplements (3 athletes), systemic isotretinoin (1 athlete), escitalopram (1 athlete), and the aforementioned adalimumab and azathioprine (1 athlete). Pedicures were common (50 athletes, 43.5%), with one reporting complications. Non-sports-related foot trauma was reported by 13 athletes.

Ingrown Toenails

A history of ingrown toenails was reported by 81 athletes (67.5%). Demographic and behavioral characteristics stratified by the presence of ingrown toenails are presented in Table 1. Age and duration of sports activity were significantly associated with ingrown toenail occurrence ($p=0.006$ and $p<0.001$, respectively), as detailed in Table 2, which illustrates the correlation between these variables and ingrown toenail incidence. The practice of drying between toes was significantly more common in those with a history of ingrown toenails ($p=0.005$). No significant correlations were found with other researched factors.

The number of past ingrown toenail episodes was recorded for 46 athletes, with a distribution as follows: one episode (11 athletes), two episodes (12 athletes), three episodes (2 athletes), four episodes (20 athletes) and five episodes (1 athlete).



Figure 1. Photographic representations of participant cases. Figures 1-11 depict dystrophic nail changes attributed to sports-related trauma. Figures 12-15 demonstrate subungual hematomas alongside traumatic nail alterations.

Preventative Measures and Treatments

For prevention purposes, 27.6% cut the nail corner, 2.6% rested their feet elevated, 9.2% applied antibiotic cream, and 60.5% received professional help.

For treatment, athletes consulted manicurists/pedicurists (41.8%), podiatrists (18.2%), family physicians (16.4%), orthopedic specialists (14.5%), general surgeons (3.6%), and dermatologists (5.5%). Despite being included as an option in our survey, none of the participating athletes selected the choice indicating that they had consulted with a plastic surgery specialist.

Ingrown Toenail Characteristics

In terms of location, 35 cases involved multiple regions,

and 9 cases involved a single region. The distribution was as follows: bilateral involvement on all four sides of the first toe in 19 cases, bilateral medial edges of the first toe in 5 cases, bilateral lateral edges of the first toe in 5 cases, bilateral involvement with one medial and the other mediolateral side of the first toe in 3 cases, bilateral involvement of the fourth and fifth toes in 1 case, involvement of all four sides on the first toe plus one side of the second toe in 2 cases, and unilateral involvement of the first toe (medial side in 4 cases, lateral side in 3 cases) and the lateral sides of the second toe in 2 cases.

Treatment Modalities

Treatments included nail avulsion (24 cases, 61.5%), nail brace and tube treatments (3 cases, 7.7%), oral

Table 1. Demographic and Behavioral Characteristics by Presence of Ingrown Toenails

| Variables | Overall Population (n=120) | No Ingrown Nails (n=39) | Ingrown Nails (n=81) | p-value |
|-------------------------------------|----------------------------|-------------------------|----------------------|---------|
| Age (years) | 22.87±4.68 | 21.39±4.32 | 23.60±4.70 | 0.006 |
| Gender | | | | |
| Female | 13 | 6 | 7 | 0.348 |
| Male | 107 | 33 | 74 | |
| Duration of sports activity (years) | 6.72±4.89 | 4.24±4.08 | 7.65±4.88 | 0.000 |
| Type of Sports | | | | |
| Basketball | 12 | 5 | 7 | 0.523 |
| Soccer | 108 | 34 | 74 | |
| Pedicure History | | | | |
| Absent | 65 | 23 | 42 | 0.150 |
| Present | 50 | 11 | 39 | |
| Non-Occupational Trauma | | | | |
| Absent | 104 | 35 | 69 | 0.063 |
| Present | 13 | 1 | 12 | |
| Preferred Non-Sport Shoes tip type | | | | |
| Narrow | 8 | 1 | 11 | 0.393 |
| Wide | 30 | 11 | 19 | |
| Preferred shoe size | | | | |
| Large | 25 | 5 | 20 | 0.179 |
| Fitting | 41 | 15 | 26 | |
| Person who cuts nails | | | | |
| Self | 103 | 33 | 70 | 0.339 |
| Others | 13 | 2 | 11 | |
| Nail Cutting Style | | | | |
| Short and Deep | 6 | 1 | 5 | 0.542 |
| Rounded | 71 | 19 | 52 | |
| Deep Corners | 12 | 3 | 9 | |
| Straight Across | 25 | 10 | 15 | |
| Sweating | | | | |
| Absent | 97 | 30 | 67 | 0.935 |
| Present | 20 | 6 | 14 | |
| Bad Odor | | | | |
| Absent | 112 | 33 | 79 | 0.169 |
| Present | 5 | 3 | 2 | |
| Swelling | | | | |
| Absent | 111 | 36 | 75 | 0.175 |
| Present | 6 | 0 | 6 | |
| History of fungal Mycosis | | | | |
| Absent | 99 | 34 | 65 | 0.603 |
| Present | 21 | 5 | 16 | |
| Onychomycosis | | | | |
| Absent | 109 | 36 | 73 | 0.698 |
| Present | 11 | 3 | 8 | |
| Frequency of Washing Feet | | | | |
| Once a day | 102 | 33 | 69 | 0.672 |
| Less often | 11 | 3 | 8 | |
| Drying Between Toes | | | | |
| Absent | 48 | 22 | 28 | 0.005 |
| Present | 68 | 14 | 54 | |

Table 2. Correlation Between Age, Duration of Sports Activity, and Incidence of Ingrown Toenails

| variable | Correlation Coefficient | P-value |
|-----------------------------|-------------------------|---------|
| Age | 0.264 | 0.006 |
| Duration of sports activity | 0.348 | <0.001 |

antibiotics (4 cases, 10.3%), antibiotic creams (7 cases, 17.9%), and pain medication (1 case, 2.6%).

Physical examination findings

We observed subungual hematoma in 25 cases, subungual hyperkeratosis in 5 cases and dystrophic changes such as nail splitting, ridging, and pigmented bands at the nail tips in 23 cases (Figure 1).

Discussion

Athletes especially soccer players are prone to specific nail dystrophies due to the considerable forces exerted on the feet during abrupt kicking motions. The nail plate and surrounding periungual area are subject to significant pressure and trauma during athletic

activities. The specific forces exerted on the feet vary by sport, leading to distinct sport-related nail changes (1,2). Trauma to the nail unit is a common cause of onychodystrophy and may be acute, resulting from a single severe injury, or chronic, due to repetitive minor injuries. Acute trauma can promptly lead to splinter hemorrhages, subungual hematomas, and potential nail loss. In soccer players, traumatic injuries to the toenails frequently result in subungual hematoma. This condition is analogous to 'tennis toe', which typically affects the first and second digits as a result of abrupt stops and starts, as well as 'jogger's toe', commonly involving the third to fifth digits (1). In our study, subungual hematoma was observed in the first toe of 22 soccer players and 2 basketball players, while

separately, a hematoma was detected in the second toe of another soccer player.

Delayed nail deformities may encompass nail splitting and ridging, pterygium development, hook nails, pigmented bands and ectopic nail formation (3). Chronic sports-related trauma is also associated with subungual hyperkeratosis, as indicated in the study by Ergun et al. with a prevalence of 14.6% among the subjects examined (4,5). Our study identified subungual hyperkeratosis in 5 soccer players and dystrophic changes such as nail splitting, ridging, and pigmented bands in 23 athletes, 21 of whom were soccer players. In our study, the low incidence of subungual hyperkeratosis and dystrophic nail changes is attributed to the high rate of ingrown toenails and the subsequent increased attention to foot care.

Sporting activities may be regarded as a potential risk factor for onychocryptosis (ingrown nails), but the sparse data available do not establish a direct correlation between these factors (6-10). Onychocryptosis is an exceedingly uncomfortable and painful condition, occurring when the lateral edge of the nail embeds or is forced into the lateral nail fold (6,7). The prevalence of this condition is not well-defined; however, a screening study in the United States identified a rate of ingrown nails at 24 cases per 1,000 individuals (11). Trauma is recognized as one of the causative factors for ingrown nails (7-10). In our previous study, which assessed the clinical features of 206 adult patients with ingrown toenails, we found that 20.5% had a history of engagement in sports activities and 24.3% had a history of trauma (12). In our current study, we detected onychocryptosis in 67.5% of professional athletes. Only 14.8% of the cases with onychocryptosis had a history of non-sport related trauma. We found a statistically significant correlation between the age of our subjects and the duration of their sports activities with the frequency of onychocryptosis.

One of the most significant factors known to contribute to the development of ingrown nails is the use of inappropriate footwear, such as shoes with pointed toes, or socks that cause recurring trauma (12,6,7,10,13). Tight shoes or socks can compress the lateral part of the nail, leading to penetration of the soft tissue. Consequently, inflammation and foreign-body reactions may occur in this area. In our previous study, an alarmingly high rate of 46.2% of subjects were found to be wearing unsuitable shoes (12). Additionally, the practice of nail cutting has been correlated with ingrown nails in several studies, with improper techniques being identified as common etiological factors (12,6,7,10,13). Cutting the nail at an angle can result in the formation of spicules. As the nail grows out, these spicules can embed into the distal lateral nail fold, thereby provoking a foreign-body response. Therefore, trimming the nail too short or at an angle can cause the corners of the nail to be situated more proximally, leading to the corners growing inward towards the depth of the fold. In our previous study, 73.5% of patients trimmed their nails in a rounded fashion (12).

Prevention strategies are crucial and should include the use of well-fitting footwear that provides midfoot stability and ample space in the toebox to avert compression-related issues. It is also recommended to trim nails straight across to distribute force evenly and reduce the likelihood of nail dystrophies (2,14). When our subjects developed symptoms of onychocryptosis, they frequently sought initial treatment from manicurists and podiatrists. We believe that early diagnosis and proper management are crucial for professional athletes with onychocryptosis to prevent impairment of performance and quality of life. Therefore, providing education on this topic to both athletes and those who support them is essential.

However, in this current study involving professional athletes, when we assessed the predisposition to ingrown nails in relation to incorrect cutting habits and footwear choices, we did not find any significant difference in cases with ingrown nails. This suggests that professional athletes may be more attentive to their foot care.

Hyperhidrosis can compromise foot hygiene by causing maceration of the skin, and this moist environment may lead to foot infections. The edema associated with such infections can create conditions that promote the development of ingrown nails (6,7,15,16). In our previous study, the incidence of hyperhidrosis in patients with ingrown toenails was reported as 16.8% (12). Similarly, in this study focused solely on athletes, we found a comparable hyperhidrosis frequency of 15.7%. However, we did not observe a significant difference in the prevalence of hyperhidrosis between patients with ingrown nails and those without.

Ingrown nails are commonly observed in the hallux, which is the medical term for the big toe (12,17). The hallux bears a significant portion of the body's weight during walking, which can push the soft tissue upward around the edge of the nail, leading to ingrown nails. The hallux is also the toe most affected by the interaction between the foot and the shoe, as well as by any abnormalities in pedal biomechanics. The literature often reports a higher incidence of ingrown nails on the lateral (outer) margins of the nail (6,12,15,18). When a person stands, the hallux tends to rotate medially (inward), and when the foot is lifted, it returns to its original position. Concurrently, the body of the nail may move laterally, which is why ingrown nails are more commonly observed on the lateral side (15). Additionally, within the confines of a shoe, the second toe may be pressed against the lateral margin of the hallux, increasing pressure on that side and thus promoting ingrowth (13). Consistent with these findings, our study also found that ingrown nails were present in the first toe (hallux) of 41 cases.

Pico et al.'s study found a notable occurrence of onychocryptosis in athletes, linking it to nail plate hardness, which may be caused by the mechanical stress of sports activities. (8,9,19) Their research, involving 140 young athletes and non-athletes, also suggests that active males and non-active females

are more prone to ingrown toenails, indicating that physical activity and gender may influence the development of this condition. However, our study did not find a significant gender-related difference in the incidence of onychocryptosis, which could be due to variations in sample size, sporting activities included, or diagnostic methods. These contrasting findings highlight the complexity of factors contributing to onychocryptosis.

Zaraa et al.'s study examined sports-related skin issues among 30 athletes, consisting of 18 soccer players and 12 basketball players, and reported that 87% prevalence of skin infections were mostly fungal (20). The average age of the cohort was 25.3 years, ranging from 18 to 35 years. In addition to infections, traumatic skin lesions were also common, with 20 of the 30 athletes affected, primarily by calluses and nail disorders, which comprised 80% of the traumatic dermatoses noted. These findings highlight the importance of routine dermatological screenings for athletes to ensure early detection and treatment of sports-related dermatoses that could impair performance. The higher occurrence of dermatoses compared to our younger cohort may reflect the older age and longer sports involvement of Zaraa et al.'s participants.

Athletes, including soccer players, are prone to cutaneous mycotic infections. The chronic sweating experienced by athletes leads to skin maceration, which compromises the protective barrier of the stratum corneum and increases susceptibility to infections. The interdigital spaces of the feet are particularly vulnerable. The combination of warmth, friction, and physical contact, along with communal use of showers and changing areas, contributes to the high incidence of viral, bacterial, and fungal infections in athletic populations. Onychomycosis in athletes commonly affects nails that have been damaged or are under trauma, and this may be exacerbated by bacterial infections, potentially leading to paronychia. Prompt diagnosis and treatment are essential to reduce the spread of these conditions.

In a study by Purim KS et al., which involved 105 soccer players and 24 control subjects, tinea pedis was observed more frequently in the control group whereas onychomycosis was more prevalent among the athletes. The reduced incidence of tinea pedis in soccer players was attributed to professional foot care and health education initiatives (21).

Ergun et al. examined 137 football players for superficial fungal infections (4). Onychomycosis was diagnosed in 9.5% of the players (13 cases), with one case also displaying concurrent tinea pedis. Isolated tinea pedis was found in 3 cases (2.2%). Additionally, 20 players (14.6%) presented with subungual hyperkeratosis, 14 (10.2%) with yellow nail discoloration, 11 (8%) with onycholysis, and 5 (3.6%) with black discoloration of the nail. In 9 of the 20 players with subungual hyperkeratosis, no fungal growth was detected through direct microscopy or culture. Similarly, 6 of the 14 players with yellow nail discoloration showed

no fungal growth. Another study found that 18 out of 23 soccer players (78.26%) displayed no signs of mycotic infection. However, two players (8.70%) were diagnosed with tinea pedis, and three participants (13.04%) had onychomycosis concurrent with tinea pedis (22). Our study did not include a laboratory evaluation for fungal infections as per our research design. Nevertheless, medical histories revealed that 21 cases (17.5%) had a history of foot fungus, and 11 cases (9.2%) had a history of nail fungus.

Poor foot hygiene and a higher rate of fungal and bacterial infections can lead to inflammation and edema, which may predispose individuals to developing ingrown toenails (6,15). The discomfort caused by ingrown toenails typically results in increased attention to foot care. This level of care is likely to be even more pronounced among professional athletes.

Conclusion

It is imperative that athletes undergo routine dermatological screenings to identify and manage skin conditions early, preventing any adverse impact on their athletic performance. Within the population of professional athletes, we have observed a significant prevalence of ingrown toenail occurrences that directly correlate with the extended periods of sporting engagement. Interestingly, our study did not establish any significant relationship between this condition and the commonly acknowledged contributory factors, such as the practice of incorrect nail trimming techniques or the selection of inappropriate footwear. This unexpected finding might be attributed to the heightened diligence that athletes typically apply to their foot care routines, which could potentially counterbalance the effects of these otherwise contributory factors. Implementing an educational program specifically designed for athletes is vital. This program would teach athletes to recognize the early signs of nail and skin disorders, underscore the significance of maintaining proper foot hygiene, guide them in choosing suitable footwear, and instruct them on appropriate responses to injuries or infections.

Conflict of Interest:

The authors declare that there is no conflict of interest.

Financial Disclosure:

The authors do not declare any financial support

Ethical Declaration

For research articles:

Ethical permission was obtained from the Karadeniz Technical University, Medical Faculty Clinical / Human Research Ethics Committee for this study with date 2017 and number 44, and Helsinki Declaration rules were followed to conduct this study.

Authorship Contributions

Concept: D.A.A., L.B.S., Design: D.A.A., L.B.S., E.A., C.Y., İ.E.A., Supervising: D.A.A., L.B.S., EA, C.Y., İ.E.A., Financing and equipment: D.A.A., L.B.S., C.Y., İ.E.A.,

Data collection and entry: D.A.A., L.B.S., C.Y., İ.E.A.,
 Analysis and interpretation: D.A.A., L.B.S., E.A.,
 Literature search: D.A.A., L.B.S., E.A., Writing: D.A.A.,
 L.B.S., Critical review: D.A.A., L.B.S.

22.Purim KS, de Freitas CF, Leite N. Dermatofitoses podais em futebolistas [Foot dermatophytosis in soccer players]. *An Bras Dermatol.* 2009;84(5):550-552.

References

- 1.Metelitsa A, Barankin B, Lin AN. Diagnosis of sports-related dermatoses. *Int J Dermatol.* 2004;43(2):113-119
- 2.Adams BB. Sports dermatology. *Adolesc Med* 2001; 12: 305-322
- 3.Mortimer PS, Dawber RP. Trauma to the nail unit including occupational sports injuries. *Dermatol Clin.* 1985 Jul;3(3):415-20. PMID: 3830505.
- 4.Ergun M, Ertam , Aytimur D, legen Ç, Erboz S. Incidence of superficial mycotic infections in football players. *TURKDERM* 2001; 35: 312-314
- 5.Ergun 4. Levine N. Dermatologic aspects of sports medicine. *Sports Medicine.* 1980;3(4):415-24
- 6.Khunger N, Kandhari R. Ingrown toenails. *Indian J Dermatol Venereol Leprol.* 2012 May-Jun;78(3):279-89.
- 7.DeLauro NM, DeLauro TM. Onychocryptosis. *Clin Podiatr Med Surg.* 2004 Oct;21(4):617-30, vii.
- 8.Pico AM, Verjano E, Mayordomo R. Relation Between Nail Consistency and Incidence of Ingrown Toenails in Young Male Runners. *J Am Podiatr Med Assoc.* 2017;107(2):137-143.
- 9.Bordelon RL. Management of disorders of the forefoot and toenails associated with running. *Clin Sports Med.* 1985 Oct;4(4):717-24.
- 10.Griffin LY. Common sports injuries of the foot and ankle seen in children and adolescents. *Orthop Clin North Am.* 1994 Jan;25(1):83-93.
- 11.Levy LA. Prevalence of chronic podiatric conditions in the US. National Health Survey 1990. *J Am Podiatr Med Assoc.* 1992 Apr;82(4):221-3.
- 12.Arica IE, Bostanci S, Kocyigit P, Arica DA. Clinical and Sociodemographic Characteristics of Patients with Ingrown Nails. *J Am Podiatr Med Assoc.* 2019 May;109(3):201-206.
- 13.Günel I, Koşay C, Veziroğlu A, Balkan Y, İlhan F. Relationship between onychocryptosis and foot type and treatment with toe spacer. A preliminary investigation. *J Am Podiatr Med Assoc.* 2003 Jan-Feb;93(1):33-6.
- 14.Adams BB. Running-related toenail abnormality. *Phys Sportsmed.* 1999 Dec;27(13):85-7.
- 15.Langford DT, Burke C, Robertson K. Risk factors in onychocryptosis. *Br J Surg.* 1989 Jan;76(1):45-8.
- 16.Haider A, Solish N. Focal hyperhidrosis: diagnosis and management. *CMAJ.* 2005 Jan 4;172(1):69-75.
- 17.Rauch C, Cherkaoui-Rbati M. Physics of nail conditions: why do ingrown nails always happen in the big toes? *Phys Biol.* 2014 Oct 16;11(6):066004.
- 18.Darwish FM, Haddad W, Ammari F, Aoudat Z. Association of abnormal foot angles and onychocryptosis. *Foot (Edinb).* 2008 Dec;18(4):198-201.
- 19.Jenkins DW, Cooper K, O'Connor R, Watanabe L, Wills C. Prevalence of podiatric conditions seen in Special Olympics athletes: Structural, biomechanical and dermatological findings. *Foot (Edinb).* 2011 Mar;21(1):15-25.
- 20.Zarâa I, Trojjet S, Mokni M, El Euch D, Laabidi H, Mezlini S, Ben Osman Dhahri AB. Les dermatoses du sportif: a propos de 30 athletes [Dermatologic disorders of the athlete: a report of 30 cases?]. *Tunis Med.* 2008 Oct;86(10):865-8. French.
- 21.Purim KS, Bordignon GP, Queiroz-Telles Fd. Fungal infection of the feet in soccer players and non-athlete individuals. *Rev Iberoam Micol.* 2005;22(1):34-38.