Epidemiological aspects of the feet mycosis in a Chinese soccer team

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ABSTRACT

Podal fungal infections can interfere in the sportive performance, since they provoke discomfort and pain in the athletes. The purpose of this study was to assess the prevalence of podal fungal infections in a professional soccer team, verifying the more frequent agents and the predisposing factors to that condition. The research had a transversal and descriptive outlining. The sampling was composed by twenty-two 23 to 36 years old male athletes from the professional Chinese soccer team on the occasion they participated in a game series in Curitiba (PR). All athletes were clinically assessed, and they were submitted to mycological examinations (direct and culture) of the skin and nail's squamas from their feet, as well as to a histopathologic study of the ungual fragment. The results found were: twelve cases (54.5%) did not present mycosis; 5 cases (22.72%) presented isolated onychomycosis, and 5 cases (22.72%) presented onychomycosis associated to *tinea pedis*, having as major isolated agent the *Trichophyton rubrum*. The predisposing agents pointed by athletes included: bath in a public place (85%), sports practice (76%), use of closed shoes (70%), contact with pets (63%), and irregular feet hygiene (50%). **Conclusion:** The frequency of the onychomycosis in Chinese athletes was higher than in the general population. The most frequent agent found it was the *Trichophyton rubrum*. The individual habits may contribute to the acquisition of these fungal infections added to the direct trauma provoked by the shoe and the ball, as well as to the physical contact during the trainings and games that may favor the cutaneous and ungual injuries.

Keywords: Soccer athletes. *Tinea pedis*. Onychomycosis.

INTRODUCTION

The clinical importance of the feet mycosis was recently shown in the Achilles Project that had the proposal to increase the worldwide knowledge on diseases attacking that anatomic region, and stimulating the early diagnosis and medical treatment when the first discomfort signals appear[1-4].

In Europe[2,3], that Project revealed a 35% prevalence of fungal infections among the general population. In individuals attacked, the most diagnosed diseases were the *tinea pedis* (22%), and the onychomycosis (23%). In Asia[4], the prevalence of the *tinea pedis* was a little higher (37%), while the onychomycosis (23%) showed similar results than the ones found in the European study.

The Achilles-Brazil Project did not comprise the accomplishment of mycological examinations, but among the clinical suspicions of fungal infections, the isolated onychomycosis was the most frequent one (38.40%), and male obese and diabetic individuals presented a higher amount of suspicions of feet infections[5].

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The prevalence of feet mycosis varies according to the geographic region assessed, the weather conditions, social-economical level of the population, age level, and predisposing factors such as co-morbity and individual habits. The bath in a public place, the use of closed shoes, contact with pets, and insufficient feet hygiene are considered risk factors to acquire the podal fungal infections. The most likely transmission way is the direct contact with contaminated human beings, animals or ground, or the indirect contact through the exposition of contaminated objects and floors[4-7].

Dermatophytes are responsible by the major number of cases, and among other etiologic agents, it can be pointed out the *Trichophyton rubrum*[5]. Yeasts and non-dermatophyte fungi are less isolated microorganisms, and in some cases, the associated infection occurs through the bacteria and yeasts. Once acquired, the mycosis can be disseminated to other portions of the body, such as the inguinocrural region, or even to another part of the feet, presenting a bias towards the chronicity[4,5,8].

When it is not appropriately treated, the fungal process may cause discomfort, pain, and even cellulitis in the lower limbs, making difficult or even impeding elite athletes to participate in trainings or competitive games. In the event of an acute or cutaneous infection, the participation in sportive events should be counterindicated, mainly in sports with intense personal contact, as is the case of the soccer game[9].

In these events, mainly when the *tinea pedis* is infected or associated to the onychomycosis, it surpasses the individual to be reflected in the collective. Added to the contagion issue that perpetuates the fungal infection into the environment, the functional limitations to those activities involving the feet and nails can constitute a serious problem as to the sportive team performance. Therefore, the assessment, the early diagnosis, the appropriate handling and the prophylaxis are favorable factors for the necessary health, aiming the adequate practice of the profession.

That mycosis has been related in the sports practice. Nevertheless, several points are still unclear as to its occurrence in professional athletes. There still are several unsolved questions related to its importance among soccer athletes, whose main work instruments are their feet[10].

The purpose of this study was to assess the prevalence of the mycosis in the feet region, identifying the most frequent agents and the predisposing agents to fungal infections in professional Chinese soccer players.

METHOD

It was performed a transversal and descriptive study assessing the presence of mycotic injuries in the feet in twenty-two male Chinese athletes with ages from 23 to 36 years old from a professional soccer team who participated in games accomplished in the Curitiba City (PR) between July and August, 2001.

The research protocol was approved by the Human Research Ethics Committee from Hospital de Clínicas of the Paraná Federal University, complying with the Resolution 196/96. It was assured to all participants the confidentiality and anonymity of their identity and information.

The medical attendance to athletes started by those presenting onychopathies by request from their coach, and that was an opportunity to assess the whole team. After the written free and informed consent both in Chinese and in Portuguese with the same content was signed, and with the assistance provided by the official translator for the group, all individuals were interviewed and clinically assessed, in order to obtain the data as to the occurrence of mycosis in the feet region, when they were submitted to the mycological investigation from their nails and skin.

During the interview, all personal data were obtained as to their profession, habits, and care with their feet, and those factors associated to the acquisition of superficial mycosis were verified[5].

The physical examination was performed by a dermatomycologist, and the assessment emphasized the feet region. The anthropometrical data related to the weight (kg) and height (m) informed by athletes were used to calculate the body mass index (BMI).

The nail and skin squama samplings were collected, as well as material from their plantar and interdigital regions, in order to perform the direct and culture mycological examination based on data found in the literature[5,8,11], as well as a histopathologic examination of the PAS-stained ungual fragment with digestion, aiming to assess the invasion of fungal elements inside the keratin[12].

Athletes were classified in two subgroups, according to the presence or not of podal mycosis, and these subgroups were divided as to their position in the field: forwards, attacker, mid-fielder, goalkeeper.

The statistical analysis was performed through the calculation of the mean and standard deviation, and all data are presented on the tables and graphics. The non-paired t-Student test was used in the quantitative variable analysis considering as significant $p < 0.05$.

RESULTS

The assessed athletes' sampling was constituted by twenty-two male individuals whose main features are presented on table 1. Both subgroups (with and without mycosis) are not significantly different as to the age, weight, height, body mass index, and time of profession.

TABLE 1
Mean values and standard deviation of the major features of the assessed Chinese soccer players

Major features	Athletes with mycosis (n = 10)	Athletes without mycosis (n = 12)	Total of the group (n = 22)
Age (years)	26.80 ± 3.74	24.75 ± 4.09	25.68 ± 3.98
Weight (kg)	72.90 ± 4.77	76.58 ± 7.65	74.91 ± 6.63
Height (m)	1.75 ± 0.04	1.76 ± 0.04	1.76 ± 0.04
Body mass index (BMI)	23.76 ± 1.01	24.55 ± 1.60	24.19 ± 1.39
Time of the profession (years)	7.70 ± 4.60	5.92 ± 3.20	6.73 ± 3.91

The distribution of athletes with and without mycosis, according to their field positioning can be seen on table 2. None of the goalkeepers had feet mycosis.

The percentage of cases presenting mycosis on feet spots upon the assessment of the prevalence of such infections is presented on table 3. Among the assessed athletes, 10 (45.54%) presented onymycosis isolate or associated to the *tinea pedis*, and 12 (54%) did not present mycosis.

TABLE 2
Percentual distribution among Chinese athletes with and without podal mycosis according to their field positioning

Field positioning	Athletes with mycosis (n = 10)	Athletes without mycosis (n = 12)	Total of the group (n = 22)
Forwards	3 (30%)	3 (25%)	6 (27%)
Attacker	1 (10%)	2 (17%)	3 (14%)
Mid-fielder	5 (50%)	1 (8%)	6 (27%)
Lateral	1 (10%)	3 (25%)	4 (18%)
Goalkeeper	0 (0%)	3 (25%)	3 (14%)
Total	10 (100%)	12 (100%)	22 (100%)

TABLE 3
Prevalence of the mycosis in the feet region of Chinese athletes

Mycosis in the feet regions	Chinese athletes (n = 22)
Absence of mycosis	12 (54.50%)
Isolated onychomycosis	5 (22.72%)
Onychomycosis associated to the *Tinea pedis*	5 (22.72%)
Total	22 (100.00%)

The direct mycologic examination was positive in both cases (9.09%) on the heel; in two cases (9.09%) it was positive also at the interdigital spot, and in one case (4.54%) on the nail.

In every case, the culture of the material collected from heel spots was negative; in four cases (18.18%) on the interdigital spot, and in two cases (9.09%) on the nails.

The histopathologic examination was positive in two cases (9.09%). The results of the laboratorial examinations are shown on table 4.

TABLE 4
Results of the laboratorial examinations attained in the study

Area/material	Laboratorial examinations	Chinese athletes (n = 22)
Plantar region (squamas)	Direct examination	2 (9.1%)
	Culture	0 (0%)
Interdigital region (squamas)	Direct examination	2 (9.1%)
	Culture	4 (18.2%)
Nail (squamas)	Direct examination	1 (4.6%)
	Culture	2 (9.1%)
Nail (fragment)	Histopathology	2 (9.1%)

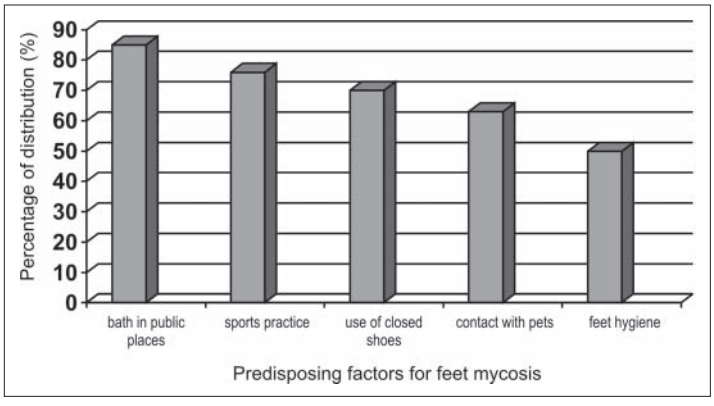
The main etiological agents isolated in ten athletes presenting mycosis were the *Trichophyton rubum* and the *Trichophyton mentagrophytes*. There was one bacterium case. The composition of the microbiota found is reported on table 5.

TABLE 5
Agents identified in the Chinese athletes with feet mycosis

Agent identified	Chinese athletes (n = 10)
Trichophyton rubrum	66.6%
Trichophyton mentagrophytes	16.6%
Candida spp.	0%
Bacteria	16.6%

When considering individual habits, the predisposing factors to acquire superficial mycosis, such as the bath in public places (85%), spots practicing (76%), the use of closed shoes (70%), contact with pets (63%), and irregular care with the feet hygien (50%) are

shown on graphic 1. As to the issue of the daily hygienic measures, 11 athletes (50.0%) reported the regular habit of drying their feet, while 6 athletes (27.7%) reported to dry their feet once in a while, and in five cases (22.72%) they rarely did it.



Graphic 1 *– Predisposing factors to the mycosis in the feet connected to the individual's habits in Chinese athletes*

DISCUSSION

Upon the analysis of the main features among Chinese athletes presenting mycosis on their feet (table 1), it was comparatively observed a discrete increase in the mean age and time of professional actuation compared to athletes who did not present it. This maybe facilitates the higher physical wearing and overload on the body ends.

As to the position in the team (table 2), despite the inter-individual differences among athletes, the functions performed by midfielders requires high physiological demands and a great amount of distance to run[13], and this would imply in damages to the feet's health and integrity.

The biomechanical factors present in the soccer activities actuate in a prolonged way, with sufficient intensity and time. They can be able to cause the appearance of injuries if they surpass the adaptation or recovery ability of the osteomuscular system and its cutaneous liner[10].

In this study, the percentage of the *tinea pedis* cases (table 3) was similar to what was found in the European Achilles Project[2,3], but below the results found in the Asian study[4] and disagrees to other studies performed among the Chinese population[14,15]. The fact that the *tinea pedis* solely was not detected can be explained by the natural progression of the fungal process, since in general, the onychomycosis is preceded by the *tinea pedis*.

Upon the verification of the results found as to the solely onychomycosis, it can be verified a similarity related to the European and Asian percentages, but whenever it is associated to the *tinea pedis*, the percentual value found was higher (45.5%). Soccer players constitute a professional group with high bias to integumentary injuries[10].

In the soccer game, the attrition provoked by the too tight football shoes, the trauma produced by the impact of the ball and the feet on the ground, as well as the direct contact between athletes during the trainings and games can produce repetition micro-traumas both in the nails and on the skin. Generally, these athletes run the risk to develop traumatic entities in their feet, such as ungual dystrophy, corns, and blisters, as well as mycosis, virosis, and other dermatosis[16].

Five athletes presented onycopathies, and that motivated the dermatologic consultation, when it was verified the chronic ungual alterations consequence of the fungal infection, parallel to the subungual hematomas that disguised the diagnosis and complicated its evolving course, and thus making difficult to handle it.

The hallux was the most compromised spot, revealing fragile and easy broken nails with distal abruption, transversal canalizations, stained stripes due to the pigment accumulation, blood, debris, and air under the nails, followed by subungual hyperkeratosis. In the Asian study, the onychomycosis was also predominant in the hallux[4].

It is important to point out that the most frequent ungual alterations, that means, the onycholysis, hyperkeratosis, dyschromias, dystrophies, and the subungual hyperkeratosis are among the differential diagnosis for other onychopathies. In soccer players, it is more difficult to analyze the ungual pathologies, since they always include traumatic injuries in the feet.

The coexistence of the ungual and cutaneous infection in other five athletes may have been increased by components of the international trips. It must be considered that the constant and prolonged working trips performed by the group seeking the Worldwide Soccer Championship preparation would interfere in their sleeping, nutritional, hygiene patterns, as well as in their organic resistance[17].

On the other hand, Huguer[18] pointed out that the impact of the extenuating physical exercises on the defense system may present opposite results, since it seems there is a temporary increase in the susceptibility for cutaneous infections by virus and fungi, such as the *Trichophyton* species.

As to the results found on the laboratorial examinations used in this study (table 4), it is known that the skin is an easily accessed spot to collect any material, and it allows the selection of the better spot presenting fungal activity. As to the nail, the material collection is not easy, due to the lack of collaboration from the patient, since it was necessary to obtain ungual squamas and fragments close to the healthy area, and this has caused some discomfort. Due to the technical difficulties, the correct interpretation of the findings was quite important, since negative examinations would not exclude the possibility of the onychomycosis[5,6].

The nail investigation may require multiple examinations to attain laboratorial confirmation. In this research, it was complemented by the histopathological examination of the ungual fragment, which was used to view the fungal structures of the ungual keratin[12,19].

Assessing the agents isolated in the culture, the *Trichophyton rubrum* was the prevalent fungus in the group (table 5), agreeing to the worldwide literature[2,3,5,7,14].

Nevertheless, as the urban development, the industrialization, the geographic location, the weather conditions, and the time of exposition to ultraviolet radiation periodically change the fungal microbiota composition in the whole world, it is important to know the types of regional fungi that may be relevant to the contagion and prognostic of the mycosis[20].

As to the predisposing conditions to the mycosis (graphic 1) found in the present investigation, according to those athletes, it was observed that the bath in a public place showed to be significant to the acquisition of podal fungal infections, whose possibility of occupational exposition was increased due to the trips, concentrations, and constant displacements. Agreeing with Araújo[20], high contamination levels in the common bath places cannot be reduced, unless the affected individuals are successfully treated.

The sports practice showed to be an important factor, as the high physical performance required from professional soccer athletes predisposes them to the occurrence of several aggravations. Although such collective risk exists in the sportive activity, it was not unanimously considered an individual risk by the assessed athletes.

The use of closed shoes has been described in the literature as a feasible habit associated to the acquisition of the mycosis in certain groups of patients or even in those considered healthy subjects, but who could be predisposed to injuries directly caused by the occlusive condition of the shoe, as well as by the implantation and multiplication of fungi both on the skin and in already injured or healthy nails[21-23].

Unlike the general population and other groups of workers, the assessed athletes were constantly exchanging shoes, stocks and equipment, as part of their daily process of the technical preparation before trainings and games.

Such peculiar characteristic of the professional soccer game allows time intervals for the feet occlusion, and this may help to reduce the heat and the necessary local humidity to develop the mycosis[10,19].

Despite the athletes informed that the contact with pets can be a predisposing factor to the acquisition of the superficial mycosis in the podal region, the main isolated agent from the epidemiologic point of view found in this study was the dermatophyte fungus from anthropophilic origin. These results are similar to the investigations performed among the Asian population[4,14,15].

According to the findings related as to their feet hygiene, it can be verified that half of the assessed group did not practice any regular prophylactic measure, and this could favor the mycosis. According to Braham[24], the athlete's skin remains wet for a long period of time, and this induces a real imbibition that may cause damages to the corneous layer, and the penetration of pathogens in the feet may occur in the entries through the contiguous solutions of the desquamation, blisters or interdigital fissures.

Nevertheless, when it is considering professionals with a good scholar level and good understanding level, it is possible that the socio-educational aspects as well as the organizational and environmental factors might have minimized the occurrence of cutaneous injuries, but without sparing the nails, that in this research appeared as being home for clinically significant injuries, perhaps augmented by the traumatisms.

In this study, the prevalence of the *tinea* pedis was similar to the data found in the literature, unlike the onychomycosis, that presented a higher prevalence among Chinese soccer players than in the Asian population, having as agent the *Trichophyton* rubrum. As to their individual habits, the bath in a public place was pointed by athletes as a predisposing factor to the acquisition of the feet mycosis.

The limitation of this study is related to the low amount of individuals of the sample, mainly related to the prevalence of podal injuries and the players' positioning inside the field.

At last, searching for information to make a comparative analysis to other teams as to that specie of fungal infections, it was possible to verify scarcity of investigations on the subject. Despite the data obtained, it remains a few unsolved questions, pointing that the matter must be further investigated in order to attain complementary data.

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