

Prevalence of *Tinea unguium* (Onychomycosis) in Toe Nails of boot wearing group in Owerri, Imo State, Nigeria

¹Ohalete , Chinyere .N, ²Dike-Ndudim Joy. N, ²Mbiaka, Judith. A and ²Nnodim Johnkennedy

¹Department of Microbiology, Imo State University Owerri, Nigeria.

²Department of Medical Sciences, Imo State University, Owerri.Nigeria.

Abstract

Foot mycoses are a frequent disease that represents a public health problem worldwide. This study among footballers in Owerri, Imo State, Nigeria, with the aim to evaluate the epidemiology of foot mycoses, in order to determine the etiological fungal agents and to identify possible risk factors, as well as investigate the treatment and preventive measures for the susceptible groups. A total of 50 samples were collected by nail scraping method; *Tinea unguium* was confirmed in 88.2% of cases using direct microscopy and cultural methods in lactophenol cotton blue and Sabouraud agar media respectively. A prospective study of fifty footballers was undertaken within one year. A complete mycological diagnosis was carried out on all footballers using direct microscopy and cultural methods in lactophenol cotton blue and Sabouraud agar media respectively. Confirmatory test such as germ-tube test was carried out on the yeast *Candida albicans* isolates for accurate identification. The results obtained were subjected to statistical analysis using percentage and ANOVA revealed that out of the 50 toe nail samples of footballers examined 28(56.0%) were positive for the infective agent on direct microscopy which served as the screening test. The causative pathogens of Ohalete , Chinyere N., Dike-Ndudim J.N, Mbiaka, J.A. and Nnodim J. Prevalence of *Tinea unguium* (Onychomycosis) in Toe Nails of boot wearing group in Owerri, Imo State, Nigeria. Journal of Medicine and Health Sciences. 2021; 1(1) 31 – 44

Onychomycosis isolated from fungal culture on Sabouraud agar medium, are dermatophytes, and the most frequent pathogen was *Trichophyton rubrum* 15(30.0%), yeast isolates were confirmed by germ-tube test, *Candida albicans* 9(18.0%). Non-dermatophyte molds were observed in 8(16.0%) cases and *Fusarium* species was the most frequent genus 14(28.0%) and *Aspergillus* species 4(8.0%). The main predisposing factors of fungal foot infections were practicing ritual washing (56.6%) and frequentation of communal showers (50.5%). The age group 31- 35 years had the highest prevalence of onychomycosis 12(92.30%) and age group 16-20 years presented the lowest prevalence of onychomycosis 4(28.57%). The confinement of toe nail inside dark, warm and moist environment inside shoes is the major factor that promotes this fungal infection. Therefore proper care of toe nails and boots is necessary to prevent the increasing rate of those infection.

Keywords: Mycoses, epidemiology, *Tinea unguium*, Onychomycosis, infections.

1.0 Introduction

Onychomycosis also known as *Tinea unguium* is a fungal infection of the nail [1] (Ada *et. al.*, 2018). It is the most common disease of the nail and constitutes about half of all abnormalities. This condition may affect toe nails or finger nails. Toe nail infections are partially the most common, because toe nails are more likely to be infected with fungus, than finger nails, since toe nails are often confined in a dark, warm, and moist environment inside shoes which encourages their growth. Complications may include cellulites of the lower leg (Robert and Andrew, 2018). These infections are frequently ignored because though they are unsightly, they rarely cause discomfort.

The nail plate can have a thickened, with yellow or cloudy appearance: The nails can become though and crumbly, or can separate from nail bed. There is usually no pain or other bodily

symptoms, unless the disease is severe. This disease has an impact on the patient quality of life and affect the social relationship and psychological health and makes work related activities difficult. The quality of life will be affected especially when the manifestation occurs in visible areas of the body such as face, arms, hands and nails, in addition to the consequent physical limitation and pain that result from the disease. (Ventura *et. al.*, 2017). The causative pathogens of onychomycosis include dermatophytes, yeast and non-dermatophytic molds.

Approximately 60-70% of infection are caused by dermatophytes fungi, the most common is *Trichophyton rubrum* (>50%) and *T. Methagrophytes* (20%), and another 30-40% have non-dermatophyte filamentous fungi and yeast as etiological agents. (Lipner *et al.*, 2019). The dermatophyte *Trichophyton rubrum* is the major cause of onychomycosis. After originating in West African, Southeast Asia, Indonesia and Northern Australia, *Trichophyton rubrum* spread to Europe, north and South America in the late 19th and early 20th centuries, were it found a niche with recently shod populace (Larone, 2006).

Onychomycosis often result from untreated *Tinea pedis* (feet) or *Tinea manuum* (hand). It may follow an injury to the nail. If all nail are affected then fungal infection is improbable. To avoid misdiagnosis as psoriasis, lichen planus, contact dermatitis, trauma, nail bed tumor or yellow nail syndrome, laboratory confirmation may be necessary. The two main approaches are potassium hydroxide (KOH) wet mount preparation, also known as Direct Microscopy and fungal culture. The examination is generally nail scrapping or clipping (Westerberg and Voyack, 2013).

Treatment of onychomycosis is challenging because the infection is embedded with the nail and is difficult to reach. As a result of full removal of symptoms is very slow and may take a year or more. Pharmacological treatment are either systemic antifungal medication such as terbinafine and itracolazole or topical such as nail paints containing ciclopirox or amorolfine.

Ohalete , Chinyere N., Dike-Ndudim J.N, Mbiaka, J.A. and Nnodim J. Prevalence of *Tinea unguium* (Onychomycosis) in Toe Nails of boot wearing group in Owerri, Imo State, Nigeria. *Journal of Medicine and Health Sciences*. 2021; 1(1) 31 – 44

Oral antifungal medications usually are administered over 3 month period. Two available brands, including lamisil, sporanox. These medications are fairly safe, with few contraindications, they should not be taken by patients with liver disease. Topical antifungal treatment (penlac) consists of the nail lacquer that is applied daily to affect nail. This medication may irritate surrounding skin in rare cases. Due to nail grow very slowly, and receive very little blood supply, it typically takes 6 months to a year for the nail to regain a healthy, clear, thin appearance (Gupta, 2000).

Some physicians decline to treat onychomycosis, despite the negative consequences of this infection on patient health and quality of life. Physicians who feel it unnecessary to treat onychomycosis may regard the disease as a cosmetic problem rather than a health problem. Physicians may also be concerned that the risk of systemic therapy may also be concerned that the risk of systemic therapy may outweigh the benefits. The World wide incidence of onychomycosis is increasing and a number of factors contribute to this rise. (Almed et al., 2010)

2.0 METHDOLOGY

The clinical diagnosis of anychomycosis is quite accurate but laboratory confirmation is always needed to avoid wrong diagnosis as well as unnecessary exposure to antifungal medication. The most common method used for the diagnosis of onychomycosis are direct microscopic examination and fungal culture. (Feng *et al* 2013; Liu *et al.*, 2013). The appropriate material and method for the test was used and applied.

2.1 STUDY AREA / POPULATION

The area of study was Owerri in Imo State. Owerri is a city in south eastern Nigeria. It is the capital of Imo State and is set in the heart of the Igbo land. Owerri consists of three local government areas (Owerri Municipal, Owerri North and Owerri West). It currently has a population of about 400,000 and is approximately 40 square miles in area. Nail samples were Ohalete , Chinyere N., Dike-Ndudim J.N, Mbiaka, J.A. and Nnodim J. Prevalence of Tinea unguium (Onychomycosis) in Toe Nails of boot wearing group in Owerri, Imo State, Nigeria. Journal of Medicine and Health Sciences. 2021; 1(1)

collected from toe nails of 50 footballers (Vejle Football club Owerri) by nail scrapping. The population survey was stratified according to age from 16 to 35 years into four group (16 to 20 years), second group (21 to 25years), third group (26 to 30 years) and the fourth group (31 to 35 years).

2.2 Subjects Assessment

The assessment of the participants was conducted and consisted of an interview by using a questionnaire item prepared and collection of specimens for microbiological studies. All subjects completed the questionnaires providing information's on age, gender (all men), patient's history of toe nail care and other nail related issues.

2.3 Specimen Collection

The specimens were collected for microbiology analysis. Specimens were collected by vigorously scrapping the distal portion of the nail, the underside area as well as the nail bed in a small clean paper envelope.

2.4 Laboratory Processing & Analysis

All specimen collected were examined by direct microscopy in KOH and culturally. The biological materials were placed in small paper envelopes and were transported to the laboratory.

2.4.1 Direct Microscopy (KOH Wet Preparation)

The first step in the diagnosis of onychomycosis is usually the direct microscopic examination of scrapping from the nail bed and nail plate for the presence of fungal elements. This procedure is termed KOH wet preparation test because, material obtained from the nail was mixed with potassium hydroxide solution before microscopic visualization. This chemical (potassium hydroxide) dissolves everything in the sample except for the fungal element which

can then be identified through a microscope at x10, x40. Although this method detects the presence of infection, it does not identify the specific pathogen (Kane and Summerbell, 1997).

Procedure:

The lesion was cleaned with methylated spirit to remove contaminations such as bacteria and allowed to air dry. Sharp blade was used to scrap the nail, the underside area as well as the nail bed, where new growth of the fungus is most likely to occur. Two drops of 40% KOH was placed on a clean grease free slide. With the aid of a moisten wire loop, a quantity of the scrapping was transferred to the slide and teased out for some seconds using mounting needle. It must be covered with cover slip and pressed down to ensure uniform spreading. The slide was passed through the bunsen flame to fasten or hasten the digestion processes of the debris and exclude air bubbles. It was allowed to stand for 30 minutes and then viewed microscopically using x10 and x40 objective lenses.

2.4.2 Cultivation:

The medium for the fungal culture was Sabouraud dextrose agar. It was bought commercially and prepared according to the manufacture's instruction. Chloramphenicol was added to suppress the growth of bacteria that can overrun the culture.

Procedure:

Nail specimen was pulverized and placed on medium, taking care not to close the cap tightly. This was incubated at room temperature for one month, and then monitored weekly for fungal growth.

3.0 STATISTICAL ANALYSIS

Data for this study were statistically analyzed by percentage as follows:

$$\text{Prevalence (\%)} \text{ of positive cases} = \frac{\text{No of positive cases}}{\text{Total number of samples}} \times \frac{100}{1}$$

$$\text{Prevalence (\%)} \text{ of fungal organisms} = \frac{\text{rate of occurrence}}{\text{Total number of samples}} \times \frac{100}{1}$$

RESULTS

Out of the 50 subjects samples examined in this study 28 (56.0%) were found to have positive for cases on direct microscopy. According to age group distribution the age group 16-20 years has the lowest percentage of occurrence with 4 (28.57%), 21-25 years with 3 (30.0%), 26-30 years with 9 (69.23%) and the age group 31-35 years has the highest percentage of occurrence with 12 (92.31%). The most frequent fungal organisms isolated were *Trichophyton rubrum* 15 (30%), *Candida albicans* 9 (18%) and *Aspergillus sp* 4 (8%).

TABLE 1: Age Distribution Of Positive Cases And Percentage Prevalence

Age Distribution	Total Number Of Samples	Number Of Positive Cases	Prevalence(%)
16-20	14	4	28.57
21-25	10	3	30.00
26-30	13	9	69.23
31-35	13	12	92.30
Total	50	28	56.00

TABLE 2: Percentage Of Occurrence Of Micro Organisms Isolated

Micro Organisms	Total Number Of Samples	Rate Of Occurance	Prevalence (%)
<i>Trichophyton rubrum</i>	50	15	30
<i>Candida albicans</i>	50	9	18
<i>Aspergillus sp</i>	50	4	8

TABLE 3: Colonial Apperance Of Isolates And Criteria For Idetification

Micro Organisms	Colonial Colour	Reverse Colour	Colonial Textures	Identification
<i>Trichophyton rubrum</i>	White	Wine red	Cottony	
<i>Candida albicans</i>	Creamy White		Moist and smooth	Gem-tube positive
<i>Aspergillus sp</i>	Brownish Black		Powdery	

5.0 DISCUSSION

Onychomycosis is a common infection of nail and has been recognized as being a very difficult type of fungal infection to treat. Although not life threatening, this infection constitute an important public health problem because of its high prevalence and associated morbidity. The disease can have certain negative consequences on patients, such as pain and can potentially undermine their work and social lives (Scher, 1994).

Dark, warm, moist environment favours the growth of fungal organisms that causes this infection (Perea *et. al.*, 2000). The fungi can live alongside the nail, or under the nail. However, this may depend on many factors such as the progression or severity of the condition. Increasing age, and nail trauma are some of the major risk factors of onychomycosis (Summerbell, 1997). The reason for decrease in the prevalence of onychomycosis in younger age groups relative to older age groups may include reduced exposure to fungus, because lesser time is spent in environments containing pathogens; faster nail growth; smaller nail surface for invasion, and lower prevalence of *Tinea pedis*. Defect trauma to the nail may result from wearing of occlusive foot wear like boots.

This was evidenced in this study as 28 (56.0%) football subjects were found to have positive results (see table 1). this study showed that *Trichophyton rubrum* 15 (30%) was the most frequent isolated fungal organism, followed by *Candida albicans* 9 (18%)) and *Aspergillus sp* 4 (8%) see table 2. The prevalence of onychomycosis was found to be highest in age group 31-35 years with 92.31%. This is in line with the report of Schein *et. at.*, 1997. Identification of *Trichophyton rubrum* in this study is in accordance with the report of Dike-Ndudim *et al.*,(2013), but with higher prevalence.

5.1 CONCLUSION AND RECOMMENDATIONS

Wearing of boot by footballers should not be stopped because of all these fungi isolated from their nails, but proper care of their toe nails and boots is necessary to prevent the increasing rate of this infection.

Therefore, the following precautions are recommended. Old foot wear (boots) should be discarded and multiple pairs of new boot purchased. Insoles of boots should be replaced if discarding foot wear is not possible. Antifungal powder or disinfectant should be applied to boot, in order to reduce fungal reservoir that develops. Feet should be kept clean and dry in order to reduce the growth of the fungal pathogens. Wet cotton socks should not be worn before wearing boot

REFERENCES

- Ada Medical team, Onychomycosis: current trends in diagnosis and treatment.” American Family physician”. December 2013).
- Ada Medical team, Onychomycosis: current trends in diagnosis and treatment.” American Family physician”. December 2013).
- Ahmed, M. and Gupta S.A. (2010) Clinico-mycological study of Onychomycosis. Egyptian Dermatology online. 6:4-10.
- Chi, C.C., Wang, S.H., and Chou, M.C. (2005). The causative pathogens of onychomycosis in Southern Taiwan. *Mycoses* 48 (60): 413-420.
- Daniel C.R., Gepta, A.K., Dainiel, M.P., and Daneil, C.M. (1997). Two feet-one hand syndrome: a retrospective multicenter survey. *International Journal of dermatology* 36:658-660.
- Dike-Ndudim, J.N., Ukogo, I., Dike, K.O., Okorie, H.M., Uduji, H.I., Egbuobi, R.C., Ogoamaka, A., Nwosu, D.C. and Opara, A.U. (2013). Fungal agents associated with dermatophytosis among pupils in Isu Local Government Area (L.G.A), Imo State, Nigeria. *International Reasearch on Medical Science*, 1(3);
- Feng .J, Chen .J, Fan M. 2013 pathogenic analysis of 127. Cases of Onychomycosis J. Postgra 8:807-809
- Feng .J, Chen .J, Fan M. 2013 pathogenic analysis of 127. Cases of Onychomycosis J. Postgra 8:807-809
- Ohalete , Chinyere N., Dike-Ndudim J.N, Mbiaka, J.A. and Nnodim J. Prevalence of Tinea unguium (Onychomycosis) in Toe Nails of boot wearing group in Owerri, Imo State, Nigeria. *Journal of Medicine and Health Sciences*. 2021; 1(1) 31 – 44

- Gupta, A.K.(2000). Pharmacoeconomic analysis of ciclopirox nail lacquer solution 8% and the new oral antifungal agents used to treat dermatophyte toe onychomycosis in the United States. *American Journal of Academic Dermatology*. 43:S81-S95.
- Liu .C, Liu .F, Zhang .D 2013 Analysis of pathogenic fungi of onychomycosis from 29 cases. *Chin .J, Dermato Venerol Integra, .Trad W. med* 12:295-297
- Liu .C, Liu .F, Zhang .D 2013 Analysis of pathogenic fungi of onychomycosis from 29 cases. *Chin .J, Dermato Venerol Integra, .Trad W. med* 12:295-297
- Onychomycosis-Dermatologic disorder, Merck manuals professional edition February 2017. Retrived 2june 2018.
- Onychomycosis-Dermatologic disorder, Merck manuals professional edition February 2017. Retrived 2june 2018.
- Perea, S., Ramos, M.J., and Noriega, A.R. (2000). Prevalence and risk and factors of tinea unguium and tinea pedis in the general population in Spain. *Journal of Clinical Microbiology*. 38 (9): 3226-3230.
- Robert . B and Andrew . J (2018) Onychomycosis-Dermatologic disorder, Merck Manual, Professional Edition February 2017. Revised 2 June 2018.
- S.R. Lipner and R.K. seher, “Onychomycosis”, *Journal of the American Academy of Dermatology*, vol. 80, No 4. Pp. 835-851 2019
- S.R. Lipner and R.K. seher, “Onychomycosis”, *Journal of the American Academy of Dermatology*, vol. 80, No 4. Pp. 835-851 2019
- Ohalete , Chinyere N., Dike-Ndudim J.N, Mbiaka, J.A. and Nnodim J. Prevalence of Tinea unguium (Onychomycosis) in Toe Nails of boot wearing group in Owerri, Imo State, Nigeria. *Journal of Medicine and Health Sciences*. 2021; 1(1) 31 – 44

- Scher, R.K. (1996). Onychomycosis is more than a cosmetic problem. *Britain Journal of Dermatology*. 130 (43): 15.
- Summer bell, R.C. (1997). Epidemiology and ecology of onychomycosis. *Dermatology*, 194:32-36.
- Ventura, A. Mazzeo M. Gaziano, R. Galluzzo, M. Bianchi L. and Campione, E. “New insight into the pathogenesis of Nail psoriasis and Overview of treatment strategies,” *Drug design development and therapy* vol. 11 pp. 2527-2535, 2017
- Ventura, M. Mazzeo, R. Gaziano, M. Galluzzo, L. Bianchi and E. campione, “ New insight into the pathogenesis of Nail psoriasis and Overview of treatment strategies,” *Drug design development and therapy* vol. 11 pp. 2527-2535, 2017
- Westberg D.P, Voyack M.J, (December 2013) “ Onychomycosis current trends in diagnosis and treatment”. *American Family Physician*: 88(11): 762-70.