



Prevalence of Superficial Mycoses Affecting the Feet of Some Primary Schools Pupils in Jos Metropolis

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ABSTRACT

An investigation was carried out to determine the prevalence of superficial mycoses (Athlete's foot) affecting the feet of some primary schools pupils in Jos metropolis. About 50 pupils each from three locations (Primary Schools) were examined and samples (scrapings) from the feet were collected and analysed by a direct microscopy or direct wet preparation in the Medical laboratory of National Veterinary Research Institute (NVRI) Vom Plateau State. The result showed that only 31.3% were positive while 68.7% were negative out of the 150 pupils screened for superficial mycoses. The result of the distribution of the disease according to location showed that Barkin Acha Gyel had the highest number of infected pupils of 52.0% while the least is University of Jos primary school with 10.0%. The result of the distribution of the superficial mycoses by sex showed that the male pupils had the highest percentage of infection of 45.6% while the female counterpart had 15.5%. The result of the distribution of the disease by age showed that age group 11-15 years had the highest distribution of 57.1% while the least was 3-5 years of 2.0%. The study further revealed that *Tinea pedis* (Athlete's foot) was high and the most prevalent dermatophytes causing superficial mycoses in the feet of the primary school children which have been known to impact negatively on health and wellbeing of children. Thus control measures should target this vulnerable group to reduce its prevalence in the subsequent research.

Keywords: Prevalence, superficial, mycoses, pupils, Jos.

INTRODUCTION

Superficial mycoses also known as cutaneous mycoses, are usually confined to the outer layer of skin, hair and nails and do not invade living tissues. Athletes foot was first medically described in 1908 (Moriarty, 2012). Globally, athlete's foot affects about 15% of the population. Males are more often affected than females. It occurs most frequently in older children or younger adults (Hawkins and Smidt, 2014). Historically it is believed to have been a rare condition that became more frequent in the 1900s due to the great use of shoes, health clubs, war, and travel (Moriarty, 2012). The fungi are called dermatophytes or more properly keratinophilic fungi which produces extracellular enzymes (keratinases) which are capable of hydrolyzing keratin (Chukwu *et al.*, 2011). Dermatophytosis (dermatomycosis) or ring worm infection which ranked as one of the most common cutaneous conditions all over the world is simply a fungal related infection of the stratum corneum of the epidermis and keratinized tissues such as skin, hair and nails of humans and animals (Popoola, *et al.*, 2006; Amen, 2010). These keratinophilic and keratinolytic ascomycetous molds are recognizable by their typical macrospora, which are also used to identify their genera (White, *et al.*, 2008). Tinea is a mycosis caused by dermatophytes and filamentous fungi that invade the keratinized tissues. The most frequent agents are anthropophylic or zoophilic species like *Trichophyton rubrum* (Havlickova *et al.*, 2008).

Athlete's foot a chronic superficial fungal infection of the foot, especially of the skin between the toes and on the soles (Kaushik, 2015). It is common worldwide and is most commonly caused by

Trichophyton rubrum, *T. mentagrophytes*, and *Epidermophyton floccosum* (Hainer, 2003). Adults are most susceptible. The wearing of constricting footwear such as sneakers seems to induce the infection. A malodorous dermatophytosis affecting moist, warm toe webs and soles of feet; Athlete's Foot often occurs in athletes, especially in adolescent men, and causes maceration, flaking, peeling, erosion, and pruritus (Kaushik, 2015). Risk factors Poor hygiene, occlusive footwear, prolonged moisture of skin, minor skin or nail injuries; tinea infections are contagious, and can be passed through direct contact, or contact with items such as shoes, stockings, and shower or pool surfaces (Bell-Syer, et al., 2012).

Athlete's foot, known medically as *Tinea pedis*, is a common skin infection of the feet caused by fungus (Bell-Syer, et al., 2012). Signs and symptoms often include itching, scaling, and redness. In severe cases the skin may blister. Athlete's foot fungus may infect any part of the foot, but most often grows between the toes (Moriarty, 2012). The next most common area is the bottom of the foot. The same fungus may also affect the nails or the hands (Rapini, 2007). It is a member of the group of diseases known as tinea. *Tinea pedis* is caused by a number of different fungi (Moriarty, 2012). These include species of *Trichophyton*, *Epidermophyton*, and *Microsporum* (Rapini, 2007). The condition is typically acquired by coming into contact with infected skin, or fungus in the environment (Bell-Syer, et al., 2012) Common places where the fungi can survive are around swimming pools and in locker rooms. They may also be spread from other animals (Hawkins and Smidt, 2014). Usually diagnosis is made based on signs and symptoms; however, it can be confirmed either by culture or seeing hyphae using a microscope (Rapini, 2007). *Tinea pedis* is caused by a number of different fungi. These include species of *Trichophyton*, *Epidermophyton*, and *Microsporum*. The condition is typically acquired by coming into contact with infected skin, or fungus in the environment. Common places where the fungi can survive are around swimming pools and in locker rooms. Usually diagnosis is made based on signs and symptoms; however, it can be confirmed either by culture or seeing hyphae using a microscope (Rapini, 2007). Some methods of prevention include avoiding walking barefoot in public showers, keeping the toenails short, wearing big enough shoes, and changing socks daily (Rapini, 2007). When infected, the feet should be kept dry and clean and wearing sandals may help (Mahmoud, 2009). Treatment can be either with antifungal medication applied to the skin such as clotrimazole or for persistent infections antifungal medication that are taken by mouth such as terbinafine (Mahmoud, 2009). The use of the cream is typically recommended for four weeks (Mahmoud, 2009). *Trichophyton rubrum*, *Trichophyton mentagrophytes* and *Epidermophyton floccosum* are responsible for vast majority cases of *Tinea pedis*; throughout the world of keratinophilic organisms, *Trichophyton rubrum* is the most common pathogen associated with chronic *Tinea pedis* and most common anthropophilic dermatophyte infection ever seen (Hainer, 2003). A recent study showed that *Tichophyton rubrum* accounted for over 76% of all dermatophytes infections (Weinstein et al., 2002) and may account for over 2/3 of all *Tinea pedis* infections. Another pathogen known to cause *Tinea pedis* infection and is *Epidermophyton floccosum* responsible for 5% of the anthropophilic fungus infections found worldwide and has been incriminated in several types of *Tinea* infections. They are flat colonies and grainy, yellow to brown in colour and have separate hyphae with club shape macroconidia. There are no microconidia observed in this species, but clamidoconidia can sometimes be seen in older colonies (Sutton, et al 1998). Literature abounds on the health problems such as superficial disfigurement and deep invasion of human tissues due to symptomatic dermatophytoses, spectrum of etiological agents and epidemiology of dermatophytic infections from different parts of the world especially Nigeria (Sahin et al, 2004; Ngwogu and Otokunefor, 2007; Nweze, 2010b). Nigeria being a developing nation located in the tropics with wet humid climate falls into the category of regions with high prevalence of dermatophytosis especially in school children of rural, sub-urban and urban areas (Gugnani and Njoku-Obi, 1998, Rudy 1999). Sporadic reports on the frequency of dermatophytes and dermatophytosis emerging from different parts of the country agreed with the work of Hay, (2003). Over the past decade, many fungi that were once thought not to infect humans have suddenly emerged as human pathogens. A number of these host factors have suddenly immersed as human pathogens and this host factors have contributed to the prevalence of these fungi in *Tinea pedis*. This work is aim at ascertaining the prevalence of *Tinea pedis*/Interdigitale among primary school children of different age and sex groups.

MATERIALS AND METHODS

Study Area

The study was carried out in the University of Jos, Barkin Acha and Rantya Gyel primary schools all within Jos metropolis of Plateau State.

Study Population

The studied populations were within age groups of 3 to 15 years old who showed apparent symptoms of mycosis on their feet.

Sample Size

Prevalence rate of Disease: $N = z^2 p(1-p) / d^2$

N = the desired sample size

Z = the normal standard deviation set at 1.96 which correspond to the 95% confidence level.

P = the proportion in the target population estimated to have a particular characteristics.

d = the degree of accuracy desired usually set at 0.05.

A total of 150 children were recruited for the study; 50 from each of the three schools.

Ethical Consideration (Ascent)

Permission was sought and obtained from FCVMLT, NVRI Vom, the three primary school authorities, as well as the parents of the selected children.

A description of the study was provided to the children's parents or guardians and their consent was obtained, together with the response of the written questionnaire. Personal data were compiled; age and sex of child as well as determining whether their feet and shoes were most often exposed to moisture (dampness).

Specimen Collection

Each child was visually examined; samples (scrapings) from the feet were collected using sterile blunt blade. The interdigital surfaces of the feet was sterilized with 70% alcohol and scraped into clean carbon paper, it was folded aseptically and recorded appropriately.

Processing Of Samples

The samples were processed by direct microscopy of Potassium hydroxide (KOH) preparation.

Direct Wet Preparation Using (KOH).

-A portion of the scrapings were placed aseptically on a clean grease free glass slide with a sterile scalpel blade.

-A drop of 10% KOH solution was added on the slide.

-It was heated gently to dissolve the cells while keeping the fungal hyphae intact.

-It was examined under the microscope under low ($\times 10$) power and ($\times 40$) medium power of the microscope.

Inoculation Procedure

A Portion of the skin scrapings that was collected were placed on the agar slants and smeared. It was then incubated at room temperature for 3-15 days for the growth of the colonies. The agar slants were checked starting from the 3rd day to the 15th day. Specimens showing growth were stained using Lactophenol in cotton blue.

Staining Procedure

-A portion of the growth on the agar slant was picked using a sterilized straight wire and was placed on a clean grease free slide containing few drops of Lactophenol in cotton blue.

-The preparations was teased gently and covered with a cover slip avoiding over floating and air bubbles.

-It was then examined under the microscope using ($\times 10$) low and ($\times 40$) medium power objectives.

-The result was observed under microscope with comparison from the mycology atlas for the presence of complete identification of hyphae, macro and micro conidia in positive cases of *Tinea pedis*.

Analysis

i.) Prevalence in the schools will be determined.

ii) Prevalence according to age will be determined.

iii) Prevalence according to sex will be determined.

RESULTS

A total of 150 students were examined for superficial mycosis 47 (31.3%) were positive while 103 (68.7%) were negative for superficial mycosis among selected school children in Jos metropolis (Table 1). Of the 50 pupils examined in University primary school, 5(10.0%) were positive and 45 (80.0%) tested negative. In LGEA Primary School Barkin Acha, 50 pupils were examined, out of which 26 (52.0%) were positive while 24 (48.0%) were negative and in L.G.E.A Abattoir, 50 pupils were examined out of which 16 (32.0%) were positive and 34 (68.0%) were negative for superficial mycosis. The result showed a significant difference (p = 0.001) in the prevalence of superficial mycosis across the studied schools with L.G.E.A primary school Barkin Acha Gyel having the highest infection rate of 52.0% and University of Jos primary school having the least (10.0%) (Table1). Meanwhile, the result of sex distribution for superficial mycosis is showed that of the 79 male school children examined for superficial mycosis, 36 (45.6%) were infected while 43 (54.4%) were negative for the males while 11 (15.5%) out of the 71 examined were positive for female and 60 (84.5%) were negative. This result showed a significant difference (P=0.001) in the infection rate of superficial mycosis in male (45.6%) than in female (15.5%) (Table2). Result of age distribution of superficial mycosis is as showed that of the 50 children between ages 3-5 years examined, 1 (2.0%) was positive while 49 (98.0%) were negative. For age bracket 6-10 years, 18 (35.3%) out of 51 tested positive and 33 (64.7) were negative. With respect to age group 11-15 years, 28 (57.1%) of the 49 examined were positive while 21 (42.9%) were negative (Table 3). The result showed a significant difference (P = 0.001) across the age group of the children with infection rate increasing with increase in years.

Table 1. Distribution of Superficial Mycoses among Primary School Children in Jos Metropolis

Location of school	No examined	No. Infected	No. Not infected	χ^2	P value
University of Jos primary	50	5(10.0)	45(80.0)	20.512	0.001
LGEA Primary school Barkin acha Gyel	50	26(52.0)	24(48.0)		
LGEA Primary school Abattoir	50	16(32.0)	34(68.0)		
Total	150	47(31.3)	103(68.7)		

Table 2: Sex Distribution of Superficial Mycosis

Sex	No examined	No. Infected	No. Not infected	χ^2	P value
Male	79	36(45.6)	43(54.4)	15.722	0.001
Female	71	11(15.5)	60(84.5)		
Total	150	47(31.3)	103(68.7)		

Table 3: Age Distribution of superficial mycosis

Age	No examined	No. Infected	No. Not infected	χ^2	P value
3-5	50	1(2.0)	49(98.0)	35.538	0.001
6-10	51	18(35.3)	33(64.7)		
11-15	49	28(57.1)	21(42.9)		
Total	150	47(31.3)	103(68.7)		

DISCUSSION

Numerous reports abound in medical and mycological literatures in the incidence of dermatophytic infections around the globe with high prevalence rate recorded in many developing countries within the tropical and subtropical regions of the world including Nigeria. The distribution of the dermatophytoses which consequently reflected distribution of the causative agents in the African continent was attempted by (Ngwogu *et al.*, 2007) with countries according etiological species. Dermatophytic infections which according to (Havlickova *et al.*, 2008) may be symptomatic or asymptomatic pose public health problems in many parts of the world causing cutaneous disfigurement and discomfort in both children and elderly (Rahbar *et al.*, 2010).

Although the prevalence of Tinea has decreased in industrialized countries, there is a marked difference depending on the region studied, along with the causative species. Thus it is necessary to conduct geographically defined studies for the knowledge of the epidemiology of Tinea. The prevalence of Tinea of the feet has been ten times higher in this study than that of others. The etiology of Tinea is similar to the one found in France, Italy and other countries with two predominant agents; *T. rubrun* and *T. mentagrophytes* (Raymond, 2008). In this study, increase in the frequency of Tinea of the feet was observed with age. The prevalence according to age and sex of the school children shows that the prevalence of superficial mycosis is higher in male children of 11-15 years old group, coinciding with other similar studies of Lavi *et al.*, (2005). The results obtained have shown that superficial fungal infections are relatively common in tropical countries and are exacerbated by the wearing of occlusive clothings. In addition it is associated with the use of wet/moist foot wears, sport wears and wet stockings (Caputo, 2001). The frequency of dermatomycosis is greater in communities with low socio economic statues: like in this studies L.G.E.A primary school Barkin Acha which can be acknowledged to be situated at one of the low socio economic areas by statue, and mostly populated with less privileged group of people, had the highest prevalence rate of 26 (17.3%), followed by L.G.E.D primary school Abatior who's socio economic statues seem relatively higher than that of Barkin Acha, had prevalence rate of 16 (10.6%), and the least prevalence rate was University of Jos primary school who had 5 (3.3%). Superficial skin infections show a low tendency to self-limitation and absence of poor care of Parents or Guardians and teachers, including older children which tend to increase the epidemic spread. This is so probably due to the fact that at that level they are relieved by their parents to clean themselves. Nevertheless considering classification by sex, it can be seen that the boys are most likely affected with (24.0%).

Consequently, by school classification, L.G.E.A Primary school Barkin Acha happens to have the highest prevalence rate which is (17.3%). This can be attributed to the fact that the residents of that area care less about adequate or proper hygiene by virtue of the fact that they have a low socio-economic living standard.

CONCLUSION

From this finding, it can be concluded that the study area in the Jos metropolis were reasonably well spaced and the children that were recruited for the research came from various places and backgrounds. Therefore considering all the precautions taken to achieve accurate results, the prevalence rate was discovered. It can be concluded that the children between the age group of 11-15 are most vulnerable to superficial mycosis infection.

It is important to promote preventive measures, thereby avoiding possible infection through contact as well as using common sport spaces (recreational facilities). Guidelines aimed at preventing the spread of dermatophytes should be available in schools and educational health programs informing the nature and ways of prevention of *Tinea pedis*. Also physical examination of the feet should be stressed to the children to report immediately any possible sign of infection for quick medical attention.

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