Global Advanced Research Journal of Medicine and Medical Sciences Vol. 1(3) pp. 049-056, April, 2012
Available online http://garj.org/garjmms/index.htm

Full Length Research Paper

Prevalence of Dermatophytes and other associated Fungi among school children

Ndako, J.A,[1] Osemwegie, O.O,[1] Spencer T.H.I[2] Olopade,B.K[1] Yunusa, G.A,[3]and Banda J[4]

[1]Department of biological sciences, college of science and engineering, Landmark University, PMB 1001 Omu Aran, Kwara State, Nigeria.
[2]Department of medical laboratory sciences, University of Maiduguri, Nigeria.
[3]Department of medical microbiology, federal college of veterinary and medical laboratory sciences, Vom Nigeria.
[4]Department of pathology, general hospital Kafanchan, Nigeria.

Accepted 02 March, 2012

The study investigated the prevalence of dermatophytosis and associated non-dermatophytes among Islamiyya school children of ages 5 – 13 years old in Kano metropolis. A total of 100 samples were collected and 91 (91%) yielded positive to fungal growth from which 66 (72.5%) were identified from males and 25 (27.5%) from females school children respectively. Dermatophytes amounting to 53 (58.2%) in frequency were recorded out of which 39 (73.6%) were isolated from males and 14 (26.4%) on females. Non-dermatophytes were also more in males (27 isolates) than females which had 11. The etiological agents of dermatophycoses recorded in this study in descending order of prevalence are *M. ferrugineum* (15.4%), *M. canis* (15.4%), *M. audounii* (9.9%), *T. concentricum* (5.5%), *T. verrucosum* (3.3%), *T. rubrum* (3.3%), *T. mentagrophyte* (2.2%), *T. tonsorans* (1.1%) and *T. schoenleini* (1.1%). *A. flavus* (9.9%), *A. niger* (8.8%), *Penicillium* sp. (7.7%), *Candida albicans* (5.5%), *Mucor* sp. (4.4%), *Trichoderma* sp. (3.3%) and *A. fumigatus* (2.2%) constituted the non-dermatophytes associated with these cutaneous infections. Higher frequency of dermatophytosis occurred more in children with greater propensity for play, interaction with domestic animals and who lacked the luxury of school seats during classroom learning.

Keywords: Dermatophytosis, non-dermatophytes, prevalence, school children, etiological agents, Kano metropolis

INTRODUCTION

Dermatophytosis (dermatomycosis or ringworm 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; Ameen, 2010). A group of closely related fungi comprising of 40 identified species in the dermatophytic genera that include *Trichophyton, Microsporum* and *Epidermophyton* are documented in literature as potential etiological agents of dermatophytosis (Nweze, 2010a; Adefemi *et al*., 2011). They are ecologically classified into zoophilic (animal loving), anthropophilic (human loving) and geophilic earth loving) with *Trichophyton, Microsporum* and *Epidermophyton* constituting the prominent dermatophytes globally (Weitzman and Summerbell, 1995; Rudy, 1999). Dermatophytes have been reported worldwide, though with variation in distribution, incidence, epidemiology, etiology and target hosts from one location to another with the passage of time. According to Hay (2003) and Havlickova *et al*. (2008), a number of factors including geographic location, prevailing climate (temperature, humidity, wind etc.), overcrowding, health care, immigration, environmental hygiene culture and socioeconomic dispositions have great implication for the proliferation of dermatophytosis. 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

*Corresponding author E-mail: ndakoj@yahoo.co.uk

parts of the world especially Nigeria (Weitzmann and Summerbell, 1995; Sahin *et al*., 2004; Ngwogu and Otokunefor, 2007; Nweze, 2010b). Reports on non-dermatophytic fungi associated with dermatophytoses e.g tinea cruris (groin), tinea capitis (scalp), tinea unguium (toenails), tinea faciae, tinea pedis (toe web), tinea manuum (palm), tinea barbae (beard and neck) and tinea corporis (non-hairy parts of the skin), etiological agents and control of their spread are scanty (Oyeka and Okoli, 2003; Vonshak *et al*., 2003; Mbata and Nwajagu, 2007).

In recent decade, the prevalence of dermatophytosis has significantly reduced in many developed nations of the world compared to the developing ones due to improved social, economic, health care and hygiene practice factors evident in the former (Havlickova *et* al., 2008; Ilkit, 2010). Nigeria being a developing nation located in the tropic with wet humid climate fell into the category of regions with high prevalence of dermatophytosis, especially in school children of rural, suburban and urban extract (Gugnani and Njoku-Obi, 1995; Rudy, 1999). Sporadic reports on the frequency of dermatophytes and dermatophytosis emerging from different parts of the country agreed with Hay (2003). These literatures are incidentally more prolific on dermatophytotic infections from the southwest and southeast part of Nigeria (Enzeani *et al*., 1996; Nweze, 2001; Nweze and Okafor, 2005, Adefemi *et al*., 2011). Scarcity of adequate comparative data has undermined information on hot spot zones and control management strategies of dermatophytosis in Nigeria. Ibrahim and Mohammed (2004), Nwadiaro and Ogbonna (1998), and Nweze (2001) observed that nomadic lifestyle and/or constant interactions by human with domestic animals promotes the prevalence of dermatophytic infections. Tinea capitis remained the most common form of dermatophytosis in Nigeria with astounding level of prevalence (Gugnani and Njoku-Obi, 1995; Ngwogu and Otokunefor, 2007; Mbata and Nwajagu, 2007). The current state of dermatophytic infections encourages collective search for sustainable ethnopharmacological control alternative to chemical antidermatophytic formulations or drugs which became unsatisfactory for clinical treatment of dermatophytoses (Vonshak *et al*., 2003; Awoderu *et al*., 2005). Transmission pattern of most dermatophytoses, their causal agents and entry portals are not yet fully understood.

This study therefore investigate the prevalence of dermatophytic infection and associated fungi in school children within Kano metropolis relative to nature of school facilities, interaction with domestic animals and their play pattern with the object of assessing a correlation.

MATERIALS AND METHODS

Screening for dermatophytic infection among sample population

Children of ages 3 -13 years old were randomly screened during the wet months of March – August, 2008 for fungal infections consistent with dermatophytosis on the skin of the scalp, hands, trunk and legs from five selected Islamiyya nursery and primary schools scattered across Nassarawa Local Government Area of Kano metropolis after due clearance from the school heads, parents and students. A total of 100 students that showed visible clinical signs (erythema, alopecia, scaling, crusting, circinate lesions or follicular inflammation, pruritus etc.) of dermatophytic infection constitute the study population.

Sample Collection and handling

Scrapings from the edge of the skin or dull broken hairs from the margin of lesions consistent with dermatophytosis and previously swapped with 70% (v/v) ethanol were collected using sterile razor blades and epilator forceps respectively into folded aseptic papers. Each of these papers was appropriately labeled with the students name, age, sex, date of collection, locale of infection and subsequently taken within 24 hours to the Medical laboratory of the Federal College of Veterinary and Medical Laboratory Sciences, Vom for identification and further confirmatory tests including microscopy and culturing. Information about the state of the classrooms/school compound (environmental hygiene, amenities) and the children's play pattern were also carefully gathered using both direct observation and/or interview methods during the study.

Microscopic and culture examination

Collected samples (scales from skin or dull, lusterless stubs of hairs from scalp) were observed under the microscope according to Collee *et al*. (1989). A portion of each sample collected from an affected skin part was reduced to fragmentary mount on a glass slide to which 4 drops of 10% (v/v) KOH was added, covered with a cover slip and then subjected to slight heat for one (1) minutes to aid rapid penetration and complete tissue maceration. Each prepared slide is later examined under low (X10) and high (X40) magnification of a simple light microscope for hyphae and arthroconidia respectively using lactophenol blue stain.

Table 1. Qualitative and percentage distribution of dermatophytotic and associated fungi across age groups of sampled population.

Organisms	Age					
	5-6	7-8	9-10	11-13	Frequency	Percentage (%)
Trichophyton spp.	+	+	+	+	16	17.6
Microsporum spp.	+	+	+	+	37	40.7
Aspergillus spp.	-	+	-	+	19	20.9
Candida spp.	-	-	-	+	5	5.5
Mucor spp.	-	-	+	+	4	4.4
Penicillium spp.	-	-	-	+	7	7.7
Trichoderma spp.	-	-	-	+	3	3.3
Total					91	100

The other portion of each of the samples was cultured on Saboraud Dextrose Agar (SDA) medium supplemented with 0.5 mg/ml each of chloramphenicol and cycloheximide and incubated at room temperature (37^0 Celsius) for a period of 3 weeks to form the stock culture. Pure isolates were generated by sub-culturing on Saboraud Dextrose and Potato Dextrose Agar (PDA) media respectively for both visual and microscopic examinations of cultural (colour and growth pattern) and morphological characteristics respectively for further differentiation. The isolates were also tested for their ability to produce urease. Each suspected yeast colony was picked with a sterile wire loop, emulsified in a drop of sterile normal saline on a clean slide, air dried and fixed over a flame. This was later treated with crystal violet for 1 mins, washed up with tap water, Lugos iodine for 30 secs and washed by tap water again. The smear was decolorized with acetone which was later washed off with sterile water, air dried and fixed in safranin for 60 seconds after which it is microscopically examined for buddy cells with or without pseudo-hyphae. Observations were then compared to the identification criteria enumerated in Frey *et al*. (1979), Rippon (1988), Laron (1995) and British National Formulary for Children (2005).

RESULTS

The sample population yielded nine (9) samples without any visible fungal growth in culture despite being obtained from lesions compatible to dermatophytoses. A total of ninety one (91) samples were however microscopically observed and yielded fungal growths differentiated into 53 (58.2%) dermatophytes and 38 (41.8%) non-dermatophytic fungi. *Microsporum* and *Trichophyton* species were the only genera of dermatophytes isolated while *Candida*, *Aspergillus*, *Mucor*, *Penicillium* and *Trichoderma* were the representative non-dermatophytic isolates recorded from the study (Table 1). *Microsporum* and *Trichophyton* species were the most prevalent dermatophyte accounting for 40.7% (37) and 17.6% (16) level of incidence respectively. This is followed by non-dermatophytic *Aspergillus* and *Penicillium* species with frequencies of 20.9% and 5.5% respectively. *M. ferrugineum* (15.4%), *M. canis* (15.4%), *M. audounii* (9.9%) and *T. concentricum* were the dominant representative species of dermatophytes while *A. flavus* (9.9%), *A. niger* (8.8%), *Penicillium* spp (7.7%) and *Candida albicans* (5.5%) were the most prevalent species of non-dermatophytes recorded by the study.

The distribution of dermatophyte within age groups showed a consistent rise in the frequencies of *Microsporum* and *Trichophyton* species from ages 3 - 10 and a decline between ages 11 – 13 as enumerated in of the Table 2. The peak frequency of 12.1% was recorded for *Aspergillus* species for sampled school children within the ages of 7 – 8 while there were no observed non-dermatophytic fungi in children below the age of 6 years. The prevalence of non – dermatophytes with the exception of *Candida* species declined among Islamiyya school children of ages 9 – 13 years.

A total of 66 male and 25 female children showed visible signs of fungal infection with about 53 recorded cases of dermatophytes in 39 males and 14 females respectively. Non-dermatophytic fungi were recorded in 38 children comprising 27 males and 11 females (Table 3).

Lower frequencies of dermatophytic and non-dermatophytic fungi were observed to be consistent with children who had school seats compared to those that sat on mats and on bare classroom floor respectively (Table 4). Peak prevalence of all the fungal isolates was observed school children without the luxury of classroom sits while learning. *Mucor* species recorded a peak frequency of 75% in school children on mats compared to 24.3% for *Microsporum* species.

The total number of 30 children who played only at school recorded 26.4% (24) fungi isolates (dermatophytic and non-dermatophytic) while those who played both at

Table 2. Frequency distribution of dermatophytotic and associated fungal isolates by age group of sampled population

Organisms	Age			
	5-6	7-8	9-10	11-13
Trichophyton spp.	1	5	3	7
Microsporum spp.	6	9	19	3
Aspergillus spp.	-	11	-	8
Candida spp.	-	-	-	5
Mucor spp.	-	-	3	1
Penicillium spp.	-	-	-	7
Trichoderma spp.	-	-	-	3

Table 3. Species, frequency and percentage distributions of dermatophytotic and associated fungal isolates based on sex.

Organism	No of isolates		Total No	Percentage (%)
	Male (%)	Female (%)		
Dermatophyte				
Trichophyton verrucosum	3 (4.5)	-	3	3.3
Trichophyton rubrum	1 (1.5)	2 (8.0)	3	3.3
Trichophyton concentricum	4 (6.1)	1 (4.0)	5	5.5
Trichophyton tonsurans	1 (1.5)	-	1	1.1
Trichophyton schoenlenii	1 (1.5)	-	1	1.1
Trichophyton mentagrophytes	2 (3.0)	1 (4.0)	3	3.3
Microsporum ferrugineum	9 (13.6)	5 (20.0)	14	15.4
Microsporum canis	11 (16.7)	3 (12.0)	14	15.4
Microsporum audounii	7 (10.6)	2 (8.0)	9	9.9
Non-dermatophyte				
Aspergillus flavus	4 (6.1)	5 (20.0)	9	9.9
Aspergillus fumigatus	2 (3.0)	-	2	2.2
Aspergillus niger	6 (9.1)	2 (8.0)	8	8.8
Mucor spp.	4 (6.1)	-	4	4.4
Penicillium spp	6 (9.6)	1 (4.0)	7	7.7
Candida albicans	3 (4.5)	2 (8.0)	5	5.5
Trichoderma	2 (3.0)	1 (4.0)	3	3.3
Total	66 (100)	25 (100%)	91	100

Table 4. Distribution of dermatophytotic and associated fungal isolates of sampled population based on classroom seat access.

Sitting	No of Isolate	Percentage	Isolate
On the chair	3	18.8	*Trichophyton spp.*
	5	13.5	*Microsporum spp.*
	3	15.8	*Aspergillus spp.*
	1	14.3	*Penicillium spp.*
On mat	5	31.3	*Trichophyton spp.*
	9	24.3	*Microsporum spp.*
	6	31.6	*Aspergillus spp.*
	3	75.0	*Mucor spp.*
	2	40.0	*Candida spp.*
On floor	8	50.0	*Trichophyton spp*
	23	62.2	*Microsporum spp*
	10	52.6	*Aspergillus spp.*
	3	60.0	*Candida spp.*
	1	25.0	*Mucor spp.*
	6	85.7	*Penicillium spp*
	3	100	*Trichoderma spp*

Table 5. Distribution of dermatophytotic and associated fungal isolates based play pattern of sampled population.

Playing Habit	No. of Children	No of Organism	Percentage (%)	Fungal isolate
At school only	30	24	26.4	*Trichophyton spp* *Microsporum spp* *Aspergillus spp* *Penicillium spp*
Both School And Home	70	67	73.6	*Trichophyton spp* *Microsporum spp* *Aspergillus spp* *Penicillium spp* *Candida spp* *Mucor spp* *Trichoderma spp*
Total	100	91	100%	-

Table 6. Distribution of dermatophytic and non-dermatophytic fungal isolates of sampled population based on interaction with domestic animals.

Domestic Animals	No of Isolates	Percentage (%)	Isolate	
Dogs	13	14.3	*T. verrucosum* (1)	*A. niger* (2)
			T. rubrum (1)	*A. flavor* (2)
			T. metagrophyte (2)	*Mucour* (1)
			M. canis (4)	
Cats	35	38.5	*T. verrucosum* (2)	*M. audounii* (2)
			T. rubrum (1)	*A. flavus* (5)
			T. concentricum (3)	*A. niger* (3)
			M. canis (9)	*Penicillium* (2)
			M. Ferrugineum (7)	*Candida albicans* (1)
Goats	22	24.2	*T. rubrum* (1)	*M. audounii* (3)
			T. concentricum (2)	*A. niger* (3)
			T. tonsorans (2)	*Penicillium* (3)
			M. ferrugineum (5)	*Candida* (3)
Poultry	13	14.3	*T. schoenleinii* (1)	*Mucor* (2)
			T. mentagrophytre(2)	*Penicillium* (1)
			M. ferrugineum (2)	*Trichoderma* (1)
			M. audounii (1)	*A. flavus* (1)
				A. fumigates (2)
Nil	8	8.9%	*M. audounii* (3)	*Trichoderma* (2)
			M. canis (1)	*Mucor* (1)
				A. flavus (1)

Frequencies of isolates are in parenthesis

school and home respectively showed high incidence of 73.6% (67) of fungal isolates (Table 5). The distribution of fungal isolates among children who played with domestic dogs, cats, goats and poultry birds were 13 (14.3%), 35 (38.5%), 22 (24.2%) and 13 (14.3%) respectively. On the contrary, a frequency value of 8.8% was recorded for the population of children that had little or no contact with any form of domestic animal (Table 6).

DISCUSSION

Numerous reports abound in medical and mycological literatures on 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 dermatophytoses which consequently

reflected the distribution of the causative agents in the African continent was attempted by Ngwogu and Otokunefor (2007) with countries recording variations in dominant 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). People that are immunocompromised by systemic infections such as AIDS, cancer, diabetes, tuberculosis etc., chemo-therapy, organ transplants or drug abuse gave prominence to quantitative research on dermatophytic infections. These factors influence the demographic pattern of the etiology and epidemiology of dermatophytosis while also underpinning the need for their strategic management (Sahin *et al*. 2004). In this present study which was carried out in one of the most populous metropolis in Nigeria, 58.2% (n = 100) prevalence of dermatophytic infections was recorded among randomly sampled school children within Nassarawa Local Government Area of Kano State. This is however higher compared to the frequency reported among school children in Nigeria and other parts of Africa which ranged from 5 – 20% (Enweani *et al*., 1996; Nweze, 2001; Ogunbiyi *et al*., 2005; Ngwogu and Otokunefor, 2007; Adefemi *et al*., 2011). The reason for this may be linked to several factors such as the host socioeconomic characteristics (age, gender, family size, individualistic and communal life style), over-crowding, geography, level of hygiene practice, nature of school infrastructure and amenities, locality, climate, affinity for contact sports, frequent contact with domesticated animals and nature of health care system that facilitate the transmission of dermatophytic infections (Efuntoye and Fashanu, 2002; Khosravi and Mahmoudi, 2003; Nweze, 2010b). Furthermore, prevailing climate at the time of study, inadequate classroom seats which caused some of the children to learn sitting on mats or bare floor, and the children play pattern which promote person-to-person transmission and create epidemiological circumstances for re-infection of human hosts by dermatophytes may also largely account for the escalated value of prevalence recorded in this study. This observation therefore debauches earlier studies linking high dermatophytic infection prevalence to rural and suburban communities (Ngwogu and Otokunefor, 2007; Nweze, 2010a, 2010b). The scarcity of adequate comparative data equally confounds this line of thought. The failure of 9% dermatophytes and associated fungi to show visible sign of growth in culture among the sampled population may be due to reasons ranging from poor inocula viability to weak nutrient utilization and competitive growth capacities (Nweze and Okafor, 2005).

The incidence of non-dermatophyte fungi associated with dermatophytosis among the sampled population of school children within the ages of 5 and 6 years was insignificant compared to microscopic and culture results from those within ages 11 to 13. Dermatophytosis is also low (7.7%; n = 91) within this age group largely as a result of close parental care and guardianship to which these children are subjected. Dermatophytes and associated fungi recovered steadily rises in frequency across age groups and peaked at 37.4% for school children ages 11-13 years old. This attributed transitional puberty and concurred with previous works within and outside Nigeria (Ngwogu and Otokunefor, 2007; Nweze, 2010a). The physical engagement of male children in contact sports such as wrestling, football, boxing and tag games coupled with a tradition that subjugate females over males in tending to animals in household farms are factors that pre-dispose males to high prevalence of superficial fungal infections. The tattered nature the classrooms floor, school environmental hygiene and lack of adequate seats which left some of the sampled population on mats and bare floor during learning also promote the prevalence of dermatophytic infections and associated non-dermatophytic fungi among the sampled population (Oyeka and Okolie, 2003). These reasons which cannot be separated from the socioeconomic base of guardians may have contributed to a linear rise in the incidence of fungal isolates among school children who learnt by sitting on mats and denudate floor respectively. Further study is however required for better understanding of the dynamics of floor to human transmission across metropolitan schools relative to location and defined sets of facility characteristics. Infrastructural and facility status of the schools from which the sampled population of children was drawn were considered for the first time in this present study.

M. ferrugineum (15.4%), *M. canis* (15.4%), *M. audouinii* (9.9%) and *T. concentricum* (5.5%) constituted the predominant representative dermatophytic species recorded during the study. It is imperative to emphasize that *M. ferrugineum* and *T. concentricum* were scarcely reported in many related studies from other parts of Nigeria despite being implicated a spectrum of dermatophytic infections including tinea imbricata, faciei, corporis and capitis (Ajello, 1974). This present study may have been the first time account of these dermatophytes among school children in the northeastern part of Nigeria despite also recording dermatophytes of anthrophilic, geophilic and zoophilic origins. Unlike the *M. ferrugineum* with a wider range of geographic distribution, *T. concentricum* was reported to limited in distribution to south-east Asia and Central America by Weitzman and Summerbell (1995) and have been recently introduced to the metropolis by human and/or animal immigrants. The positive absence of *Epdermatophyton* species especially *E. floccosum* reported by Nweze (2010a) and Adeleke *et al*. (2008) on related studies in Northern Nigeria was not yet understood. It might however be attributed to unfavorable growth conditions which repressed

arthroconidia germination or hyphal growth. Furthermore, all the etiological agents that were positively identified from the study have been reported in Nigeria and other parts of the world (Barbić-Erceg *et al*., 2004; Sahin *et al*., 2004; Nweze and Okafor, 2005; Popoola *et al*., 2006; Mbata and Nwajagu 2007). Incidentally, a critical study of the play pattern of the children that composed the sampled population showed that those that were more playful tested positive to higher number of microscopically and culturally identified fungal isolates consistent with dermatophytic infections. This according to Mbata and Nwajagu (2007) may be indirectly linked to malnutrition which is capable of causing depressed cell-mediated immunity exemplified by Mendell *et al*. (1995) as low sebaceous and apocrine gland activity. High frequencies of *M. canis*, *M. ferrugineum* and anthrophilic *M. audouinii* concurred with Popoola *et al*. (2006) and may be attributed to the constant exposure of the children to domestic animals in the locus of sampled population. *A. flavus* (9.9%), *A. niger* (8.8%), *Penicillium* sp. (7.7%) and *Candida albicans* (5.5%) were the most predominant non-dermatophytes identified by microscopy and culture. This result concord with the reports of Rahbar *et al*. (2010) and Mbata and Nwajagu (2007) as well as implied that non-dermatophytic fungi (yeast and conidial forms) synergize with dermatophytic fungi in a yet undefined phenomenal interaction to cause symptomatic superficial fungal infections across a range of human and animal hosts.

Ample literature exists on the zoophilic, geophilic and anthropohilic sources of dermatophytic infections but little is presently known on the spectrum of zoonotic dermatophytes in Nigeria to illicit the best sustainably affordable epidemiological control strategy. The level of interactions of the sampled population with different kinds of domesticated animals in this present study revealed that children who related with cats had the highest incidence (35.5%) of superficial skin infections consistent with dermatophytosis. This observation was corroborated by Nweze, (2011) who recovered 53.2% dermatophytic isolates and lend credence to earlier views of predominant dermatophytic zoonosis in cats. Prevalence was however less in school children that were exposed to dog (14.3%) and poultry (14.2%) respectively. Although the reasons for the observed variation in the spectrum of microscopically and culturally identified isolates from school children's interaction with domestic animals is not yet fully understood but may be caused by the restriction of poultry birds and dogs to the household environs. The implication of this observation from animal to human transmission especially around the northern parts of Nigeria where animal rearing is a common vocation and an occupation in many rural communities cannot be overemphasized (Khoaravi and Mahmoudi, 2003; Kabir *et al*., 2004).

The confirmation of both dermatophytic and non-dermatophytic fungal isolates from the sampled population suggests a relationship that requires further investigation and whose complete understanding has a strong implication for the control of dermatophtosis in children. This study also recorded high prevalence of *M. ferrugineum* and *T. concentricum* which are uncommon dermatophytes in Nigeria. Furthermore, many primary schools depending their conduciveness i.e. state of infrastructure, facilities and location are potential hot spots for the spread of dermatophytosis and their reinfections. This study incidentally provided new insight into some epidemiological facilitator of dermatophytosis and transmission portals while also contributing to existing knowledge useful for the efficient screening, management, reduction and treatment of the .

REFERENCES

Adefemi AS, Odeigah OL, Alabi KM (2011). Prevalence of dermatophytois among primary school children in Oke-oyi community of Kwara State. Niger. J. Clin. Practice 14(1):23-27.

Adeleke IS, Usman,B. Ihesiulor,G. 2008. Dermatophytosis among itinerant quranic scholars in Kano (Northwest) Nigeria. Niger. Med.Practitioner 53(3): 33-35.

Aho R (1980). Studies on fungal flora in hair from domestic and laboratory animals suspected of dermatophytosis. I. Dermatophytes. Acta Pathologica et Microbiologica Scandinavica Section B 88:79-83.

Ajello L (1974). Natural history of the dermatophytes and related fungi. Mycopathologia et Mycol. Applicata 53:93 -110.

Ameen M (2010). Epidemiology of superficial fungal infections. Clin. Dermatol. 28:197 -201.

Awoderu VA, Nebo GC, Otuderu VO (2005). Occurrence of dermatomycoses and in vitro therapeutic efficacy of three antifungal drugs on growth of *Microsporum canis*. Afr. J. Pure and Appl. Sci. 1:23-29.

Babić-Erceg A, Barisić Z, Erceg M, Babić A, Borzić E, Zoranić V, Kaliterna V (2004). Dermatophytes in Split and Dalmatia: Croatia 1996-2002. Mycoses 47: 297-299.

BNF for children (2005). British National Formulary for children. London's British Medical

Association and the Royal Pharmaceutical Society of Great Britain.

Collee JGD, Fraser JP, Marmion BP (1989). Mycological techniques in: Mackie and McCarteny: Practical Medical Microbiology, 13th edition, Churchill Livingstone New York. Pp. 910.

Efuntoye MO, Fashanu SO (2002). Fungal isolates from skin and pens of healthy animals in Nigeria. Mycopathol. 153: 21-23.

Enzeani IB, Ozan CC, Agbonlahor DE, Ndip RN (1996). Dermatophytoses in school children in Ekpoma Nigeria. Mycoses 39: 303-305.

Frey D, Oldfield RJ, Bridger BCA (1979). Coloured atlas of pathogenic fungi. London Wolfe Medical Publications Ltd (s).

Gugnani HC, Njoku-Obi ANU (1995). Tinea capitis in school children in Eastern Nigeria. Mycoses 89:132-144.

Havlickova B, Czaika VA, Friedrich M (2008). Epidemiological trends in skin mycoses worldwide. Mycoses 51:2-15.

Hay RJ (2003). Fungal infections (mycoses). In: Warrell DA, Cox TM, Firth JD and Benz EJ Jr (Eds.). Oxford Textbook of Medicine 4th Ed. Oxford. Oxford University Press Section 7.12.1

Ibrahim S, Muhammed H (2004). Incidence of ringworm (Tinea capitis) among elementary school children in Gwale and Tarauni Local Government areas, Kano state, Nigeria. Biol. Envir. Sci. J. Tropics 1: 25-31.

Ilkit M (2010) Favus of the scalp: an overview and update. Mycopathologia 170: 143-154.
Kabir M, Iliyasu Z, Abubakar IS, Ahmad DZ (2004). Medico-social problems itinerant Almajiris. Niger. J. Paediatrics 32(1):15-18.
Khosravi AR, Mahmoudi M (2003). Dermatophytes isolated from domestic animals in Iran. Mycoses 46:222-225.
Laron DH (1995). Medically important fungi: a guide to identification. 3rd edn. Washington DC. Am. Society of Microbiol. 209-223
Mbata TI, Nwajugu CC (2007). Dermatophytes and other fungi associated with hair-scalp of nusery and primary school children in Awka, Nigeria. The Internet J. Microbiol. 3(2): 1-6.
Mandell GL, Banneth JE, Dolin R (1995). Tinea capitis in Dermatophytosis and other superficial mycosis in principle and practice of infectious disease Hospital New York. Churchill Livingstone 2379 – 82
Ngwogu AC, Otokunefor TV (2007). Epideiology of dermatophytoses in a rural community in Eastern Nigeria and review of literature from Africa. Mycopathol. 164: 149-158.
Nwadiaro PO, Ogbonna CIC (1998). The incidence of dermatomycosis among a rural population in Plateau State. Afr. J. Natural Sci. 2:20-21.
Nweze EI (2001). Etiology of dermatophytoses among school children in northeastern Nigeria. Med. Mycol. 39:181-184.
Nweze EI, Okafor JI (2005). Prevalence of dermatophytic fungal infections in children: a recent study in Anambra State, Nigeria. Mycopathol. 160: 239 – 243.
Nweze EI (2010a). Dermatophytosis among children of Fulani/Hausa living in Southeastern Nigeria. Revista Iberoamericana de Micol. 27(4): 191-194.
Nweze EI (2010b). Dermatophytosis in Western Africa: a review. Pakistan J. Biol. Sci. 13(13): 649-656.
Nweze EI (2011). Dermatophytosis in domesticated animals. Revista do Instituto de Medicina Tropical de Sao Paulo 53(2): 95 – 99.
Ogunbiyi AO, Owoaje E, Ndahi A (2005). Prevalence of skin disorder in school children in Ibadan, Nigeria. Pediatr. Dermatol. 22:6-10.
Oyeka CA, Okoli I (2003). Isolation of dermatophytic and non-dermatophytic fungi from soil in Nigeria. Mycoses 46: 336-338.
Popoola SOT, Ojo AD, Alabi OR (2006). Prevalence of dermatophytosis in junior secondary school children in Ogun State, Nigeria. Mycoses 49: 499-503.
Rahbar M, Mehrabani HG, Dahiml P, Dahn P (2010). Prevalence and etiological agents of cutaneous fungal infection in Milad Hospital of Tehran, Iran. Egyptian Dermatol. Online J. 6(2):3.
Rippon JW (1988). Medical mycology. The pathogenic fungi and pathogenic Actinomycetes. WB Saunders. Philadelphia, USA.
Rudy SJ (1999). Superficial fungal Infection in children and adolescents. Nurse Practical Forum 10: 56-66.
Sahin I, Oksuz S, Kaya D, Sencan I, Cetinkaya R (2004). Dermatophytes in rural area of Duzce, Turkey. Mycoses 47: 470-474.
Vonshak A, Barazani O, Sathiyamoorthy P, Vardy D, Golan-Goldhirsh A (2003). Screening South Indian medicinal plants for antifungal activity against cutaneous pathogens. Phytotherapy Res. 17: 1123-1125.
Weitzman I, Summerbell RC (1995). The dermatophytes. Clin. Microbiol. Rev. 8: 240-259.