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INCIDENCE AND DISTRIBUTION OF RINGWORM INFECTION AMONG PRIMARY SCHOOL CHILDREN IN KANO MUNICIPAL LOCAL GOVERNMENT AND DAWAKIN TOFA AREAS OF KANO STATE, NIGERIA

Shehi B.I.,[1]Idris S.L.[2],. Sambo F.I.[3], Magaji A.S. [4], Usman B.I.[5] Saidu B.M.[6]
[2,3&4]Department of Biological Sciences, Faculty of Science, Yusuf Maitama Sule University, Kano, Nigeria
[6]Department of Biological Sciences, Aliko Dangote University, Kano, Nigeria
Corresponding author: idrissurayyalawan@yahoo.com

ABSTRACT
Ringworm infection is a fungi infection of the scalp, body and feet that disproportionately affects children in rural and underserved communities in Nigeria. This study investigates the incidence of ringworm infection in rural and urban areas of Kano state. Pupils of ages 5 - 13 years old were selectively screened and examined for fungal infections consistent with dermatophytosis on the skin of the scalp, hands, trunk and legs from six selected primary schools across Kano Municipal (located in urban area) and Dawakin Tofa Local Government Area LGA (located in rural area) Kano, Nigeria. Collected samples (scales from skin or hairs from scalp) were observed under the microscope. The other portions of each sample were cultured on Saboraud Dextrose Agar (SDA) medium, and incubated at temperature of 37^0 Celsius for a period of 2 weeks. Distribution of the pathogens showed that pupils between 5-7 years were the most infected with highest number of fungi isolated. T. mentagrophyte was more common in all the age groups. M.fulvum and M. nanum were the more prevalent pathogens. Pupils from Dawakin Tofa, Kwa, and Dawanau primary schools (all located in the rural area) were more infected. The incidence of the infection in relation to gender showed that in five out of the six primary schools studied, male pupils were more infected than female. There should be avoidance of overcrowding at homes and schools as well as proper maintenance of general hygiene. This could be achieved by provision of health care services, regular sanitary hygiene and health education to school children and parents as well.
Key words: Dermatophytosis, Primary School Children, Kano Municipal, Dawakin Tofa,

INTRODUCTION

Ringworm infection medically known as dermatophytosis caused by dermatophytes which are highly specialized group of fungi. It is a common superficial fungal infection found throughout the world (Dogo *et al*., 2016). It occurs primarily in prepubatal children over the age of 6 months (Ekeski and Hay, 1996). It is highly contagious and represents a significant public health problem, particularly among school children (Fatini and Al-Samarai, 2000). Ringworm infection is not a reportable disease but is a cause for concern because of its contaginous nature. It can be transmitted though body contacts (person to person transmission) mainly in refuge corrupt or schools or through inanimate objects like cloths combs or hair dressers equipment.

Dermatophytes damage both human and animal surface keratinized tissue, such as the skin, hair, and nails. Because of their enzymatic systems, these fungi can penetrate, colonize, and feed on the tissues of humans and other animals. They can break down keratins, a highly specialized family of proteins produced by epithelial cells (Higgins et al., 2000). The symptoms of ringworm (dermatophytosis), which can be unattractive or disfiguring depending on the area of the body affected, vary. For instance, Tinea corporis, a type of ringworm of the skin, produces annular lesions with clearing, scaly centers, and a red, advancing border that may be dry or vesicular. Additionally, there is scalp ringworm (Tinea capitis), which results in black dots, scaling, itching, and dull gray circular alopecia patches (Higgins et al., 2000). Tinea pedis, Tinea curis, Tinea barbae, and Tinea unguinum are other ringworms that, respectively, affect the foot, groin, beard, and nails. Many people still associate the term "ringworm" with social stigma, conjuring images of filth, slums, and the shaved heads that were signs of widespread epidemics in European cities 100 years ago (Fathi and Al-samarai, 2000). High contagiousness makes this virus a serious public health concern, especially for school-aged children (Elowski and Hary, 1996). It can spread from person to person by physical contact, often in refugee camps or schools (Omar, 2000), or through inanimate objects like clothing, combs, or hairstyling tools. Ringworm is still an issue around the world, especially in underdeveloped nations where social understanding of hygiene, medicine, and prevention practices is generally quite low (Mantovani, 2002). Due to the huge number of children of all ages in close proximity to one another, some of whom may not have established sufficient hygiene or immunity to various diseases, schools are perfect settings for the transmission of infectious diseases (Sharma, 2015). This study investigates the incidence of ringworm infection in Dawakin Tofa and Kano Municipal LGA located in rural and urban areas of Kano state.

MATERIALS AND METHODS

Screening for dermatophytes infection among sample population

Children of ages 5 - 13 years old were selectively screened for fungal infections consistent with dermatophytosis on the skin of the scalp, hands, trunk and legs from six selected primary schools across Kano municipal (located in urban area) and Dawakin tofa L.G.A. (located in rural area) Kano state, Nigeria, after due clearance from the school heads, and students (Adefemi, 2011).

Specimen Collection and Handling

The collection of samples was through the selection and visitation of six primary schools during the research period. Classes were randomly chosen. This was followed by examination of the children for the clinical symptoms of the infection on different part of the body (head, hand, body and feet). Each of the children with infection was asked some questions from the prepared and numbered questionnaire containing their socio-demographic information. Scrapping was aseptically taken from the edge of the lesion using epilator forcep.

Scrapings from the edge of the skin or dull broken hairs from the margin of lesions consistent with dermatophytosis and previously swapped with 70% ethanol was collected using epilator forceps respectively into folded aseptic papers, and subsequently taken within 24 hours to the laboratory of Biological Sciences, Yusuf Maitama Sule University Kano, for identification and further confirmatory tests, which includes microscopy and culturing (Adefemi, 2011).

Microscopic and Culture Examination

Collected samples (scales from skin or hairs from scalp) were observed under the microscope. A portion of each sample collected from an affected skin part was reduced to fragmentary mount on a glass slide, to which 3 drops of 10% (v/v) KOH was added, covered with a cover slip and then subjected to slight heat for one (1) minute to aid rapid penetration and complete tissue maceration. Each prepared slide was later examined under low (x10) and high (x40) magnification of a simple light microscope.

The other portions of each sample were cultured on Saboraud Dextrose Agar (SDA) medium, and incubated at temperature of 37^0 Celsius for a period of 2 weeks to form the stock culture. Pure isolates were generated by sub-culturing on Sabourauds Dextrose for both visual and microscopic examinations of cultural (color and growth pattern) and morphological characteristics respectively for further differentiation (Fatini and Samarai 2000).

RESULTS

Out of the 60 subjects examined, Microsporum and Trichophyton species were the only genera of dermatophytes isolated. The results showed that different fungal organisms were isolated from the school children: *Microsporum fulvum*, *Microsporum nanum*, *Trichophyton erinaceid*, *Trichophyton schoeleini* and *Trichophyton mentagrophytes.* Fungal isolates were detected from all the 20 students of Kwa and Dawakin tofa primary schools that showed symptoms of the ringworm infection, while 9(90) from Dawanau, 7(70) from Hudaibiyya, 6(60) from Kofar kudu and 7(70) from Gandun albasa primary schools yielded fungal growth (Table 1).

Distribution of the pathogens within the age group examined (5-13 years) (Table 2) showed that pupils between 5-7 years were the most infected with highest number of fungi isolated*. T. mentagrophyte* was more common in all the age groups. *M.fulvum* and *M. nanum* were the more prevalent pathogens. Pupils from Dawakin Tofa, Kwa, and Dawanau primary schools (all located in the rural area) were more infected (Table 4). The incidence of the infection in relation to gender shows that in five out of the six primary schools under study, male pupils were more infected than female.

Table 1: Distribution of the organism isolated among the six primary schools studied

School	No of Pupils showing symptoms	No of infected pupils (%)	Organisms isolated
Dawakin Tofa LGA			
Dawakin Tofa PS	10	10(100)	*T. schoeleini, M. fulvum* , *M. nanum*
Kwa PS	10	10(100)	*M. fulvum*, *T. erinacei,* *M. nanum*
Dawanau SPS	10	9(90)	M. fulvum, *T. mentagrophytes*
Kano Municipal LGA			
Hudaibiyya	10	7(70)	*T. schoeleini, T. mentagrophytes,* *M. fulvum*
Kofar Kudu PS	10	6(60)	*M. nanum, M. fulvum,* *T. mentagrophytes*
Gandun albasa	10	7(70)	*M.fulvum*, *T. mentagrophytes* *T. erinacei* PS

Key: PS- Primary school

Table 2: Incidence of Ringworm lesions among the pupils examined according to age group

Age (years)	No of Pupils Showing symptoms	T. *mentagrophytes*	*T. schoeleini*	*T. erinacei*	*M. nanum*	*M. fulvum*
5-7	29	8	5	4	3	5
8-10	18	5	2	2	2	3
11-13	13	5	3	1	0	1
Total	60	18	10	7	5	9

Table 3: Distribution of the organism isolated among the six primary schools under study

School	No of Pupils Showing symptoms	T. *mentagrophytes* (%)	*T. schoeleini*	*T. erinacei*	*M. nanum*	*M. fulvum*
Dawakin tofa PS	10	0(0)	4(40)	0(0)	2(20)	4(40)
Kwa PS	10	0(0)	0(0)	2(20)	4(40)	4(40)
Dawanau PS	10	2(20)	0(0)	0(0)	2(20)	5(50)
Hudaibiyya PS	10	3(30)	1(10)	1(10)	0(0)	2(20)
Kofar kudu PS	10	3(30)	0(0)	0(0)	2(20)	1(10)
Gandun albasa PS	10	1(10)	0(0)	4(40)	0(0)	2(20)

Key: PS-Primary School

Table 4: Number of children examined in each school in relation to gender (sex)

School SPS	No examined (%) Male	Female	No infected Male	Female	Incidence (%) Male	Female
Dawakin Tofa LGA						
Dawakin tofa PS	7(70)	3(30)	7	3	100	100
Kwa PS	8(80)	2(20)	7	2	100	100
Dawanau PS	6(60)	4(40)	6	3	100	75
Kano Municipal LGA						
Hudaibiyya PS	8(80)	2(20)	7	0	87.5	0.0
Kofar kudu PS	7(70)	3(30)	4	2	57.1	66.7
Gandun albasa PS	7(70)	3(30)	6	1	85.7	33.3
Total	43(71.7)	17(28.3)	37(61.7)	11(20)	86.05	64.7

PS-Primary School

DISCUSSION

Out of the 60 pupils examined, 49(81.7%) of the samples were positive for culture of dermatophytes. This is however higher compared to the frequency reported among school children in Kano and other parts of Nigeria which ranged from 5 – 20% according to the previous researches carried out by Ngwogu and Otokunefor, (2007); Adefemi *et al.*, (2011). In a previous study which was carried out by Ndako et al in Kano (2012), 58.2% (n = 100) prevalence of dermatophytic infections was recorded among randomly sampled school children within Nassarawa Local Government Area of Kano State. And prevalence of 21% was recorded by Anosike *et al.* (2005) which are lower than this study finding. Among these positive dermatophytes cultured, 71.4% belong to genus Microsporium, while 28.6% belong to genus Trichophyton.

The commonest of the isolates is *Microsporum fulvum* which was isolated 18 times and this was followed by *Microsporum nanum* and *Trichophyton mentagrophytes* which were isolated 10 and 9 times respectively. Moto et al. (2015) recorded high prevalence of Tinea infections with *T. tonsurans* as the predominant etiological agent in pupils. *M. audouinii* was the commonest organism reported by Oke (2014). The result shows that younger children suffered more from ringworm infection than older children, (table 2.). In this present study which was carried out in one of the most populous metropolises in Nigeria, 81.7% (n = 60) prevalence of ringworm infections was recorded among sampled school children within Dawakin tofa and Kano Municipal Local Government Area of Kano State. The incidence of the infections tends to be more in the Rural area (Dawakin Tofa) than it is in the Urban area (Kano Municipal) due to the children's playing pattern, such as interactions with domestic animals and playing at soil surfaces.The incidence of non-dermatophytes 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 was 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, 2010). This is contrary to our finding where the infection ia higher in children within age 5-7 years. Another study by Adesiji (2019) also recorded highest prevalence of the infection in pupils between 4-7 years (67%) followed by pupils between 8-11 years (39%).

The incidence of the infection in relation to gender shows that in five out of the six primary schools under study, male pupils were more infected than female.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. Pupils from Dawakin tofa, Kwa, and Dawanau primary schools (all located in the rural area) were more infected.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.

The absence of Epidermatophyton species especially *E. floccosum* reported by Nweze (2010) 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 (Barbi ć-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.

CONCLUSION

This study finds that, children within the age group 5-7 years were more infected, 29(48.33%) children were infected within the age group .*T. mentagrophyte* was more common in all the age groups. *M. fulvum and M .nanum* were the most isolated organisms. Students from primary schools located in the rural arrears (Dawakin Tofa LGA) were more infected. Also, male students were more infected (86.05%) than the female participants in this study. There should be avoidance of overcrowding at homes and schools and also a proper maintenance of general hygiene. All of this might be accomplished by giving schoolchildren and their parents access to health care services, normal sanitary practices, and health education. Public elementary schools should be recognized by the government as a setting where infectious diseases might easily spread, and measures to avoid this should be taken.

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