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Survey of *Tinea Capitis* among Primary School Pupils in Sapele and Ethiope West Local Government Areas of Delta State, Nigeria

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ABSTRACT: *Tinea capitis* is a common dermatophyte infection associated with pupils of primary school age group. Dermatophytosis is relatively common in tropical and sub-tropical regions where warm and humid climates provide a favorable environment for the fungal to thrive. Prevalence in many of these regions are unknown and shift in etiology has frequently been observed. Hence the objective of this paper was to carry out a survey of Tinea capitis among primary school pupils in Sapele and Ethiope West Local Government Areas in Delta State, Nigeria using standard procedures and estimating its prevalence on the scalp of primary school pupil. Pupils (5,876) aged 4-13 years in government-owned primary schools located in urban and rural areas of Sapele and Ethiope West Local Government Areas, were physically screened for hair-scalp fungal infection. Mycological examination revealed *Microsporum audouinii* (24%) as the most implicated dermatophyte in these local government areas. Boys; 190 (65%) were more infected than girls 103 (35%) and prevalence was among children between 4-7 years old (51%). Thus male pupil are affected by *Microsporum audouinii* in these local government areas under study.

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Dermatophytes are exceptional group of fungal that affect keratinous tissues of humans and animals. They attack the superficial layers of the epidermis, predominantly the stratum corneum and the hair and nails of the living host known to contain appendages with high keratin concentration (Fernandes *et al*., 2001). They survive or multiply in the deeper tissues of the body only under special situation (Chastain *et al.,* 2001). *Epidermophyton*, *Trichophyton*, and *Microsporum* are the three types of dermatophytes accounting for majority of the infections. Dermatophytoses have similar treatment but their presentations vary and the location where they are found determines their name (Sarabi, 2008). The major types of dermatophyte infections include: involvement of the scalp (tinea capitis), feet (Tinea pedis), groin (Tinea cruris), and other body surfaces (Tinea corporis). These are typically superficial, involving the epidermis. However, in some patients, dermatophyte infections may penetrate the hair follicle and involve the dermis; this condition is termed Majocchi's granuloma. The distribution, frequency, and etiology of dermatophytosis vary according to the geographic region studied, the climatic variations, the socioeconomic level of the population, the time of study, the presence of domestic animals and age of the individual (Al-Rubiay and Al-Rubiay, 2006). Tinea is likened to parasitic larvae and over the years has become the term applied to parasitic skin infections. A synonym is “ringworm”, which describes the ring-like

lesions caused by the fungal infection. The term "capitis" refers to the scalp, and hence the term "tinea capitis" identifying a ringworm infection of the scalp and hair shafts (Elewski, 2000). In head ringworm, the hair follicles are colonized by the fungus with the result that the hairs break off near the base leaving a hairless patch. The mycelium grows in the stump of each hair and this becomes surrounded by a sheath of minute arthroconidia which can spread the disease by direct or indirect contact. Tinea capitis infections are classified into three major groups: anthropophilic, zoophilic, and geophilic. The anthropophilic infections are parasitic on humans, usually forming larger hyphae and spores inside the hair shaft, while the zoophilic tend to be parasitic on animals, usually forming smaller hyphae and spores outside the hair shaft; the geophilic infections are identified by location. Anthropophilic species cause mild lesions with minimal swelling in immune-competent humans, but geophilic and zoophilic species may result in widespread lesions secondary to inflammation, resulting to abscesses and pustules (Krajewska-Kulak *et al*., 2003). *Tinea capitis* is the commonest fungal infection among the diseases caused by dermatophytes (Rastegar *et al.*, 2005) and it is incredibly common in children between 4 and 14 years of age. It is highly contagious and represents a significant public health problem in Nigeria and Africa at large, particularly among school pupils (Fatini and Al-Samarai, 2000; Omar, 2000; Anosike *et al*., 2005). Children are particularly vulnerable because of their poor personal hygiene habits, poor environmental sanitation and close contact with other children. As human contact among children is more frequent between the ages of 4 to 14 years than in very early childhood, these age groups are similarly at greater risk of contracting infectious diseases (Nweze and Eke, 2016). Tinea *capitis* is uncommon in adults probably because of increased fungistatic action of triglycerides in the sebum that is produced following puberty (Gupta and Summerbell, 2000).

Incidence of *tinea capitis* in children may vary with respect to age and causative dermatophyte. Males are more commonly affected, with rates two to five times higher than in females (Ayaya *et al*., 2001). In Africa, *tinea capitis* is known to be an important public health problem and there are a lot of reports about its effect on 10 % to 30 % children of school age (Moto *et al*., 2015). The prevalence of superficial mycoses (*tinea capitis*) has been studied in different parts of the world (Hay *et al*., 2001; Metin *et al.*, 2002; Akpolat *et al.*, 2005). In the United States, black dot *tinea capitis* caused frequently by *Trichophyton tonsurans* is the form that is seen mostly. Favus, most frequently due to *Trichophyton schoenleinii*, is seldom seen in the United States and Europe, but may be seen in countries where *Trichophyton schoenleinii* infection is prevalent, such as Nigeria, Iran and China (Ilkit, 2010). Fungal infections of the skin and scalp represent a relatively common problem especially in the tropical and sub-tropical regions of the world where the warm and humid climates provide a favorable environment for organisms causing superficial mycoses to thrive (Shrum *et al*., 1994). Its prevalence in many of these regions are unknown due to parity of information and shift in etiology has frequently been observed. Thus the need for constant surveillance to determine the epidemiological trends of the disease in various parts of the country. Studies are very few in Delta State that had looked at the prevalence of *tinea capitis* infection among primary school pupils, and no previous study has been carried out in the selected areas of study. Therefore, the objective of the study was to carry out a survey of Tinea capitis among Primary School pupils in Sapele and Ethiope West Local Government Areas of Delta State, Nigeria.

MATERIALS AND METHODS

Materials: Methylated spirit (95 % isopropyl alcohol), Sabouraud Dextrose Agar (E.O. Labs), Chloramphenicol (GreenLife Pharmaceutical Limited), Lactophenol Cotton Blue Stain (Loba Chemie PVT Limited), UV/Visible Spectrophotometer (V-630).

Study population: Eight primary schools were selected from urban areas in Sapele Local Government Area and six primary schools from rural areas in Ethiope West Local Government Area, all in Delta State, Nigeria. The children were of pre-adolescent school age children, ranging from 4 years to 13 years old. All the pupils at each school suspected to have *tinea capitis* were included. The inform consent of parents/guidance of children under study were sorted and given before being included in the study.

Sample collection: Affected area on the scalp was thoroughly cleaned with a methylated spirit swab to remove surface bacteria contaminants. Sterile scalpel blades were used in scraping the growing margins suspected to be infected before using moistened sterile cotton wool swab applicator to rub the area scrapped. The swab was then placed carefully into its container and well labeled with the name of school, sex and age of the child written on the container. This was immediately transported in a sterile container, within 3 hours to the Research Laboratory of Pharmaceutical Microbiology Department, University of Benin, Benin City.

Culture of sample: The cotton wool swab applicators were smeared onto already prepared test tube slants containing Sabouraud Dextrose Agar (prepared according to manufacturer's prescriptions). Chloramphenicol was added to the agar preparation to prevent the growth of bacteria. Tubes were incubated at room temperature (25 to 28 ^{o}C) for five days. After the growth of the fungi was established, a subculture was made on Sabouraud Dextrose Agar for further identification. Those without growth were discarded as negative after 6 weeks and these experiments were carried out in triplicate (Rambali *et al*., 2001).

Morphological study of culture: The isolates were examined visually and microscopically for morphology of fungi. Using the tease mount method as described by Aneja (2003), a drop of lactophenol cotton blue mounting fluid was placed on a clean glass slide. A portion of mycelium was transferred to the lactophenol cotton blue stain, and teased out by using a sterile needle to separate the filaments. A cover slip was placed over the preparation and gentle pressure applied. This was examined using x10 and x40 objective to establish the presence of fungal structures. Fungal species were identified by the presence of distinguishing structure such as micro or macroconidia, spores and hyphae as described by David *et al* (2007).

Preparation of inoculum suspension: The isolates were sub-cultured onto Potato Dextrose Agar at room temperature for 7 days to enhance sporulation. Seven day old cultures were covered with 1 ml sterile distilled water. A sterile Pasteur pipette was used in stirring the colonies so that there will be a mixture of conidia and mycelium. The suspensions were transferred to sterile tubes and a vortex mixer was used to make a suitable suspension. The suspension was allowed to sediment for 15 to 20 minutes at room temperature so that larger hyphae segments have time to settle, then the upper homogeneous layer were collected as recommended by Clinical and Laboratory Standards Institute (CLSI, 2006). The turbidity of the supernatants was measured with a spectrophotometer at a wavelength of 530 nm and transmission was adjusted to 65-70 % to obtain standardized inoculum (Esteban *et al*., 2005).

Statistical Analysis: Descriptive statistics involving percentages and Student's t-test was used in evaluating the statistical difference between two groups with $P < 0.05$ were considered statistically significant.

RESULTS AND DISCUSSION

Figures 1 and 2 put the total number of pupil examined in this study at five thousand eight hundred and seventy-six (5,876). The number of pupils from schools in rural area (labeled A-H) at three thousand seven hundred and thirteen (3,713) (63 %), while the number of pupils from schools in urban areas (labeled I-N) at two thousand one hundred and sixty-three (2,163) (37 %) respectively. The total number of growth from these cultures (number of cases) stand at four hundred and eight-two (482). The rural area schools provide two hundred and ninety-eight (298) cases and one hundred and eighty-four for the urban area schools. Though the number of schools in the rural area are fewer (6) than the schools in the urban area (8) but more cases were recorded in the rural schools. Thus the average prevalence stood at 5.03 % for the urban school while the rural schools showed average prevalence of 13.95 %.

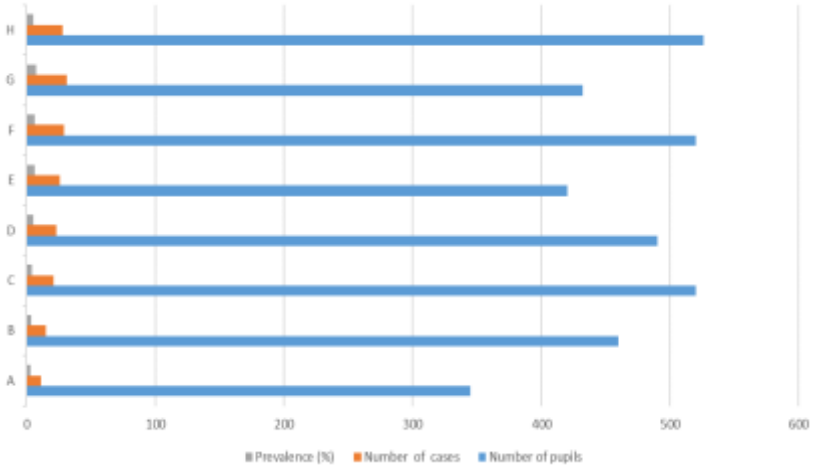

Fig. 1: Prevalence of cases of *tinea capitis* among pupils examined in urban areas.

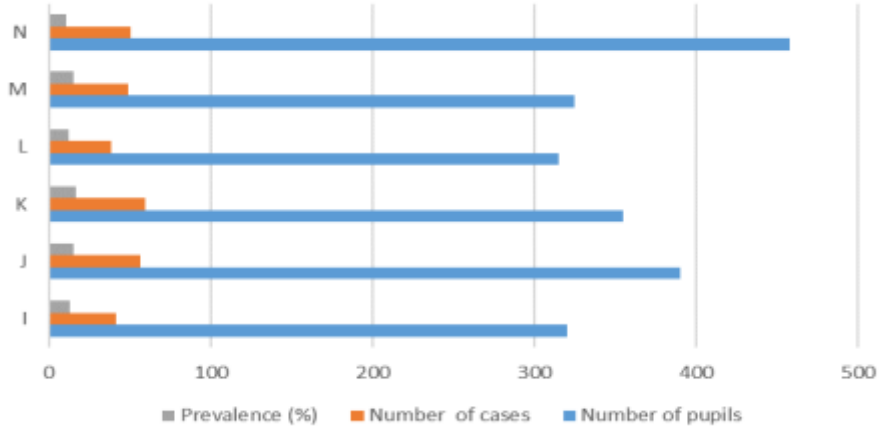

Fig. 2: Prevalence of cases of *tinea capitis* among pupils examined in rural areas.

Physical examination of the zones diameters of the scalp of the pupil present with the following findings as shown from Table 1. Grey patches with broken-off hair near the follicle was observed in 208 (71 %) with an infection zone diameter ranging from 1-3 cm. Seventy-three (25 %) presented with diffuse scaling with hair broken off at the follicle with or without black dots and with an infection zone diameter ranging from 1-3 cm. Inflammatory boggy lesions (Kerions) was observed in 12 (4 %) cases ranging from an infection zone diameter of 1-2 cm. Figure 3 shows the distribution of the 482 pupils physically confirmed to be infected with tinea capitis with regard to sex, age and number of positive cultures. More cases were found among boys, 311 (65 %), than girls, 171 (35 %), and number of positive cultures were more among boys 190 (65 %) than girls 103 (35 %). Highest prevalence was among pupil between 4-7 years old (51 %), intermediate in 8-10 years old (41 %) and least among pupil between 10-13 years old (8 %).

Table 1: Clinical picture of infection zone diameter.

Clinical pattern	Number (Percentage)	Infection zone diameter (cm)
Grey patches	208 (71 %)	1-3
Diffuse scaling with/or without black dots	73 (25 %)	1-3
Boggy lesions (kerions)	12 (4 %)	1-2

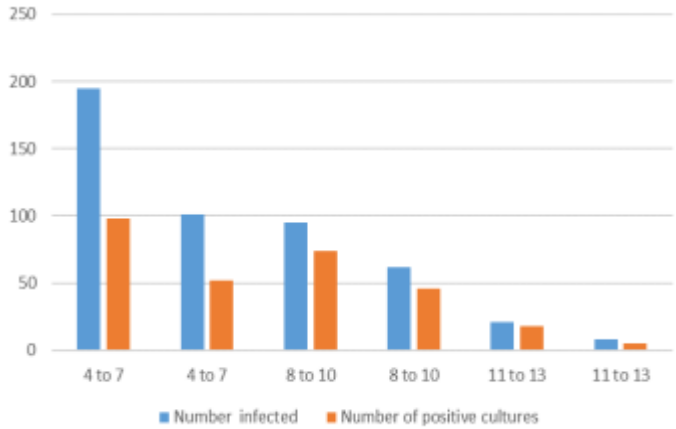

Fig. 3: Gender and age related distribution of physically observed positive cultures of tinea capitis infection.

Six dermatophyte species were identified out of the 293 positive cultures. 71 isolates were identified as *Microsporum andouinii* (24 %), 63 as *Trichophyton mentagrophytes* (22 %), 38 as *Trichophyton tonsurans* (13 %), 67 as *Microsporum canis* (23 %), 35 as *Trichophyton soudanense* (35 %) and 19 as *Trichophyton schoenleinii* (6 %) (Fig. 4 and 5). *Trichophyton schoenleinii, Microsporum canis, Trichophyton tonsurans* and *Trichophyton mentagrophytes* were distributed more in school G; School F showed more distribution *Trichophyton soudanense* and *Microsporum canis,* while *Microsporum canis* was more distributed in schools E; *Trichophyton mentagrophytes was more* in schools B,D,F,H. For schools in urban areas, out of the 293 positive cultures, School G showed the highest

positive culture of 18, while school A showed the lowest positive culture of 3. Schools B, C, D, E and F showed positive culture of 8, 12, 12, 15, 16 and 15 respectively as shown in figure 4.

Table 2: Cultural characteristics and microscopic description of isolates.

Cultural characteristics	Microscopic description	Isolates
Grayish colony with closely matted mycelia. Central knob with radiating and folded surface	It has short segmented and reflective hyphae	*Microsporum audiouinii* (71)
White to light yellow colony with fluffy button from which the colony spreads rapidly	It has ramified and septate hyphae with numerous micro conidia	*T. mentagrophytes* (63)
Brownish colony with brownish powdery aerial mycelia colonies matted to plate	It has numerous micro conidia, few macro conidia, with terminal chlamydospore	*T. tonsurans* (38)
Cottony or wooly white with flat colonies and radiating edges	It has rough, thick walled and multiseptate macro conidia	*M. canis* (67)
Yellowish colonies, with button-like centre and wrinkled surface.	Short segmented and reflective hyphae	*T. soudanense* (35)
White bulging, wrinkled prominent firm fungal cake with dry surface	Ramified and septate hyphae with roundish micro conidia	*T. schoenleinii* (19)

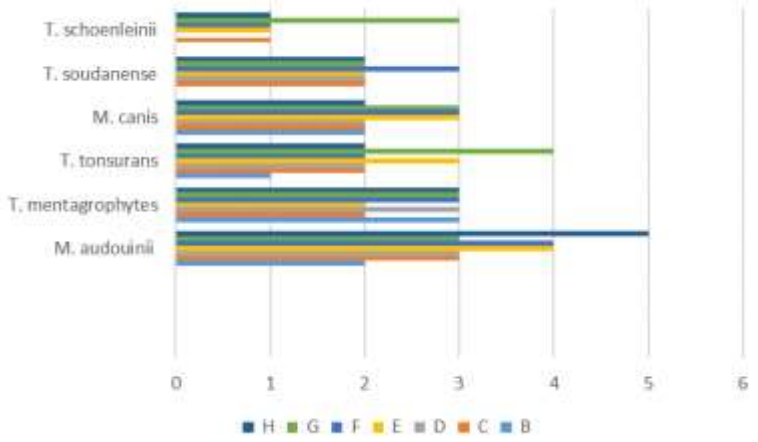

Fig. 4: Distribution of positive fungal cases in urban schools investigated

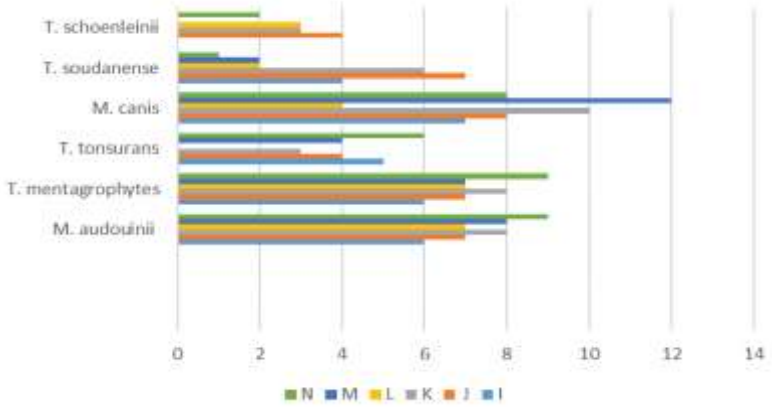

Fig. 5: Distribution of positive fungal cases in rural schools investigated

For schools in rural areas, School I had 28 positive cultures, School J had 37, School K had 38, School L had 23, School M had 33, and School N had 35 as shown in figure 5. Positive cultures from schools in rural areas were 194 (66 %), compared to 99 (34 %) from schools in urban areas. Ringworm is a common

dermatophyte infection that constitutes an important public health problem among children worldwide, including Nigeria. The disease remains common in Nigeria, largely because of lack of information on its occurrence and the nonexistence of control measures (Anosike *et al*., 2005). Success rate in culturing and examination of swabbed areas of the scalp from 482 pupils was above average because 293 cases (61 %) grew on the mycological agar with identifiable growth characteristics, with the remaining 189 cases (39 %) testing negative. The average prevalence rate of *tinea capitis* infection was 5.03 % for urban area, while in rural area the average prevalence was 13.95 %. When compared to previous studies in Nigeria and other parts of the world, it will be observed that the reported data varies from as low as 2.7 % to as high as 45 %. Fatini and Al- Samarai (2000) working on school children in Iraq reported a prevalence rate of 2.7 % and that only 120 cases out of 204 clinically diagnosed *tinea capitis* tested positive for fungi. In Nigeria, Adefemi *et al*., (2011) reported a prevalence rate of 5 % of culture confirmed dermatophyte infection among primary school children that were age 5-16 years in Kwara state. Adeleke *et al*., (2008) reported a prevalence of 9.5 % in a study carried out on Quaranic scholars in Kano State, Emele and Oyeka (2008) reported a prevalence of 9.4 % in a study involving children in Anambra State. Ogunbiyi *et al*., (2005) reported a prevalence of 15.2 % in public primary school in Ibadan, Ayanlowo *et al*., (2014) reported a prevalence rate of 15.4 % in a study carried out on 604 children in a rural settlement in South-western Nigeria, while a higher prevalence of 45 % was reported in a study carried in Osogbo, South-western Nigeria by Akinboro *et al*., (2011). It is well-known that lower prevalence rates are recorded for *tinea capitis* when prevalence is based on mycological diagnosis. The 189 cases representing 39 % that tested negative in this study could be attributed to the dry nature of some lesions leading to difficulty in sample collection, or as a result of antifungal treatment (oral or topical), orthodox or traditional that may have been administered to some of the children infected. Asymptomatic carrier of dermatophytic infection serving as reservoir of infection and constituting almost comparable prevalence to symptomatic cases has been reported in literature (Omar, 2000). This could also explain the low prevalence in a study that looked at those with detectable signs of *tinea capitis*.

Of the dermatophytes isolated, *Microsporum audouinii* with a prevalence of 24 % was the most common dermatophyte isolated in the areas studied. *Microsporum audouinii* was reported to be prevalent in Eastern and Western Nigeria (Ogunbiyi *et al*; 2005, Ezeronye, 2005). Emele and Oyeka (2008) also reported *Microsporum audouinii* as the most prevalent dermatophyte (42 %) in a study carried out among school children in Anambra State, Nigeria. *Microsporum audouinii* as an anthropophilic dermatophyte could have been transmitted from person to person contact or through contaminated inanimate objects. *Microsporum canis* with a prevalence of 23 % was the second most common dermatophyte isolated. This fungus is believed to be zoophilic and must have originated from the bodies of infected animals, such as cats, dogs, cow and other animals. It is a known practice that people in the study areas share their residential houses with domestic animals or pets. This was followed by *Trichophyton mentagrophytes* with a prevalence of 22 %. The fungus is said to be cosmopolitan and is one of the most common dermatophytes infecting man and animals (Hainer, 2003). Ayanlowo *et al*., (2014) reported *Trichophyton mentagrophytes* as the most prevalent in a community in the Southwestern part of Nigeria. Ezeronye in his study in Cross-River State also found *Trichophyton mentagrophytes* as the second most common isolate from tinea capitis lesion (Ezeronye, 2005). *Trichophyton tonsurans* with a prevalence of 13 % is the etiologic agent most commonly caught up in 'ringworm' infections of the scalp in the United Kingdom (Fuller *et al*., 2003). *Trichophyton tonsurans* was also predominant in urban schools in the study performed in Nairobi by Moto *et al*. (2015). Hogewoning *et al* (2011) who compared school children attending rural and urban schools in Gabon also found *Trichophyton tonsurans* and *Trichophyton soudanense* as the agent frequently seen in the urban school while *Trichophyton tonsurans* and *Microsporum audouinii* were commonly seen in the rural school. *Trichophyton soudanense* had a prevalence of 12 % while *Trichophyton schoenleinii* with a prevalence of 6 % was the least dermatophyte isolated in this study but was reported by Nweze (2001) to be the most prevalent cause of tinea capitis in Borno State. Species of the genus *Trichophyton* were responsible for majority of tinea capitis infection in this study, similar to that obtained in other studies.

Gender-related studies on the prevalence of ringworm in Nigeria has been patchy, with some studies claiming that male predominate (Nweze, 2001), while in some cases, it is the female that predominate (Anosike *et al*, 2005; East-Innis *et al.*, 2006). In this study, more males than females were infected just like in other previous studies carried out ($P < 0.05$). This established the observations by other workers that apart from age, sex also has influence on the prevalence of tinea capitis. The explanation for the greater prevalence in male pupils could be the fact that boys get haircuts more frequently than girls, and are more exposed to the use of clippers, combs and other

items that are inhabitant of these contaminated. It is also a known fact that boys play more with animals like dogs, cats and other pets more than girls and they are also less mindful of personal hygiene when compared with girls. In this study, a higher rate of infection was found among children between 4-7 years old (51 %), intermediate in 8-10 years old (41 %) and least among children between 10-13 years old (8 %). George and Altraide (2008) also reported tinea capitis to be more prevalent in children below the age of 10 years. Many studies offer explanations for the prevalence of tinea capitis in children. Martinez suggested that commensalism and a high blood sugar level could possibly be the reason for dermatophytes infection in healthy scalp and explained their gradual decline with advancing age (Martinez, 1980). The prevalence of fungal infection in the rural areas studied (66 %) was more than that found in the urban areas (34 %). This could be attributed to poor housing of children in the rural areas, repeated contact with infected animals, contact with infected soil while farming and poor personal hygiene. It seems that poorly kept children are the prime target of tinea capitis and is a reflection of a low standard of living and a low level of education within the family.

Conclusion: Prevalence of tinea capitis in Sapele and Ethiope West Local Government Areas of Delta state have implicated the following fungi: *Microsporum andouinii*, *Trichophyton mentagrophytes*, *Trichophyton tonsurans*, *Microsporum canis*, *Trichophyton soudanense* and *Trichophyton schoenleinii* respectively. Age and sex were identified as important in the distribution of this infection while improve hygiene is key to its reduction or elimination through enlightenment campaign. In-cooperation of routine inspection of the pupil's scalps with the intention of recommending treatment for those infected.

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