

**SUPERFICIAL FUNGAL INFECTIONS AMONG SCHOOL AGE CHILDREN: DOES PREVALENCE AND PATTERN DIFFER BETWEEN COMMERCIAL AND AGRARIAN COMMUNITIES?**

**ABSTRACT**

**Background:** Superficial fungal infections (SFIs) are common and have considerable negative impact on school children in tropics.

**Objectives:** The study compared the prevalence and pattern of SFI among primary school pupils in an agrarian (Ukpor) and commercial (Nnewi) communities in Nnewi Area

**Methodology:** A cross-sectional study was conducted among primary school pupils in Nnewi Area. Subjects were selected using stratified random sampling technique. Data was analyzed using SPSS version 21.

**Results:** Final analysis involved 773 and 789 pupils in the agrarian and commercial communities, respectively. Their mean age was  $9.0 \pm 2.0$  years and male: female ratio was 1:1. The agrarian community had a significantly higher proportion of children who were from low socio-economic class families, and had poorer hygienic practices ( $p=0.000$ ). The overall prevalence of SFIs was 28.9%. Prevalence was significantly higher in the agrarian compared to commercial community (39.3% versus 18.6%;  $p = 0.000$ ). *Tinea capitis* was the predominant form of SFI accounting for 80.3% and 83.7% of SFI cases in the agrarian and commercial

communities, respectively. Black dot tineacapitis was the commonest variant of tineacapitis in both communities while diffuse scale type was the only variant significantly different in both communities (6.3% in agrarian versus 0.0% in commercial communities,  $p=0.023$ ). The most prevalent organisms were *Trichophyton tonsurans* (37.9%), *T. mentagrophyte* (28.8%) and *T. rubrum* (18.7%) of which *T. rubrum* was significantly higher in the commercial community (27.6% versus 14.9%,  $p=0.036$ ).

**Conclusion:** The burden of SFI is high among primary school children in Nnewi area, especially among those in agrarian communities. More awareness should be created on the prevention, identification and treatment.

#### KEYWORDS

Dermatophytosis, ringworm, skin fungal infections, south-east Nigeria, tineacapitis

#### INTRODUCTION

Superficial fungal infection (SFI) are contagious, affect significant proportion of primary school children and impact negatively on their quality of life. Superficial fungal infection (SFI) refers to fungal infections superficially involving the skin, appendages, and mucosa. SFI is subdivided into superficial and cutaneous infections.<sup>1,2</sup> Superficial infections are restricted to the stratum corneum and include tinea versicolor, piedra, and tinea nigra. On the other hand, Cutaneous infections involve the skin and appendages and include onychomycosis or tinea unguium (nails), tineacapitis (scalp), tinea corporis (trunk and extremities), tinea barbae (beard), tinea pedis (feet), tinea faciei (face), tinea cruris and candidiasis of skin, superficial

mucosa, and nails. These fungal infections are caused by several species of dermatophytes (Trichophyton, Microsporum, and Epidermophyton species), *Candida*, *Malassezia* and *Trichosporon*.<sup>3,4</sup>

Children in the tropics and sub-tropics are particularly at risk due to the warm humid environment, which supports the thriving of causative organisms.<sup>5</sup> Due to the highly contagious nature of some SFI, children with poor living conditions such as overcrowding, lack of portable water and poor hygiene are at high risk of infection.<sup>6</sup> The risk may even be higher among children living in farming communities due to additional exposure to other risk factors such as frequent contact with contaminated soil and animals.

Although *skin* (~~deleted~~) SFI are generally believed to be benign, lesions are often chronic, unsightly and sometimes disfiguring. This may be attributed to the fact that majority of infected children are either untreated or subjected to unorthodox medications.<sup>7</sup> Besides, there is growing evidence that associated features such as alopecia, itchiness and chronicity have considerable negative impact on the psychosocial health of school children especially the females.<sup>8,9</sup> In addition, SFI could be complicated by superinfection with bacteria (pyoderma) and consequently post-streptococcal glomerulonephritis.<sup>6</sup> It is therefore pertinent to reduce the burden of SFI in order to improve the quality of life of school children in the tropics. However, there is currently no public health intervention to address SFI among school children in Nigeria. This may be due to lack of data on current burden to guide relevant stakeholders in adopting control interventions. Therefore, this study was conducted to compare the prevalence, clinical and mycological patterns of *skin* SFI between pupils of primary schools in an agrarian and commercial communities in Nnewi area.

## **METHODOLOGY**

A cross-sectional comparative study was conducted among pupils of selected primary schools in an agrarian (Ukpor) and commercial (Nnewi) communities in Nnewi Area. The area is in tropical rain forest vegetation zone and the climate is influenced by two major trade winds: the warm moist southwest trade winds during the rainy season (April –October) and the north east trade winds during the dry and dusty harmattan (November-March).<sup>10</sup> Both towns share common boundary with Ukpor located to the west of Nnewi. Generally, Ukpor is colder and less humid than Nnewi due to its hilly topography. The temperature of the area is generally high ranging from 19.4°C to 31.1°C in Ukpor and 23°C to 35°C in Nnewi. Most of the inhabitants of Ukpor are subsistence farmers while inhabitants of Nnewi are predominantly traders and public servants.<sup>10</sup> Ukpor is the headquarter of Nnewi South Local Government Area (LGA) while Nnewi is a one town LGA. Ukpor is classified as urban town based on the fact that it is a local government area but the setting is agrarian and typical of a Nigerian rural community. On the other hand, Nnewi is an urban town and the 2<sup>nd</sup> largest commercial city of Anambra State. According to 2006 Nigerian national population Census, Nnewi has a population of 155,443 with an annual growth rate of 3.7% while an average population of Ukpor was 25,000 to 35,000.<sup>11</sup>

Eligible children were pupils who had lived in the communities for at least 12 months, were attending school in town of residence, whose parents or guardians gave written informed consent, and who also gave an assent (where appropriate). The pupils were selected using a stratified random sampling technique.

Based on sample size formula for comparing proportions in two equal populations, minimum sample size of 800 pupils was calculated for each community.<sup>12</sup> Ethical approval for the study was obtained from the Research and Ethics Committee of Chukwuemeka Odumegwu Ojukwu University Teaching Hospital (COOUTH). Permissions were obtained from Anambra State Universal Basic Education Board (ASUBEB) and Anambra State Ministry of Health, LGA ASUBEB, LGA education authorities, and school authorities. Privacy was maintained during examination and collection of specimen and a same sex teacher was used as chaperone during physical examination.

A proforma was used to collect relevant socio-demographic, hygiene and sanitation related data of the subjects from the parents or caregivers. Socio-demographic data included their age, sex, class, family characteristics, parental occupation and highest educational attainment among others. Socio-economic status was determined using parental occupation and highest educational attainment as described by Oyedeji.<sup>13</sup>

The specimens were collected using standard procedures.<sup>14</sup> Skin scrapings (scales and crusts), hair shavings and nail snippings were collected by the investigator from pupils who have cutaneous lesions suspected to be SFI. Affected areas were first cleaned with 70.0% ethanol prior to specimen collection to remove any dirt or bacterial contamination. On evaporation of the ethanol, specimens were collected on a clean piece of square shaped paper about 5cm in length.

All laboratory procedures were conducted by a consultant microbiologist. The laboratory work was done in the Medical Microbiology Department of Nnamdi Azikiwe University Teaching Hospital, Nnewi. Apart from samples from pityriasis vesicular lesions, all samples were divided

into two portions, one for culture and the other for microscopic examination. Samples collected from pityriasisvesicolor lesions were examined by microscopy alone. Little pieces of the specimen were examined microscopically in 20.0% potassium hydroxide (KOH) solution using standard procedure.<sup>14</sup>

Culture of remaining specimens were done to identify the species of fungi. This was done in the Mycology Laboratory, using Saboraud's potassium dextrose agar (SDA) base ( Oxoid UK). The SDA was supplemented with broad spectrum antibiotics chloramphenicol and gentamycin to inhibit gram positive and gram negative bacterial contamination as well as cyclohexamide to inhibit saprophytic fungal contamination. Cultures were incubated aerobically for 1 to 4 weeks. However, to avoid overgrowth of contaminants, they were monitored every 2-3 days and sub-culturing was done as soon as significant growth was noticed. In the absence of any growth after 4 weeks, the culture was considered negative. Positive cultures were examined both microscopically and macroscopically. Macroscopic examination was for characteristic colour of surface and reverse, texture and topography. The species of dermatophyte was identified from the colonial appearance of the culture and by examining the mycelial growth microscopically using the lactophenol cotton blue stain. Specialized hyphae such as spiral, pectinate or antler hyphae, presence or absence and morphology of macroconidia, microconidia, and chlamydospores were used with reference to a mycology atlas to identify the individual fungal isolates.<sup>14-16</sup>

## **DATA ANALYSIS**

Data were analyzed using Statistical Package for Social Sciences (SPSS) software version 21. The frequency distributions of categorical variables were presented in tables and charts where applicable. Means and standard deviations of the continuous variables such as age were calculated. The proportions of different groups were compared using chi-square test for categorical variables while student t-test was used to compare the means of continuous variables. Where conditions for chi-square test were violated, Fisher exact test was used. P-values less than 0.05 were considered statistically significant.

## **RESULTS**

The study was conducted between April and July 2019. A total of 1562 primary school pupils with complete data were included in final analysis. This consisted of 773 and 789 pupils in Ukpok and Nnewi, respectively. The age of the pupils ranged from 5 to 15 years with a mean of  $9.18 \pm 2.03$  and  $8.77 \pm 1.86$  years in Ukpok and Nnewi, respectively. The male to female ratio was approximately 1:1. The pupils were predominantly Igbos (98.2% [1534/1562]), majority lived with their parents (89.8% [1402/1562]) and they were fairly uniformly distributed across primaries 1 to 6 in both towns.

As shown in Table 1, there were no significant difference in the age, sex and family size distribution of the pupils in both towns. The pupils were predominantly from public (87.8% [679/773]) and private (74.7% [589/789]) schools in Ukpok and Nnewi, respectively. A significantly higher proportion of pupils who were from low socio-economic class (69.4% versus 30.4%,  $p=0.000$ ) or polygamous families (80.0% versus 20.0%,  $p=0.000$ ) were from Ukpok

while those who lived with guardians were significantly from Nnewi (79.6% versus 20.4%, p=0.000)

**TABLE 1: SOCIO-DEMOGRAPHIC CHARACTERISTICS OF THE PUPILS**

<b>Characteristic</b>	<b>Ukpor Frequency (%)</b>	<b>Nnewi Frequency (%)</b>	<b>p-value</b>
<b>Sex</b>			
Female [n=800]	400 (50.0)	400 (50.0)	0.678
Male [n=762]	373 (49.0)	389 (51.0)	
<b>Age (years)</b>			
5 to 8 [n=640]	305 (47.7)	335 (52.3)	0.205
9-12 [n=859]	431 (50.2)	428 (49.8)	
>=13 [n=63]	37 (58.7)	26 (42.3)	
<b>Tribe</b>			
Igbo [n=1534]	767 (50.0)	767 (50.0)	0.003* (FET)
Hausa [n=19]	3 (15.9)	16 (84.1)	
Yoruba [6]	1 (16.7)	5 (85.3)	
Idoma [3]	2 (66.7)	1 (33.3)	
<b>Class</b>			
Primary 1 [n=278]	138 (49.6)	140 (50.4)	0.989
Primary 2 [n=259]	130 (50.2)	129 (49.8)	
Primary 3 [n=254]	124 (48.8)	130 (51.2)	
Primary 4 [n=263]	133 (50.6)	130 (49.4)	
Primary 5 [n=248]	124 (50.0)	124 (50.0)	
Primary 6 [n=260]	124 (47.7)	136 (52.3)	

<b>Caregiver</b>				0.000*
Parent [n=1402]	738 (52.6)	664 (47.4)		
Other extended family members [n=18]	6 (33.3)	12 (66.7)		
Guardian [n=142]	29 (20.4)	113 (79.6)		
<b>Socio-economic Class</b>				
Upper [n=268]	8 (3.0)	260 (97.0)		0.000*
Middle [n=545]	245 (45.0)	300 (55.0)		
Low [n=749]	520 (69.4)	229 (31.6)		
<b>Family setting</b>				
Single parent [n=10]	10 (100.0)	0 (0.0)		0.000*
Monogamous [n=1532]	747 (48.8)	785 (51.2)		
Polygamous [n=20]	16 (80.0)	4 (20.0)		
<b>Total family size</b>				
≤6 [n=684]	348 (50.9)	336 (49.1)		0.226
7 to 12 [n=863]	415 (48.1)	448 (51.9)		
≥13 [n=15]	10 (66.7)	5 (33.3)		

\*Statistically significant

FET=fisher's exact test (11.590)

As shown in Tables 2, pupils in Ukpok significantly had higher mean weekly frequency of walking barefoot on sand ( $5.13 \pm 1.79$  versus  $1.76 \pm 2.23$ ,  $p = 0.000$ ), touching animals ( $2.58 \pm 2.81$  versus  $0.92 \pm 2.11$ ,  $p=0.000$ ) and lower daily frequency of hand wash ( $2.42 \pm 0.86$  versus  $5.55 \pm 2.05$ ,  $p=0.000$ ) compared to pupils in Nnewi.

**Table 2:HYGIENE RELATED BASELINE CHARACTERISTICS I**

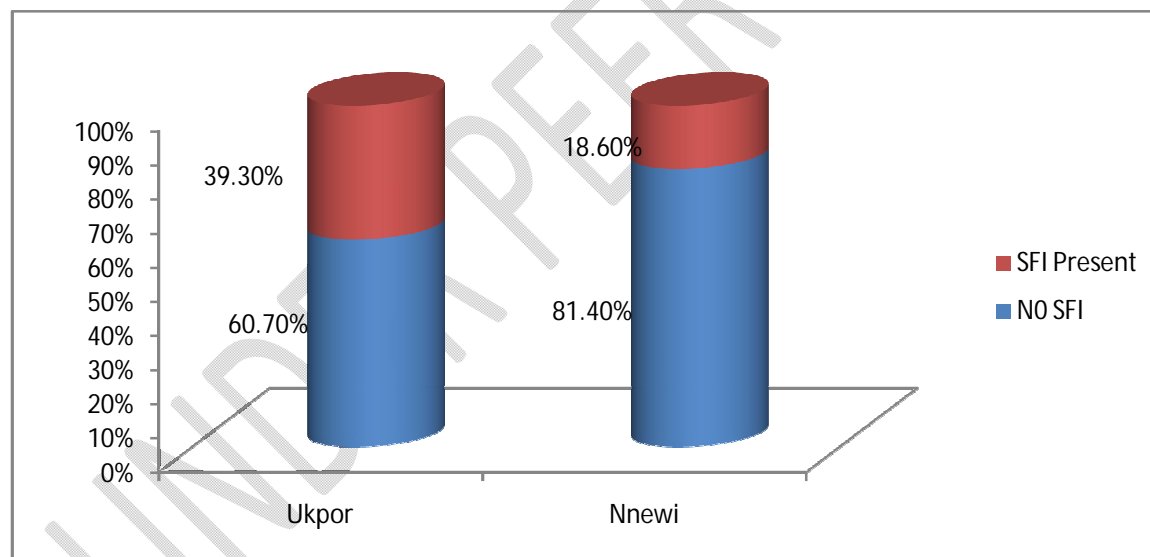
<b>Characteristics</b>	<b>Mean (SD)</b>	<b>IQR</b>	<b>p-value</b>
<b>Frequency of walking barefoot/week</b>			
Ukpok	$5.13 \pm 1.79$	3	
Nnewi	$1.76 \pm 2.23$	3	0.000*
<b>Frequency of touching animals/week</b>			
Ukpok	$2.58 \pm 2.81$	5	0.000*
Nnewi	$0.92 \pm 2.11$	0	
<b>Frequency of hand wash /day</b>			
Ukpok	$2.42 \pm 0.86$	1	0.000*
Nnewi	$5.55 \pm 2.05$	2	

IQR-Interquartile range, \*Statistically significant

The overall prevalence of SFI was 28.9%. (451/1562). The prevalence of SFI was significantly higher in Ukpok compared to Nnewi (39.3% [304/773] versus 18.6% [147/789],  $p=0.000$ ) as shown in Figure 1.

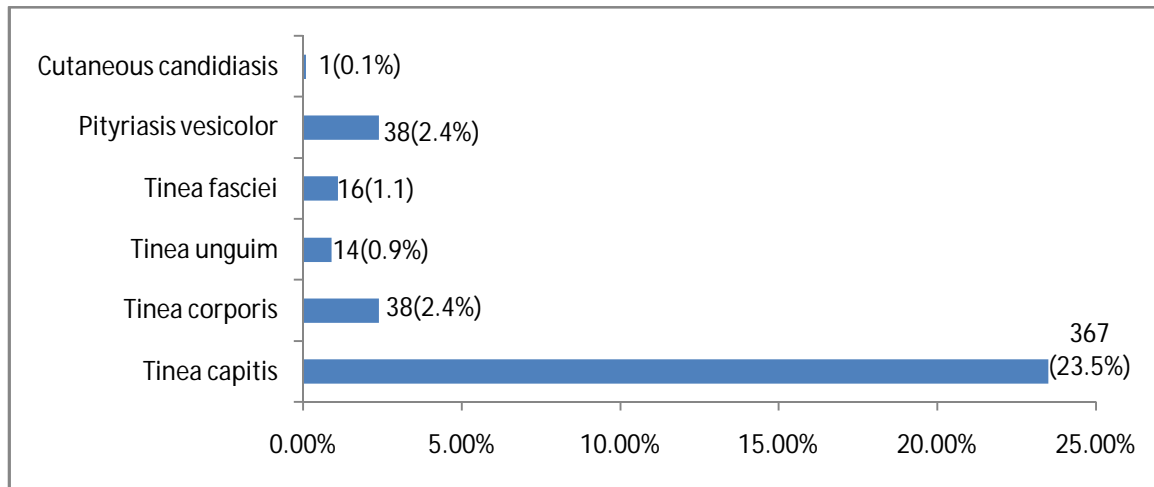
Ukpok significantly had a higher prevalence of all forms of dermatophytosis and pityriasisvesicolor ( $P=0.000$ ). The only case of cutaneous candidiasis was seen in Nnewi. The predominant form of SFIs was tineacapitis as shown in Figure 2 and Table 3. There was no significant difference in the pattern of skin SFIs in both communities as seen in Table 4. Multiple infections were seen in 5.1% of subjects (23/451)

**FIGURE 1: PREVALENCE OF SFI IN NNEWI AND UKPOR**



***P=0.000(Statistically significant)***

**FIGURE 2 :PREVALENCE OF DIFFERENT FORMS OF SFIs (n=1562) I think it will be more realistic if the infections were calculated as 100%, from which the percentage of the different types of SFI would be calculated**



**TABLE 3: CLINICAL PATTERN OF SFIs IN UKPOR AND NNEWI**

Characteristic	Yes	No	p-value
<b>Tineacapitis</b>			
Ukpor	244(80.3)	80(19.7)	0.383
Nnewi	123(83.7)	24 (16.3)	
<b>Tineacorporis</b>			
Ukpor	30(9.9)	274 (90.1)	0,113
Nnewi	8 (5.4)	139(94.6)	
<b>Tineaunguim</b>			
Ukpor	8 (2.6)	296(97.4)	0.405
Nnewi	6 (4.1)	141 (95.9)	
<b>Tineafasciei</b>			
UKpor	12 (3.9)	292 (96.1)	0.509
Nnewi	4(2.7)	143 (97.3)	

<b>Pityriasisvesicolor</b>			
<b>Ukpor</b>	28 (9.2)	276(90.8)	0.388
<b>Nnewi</b>	10(6.8)	137(93.2)	
<b>Cutaneous candidiasis</b>			
<b>Ukpor</b>	0 (0.0)	304(100.0)	
<b>Nnewi</b>	1(0.7)	146(99.3)	

Table 4 shows that non-inflammatory black dot tineacapitis was the commonest variant of tineacapitis in both Ukpor and Nnewi. The only significant difference in clinical form was seen in diffuse scale type which was significantly higher in Ukpor (6.3% versus 0.0%, p=0.023)

**TABLE 4: CLINICAL VARIANT OF TINEA CAPITIS IN NNEWI AND UKPOR**

<b>Variant of tineacapitis</b>	<b>Present?</b>		<b>p-value</b>
	<b>Yes</b>	<b>No</b>	
<b>Black dot</b>			
<b>Ukpor</b>	105(50.7)	102 (49.3)	0.135
<b>Nnewi</b>	49(60.5)	32(39.5)	
<b>Diffuse scale</b>			
<b>Ukpor</b>	13 (6.3)	194 (93.7)	0.023*
<b>Nnewi</b>	0 (0.0)	81 (100.0)	
<b>Gray Patch</b>			
<b>Ukpor</b>	73 (35,3)	134(64.7)	0.932
<b>Nnewi</b>	27(35.8)	52 (64.2)	
<b>Pustular type</b>			

<b>Ukpor</b>	13 (6.3)	194(93.7)	0.391
<b>Nnewi</b>	3 (3.9)	79 (96.3)	
<b>Kerion</b>	3 (1.4)	204 (98.4)	0.276
<b>Ukpor</b>	0 (0.0)	81 (100.)	
<b>Nnewi</b>			

\*Statistically significant      n=207in Ukpor,      n=81 in Nnewi

Organisms were isolated from 311 (84%) of 370 samples obtained from subjects with dermatophytosis or cutaneous candidiasis. *Aspergillus* and *Penicillium* contamination occurred in 89 (28.6%) and 23 (7.4%), respectively. The commonest isolated pathogens in both towns were *T. tonsurans*(37.7%), *T. mentagrophyte*(28.6%) and *T. rubrum*(18.6%). Others were *Microsporium gypseum*(6.0%), *M. canis*(4.5%), *M. aouduinii*(3.5%), *Epidermophyton floccosum*(1.5%), *Calbicans*(1.0%) Multiple pathogens were isolated in 1.5% (3/199) of subjects.

The only statistically significant difference in the organisms isolated occurred in *T. rubrum* which was significantly higher in Nnewi. (27.6% versus 14.9%, p=0.036) as shown in Table 9.

**TABLE 5: PATHOGENS ISOLATED FROM POSITIVE CULTURES IN UKPOR AND NNEWI**

	Pathogens isolated from positive culture		p-value
	Yes	No	
<b><i>T. tonsurans</i></b>			
<b>Ukpor</b>	56 (39.7)	85 (60.3)	0.357
<b>Nnewi</b>	19 (32.8)	39(62.7)	
<b><i>T. Mentagrophyte</i></b>			
<b>Ukpor</b>	44 (31.2)	97 (68.8)	0.213
<b>Nnewi</b>	13 (22.4)	45 (77.6)	
<b><i>T. rubrum</i></b>			
<b>Ukpor</b>	21 (14.9)	120(85.1)	0.036*

<b>Nnewi</b>	16 (27.6)	42 (72.4)	
<i>M. gypseum</i>			
<b>Ukpor</b>	8(5.7)	133(94.3)	0.743
<b>Nnewi</b>	4 (6.9)	54 (93.1)	
<i>M.aouduinii</i>			
<b>Ukpor</b>	6 (4.3)	135 (95.7)	0.379
<b>Nnewi</b>	1 (1.7)	59 (98.3)	
<i>M. canis</i>			
<b>Ukpor</b>	6 (4.2)	135 (95.7)	0.777
<b>Nnewi</b>	3 (5.2)	55 (94.8)	
<i>E. floccosum</i>			
<b>Ukpor</b>	2 (1.4)	139(98.6)	
<b>Nnewi</b>	1 (1.8)	57 (98.2)	
<i>C. albicans</i>			
<b>Ukpor</b>	1 (0.7)	140 (99.3)	
<b>Nnewi</b>	1 (1.8)	57 (98.2)	
<i>*Statistically significant n=141 in Ukpor, n=58 in Nnewi</i>			

As shown in Table 6, a significantly higher proportion of pupils in public schools and from families with lower social class had SFI in both communities. Gender was significantly associated occurrence of SFI in only with the commercial community Nnewi where a significantly higher proportion of boys h

**TABLE 6: FACTORS ASSOCIATED WITH SFI IN UKPOR AND NNEWI**

Characteristic	Ukpor (n=773)			Nnewi (n=789)		
	Presence of SFI		p-value	Presence of SFI		p-value
Yes	No	Yes		No		
<b>Gender</b>						
Female	147 (36.8)	253 (63.3)	0.129	58 (14.5)	342 (85.5)	0.003*
Male	157 (42.1)	216 (57.9)		89 (22.9)	300 (77.1)	
<b>School type</b>						
Public	279 (41.1)	400 (58.9)	0.007*	72 (36.0)	128 (64.0)	<0.001*

Private	25 (26.6)	69 (73.4)		75 (12.7)	514 (87.3)	
<b>Tribe</b>						
Hausa	1 (33.3)	2 (66.7)	0.777	6 (37.5)	10 (62.5)	0.215
Igbo	1 (50.0)	1 (50.0)		0 (0.0)	1 (100.0)	
Idoma	301 (39.2)	466 (60.8)		140 (18.3)	627 (81.7)	
Yoruba	1 (100.0)	0 (0.0)		1 (20.0)	4 (80.0)	
<b>Total family size</b>						
≤ 6	138 (39.7)	210 (60.3)	0.763	54 (16.1)	282 (83.9)	F=0.194
7-12	161 (38.8)	254 (61.2)		92 (20.5)	356 (79.5)	
≥13	5 (50.0)	5 (50.0)		1 (20.0)	4 (80.0)	
<b>Social class</b>						
Upper	1 (12.5)	7 (87.5)	0.015 <sup>†</sup>	29 (11.2)	231 (88.8)	<0.001 <sup>*</sup>
Middle	82 (33.5)	163 (66.5)		52 (17.3)	248 (82.7)	
Lower	221 (42.5)	299 (57.5)		66 (28.8)	163 (71.2)	
Total	304(39.3)	469 (60.7)		147 (18.6)	642 (81.4)	

## DISCUSSION

The low prevalence of *Malassezia* may refer to (1)the researcher did not use the appropriate culture medium (adding oil) to isolate it.Or (2) the low skin oil secretion of young pupils which physiologically increase between 14-24 years.

The prevalence of SFI in this study (28.9%) corroborates previous reports that the prevalence of SFI ranges from 20-3% among African children.<sup>17,18</sup> Our finding is also comparable to 35.0% reported by similar studies in Tanzania and Ile-Ife.<sup>19,20</sup> However, the prevalence of dermatophytosis in the index study was lower than 40.6% documented in Awka-South LGA,Anambra State.<sup>21</sup> This is not surprising since the Awka-South study was conducted among pupils in rural schools

The significantly higher prevalence among school children in agrarian compared to commercial town was not unexpected and agrees with previous reports.<sup>21-24</sup> This may be attributed

toprevaling poor socio-economic circumstances in agrarian compared to commercial communities as found in this study. In addition, a significantly higher proportion of pupils in the agrarian community walked barefoot, touched animals more often and washed hands less frequently. These practices are believed to favour the transmission of SFIs causing organisms. Although the agrarian community had a relatively less climatic risk for SFIs due to the fact that it is relatively colder and less humid as a result of its hilly topography, it still recorded more SFIs. The predominance of *tinea capitis* agrees with previous African and non-African reports.<sup>3,17, 25,26</sup> Despite the slight variation in the occurrence of non-*tinea capitis* dermatophytosis, findings of the index study are in tandem with other African reports that *tinea corporis* and *tinea faciei* are commoner than other non-*tinea capitis* dermatophytosis. The absence of *tinea cruris*, *tinea nigra* and *piedra* agree with reports from Tanzania and Ile-Ife.<sup>19,20</sup> Most school based SFIs studies did not report any cutaneous candidiasis. Nevertheless, a hospital laboratory based study, involving samples from the general population reported 4.4% as the rate of *Candida albicans* isolation from SFIs, which is higher than 0.1% found in the index study.<sup>27</sup> However, the immune status of the subjects in that study, which is an important determinant of cutaneous candidiasis occurrence, was not documented. The finding of cutaneous candidiasis was unanticipated in the index study involving immune competent children. However, exclusion of children with immunosuppressive illnesses such as HIV or cancer was based on only verbal response from caregivers which may not be completely reliable.

The findings of this study agree with report from Ile-Ife that pityriasis vesicolor is the 2<sup>nd</sup> most common form of SFIs in primary school children. However, this was found to have the same prevalence with *tinea corporis* in contrast to lower prevalence of the later in Ile-Ife.<sup>20</sup> The prevalence of pityriasis vesicolor was slightly lower than rates reported in Kenya and Ile-Ife.<sup>20,28</sup>

However, the mean age of the pupils in the index study was slightly lower than that of the pupils in Ile-Ife study ( $8.97 \pm 1.95$  versus  $9.42 \pm 2.0$  years) and this may explain the slight difference in prevalence since the risk of pityriasisvesicolor increases with age.

All classes of dermatophytes including anthropophilicdermatophytes (*T. tonsurans*, *T. rubrum*, *T. mentagrophytes*, *E. floccosum*, *M. audouinii*), zoophilic dermatophytes (*M. canis*, *T. mentagrophytes*) and geophilicdermatophyte (*M. gypseum*) were isolated from the pupils in both communities. The predominance of anthropophilicdermatophytes reflects the commonest mode of transmission through direct or indirect skin contact, and agrees with previous reports from Kenya, South Africa and other parts of Nigeria.<sup>5,29,30</sup>

The most prevalent organisms were *T. tonsurans* (37.7%), *T. rubrum* (18.6%) and *T. mentagrophytes* (28.6%). Our findings are in keeping with previous Anambra report which documented *T. tonsurans* and *M. aoudouinii* as the commonest and least prevalent organism, respectively.<sup>23</sup> Similar finding was also documented among children of Fulani/Hausa cattle herders in South-East Nigeria. Predominance of *T. tonsurans* has also been documented in Aba and Nairobi.<sup>30,31</sup> *T. tonsurans* is a highly contagious anthropophilicdermatophyte which predominantly causes dot-type tineacapitis. It is responsible for more than 95% of tineacapitis in North America and was previously thought to play less important roles in Africa. However, findings of the above studies and the index study suggest that *T. Tonsurans* also play a dominant role in the etiology of dermatophytosis among African children. The reason for the statistically significant higher isolation of *T. rubrum* in Nnewi compared to Ukpok is not clear. However, this may not be unrelated to variations in the survival of the athrospores of different dermatophytes. It is possible that *T. rubrum* is able to survive the relatively hotter and more humid atmosphere in Nnewi compared to Ukpok. Further studies are needed to verify this.

The association between low socio-economic class or attendance of public schools and SFI agrees with previous reports.<sup>32,33</sup> Families with low socio-economic class may be less likely to afford materials for personal hygiene as well as cleaner and less crowded home or school environments. The same may apply to public compared to private schools.

CONCLUSION: The burden of SFIs is high among school children in Nnewi area. The prevalence is particularly high among school children in agrarian communities as well as those who come from poorer homes or attend public schools. The types of SFIs and their causative organisms are comparable in both agrarian and commercial communities. Tinea capitis is the dominant form of SFI and the commonest organisms implicated are *T. tonsurans*, *T. mentagrophyte* and *T. rubrum*.

#### RECOMMENDATION

There is need to create more awareness on the prevention, identification and treatment of SFIs among school children in Anambra State. Given the high burden and negative impact of SFI among school children, it's important to institute a public health control intervention. Efforts should be intensified at improving the living condition and hygienic practices of school children in rural agrarian communities.

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